APPENDIX A.

Program Best Management Practices

Table 1. Program Best Management Practices

BMP Number	BMP Title	BMP Description
General Avoidance and Minimization Measures		
GEN-1	Staging and Access	▪ Staging, access, and parking areas will be located outside of sensitive habitats to the extent feasible. Where feasible, staging areas will be located 30 feet from the top of bank or on the outboard side of pond levees. Vegetation removal shall be limited to the minimum amount necessary to provide access. ▪ All staging shall occur on adjacent access roads or previously disturbed areas. Soil and riprap shall be staged in areas that have been previously disturbed (i.e., service road, turn-outs, etc.).
GEN-2	Minimize Area of Disturbance and Site Maintenance	▪ Areas of disturbance will be limited to the smallest footprint necessary and a single access pathway, where feasible. For maintenance activities near waterways or other sensitive habitat, the designated work area shall be clearly identified in the field using highly visible material, and work will not be conducted outside this area. ▪ Keep excavated soil and materials on the site where they will not collect into the street or get transported to storm drains or nearby water bodies by rainfall or runoff in order to avoid deleterious effects to fish, wildlife, and beneficial uses. ▪ Transfer excavated materials to dump trucks on the site.
GEN-3	Construction Entrances and Perimeter	▪ Establish and maintain effective perimeter controls and stabilize all construction entrances and exits to sufficiently control erosion and sediment discharges from site and tracking off site. ▪ Sweep or vacuum any street tracking immediately and secure sediment source to prevent further tracking. Never hose down streets to clean up tracking. ▪ When in-channel work is required, where available use existing ingress or egress points or perform work from the top of the stream banks.
GEN-4	Salvage/Reuse of Plant and Woody Material	▪ Large wood or weed-free topsoil displaced by Program activities may be stockpiled for use during site restoration. Native vegetation displaced by Program activities will be stockpiled if it would be useful during site restoration. ▪ Stockpiled material shall not be placed over riparian or wetland vegetation. Stockpiled material shall not be placed in areas where it could enter the stream, riparian or wetland areas. ▪ To the extent feasible, all other woody material that is not re-usable should be disposed at a composting facility or left at a suitable location to decompose naturally.

BMP Number	BMP Title	BMP Description
GEN-5	Hazardous Materials Storage/ Disposal	▪ Any hazardous or toxic materials that could be deleterious to aquatic life that could be washed into State waters or its tributaries will be contained in watertight containers or removed from the project site. ▪ Use biodegradable chainsaw bar oil. ▪ Label all hazardous materials and hazardous wastes (such as pesticides, paints, thinners, solvents, fuel, oil, and antifreeze) in accordance with city, county, state, and federal regulations. ▪ Store hazardous materials and wastes in watertight containers, store in appropriate secondary containment, and cover them at the end of every workday or during wet weather or when rain is forecast. ▪ Follow manufacturer's application instructions for hazardous materials and be careful not to use more than necessary. Do not apply chemicals outdoors when rain is forecast within 24 hours. ▪ Arrange for appropriate disposal of all hazardous wastes. ▪ Cleanup of all pesticide and adjuvant containers will be triple rinsed with clean water at an approved site, and the rinse water will be disposed of by placing it in the batch tank for application. Used containers will be punctured on the top and bottom to render them unusable, unless said containers are part of a manufacturer's container recycling program, in which case the manufacturer's instructions will be followed, and disposed of at an appropriate facility. Disposal of all pesticides will follow label requirements and local waste disposal regulations.
GEN-6	Spill Prevention and Control	▪ Keep spill cleanup materials (rags, absorbents, etc.) available at the construction site at all times. ▪ Inspect vehicles and equipment frequently for and repair leaks. Vehicle and equipment operators should inspect beneath all vehicles that have been parked more than 15 minutes before they leave the work area. Use drip pans to catch leaks until repairs are made. ▪ Clean up spills or leaks and any contaminated soil immediately, and dispose of cleanup materials properly. ▪ Do not hose down surfaces where fluids have spilled. Use dry cleanup methods (absorbent materials, cat litter, and/or rags). ▪ Sweep up spilled dry materials immediately. Do not try to wash them away with water or bury them. If water must be used, Midpen or its contractor shall collect the water and spilled fluids and dispose of it as hazardous waste. ▪ Clean up spills on dirt areas by digging up and properly disposing of contaminated soil. ▪ If a pesticide is spilled, immediately contact one of Midpen's qualified first responders with Hazardous Waste Operations and Emergency Response (HAZWOPER) training.

BMP Number	BMP Title	BMP Description
		▪ Small spills (less than 18 inches in diameter) including small quantities of oil, gasoline, paint or other materials should be controlled by a qualified first responder (Midpen staff has several) and do not necessarily require an emergency response team. Medium spills (greater than 18 inches but less than 6 feet in diameter) are typically controlled by the first responder (Midpen staff) but police or fire department Hazardous Materials (HAZMAT) teams may be called based on conditions. Report significant spills (larger than 6 feet in diameter and any "running" spill) immediately. You are required by law to report all significant releases of hazardous materials, including oil. To report a spill, contact the San Mateo County Environmental Health Services Division, or other emergency office (e.g., local fire or police department) as warranted, immediately and document the spill using the spill documentation form. Alternatively, 1) dial 911, the local emergency response number, 2) the National Response Center at (800) 424-8802; or 2) call the Governor's Office of Emergency Services Warning Center, (800) 852-7550 (24 hours). As appropriate, contact other agencies including California Occupational Safety and Health Administration or the Regional Water Quality Control Board. All chemical spills shall be reported as soon as possible to the emergency site contact.
GEN-7	Waste Management	▪ Cover waste disposal containers securely at the end of every workday and during wet weather. ▪ Check waste disposal containers frequently for leaks and to make sure they are not overfilled. Never hose down a dumpster on a project site. ▪ Ensure that portable toilets have a secondary containment plan (e.g., a containment pan). ▪ Clean or replace portable toilets and inspect them frequently for leaks and spills. ▪ Dispose of all wastes and debris properly. Inorganic waste removed and dewatered waste material will be compiled at a material staging yard and taken to a permitted landfill, approved upland sediment disposal site, or at an approved reuse site in accordance with applicable State and federal regulations. Organic debris removed will be distributed in upland areas similar to the surroundings of where the material was removed from. Recycle materials and wastes that can be recycled (such as asphalt, concrete, aggregate base materials, wood, pipe, etc.). ▪ All raw construction materials and wastes will be removed from project sites following the completion of maintenance activities. Food-contaminated wastes generated during work shall be removed on a daily basis to avoid attracting predators to project sites. All temporary fences, barriers, and/or flagging shall be completely removed from project sites and properly disposed of upon completion of maintenance activities. ▪ Midpen or its contractor will not dump any litter or construction debris within the project area. All such debris and waste shall be picked up daily and properly disposed of at an appropriate site. ▪ Dispose of liquid residues from paints, thinners, solvents, glues, and cleaning fluids as hazardous waste.

BMP Number	BMP Title	BMP Description
GEN-8	Vehicle Maintenance and Parking	▪ All vehicles must stay on designated roads paved and unpaved, and if it is necessary for a vehicle to travel off the designated road (paved or 2-track unpaved), a monitor will precede the vehicle to clear wildlife from the pathway of the vehicle. ▪ Designate an area, fitted with appropriate BMPs, for vehicle and equipment parking and storage. ▪ Perform major maintenance, repair jobs, and vehicle and equipment washing off site. ▪ Conduct vehicle and equipment cleaning at appropriate maintenance yards and ensure that rinse water does not run into gutters, streets, storm drains, or surface waters. ▪ Keep an ample supply of spill clean-up materials near fueling sites and vehicle maintenance and hazardous materials/hazardous waste storage areas. Inventory clean-up materials monthly and restock as needed. ▪ Post proper fueling and spill clean-up instructions at fueling areas. Never leave the area while equipment is being filled. ▪ Recycle or dispose of fluids as hazardous waste. ▪ Do not clean vehicle or equipment on-site using soaps, solvents, degreasers, steam cleaning equipment, etc. ▪ Perform vehicle and mobile equipment steam cleaning, pressure washing or degreasing only over a containment designed to collect any generated wash water. Collect wash water and properly dispose of wastewater.
GEN-9	Equipment Maintenance & Fueling	▪ Staging and storage areas for equipment, materials, fuels, lubricants and solvents shall be located away from the wetted areas. Stationary equipment such as motors, pumps, generators, compressors and welders, located within or adjacent to the creek shall be positioned over drip-pans. ▪ Any equipment or vehicles driven and/or operated adjacent to a Water of the State and/or U.S. will be checked and maintained daily to prevent leaks of materials that if introduced to water could be deleterious to aquatic life, wildlife or riparian habitat. Vehicles must be moved away from the watercourse prior to refueling and lubrication. ▪ Refueling of equipment will be conducted at least 150 feet away from streams and other waterbodies using heavy-gauge tarps made of chemically resistant polypropylene or other impervious material with vertical sides for spill containment. These containment tarps will be set up under the equipment prior to servicing or refueling. Once the work is completed, the tarp and its contents must be immediately removed from the property and all contaminants properly disposed of off-site. Standard operating procedures will be implemented immediately in case of fuel spillage. ▪ All vehicles entering the site will carry a functional fire extinguisher.

BMP Number	BMP Title	BMP Description
		▪ Equipment should not be stored in areas that will potentially drain to watercourses or drainage facilities. If equipment must be stored in areas with the potential to generate runoff, drip pans, berms, gravel bags, or absorbent booms should be employed to contain any leaks or spills. ▪ In the event of a spill, follow procedures outlined in BMP GEN-6.
GEN-10	Paving and Asphalt Work	▪ Avoid paving and seal coating in wet weather or when rain is in the forecast, to prevent materials that have not cured from contacting stormwater runoff. ▪ Cover adjacent storm drain inlets and manholes when applying seal coat, tack coat, slurry seal or fog seal; and when saw cutting asphalt or concrete. ▪ Collect and recycle or appropriate dispose of excess abrasive gravel or sand. Do not sweep this material into gutters. ▪ Do not use water to wash down fresh asphalt concrete pavement. ▪ Use filter fabric, catch basin inlet filters, or gravel bags to keep slurry out of the storm drain system. ▪ Shovel, absorb or vacuum saw-cut slurry and dispose of all waste as soon as work is complete in one location or at the end of the workday. ▪ If sawcut slurry enters a catch basin, clean it up immediately.
GEN-11	Concrete, Grout and Mortar Application	▪ Store concrete, grout, and mortar away from storm drains or waterways, and on pallets under cover to protect them from rain, runoff and wind. ▪ Wash out concrete equipment/trucks offsite or in a designated washout area, where the water will flow into a temporary waste pit, and in a manner that will prevent leaching into the underlying soil or onto surrounding areas. Let concrete harden and dispose of as garbage. ▪ When washing exposed aggregate, prevent wash water from entering storm drains. Block any inlets and vacuum gutters, hose wash water onto dirt areas, or drain onto a bermed surface to be pumped and disposed of properly.
GEN-12	Exclude Concrete from Channel	▪ For Program activities that involve concrete pouring, Midpen shall ensure that poured concrete be excluded from the wetted channel for a period of 30 days after it is poured. During that time, the poured concrete shall be kept moist, and runoff from the concrete shall not be allowed to enter a stream. Containment structures should be installed to control the placement of wet concrete and to prevent it from entering the channel outside of those structures.

BMP Number	BMP Title	BMP Description
		▪ Commercial sealants may be applied to the poured concrete surface where difficulty in excluding water flow for a long period may occur. If sealant is used, water shall be excluded from the site until the sealant is dry. ▪ No dry concrete shall be placed on the banks or in a location where it could be carried into the channel by wind or runoff.
GEN-13	Concrete Washout Facilities	▪ Concrete washout facilities should be established for Program activities that require on-site preparation and use of Portland cement concrete, asphalt concrete or cement mortar, establish concrete washout facilities. These facilities capture wash water, concrete and aggregate flushed from concrete mixers, chutes, etc. Concrete washouts may be contained settling basins dug into the ground, raised and contained structures, trailers, etc. They are also applicable for projects that require equipment washouts. ▪ An appropriate area for the washout must be identified at least 50 feet away from watercourses and storm drains in case of accidental breaching. The storage capacity of the basin must be sized correctly for the job. <u>Construction Guidelines:</u> ▪ The location of the concrete washout should be clearly labeled and all employees should be educated about proper concrete disposal. ▪ Avoid mixing excess amounts of fresh concrete or cement mortar on-site. ▪ Wash out concrete mixers only in designated washout areas where the water will flow into temporary sealed basins or onto stockpiles of aggregate base or sand. Use as little water as possible to reduce hardening and evaporation time of waste products. ▪ Construct a basin large enough to contain all liquid and waste concrete materials generated during washout procedures. A minimum basin size is 9 feet x 9 feet and 2 feet deep. Plastic liner materials shall be a minimum of 60-mil polyethylene sheeting free of holes and defects. ▪ Recycle washout by pumping back into mixers for reuse when possible. <u>BMP Maintenance:</u> ▪ The concrete washout should be checked frequently to ensure proper use and effectiveness. ▪ At 75% capacity, the washout must be cleaned or new facilities must be constructed and ready for use. <u>BMP Removal:</u> ▪ The hardened concrete and materials related to the washout must be broken up, removed, and disposed of in accordance with local regulations.

BMP Number	BMP Title	BMP Description
		▪ Area disturbed by the concrete washout must be repaired.
GEN-14	Painting and Paint Removal	▪ Never clean brushes or rinse paint containers into a street, gutter, storm drain, or stream. ▪ For water-based paints, paint out brushes to the extent possible, and rinse into a drain that goes to the sanitary sewer. Never pour paint down a storm drain. ▪ For oil-based paints, paint out brushes to the extent possible and clean with thinner or solvent in a proper container. Filter and reuse thinners and solvents. Dispose of excess liquids as hazardous waste. ▪ Paint chips and dust from non-hazardous dry stripping and sand blasting may be swept up or collected in plastic drop cloths and disposed of as trash. ▪ Chemical paint stripping residue and chips and dust from marine type paints or paints containing lead, mercury, or tributyltin must be disposed of as hazardous waste. Lead based paint removal requires a state-certified contractor.
GEN-15	Dust Management Controls	Midpen will implement the Bay Area Air Quality Management District (BAAQMD) Basic Dust Control Measures. Current measures stipulated by the BAAQMD Guidelines include the following: 1. All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day. 2. All haul trucks transporting soil, sand, or other loose material off-site shall be covered. 3. All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited. 4. All vehicle speeds on unpaved roads shall be limited to 15 miles per hour (mph). 5. All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used. 6. Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]). Clear signage shall be provided for construction workers at all access points. 7. All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified visible emissions evaluator.
GEN-16	Site Stabilization	Earthwork will be completed as quickly as possible, and where practical, site restoration will occur immediately following Program activities. If site restoration involves planting, such activities may commence in late fall or early winter during the onset of rainy season.

BMP Number	BMP Title	BMP Description
		▪ Bare soil surfaces resulting from maintenance and/or construction activities shall be covered with suitable erosion controls (seed or plant vegetation, fabrics, hydroseeding, mulch, etc.): – Within 12 hours of any break in work unless Program activities will resume within 7 days. – No later than 3 days following the disturbance during the rainy season (approximately October through April). – No later than 7 days following the disturbance during the dry season (approximately May through September). – Every effort shall be made to immediately cover bare soil surfaces resulting from maintenance and/or construction activities prior to storms.
GEN-17	Fire Prevention	▪ All earthmoving and portable equipment with internal combustion engines will be equipped with spark arrestors. ▪ During the high fire danger period (May 1–November 30), work crews will: 1. Have appropriate fire suppression equipment available at the work site. 2. Keep flammable materials, including flammable vegetation slash, at least 10 feet away from any equipment that could produce a spark, fire, or flame. 3. Not use portable tools powered by gasoline-fueled internal combustion engines within 25 feet of any flammable materials unless a round-point shovel or fire extinguisher is within immediate reach of the work crew (no more 25 feet away from the work area). In high risk fire areas, operations involving mechanical equipment including flailing, masticating, disking, grading in heavy brush, operating a mower or brush cutter equipped with metal blades, welding, grinding, etc. or any other operation that could start a fire within or adjacent to any wildland areas will be conducted using the following protocols: ▪ Whenever possible, high risk activities in wildland areas will be conducted outside of the high fire danger period (May 1 through November 30). The high fire risk areas will be mowed early in the day when the fire risk is lower. ▪ No high-risk activities will occur within a red flag area during a red flag event or within 24 hours of a predicted red flag event as determined by the National Weather Service (*National Weather Service Monterey Office Website: http://www.wrh.noaa.gov/mtr/*) ▪ Before beginning high-risk activities, weather conditions will be monitored. Weather samples will be taken every 2 hours if the ambient temperature is below 80 degrees Fahrenheit. Weather samples will be taken hourly if ambient temperature is at or over 80 degrees Fahrenheit. If one of the following conditions occurs and the ambient temperature is at or over 80 degrees Fahrenheit, operations will be delayed or if one of these conditions occur while running equipment, all operations will cease immediately.

BMP Number	BMP Title	BMP Description
		– RH (relative humidity) is at 30 percent or lower. – Sustained wind speeds reach 10 mph or higher. ▪ If ambient temperature is at or over 95 degrees Fahrenheit, all high-risk activities will cease. ▪ Maintenance staff will also assess the surrounding wildland fire risk conditions and make a judgment regarding what would be threatened if a fire was started. Maintenance staff may choose to stop activity at a lower threshold than described above if it is determined to be a risk to life or property. ▪ If a fire district within Midpen boundaries recommends a moratorium on mowing due to conditions, Midpen will not mow within their jurisdiction unless Midpen has coordinated with the fire district and staff are operating within Midpen guidelines. <u>C. Operation</u> 1. Be aware of risks related to driving and parking in tall, dry grass—particularly with catalytic converters. 2. Have an "Action Plan" in mind if a fire starts and have an "Escape Plan" if it gets beyond your ability to control with suppression equipment on-hand. Plan how to communicate with nearby coworkers or others threatened by fire. 3. If possible, plan mowing operations so that prevailing wind will blow over areas that have already been mowed. If a fire starts, it will initially burn in mowed grass with a better chance of stopping the fire early. 4. Before starting *high-risk* operations using tractor mowers on District roads, a non-divertible pumper-equipped pickup will be assigned to the operation. An observer that is familiar with pumper operations; vehicle radio; must staff the truck. The employee acting as spotter will be in close proximity to *high-risk* operation. 5. Any deviation from having a pumper truck and spotter on site must be approved by Area Manager. 6. When operating a hand mower or small riding mower, staff must have one round point shovel with an overall length of at least forty-six (46) inches backpack pump water-type fire extinguisher available in the immediate area. 7. When on or near a wildland and operating stationary power equipment such as a generator, motor, welder, cutting torch, grinder or similar device from which a spark, fire, or flame may originate, all of the following are required (re: Public Resource Code (PRC) 4427): a. Clear away all flammable material around the area for a distance of 10 feet. b. Have one round point shovel with an overall length of at least forty-six (46) inches backpack pump water-type fire extinguisher available in the immediate area. 8. When operating chainsaws and other portable gas-powered tools in a wildland, one of the following is required for use within 25 feet of the area (re: PRC 4431):

BMP Number	BMP Title	BMP Description
		a. One round point shovel with an overall length of at least forty-six (46) inches or a fire extinguisher appropriate to provide fire control for the area and conditions. <u>D. Fueling</u> 1. When fueling equipment, allow it to cool where there is no flammable vegetation that can be ignited by the hot exhaust, preferably in a dirt area. 2. See Safety Manual Chapter 1.7.00 regarding fire prevention requirements and Sections 1.6.5.4 to 1.6.5.7 regarding safe fueling of equipment.
GEN-18	Project Completion by End of Work Period	No project shall be initiated unless there is high confidence it can be completed, including installation of any erosion and drainage control features, before the appropriate end of the work windows designated in BMP BIO-21, Salmonid Protection Measures. After September 15 of each year, projects that have not been started, or are still underway, or meet the conditions in BMP BIO-21 shall be evaluated to ensure they can be completed before the end of the applicable seasonal work window. Program activities in streams that support anadromy will occur beginning June 15. Program activities will be at least 50% complete by October 15 of any year, and will be completed by October 31 or before the first significant rainfall occurs. Those projects unlikely to be completed before the end of the seasonal work windows will not be started or will be winterized to be completed in the following year.
GEN-19	Avoid Inclement Weather	▪ The Midpen Project Manager will monitor the seventy-two-hour forecast from the National Weather Service (http://www.nws.noaa.gov and https://www.accuweather.com). When there is a forecast of more than 40% chance of rain, or at the onset of unanticipated precipitation, the Project Manager shall remove all equipment from the creek zone, shall implement erosion and sediment control measures, and all Program activities shall cease. ▪ No earth work shall occur during a dry out period of 24 hours after there has been ¼ inch or more of precipitation. ▪ If, in the opinion of Midpen, conditions arise or change, in such a manner as to be considered deleterious to the stream or wildlife, project activities shall cease until corrective measures are taken.
GEN-20	Aquatic Resource Protection Measures	▪ No equipment shall be operated within the active creek (i.e., wetted channel) except in perennial streams or during wet weather years in which the channel does not dry. In these instances, work will be scheduled during periods of low flow and must adhere to the dewatering BMPs (DW-1, DW-2, and DW-3).

BMP Number	BMP Title	BMP Description
		▪ Surveys for special-status species and monitors will normally not be required for small scale pond maintenance activities using hand tools and fewer than five persons per one half acre. Activities including mechanical dredging, excavating, and bulldozing for shoring up earthen berms or leveling spillways will require pre-activity visual surveys as well as monitoring during the activities. All pond repair and maintenance activity proposals involving mechanized equipment and associated monitoring proposals must be approved by the U.S. Fish and Wildlife Service (USFWS) prior to implementation. Surveys and monitors during the pond repair and maintenance activities will only be conducted by federal and state permitted biologists in accordance with their permits, or by monitors approved to work under the direction of permitted biologists.
GEN-21	Staged Materials Management and Excavation Ramps	▪ Midpen or their contractor will visually check all construction materials (bridges, pipes, culverts) for the presence of wildlife sheltering within them prior to the materials being moved and placed in their proper locations. ▪ Building materials or equipment will not be stored where they could be washed into the water or where they will cover aquatic or riparian vegetation. ▪ Open trenches or pits, at the end of each workday, will incorporate an escape ramp at each end of the open trench to allow any animals that may have become entrapped in the trench to climb out overnight. The ramp may be constructed of either dirt fill or wood planking or other suitable material that is placed at an angle no greater than 30 degrees. ▪ Building materials and/or construction equipment shall not be stockpiled or stored where they could be washed into the water or where they will cover aquatic or riparian vegetation.
GEN-22	Spoils Management	Spoils will not be placed where it could enter the stream, riparian or wetland areas. Spoil shall not be placed over riparian or wetland vegetation, unless approved by the Midpen Natural Resources Department.
GEN-23	Vegetation and Tree Removal and Retention	▪ Native soils, rock, gravel, vegetation, and vegetation will be retained to the extent feasible. Avoid removing/thinning the canopy layer in mature, established forests and woodlands to maximize shading (thereby promoting shade and related increased moisture under the canopy level) and increase resistance to non-native plant invasion. ▪ Vegetation will not be removed or intentionally damaged beyond the construction corridor or intended vegetation management area. ▪ Hand tools (e.g., trimmer, chain saw, etc.) will be used to trim vegetation to the extent necessary to gain access to the work sites. No bulldozers, backhoes, or other heavy equipment will be used to remove vegetation along streambanks or within the stream unless submitted to California Department of Fish and Wildlife (CDFW) during annual project notifications.

BMP Number	BMP Title	BMP Description
		▪ The disturbance or removal of vegetation will be restricted to the minimum necessary to complete maintenance activities. Precautions shall be taken to avoid other damage to vegetation by people or equipment. Branches and/or limbs overhanging the trails and channel and impacting trail access and water flows shall be properly pruned. Trees may be removed from natural channels if and only if they are below ordinary high water mark (OHWM) and they are restricting the capacity of the channel and they are causing erosion or flooding. Any trees which will be cut are to be cut at ground level and the root mass left in place to maintain bank stability. ▪ Woody and herbaceous plants, fallen trees, or trunks or limbs lodged in the bed or bank of stream channels causing flow restriction will be cut off at the bed or bank invert with small tools and removed with winch and cable or other equipment operated from top of bank. Root structures will not to be disturbed. ▪ Embedded pieces of large woody material or stumps that potentially serve as basking sites or that encourage pool formation shall be left in place if it does not obstruct the flow of water and there is adequate flood flow capacity. Objects embedded/anchored in the bank, such as tree stumps, shall not be removed during periods of heavy flow if removal would result in release of sediment into the channel. However, protruding objects that could capture additional debris and result in obstruction of the channel (e.g., the branches and trunk of a downed tree) may be trimmed. If an embedded object must be removed to prevent a debris jam, BMPs EC-1 and SWQ-3 will be used to prevent the release of sediment into the channel, and the bank shall be reseeded, revegetated, mulched and/or covered with erosion-control fabric following removal. ▪ The following measures would be implemented for tree removal in riparian areas: – Prior to removal, Midpen will conduct all necessary biological surveys in compliance with regulatory permits. – No living trees, shrubs, vegetation, or woody material greater than 6 inches dbh will be removed from within a stream. – All trees that provide canopy cover along the stream will be replanted with native species, unless they are removed for fuels treatment within an overstocked forest, as determined by a qualified ecologist, identified by CALFIRE, or identified as an Ecosystem Resiliency treatment area in the Wildland Fire Resiliency Program. Any trees not providing canopy cover of the stream do not need to be replanted. Native trees less than 6 inches dbh will not be replaced unless native regeneration is not occurring. – 75% of the existing canopy will be maintained over a stream at all times. – Non-native tree removal will not require replanting if the site is regenerating native vegetation.

BMP Number	BMP Title	BMP Description
GEN-24	Vegetation Management with Prescribed Burns	1. All burnings will be conducted according to prescriptions in the vegetation management plan, and burn developed specifically for the project by the California Department of Forestry and Fire Protection (CAL FIRE), or as otherwise described in the forthcoming Wildland Fire Resiliency Program. The fire will be ignited only if the conditions are within the parameters specified in the burn plan. Smoke dispersal, emergency response, safety, and contingency planning are addressed in the burn plan. Other habitat management activities (i.e., invasive plant removal and cattle grazing) may occur year-round if prescriptions are not likely to adversely affect San Francisco garter snake (SFGS) or California red-legged frog (CRLF). 2. All participants in the burn will be briefed on the endangered species potentially present, where they would likely be found, and who to contact if one is sighted. This briefing will be performed by the Resource Advisor, who is a biologist or cultural resource specialist with fire training. Resource Advisor will work with the ignition teams, and be a part of any ignition sequence planning. Resource Advisors will be in radio contact with either the Ignition Specialist or the Incident Commander directly to ensure quick communication and decision-making regarding the safety of sensitive wildlife. 3. No more than 350 acres (141.6 hectares) of habitat will be manipulated by prescribed fire per treatment period. An average 20-foot (6.1-meter) buffer will be established around all ponds prior to conducting prescribed burns, depending on the vegetative cover. Those shorelines with vegetation that provide cover for the snake will provide the greatest buffer, while those shore-lines without adequate vegetative cover will be given less buffer. These buffer areas may be managed using other habitat management techniques following each burn (e.g., cattle grazing), but are to remain completely undisturbed during prescribed fire events. Every reasonable attempt will be made to maintain 1/4 to 1/2 acre (0.1 to 0.2 hectare) of unburned area for every 10 acres (4 hectares) of burned habitat (i.e., 4 to 8 acres of refugia habitat are needed for a 160-acre burn, and 9 to 18 acres are needed for a 350-acre burn). When feasible, refugia areas will be conserved randomly throughout the treatment area, especially in areas with known populations of SFGS and CRLF. These refugia areas may be naturally occurring areas such as rock formations, ponds and other wetland/riparian areas, areas with a high density of burrows, and other areas not prone to burn, or these areas may be created and maintained using hand tools or water to create fire-breaks or wet-lines.

BMP Number	BMP Title	BMP Description
		4. No more than 24 hours prior to conducting prescribed fires, visual surveys will be conducted by walking transects throughout the proposed burn area in an attempt to locate individual SFGS and CRLF. A trained biologist or biological monitor will capture, transfer, and release in a safe area any SFGS and CRLF deemed to be in danger of being harmed by the prescribed fire activities. If SFGS or CRLF are located during the pre-treatment surveys but escape capture, an area approximately 50 feet (15 meters) in diameter around the individual will be protected from the burn. If necessary, individual SFGS may be held in captivity in a pillowcase for less than 24 hours and may later be released near the point of capture after the burn has been completed. The number of SFGS and CRLF encountered and transferred to safe areas or held in captivity during treatment will be reported to USFWS, and each individual SFGS will be photographed for use in identification. 5. All vehicles involved with the site-specific burn will be retained in a prearranged, marked parking area in a clearing as close to the main road as possible. At least one monitor will ensure wildlife is clear from the parking area while vehicles are arriving and leaving. All vehicles must stay on designated roads, and if it is necessary for a vehicle to travel off the designated main road, a monitor will precede the vehicle to clear wildlife from the pathway of the vehicle. Only biological monitors specifically authorized by the USFWS and CDFW to handle SFGS or CRLF (normally these will be individuals holding a federal recovery permit for the species) will be allowed to handle, transport, and relocate individuals of these species. 6. Below ground temperature monitoring will be conducted during the burn to monitor air temperatures in San Francisco garter snake refugia. One or more biologists or biological monitors will place "hobo thermocouples" (ground temperature monitoring devices) in rodent burrows throughout the burn area to monitor changes in temperature in the burrows as fire moves across the landscape. The knowledge gained will be useful in determining how to conduct future prescribed fires in San Francisco garter snake habitat in a manner that will minimize potential effects to the species. 7. Immediately following each prescribed fire, the permittee will search the affected post-treatment area to identify dead or injured individuals of all vertebrate taxa. Dead SFGS and CRLF will be salvaged and deposited at an approved repository. Injured individuals will be handled only by a permittee authorized to capture and handle SFGS and CRLF. Medical assistance will be provided to injured animals by a certified wildlife veterinarian familiar with amphibian and reptile care. 8. Ignition will be completed in less than three hours. The fine fuels should be consumed quickly and most coyote brush and grass thatch are expected to bum down within one hour after ignition. Some minor smokes may be evident for one day following the burn. Spot checks of the plot will be conducted until all smokes are out.

BMP Number	BMP Title	BMP Description
		9. A pond located to the northeast of the former Wool Ranch has been designated for fire use. Emergency response plans that identify designated water sources for fire use are being developed for all Midpen Preserves. Existing hydrants or fire storage tanks will be targeted first, and ponds that are known to support California red-legged frogs and other protected species will be utilized as a last resort in emergency situations. Midpen currently provides a patrol map book to fire agencies that has all water sources including water storage tanks mapped. In addition, Midpen Natural Resources staff maintains fire training in order to function as resource advisors to the Incident Commander in the event of a large wildland fire. If an emergency situation necessitates the use of water from a CRLF-occupied pond, a striker pump and intake hose may be used to draw water from one of the small wetland ponds in the burn area to fill engines or back pumps. The intake hose will be screened with 1/4-inch mesh to prevent intake of California red-legged frogs. The burn plan details the use of lake and ocean water to fill helicopter buckets to aid suppression efforts. If a helicopter bucket is used, it will draft from the center of the pond, to prevent uptake of California red-legged frogs that may potentially be present. 10. Within San Francisco garter snake habitat, post-burn monitoring will be conducted as part of the project and will include (1) vegetative response to the burn, (2) wildlife response to the burn, and (3) fire behavior and burn conditions. Because the burn is intended to enhance San Francisco garter snake habitat, the monitoring emphasis for vegetation and wildlife will be on the wildlife and habitat features that are considered to be necessary to support San Francisco garter snakes. The variables measured for San Francisco garter snake response to habitat are pre- and post-burn data on the (1) pre- and post-burn vegetation community in the burn area in order to determine vegetative response to the burn and (2) the frequency of valley pocket gopher (*Thomomys bottae*) burrows and other burrows. As part of its standard post-fire evaluation CALFIRE will provide an analysis of the burn, including how the fire responded to weather and other burn conditions, and percent coverage of the burn within the boundaries of the burn area. Beginning immediately after the burn the frequency (number) of rodent burrows will be measured during the vegetation transect monitoring. Vegetation monitoring will include the establishment of four transects within and three transects outside of the burn area for comparative analysis. Transects will be randomly established in burned and unburned areas and each transect will measure 50 meters in length. A meter-square plot will be established at five-meter intervals along the transects. Vegetative composition and percent cover for all plant species will be recorded for each plot. Transects sampling will take place prior to the burn and at least once per year after the burn for three years. Response of native and non-native grasses and coyote brush to the burn will be of particular interest. Data collected before, during, and after the burn, and the observations made during the evaluation of the burn will be compiled into a report within one year following the burn. Upon completion, the report will be submitted to USFWS.

BMP Number	BMP Title	BMP Description
GEN-25	Vegetation Management with Livestock	▪ Livestock will be used for vegetation management to avoid the use of chemical herbicides, to control invasive vegetation, and promote the growth of native vegetation. Where livestock is used in association with a specific routine maintenance project, vegetation removal will not exceed 2,000 square feet (0.05 acres) in size, 150 adjacent linear feet, or the minimum necessary to complete the operation, whichever is less, and livestock will be managed and prohibited from creating or worsening existing erosion and sedimentation to flowing stream channels. ▪ Monitor and protect ponds that provide habitat for special-status species, depending on the vegetative cover. Those shorelines with vegetation that provide cover for special-status species will provide the greatest buffer, while those shore-lines without adequate vegetative cover will be given less buffer. ▪ Monitor forage utilization and distribution by grazing animals to assure appropriate amounts of residual dry matter (RDM) remain on the ground to achieve desired resource management objectives. In the course of RDM monitoring, evaluate and report on wildland fire fuel levels that may result in an increased risk of wildland fire. ▪ Manage access to existing water features and where needed supply supplemental drinking water through stock ponds and water troughs to preserve clean water for livestock, protect water quality, and enhance habitat for wildlife.
GEN-26	Non-native Plant Removal and Herbicide Management	▪ Focus vegetation biomass reduction on non-native vegetation and avoid damaging native grasses, and mature shrublands and forests wherever possible. Where active treatment is needed, seek to break the vertical fuel ladder connection between the ground and the canopy layer, and create some horizontal physical separation between plants where possible. Prioritize projects where invasive plant removal alone can result in fire-safe landscapes. ▪ Implement fuel management projects with low impact tools and methods such as hand cutting and pruning rather than vegetation removal or soil disturbance with hand methods or machines. ▪ Prioritize leaving forest duff and organic soil layers undisturbed in all fuel management actions. ▪ For invasive pest management and hazardous fuel reduction activities: 1. Prior to conducting non-native (e.g., pampas grass) and native (e.g., cattail, cocklebur) plant removal or treatments (e.g., spraying with herbicide or fungicide, cutting, pulling, digging out), the permittee will make every reasonable attempt to ensure that SFGS and CRLF are not hidden within the plant or the residual plant matter to be treated. 2. All invasive plant and animal work will be done in accordance with the Midpen's other and Best Management Practices identified in the Midpen Integrated Pest Management Program.

BMP Number	BMP Title	BMP Description
		3. No burrow fumigants will be used. Only pesticides that are part of the Midpen Integrated Pest Management Program will be used, and only if they are used in accordance with the guidelines on the label and if they comply with the restrictions listed in the critical habitat designation. ▪ Midpen will choose site-specific strategies and times of treatment that provide the best combination of protecting preserve resources, human health, and non-target organisms and that are efficient and cost-effective in controlling the target invasive species. Direct the control method narrowly at the target organism to avoid broad impacts on the ecosystem. Modify control methods over time as site conditions and treatment techniques change. Use pesticides only where alternative methods are known to be ineffective. Apply pesticides in an environmentally safe manner. Take all reasonable precautions to protect the environment, the health and safety of employees, adjacent lands and preserve visitors. ▪ Midpen will comply with BMPs and other mandatory measures to protect sensitive resources and employee and public health during pesticide application. All appropriate laws and regulations pertaining to the use of pesticides and safety standards for employees and the public, as governed by the U.S. Environmental Protection Agency (USEPA), the California Department of Pesticide Regulation, and local jurisdictions will be followed. All applications will adhere to label directions for application rates and methods, storage, transportation, mixing, and container disposal. Midpen staff will coordinate with the County Agricultural Commissioners, and all required licenses and permits will be obtained prior to pesticide application. ▪ All pesticides will be implemented consistent with Pest Control Recommendations prepared annually by a licensed Pest Control Advisor. ▪ Midpen will maintain a minimum 30-foot buffer around special-status species habitats and a 15-foot buffer around all other aquatic and riparian habitats when applying pesticides, unless specially requested to work closer. ▪ All vegetation management activities that could result in the runoff of pesticides that are not registered for aquatic use into waters of the State and/or U.S. will be avoided. Only pesticides and adjuvants registered for aquatic use will be applied to aquatic areas or within the banks of channels. ▪ Only pesticides and adjuvants registered for aquatic use will be applied to aquatic areas or within the banks of channels. All conditions of the herbicide label will be followed. ▪ Surfactants and other adjuvants will be used and applied consistent with the District's Pest Control Recommendations. ▪ Avoid pesticide drift by not applying pesticides under windy conditions in close proximity to special-status species or their habitat, and by using plastic shields around target weeds and pests, ground-based applicators, low tank pressures and spray nozzles adjusted for larger droplet sizes and to limit the spray area.

BMP Number	BMP Title	BMP Description
		▪ Pesticide application will cease when weather parameters exceed label specifications, when wind at site of application exceeds 7 miles per hour, or when precipitation (rain) occurs or is forecasted with greater than a 40 percent probability in the next 24-hour period to prevent sediment and pesticides from entering the water via surface runoff. ▪ None of the following activities will be undertaken in aquatic or riparian areas: mixing, loading and storage of pesticides; rinsing of equipment and pesticide containers. All activities will take place at least 300 feet from aquatic or riparian areas. ▪ Refilling of pesticides will be required to occur at least 300 feet way from any body of water in a contained area and include a secondary containment plan. Any transfer or mixing on the ground shall be within containment pans or over tarps. ▪ A 30-foot buffer will also be maintained when applying pesticides unless previously approved by the regulatory agencies. ▪ Midpen staff, contractors, and tenants will undergo annual pesticide safety training. Pesticide applicators will have or work under the direction of a person with a Qualified Applicator License (QAL) or Qualified Applicator Certificate (QAC). Contractors and grazing and agricultural tenants may apply approved herbicides after review and approval by Midpen and under the direction of QAL/QAC field supervisors. ▪ Appropriate non-toxic colorants or dyes will be added to the pesticide mixture to determine treated areas and prevent over-spraying. ▪ The following general application parameters will be employed during pesticide application: – Spray nozzles will be configured to produce a relatively large droplet size; – Low nozzle pressures (30-70 pounds per square inch) will be observed; – Spray nozzles will be kept within 24 inches of vegetation during spraying; ▪ Signs will be posted notifying the public, employees, and contractors of the use of pesticides. The signs will consist of the following information: signal word, product name, and manufacturer; active ingredient; USEPA registration number; target pest; preserve name; treatment location in preserve; date and time of application; date which notification sign may be removed; and contact person with telephone number. Signs will generally be posted 24 hours before the start of treatment and notification will remain in place for 72 hours after treatment ceases, in compliance Midpen's Integrated Pest Management Program.

BMP Number	BMP Title	BMP Description
GEN-27	Snags	To the maximum amount practicable, individual dead or dying trees shall be retained, with modification if appropriate, as snags. This measure should not be considered to apply in areas where removal is warranted to control spread of a disease or for human safety purposes.
GEN-28	Culvert Replacement	▪ The following alternatives and structure types should be considered in order of preference: 1. Streambed simulation strategies - bottomless arch, embedded culvert design, or ford 2. Non-embedded culvert - this is often referred to as a hydraulic design, associated with more traditional culvert design approaches limited to low slopes for fish passage 3. Baffled culvert, or structure designed with a fishway - for steeper slopes. If a segment of stream channel where a crossing is proposed is in an active salmonid spawning area then only full span bridges or streambed simulations are acceptable. ▪ Replacement of any existing concrete, wood, plastic (ABS, HDPE etc.) or metal pipe culvert up to 48 inches inner diameter (unless authorized to be a larger diameter by CDFW) with the following restrictions: 1. Work will be done only when the channel is dry, except in perennial streams or during wet weather years in which the channel does not dry. In these instances, work will be scheduled during periods of low flow and must adhere to the dewatering BMPs (DW-1, DW-2, and DW-3). 2. The new culvert will typically be as large as or larger than the existing culvert unless the original culvert was oversized or a natural obstruction such as bedrock is encountered. For anything other than an ephemeral drainage, the culvert will be sized where feasible to convey a 100-year flow or cover the entire channel width. 3. Total earthwork will be limited to the extent necessary at each project to complete the work, and will not exceed 80 cubic yards per culvert. 4. The new culvert will be installed at or below grade.
GEN-29	Culvert Maintenance	▪ Culverts with recurring blockages are cleaned annually, regardless of the amount of blockage. Sediment, vegetation or debris will be removed using hand tools in creeks supporting salmonids, unless other methodology is submitted to CDFW in writing during annual project notifications. Sediment, vegetation or debris will be removed with mechanized equipment in creeks that do not provide habitat for salmonids where hand removal is infeasible. ▪ Culverts that are more than 1/3 blocked may be cleaned at any time, even during periods when the channel is wet, with the following restrictions: 1. Up to 32 cubic yards of material may be removed, using hand tools only, under any conditions.

BMP Number	BMP Title	BMP Description
		2. Removal of amounts greater than 32 cubic yards requires that the channel be dewatered first and heavy equipment may be used with written approval from CDFW. 3. The total cumulative area of disturbance will not exceed 150 feet of channel or 2,000 square feet of area, whichever is less. 4. After completion of the work, the disturbed area will immediately be treated with erosion control materials BMPs sufficient to control turbidity and sediment loss. 5. Nearby perched or otherwise unstable fill may be removed as well, up to 10 cubic yards. 6. No Coho salmon are present.
GEN-30	Culvert Removal and/or Replacement with Rolling Dips or Fords	▪ If the channel was created by the original emplacement of the culvert, any number may be removed. ▪ Culvert replacements will be installed at or below stream grade. Align the slope and gradient of replacement culverts that will discharge to a ditch, creek, or channel consistent with the direction of the receiving water course.
GEN-31	New Culvert Installation (non-stream crossings)	▪ The following alternatives and structure types should be considered in order of preference: 1. Streambed simulation strategies - bottomless arch, embedded culvert design, or ford 2. Non-embedded culvert - this is often referred to as a hydraulic design, associated with more traditional culvert design approaches limited to low slopes for fish passage 3. Baffled culvert, or structure designed with a fishway - for steeper slopes. If a segment of stream channel where a crossing is proposed is in an active salmonid spawning area then only full span bridges or streambed simulations are acceptable. ▪ Design new culverts to blend in with the surrounding environment and to not interfere with the movement of fish. ▪ Design and install new culverts in fish bearing streams to provide sufficient depth and velocity of water for passage of native fish and other native aquatic species during high and low flow conditions. ▪ Outside of stream crossings, new culverts may be installed to maintain existing roads and trails with the following restrictions: 1. New culverts will not be installed in streams but will be limited to engineered drainage ditches associated with roads and trails.

BMP Number	BMP Title	BMP Description
		2. If an existing road or trail has an inadequately drained inboard ditch (excessive length between existing ditch relief culverts or dips), new ditch relief culverts (where rolling dips would be insufficient) may be placed as directed by the project engineer to adequately convey stormwater and reduce sediment to downstream watercourses.
GEN-32	Bridge and Puncheon Replacement	▪ Removal, or replacement of any size bridge (including puncheons) in the same location, on any trail or road, where no channel entry is necessary, no work is proposed to in-channel abutments or supports and vegetation removal is limited to no more than a six (6) foot buffer around the existing bridge structure and to trimming of no more than 20% of any individual tree canopy within that six-foot buffer. ▪ Bridge replacement (not in the same location, such as higher on the bank or upstream/downstream) will be allowable if it reduces overall habitat impacts and/or removes the bridge completely from the stream bed, bank or channel (for example, a bridge for which the current bridge or footings are located below the OHWM) made longer to be placed above the OHWM. ▪ Removal, or replacement of any size bridge in the same location, with limited channel entry to place fabric or other devices to catch debris or place falsework, with the following restrictions: 1. Work may only occur when the channel is dry, except in perennial streams or during wet weather years in which the channel does not dry. In these instances, work will be scheduled during periods of low flow and must adhere to the dewatering BMPs (DW-1, DW-2, and DW-3). 2. Only very limited modifications to the channel surfaces are proposed. 'Very limited' means movement of rocks less than 8 inches in size, less than two hand shovels of earth, footprints and indentations caused by equipment and structures. Any modifications to correctly place falsework will occur to the falsework rather than the channel. 3. Vegetation removal is limited to no more than a six (6) foot buffer around the existing bridge structure and to trimming of no more than 20% of any individual tree canopy within that buffer. ▪ Removal, or replacement of smaller bridges (up to six [6] feet width) on trails, as long as work is completed when the channel is dry or during periods of low flow (for perennial streams) and must adhere to the dewatering BMPs (DW-1, DW-2, and DW-3). The bridge will be supported on mudsills or abutments placed outside of the channel.
GEN-33	Bridge and Puncheon Repair and Maintenance	Repair and maintenance of bridge (including puncheon) parts and grading for drainage correction on the approaches will implement the following conditions: 1. All work shall be done from the bridge or by workers standing in the channel or on a ladder in the channel.

BMP Number	BMP Title	BMP Description
		2. A net or other device (e.g., diaper, underlayment) shall be attached to the underside of the bridge to catch any debris falling from bridge. 3. Pressure treated lumber shall be sealed and coated off-site. Sealants shall be approved by Midpen Natural Resources Department prior to their incorporation into the bridge. Tread material shall not be pressure treated to prevent leaching and breakdown of pressure treated materials into the waterway. 4. Only minor saw work and drilling shall occur; the primary work shall occur off site. 5. Grading on the approaches is limited to a maximum of five (5) cubic yards per bridge. This amount is not cumulative with the culvert replacement standard of five (5) cubic yards.
GEN-34	Ford and Swale (including Drain Lenses and Causeways) Replacement	Full replacement of existing fords or repair/maintenance by replacing rock and removing sediment and woody debris with the following restrictions: 1. No use of chemicals, concrete, mortar or other sealants or adhesives. 2. This category applies only to narrow width trails and emergency vehicle/multi-use trails where the drainage does not support salmonids. 3. The ford is not on an intermittent or perennial drainage or, if it is, the ford has been confirmed by CDFW to not be considered a barrier to the movement of aquatic organisms. 4. Vegetation removal is limited to no more than a five-foot buffer around the existing ford and to trimming of no more than 20% of any individual tree canopy within the five-foot buffer only. 5. All work shall be done when the channel is dry, except in perennial streams or during wet weather years in which the channel does not dry. In these instances, work will be scheduled during periods of low flow and must adhere to the dewatering BMPs (DW-1, DW-2, and DW-3).

BMP Number	BMP Title	BMP Description
Biological Resource Measures		
BIO-1	Environmental Awareness Training	Prior to commencing maintenance activities in a given year, all participating maintenance personnel will attend a worker environmental awareness training program. The training will include a brief review of special-status species, sensitive habitats, and other sensitive resources that may exist in the project area, including species identification, habitat requirements, procedures to follow when encountering any species in the work area, and the legal status and protection of each relevant species, penalties for take, work restrictions, as well as locations of sensitive biological resources. The training will include materials concerning the following topics: sensitive resources, resource avoidance, permit conditions, and possible consequences for violations of State or federal environmental laws. The training will cover the maintenance activity's conservation measures, environmental permits, and regulatory compliance requirements, as well as the roles and authority of the monitors and biologist(s). It will include printed material (with photos of San Francisco garter snake and California red-legged frog) and an oral training session by a qualified biologist or biological monitor.
BIO-2	Biological Monitor	▪ A **qualified biologist** is an individual who has a minimum of five (5) years of academic training and professional experience in biological sciences and related resource management activities, with a minimum of two survey seasons years (e.g., two seasons during the blooming season of sensitive plants) conducting surveys for each species that may be present within the Project area. ▪ A **biological monitor** is an individual who has academic and professional experience in biological sciences and related resource management activities, experience with construction-level biological monitoring, be able to recognize species that may be present within the Project area, and be familiar with the habits and behavior of those species. ▪ The biological monitor(s) or qualified biologist(s) shall have the responsibility and authority of stopping the proposed project if any crews or personnel are not complying with regulatory permit conditions. The biological monitor or qualified biologist will possess necessary agency approvals and/or regulatory permits required for project work, dependent on the location and potential to encounter special-status species, prior to the initiation of Program activities. The biological monitor or qualified biologist will have stop-work authority over Program activities to avoid take or impacts to special-status species or protected biological resources. ▪ To maintain safety and limit any chance of take or habitat disturbance, a simple system of hand signals will be established for the monitors, truck drivers, equipment operators, and field personnel to use during habitat enhancement and related activities.

BMP Number	BMP Title	BMP Description
BIO-3	Work Area Designation	Prior to Program activities in suitable habitat for special-status species, a biological monitor or qualified biologist shall clearly mark/flag or erect temporary construction fencing to designate the work area and to delineate the areas that shall be avoided. The boundaries shall be inspected on a regular basis to ensure that work has remained within the marked boundaries. If one or more boundary(ies) has/have been violated, work shall cease until the Midpen Project Manager has taken action to ensure there is no recurrence of the trespass. Flagging and/or temporary construction fencing shall be removed immediately after the completion of construction work.
BIO-4	Special-Status Plant Species Avoidance Measures	This measure includes, but is not limited to, Mt. Hamilton fountain thistle (MHFT), western leatherwood (WL), Loma Prieta hoita (LPH), San Francisco popcorn flower, Santa Clara Valley dudleya, and Congdon's tarplant (CT). The following rare plant avoidance measures will be implemented within riparian habitat or Waters of the State and/or U.S. and within one-quarter (1/4) mile of a known rare plant occurrence, or within suitable rare plant habitat but where rare plants are not known to occur: ▪ Prior to the start of Program activities, a qualified biologist will conduct protocol level surveys for sensitive plant species. For information on special status plant survey methodology visit: – https://cnps.org/wp-content/uploads/2018/03/cnps_survey_guidelines.pdf – https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=18959&inline – https://www.fws.gov/ventura/docs/species/protocols/botanicalinventories.pdf ▪ If at any time MHFT, LW, LPH, popcorn flowers, CT or other rare plant species is found, it will be flagged for avoidance and site-specific avoidance buffers, developed through coordination with CDFW, will be implemented. Rare plants and associated buffer zones shall be avoided during Program activities. ▪ If at any time, MHFT, LW, LPH, CT, or popcorn flower cannot be avoided, Program activities will not be conducted until Midpen coordinates with CDFW and mitigation plan is agreed upon.
BIO-5	Sensitive Natural Communities	Sensitive Natural Communities of plants occur throughout Midpen's lands, but are not well mapped as distinct areas from other vegetation types, and some are too small of scale to accurately map. Many of Midpen's activities will have no effect on the communities (such as grading an existing road). The following measure will take place before vegetation projects covered by the program occur: ▪ During treatment of vegetation within a CDFW designated sensitive natural community, treatments will be implemented to maintain the membership rules of the natural community. Characteristic species will be preferentially retained over other species to maintain the structure and composition consistent with current membership rules for the subject community based on the Manual of California Vegetation Online."

BMP Number	BMP Title	BMP Description
BIO-6	Invasive Plant Material Management and Disposal	▪ All staff, contractors, and volunteer crew leaders will be properly trained to prevent spreading weeds and pests to other sites. Midpen staff will appropriately maintain facilities where tools, equipment, and vehicles are stored free from invasive plants. Midpen staff will inspect rental equipment and project materials (especially soil, rock, erosion control material, and seed) to confirm as much possible that they are free of invasive plant material before their use at a worksite. ▪ All personnel working in infested areas will take appropriate precautions to not carry or spread weed seed outside of the infested area. Such precautions will consist of, as necessary based on site conditions, cleaning of soil and plant materials from tools, equipment, shoes, clothing, or vehicles before entering or leaving the site. ▪ Develop and implement an employee and contractor training program; include aquatic invasive plant identification and cleaning protocols for clothing, tools, vehicles, and boats. Prevent the spread of plant fragments (roots, stems) of certain species that can produce new plants in ditches, canals, and streams. ▪ Construction equipment will arrive at project sites clean and free of soil, seed, and plant parts to reduce the likelihood of introducing new weed species. Invasive weed species occurring within locations of construction clearing and grubbing shall be flagged for removal by the biological monitor or qualified biologist. These species, along with associated duff and topsoil, as appropriate, shall be disposed of by the contractor. These materials shall not be allowed to be integrated with other onsite topsoil materials intended for salvage and replacement. ▪ Target control of invasive species that rank high in the IPM prioritization matrix ▪ When transporting invasive plant material offsite for disposal, the plant material will be contained in enclosed bins, heavy-duty bags, or a securely covered truck bed. All vehicles used to transport invasive plant material will be cleaned after each use. ▪ Suitable onsite disposal areas shall be identified to prevent the spread of weed seeds. Invasive plant material shall be rendered nonviable when being retained onsite. Midpen staff shall desiccate or decompose plant material until it is nonviable (partially decomposed, very slimy, or brittle). Depending on the type of plant, disposed plant material can be left out in the open as long as roots are not in contact with moist soil, or can be covered with a tarp to prevent material from blowing or washing away. Midpen staff will monitor all sites where invasive plant material is disposed onsite and treat any newly emerged invasive plants. ▪ Inspect recreational facilities (e.g., parking lots, trails, visitor centers) that experience high visitor use often during target invasive plant flowering and seed production times.

BMP Number	BMP Title	BMP Description
BIO-7	Sudden Oak Death and Plant Pathogen Control	▪ All personnel working in infested areas will take appropriate precautions to not carry or sudden oak death (SOD)-associated spores or other plant pathogens outside of the infested area. Such precautions will consist of, as necessary based on site conditions, cleaning of soil and plant materials from tools, equipment, shoes, clothing, or vehicles before entering or leaving the site. ▪ Track the effects of sudden oak death (Phytophthora sp.) (SOD) disease (mapping dead oaks as staffing and budgeting permit), and share this information with the California Oak Mortality Task Force (www.suddenoakdeath.org) as staffing and funding allow. ▪ Removal of California bay trees or their branches within 15 feet of the trunks of high value oaks. Ongoing research at Midpen and other locations in the state are evaluating whether bay removal is effective for managing larger stands or forests infested with SOD or to prevent or slow down the spread of SOD. This option is costly and requires regular maintenance and monitoring and, therefore, is implemented in limited areas. ▪ For individual high value oaks such as very large mature oaks near picnic facilities, consider spot treatment of individual oaks with pest control sprays (e.g., Agri-FosTM) intended to reduce potential for SOD infection.
BIO-8	Non-Native Animal Control	▪ Midpen will attempt to trap non-native turtles and remove them in compliance with CDFW when they share habitat with protected, native species. Midpen will attempt to trap restricted turtles and remove them in compliance with CDFW regulation. ▪ Midpen will continue to capture feral pigs using baited traps and employ humane euthanasia in compliance with CDFW regulations and the Animal Welfare Act. ▪ Midpen will employ public education signage and/or brochures to prevent the intentional release of non-native or feral animals on Midpen lands and feeding of wildlife. Education can be an important tool for Midpen in preventing pets from being intentionally released onto Midpen lands. Public outreach and judiciously placed educational materials such as signs and brochures in Midpen preserves may be a useful strategy to curb intentional releases of animals. ▪ Midpen will continue eradication efforts of non-native fish and bullfrogs compliant with CDFW regulations and the Animal Welfare Act. Eradication of invasive animals (e.g., non-native fish, bullfrogs) by shooting, trapping, or gigging for the purpose of reducing predation on or competition with CRLF, must be authorized in writing by the Sacramento USFWS Office prior to conducting removal activities. Shooting, trapping, and gigging of aquatic species will be conducted only by a qualified biologist with experience in the identification of frog and turtle species. Inadvertently trapped California red-legged frogs will be released immediately upon discovery.

BMP Number	BMP Title	BMP Description
		▪ Prohibit contractors, consultants, staff and tenants from feeding feral domestic pets on Midpen property. Develop education programs to encourage the public not to feed wildlife or feral animals on Midpen property. ▪ Ensure outside garbage cans and dumpsters have tight-fitting lids to prevent foraging on human food waste. This is especially important in public gathering areas in parks and open spaces. Cans with domed lids and self-closing, hinged lids are preferred in these outside areas. ▪ Store native seeds, hay, and other vegetation-based materials that can attract animals in properly sealed containers or designated sealed storage facilities. ▪ Store all food properly, in containers with tight fitting lids, or in the refrigerator or freezer. ▪ Do not leave pet food in open bowls overnight. Wash pet food bowls immediately after feeding
BIO-9	General Wildlife Protection Measures	▪ Biological monitors will check for any reptiles, amphibians, or other animals under vehicles and equipment parked for more than 30 minutes. ▪ Vehicles traveling to and from the project sites off of established ranch roads must travel slowly (5 mph) and be preceded by a monitor to ensure that wildlife will not be run over by the passing vehicle. Vehicle monitors need not be trained biologists. ▪ Midpen generally limits the use of exclusion fencing for special-status species to limit habitat disruption and entrapment potential. Midpen more commonly uses exclusion fencing around stockpiled materials or directional fencing to move wildlife away from the worksite. Midpen rarely fences a full work site. ▪ Biological monitors/biological handlers will monitor sites for special-status species and if handling is permitted/authorized, they may relocate the special-status species or halt/modify work to avoid the special-status species as it passed through the active work site. ▪ If a fence is used and if special-status species are found in routine maintenance activity sites using large equipment to remove sediment, they will be excluded from the project site. USFWS and/or CDFW-approved exclusion fencing shall be installed around the sediment removal sites, staging areas and any areas where fill may be dumped. After installation of the fence barrier, a biological monitor or qualified biologist shall inspect the project work area daily, staging and stockpiling areas prior to the commencement of activities. Exclusion fencing will be placed, at a minimum, around the immediate work area where machinery will be operating. During activities involving mechanized equipment, biological monitors will maintain exclusion fencing and evaluate work performed during pond activities. Monitors are required to temporarily stop any work that they believe may harm the San Francisco garter snake or California red-legged frog. Work will not resume until a satisfactory method is agreed upon to minimize take of the snake or frog.

BMP Number	BMP Title	BMP Description
		▪ If the biological monitor or qualified biologist determines that sensitive species are not within the work area, equipment or materials may be moved onto the work site and Program activities may commence under the observation of the biological monitor.
BIO-10	Special-status Species Reporting	▪ Information on new localities for special-status species (e.g., SFGS, CRLF, Loma Prieta hoita) will be reported to the Sacramento USFWS Office and the California Natural Diversity Database (CNDDB) annually. ▪ Any incidental capture, injury or mortality of a federally or state listed species, with the exception of "fully protected" species which are not to be harassed, pursuant to the conditions of federal and State permit conditions shall be recorded and reported in the annual report submitted to the applicable agencies.
BIO-11	San Francisco Garter Snake Protection Measures	▪ Within riparian habitat or Waters of the State and/or U.S. and one (1) mile of a known SFGS occurrence: 1. Program activities will be conducted consistent with permit terms and conditions of the current versions of the USFWS Recovery Permit Number: TE225974-2 and CDFW Memorandum of Understanding "Research and Recovery of San Francisco Garter Snake and California Tiger Salamander". ▪ In suitable habitat where SFGS has not been documented: 1. A biological awareness training will be provided by a qualified biologist or biological monitor to all persons prior to beginning work. A biological monitor shall remain onsite in sensitive areas identified during the pre-survey. If at any time a SFGS is observed, work shall stop immediately until a biological monitor is contacted. Biological monitor(s) and/or qualified biologist(s) shall remain on the project site while initial ground disturbing activities are being conducted, after which biological monitor(s) and/or qualified biologists shall be on-call while Program activities are being conducted at these sites. 2. Vegetation Removal by Mechanized Equipment. For vegetation removal on berms around ponds or other areas within or adjacent to wetted/perennial aquatic sites, if vegetation is too tall or dense to allow adequate detection of SFGS, one of two approaches will be used to minimize the potential for impacts to individuals: – Vegetation will be mown with the blade set at least 6 inches above the ground. A qualified biologist or biological monitor will walk ahead of the mower to look for SFGS and will ensure that no impacts to individuals occur. – Vegetation will initially be cut down to three (3) inches by hand tools (weedwhacker, etc.). Once the ground is visible, a visual survey for SFGS will be conducted by a qualified biologist or biological monitor. If no sensitive species are found in the area, removal of vegetation may continue by mowing or mechanized equipment very slowly with a biological monitor walking in front of the equipment present to observe.

BMP Number	BMP Title	BMP Description
		3. If vegetation is short or sparse enough that any SFGS present can be detected by the qualified biologist biological monitor without the need for removal of vegetation by hand tools, mowing can proceed after the biologist/monitor has thoroughly surveyed the areas to be mown. If a SFGS is observed, all activities shall cease and Midpen will coordinate with CDFW immediately. Prior to the start of work, areas will be identified by the biological monitor-in-charge and approved by the USFWS and CDFW as acceptable locations to which SFGS may be relocated if these species are encountered within a work area. Relocation areas will be a minimum of 500 feet from the boundary of any work area and will not include staging areas or roads. No SFGS will be removed from the site or maintained in captivity overnight without prior notification and written approval by the USFWS and CDFW unless the animal is in need of emergency medical assistance. Medical assistance will be provided to injured animals by a certified wildlife veterinarian familiar with amphibian and reptile care. When transporting individual SFGS, precautions will be taken to ensure that the animals are not over-stressed and are maintained in safety. Such measures include keeping animals in a cool, dark, and safe location (snake bag for SFGS), providing adequate hydration, maintaining a stable cool temperature to avoid over-heating, keeping animals isolated to prevent them from harming one another, and ensuring holding tanks or bags are kept clean to prevent the spread of any diseases. 4. If feasible, mowing will not be conducted during the most active periods for SFGS (mid-March to mid-June and September-October) in areas where SFGS are known to occur. 5. No Stockpiling of Vegetation. Vegetation removed shall be placed directly into a disposal vehicle and removed from the site. Vegetation shall not be piled on the ground unless it is later transferred, piece by piece, under the direct supervision of the biological monitor or qualified biologist or is going to remain on site for erosion control or slash and not be moved or disturbed. ▪ All practicable measures will be taken to avoid killing or injuring SFGS during habitat enhancement activities. Any project-related, human caused injuries to SFGS will be reported to CDFW and USFWS.

BMP Number	BMP Title	BMP Description
		▪ No more than 24 hours prior to conducting pond enhancement activities, visual surveys will be conducted by walking at least a 50-foot buffer area around the pond in an attempt to locate individual SFGS. A trained and permitted biologist will capture, transfer, and release in a safe area any SFGS deemed to be in danger of being harmed by the prescribed enhancement activities. If a SFGS is located during the pre-treatment surveys but escapes capture, the area where the snake was lost will be marked by flag and a 50-foot (15 meter) radius will be actively patrolled during the work. If necessary, individual SFGS may be held in captivity in a pillowcase for less than 24 hours and may later be released near the point of capture after the work has been completed. After the pre-treatment survey, an avoidance strategy will be devised and presented to all individuals involved in the pond enhancement prior to starting any activities. The number of SFGS encountered and transferred to safe areas or held in captivity during treatment will be reported to USFWS, and each individual snake will be photographed for use in identification. ▪ The minimum number of qualified biological monitors required at each pond site will be determined in advance by a qualified biologist based on pond size, the amount and complexity of work to be performed, and the equipment to be used. This number of monitors will be approved by USFWS prior to the start of any work. ▪ Corridors for travel of vehicles and heavy machinery to the pond site will be established at least 24 hours in advance of the proposed work. Corridors that are not established marked improved roads (paved or unpaved) require special consideration for use by any vehicle. During the use of these off-road corridors by vehicles and machinery, a monitor will proceed directly before the vehicle or machinery to ensure all SFGS and observable wildlife is cleared from the pathway of the oncoming vehicle. Monitors will signal vehicles to stop if a SFGS is on the pathway, and will allow the animal to clear the pathway by its own direction. Any handling of the garter snake must only be done by a qualified permitted individual. Measures will be taken to minimize the number of vehicles allowed on the property. All vehicles involved with the site-specific work that are not transported to the work site will be retained in a prearranged, marked parking area in a clearing as close to the main road as possible. At least one monitor will ensure wildlife is clear from the parking area while vehicles are arriving and leaving. All vehicles must stay on designated roads.

BMP Number	BMP Title	BMP Description
BIO-12	California Red-Legged Frog Protection Measures	<u>General Measures</u> ▪ Handling of CRLF will be done by permitted and qualified biologists or biological monitors in an expedient manner with minimal harm to the individuals being handled. Handling of CRLF will be done with wet hands. The hands and arms of all workers handling CRLF will be free of lotions, creams, sunscreen, oils, ointment, insect repellent, or any other material that may harm CRLF. Larval CRLF will not be handled out of the water for longer than 30 seconds unless rewetted, and will not be retained for longer than 5 minutes for processing. If captured CRLF exhibit signs of distress (e.g., lack of response to stimuli or erratic behavior), they will be immediately released at the point of capture. All captured CRLF will be released at the point of capture unless that location puts them in imminent danger, in which case they will be placed in a nearby refugium sufficient to protect them. The number of CRLF to be captured is no more than 30 adults per habitat location per year. No egg masses may be disturbed or injured in any manner for any activity authorized in the USFWS take permit. Amplexing pairs of CRLF will not be captured, handled, or disturbed. The permittee will disinfect sampling and field gear to minimize the spread of pathogens as follows: 1. Sampling and field gear will be disinfected after exiting one aquatic habitat and before entering the next aquatic habitat unless the waters are hydrologically connected to one another. 2. All organic matter will be removed from nets, traps, boots, vehicle tires and all other surfaces that have come into contact with water or potentially contaminated sediments. These items will then be rinsed with clean water before leaving each study site. 3. Boots, nets, traps, hands, etc., will be scrubbed with a bleach solution (0.5 to 1.0 cup per 1.0 gallon of water), Quat-128™ (1:60), or a 3 to 6 percent sodium hypochlorite solution and thoroughly rinsed clean with water between study sites. Equipment will be rinsed clean with water between study sites. Cleaning equipment in the immediate vicinity of aquatic habitats will be avoided (e.g., clean in an area at least 100 feet from aquatic features). Care will be taken so that all traces of the disinfectant are removed before entering the next aquatic habitat. 4. Used cleaning materials (liquids, etc.) will be disposed of safely, and if necessary, taken back to the lab for proper disposal. Used disposable gloves will be retained for safe disposal in sealed bags. 5. CRLF will not be removed from the wild and held in captivity for any reason unless prior written approval is acquired by the appropriate USFWS Office or unless the severity of an injury to the CRLF obviates immediate care. Animals will be transported according to accepted methods, in moist cloth bags or in terrarium with moisture gel or non-cellulose sponge to minimize desiccation.

		Holdings where California Red-Legged Frogs have a Lower Density/Lower Frequency of Occurrence (Tier 2A) For maintenance activities that occur within preserves, easements, and management areas with a lower density/lower frequency of occurrence of California red-legged frogs, Midpen will implement the Tier 2A BMPs described below to avoid and minimize impacts on individual California red-legged frogs. Tier 2A BMPs ▪ Biological awareness training shall be provided to all maintenance personnel prior to beginning work. ▪ During all work, Midpen maintenance personnel (who are well-trained on the biology of California red-legged frogs, appropriate avoidance measures, and procedures to follow when they are encountered) will keep an eye out for California red-legged frogs and contact the Midpen biologist immediately if a California red-legged frog, or an individual that could potentially be a California red-legged frog, is observed. ▪ If an animal believed to be a California red-legged frog is detected during maintenance activities, those activities that could potentially affect the animal will cease until the frog is confirmed to have left the work area on its own, or until a qualified biologist or biological monitor visits the site to determine whether it is a California red-legged frog and whether it is in harm's way from the activity. If so, avoidance and minimization measures will then be implemented as described below for Tier 2B activities below, and Midpen will re-evaluate the likelihood of occurrence of California red-legged frogs in the work area vicinity for future Program activities. Any project-related, human-caused injuries to California red-legged frogs will be reported to USFWS and CDFW. Holdings where California Red-Legged Frogs have a Higher Density/Higher Frequency of Occurrence (Tier 2A, Tier 2B, or Tier 3) ▪ For preserves, easements, and management areas with a higher density/higher frequency of occurrence of California red-legged frogs, as shown on Figure 1 or based on updated mapping by Midpen, Midpen will identify streams, waterbodies, riparian habitats, and other features that support perennial water (e.g., wetlands, seeps, and spring boxes) within the maintenance activity work area and a surrounding buffer of 100 feet during the desktop audit and field review described under Impact Tiers above. Areas within 100 feet of perennial water will be identified as areas where California red-legged frogs are most likely to occur during the dry season. ▪ Midpen will then determine if the proposed maintenance activity is likely to result in take of California red-legged frogs, if frogs are present within the work area. For instance, if the activity consists of hand work or is located entirely within developed areas (e.g., roads and buildings) where no cover for California red-legged frogs is present, the likelihood of take of California red-legged frogs would be very low, even within 100 feet of perennial water. ▪ If (1) the proposed maintenance activity is not located within 100 feet of perennial water, or (2) the activity is located within 100 feet of perennial water but is not likely to result in take of California red-legged frogs, Midpen will implement the Tier 2A BMPs described above. ▪ If (1) the proposed maintenance activity is located in upland areas within 100 feet of perennial water, wet areas, or

BMP Number	BMP Title	BMP Description
		riparian vegetation; (2) no wet areas, riparian vegetation, or refugia for California red-legged frogs (e.g., woody debris and burrows) are present within the work area; and (3) no take of individuals is anticipated due to the proposed activities, Midpen will implement the Tier 2B BMPs described below. ▪ If (1) the proposed maintenance activity is located in wet areas or riparian areas, or in upland areas within 100 feet of these areas; (2) refugia for California red-legged frogs are present in the work area; and/or (3) take of California red-legged frog individuals may occur due to the proposed activities, Midpen will implement the Tier 3 BMPs described below. <u>Tier 2B BMPs</u> ▪ Prior to and within 48 hours of the planned start of Program activities, a focused survey for California red-legged frogs using an agency-approved protocol will be conducted by a qualified biologist or biological monitor to determine if they are in the area. ▪ A biological awareness training shall be provided to all persons prior to beginning work. This training will include a discussion of all practicable measures to be taken to avoid killing or injuring any life stage of California red-legged frogs during Program activities. ▪ Based on the results of the desktop audit and field visit, Midpen's biologist will determine if a qualified biologist or biological monitor is needed to monitor some (e.g., initial ground disturbance) or all activities. Regardless of whether a biologist is present, during all work, Midpen maintenance personnel (who are well-trained on the biology of California red-legged frogs, appropriate avoidance measures, and procedures to follow when they are encountered) will keep an eye out for California red-legged frogs and contact the Midpen biologist immediately if a California red-legged frog, or an individual that could potentially be a California red-legged frog, is observed. ▪ Midpen generally limits the use of exclusion fencing for special-status species to limit habitat impacts. However, if Midpen's biologist determines that the benefits of installing wildlife exclusion fencing around the work area (i.e., in terms of reducing the potential for take of individuals and/or reducing the need for a full-time biological monitor) outweigh any impacts on habitat, exclusion fencing will be installed around the work area prior to the initiation of maintenance. ▪ Any vehicle parked on-site for more than 15 minutes will be inspected by the biological monitor, qualified biologist, or a trained member of the work crew before it is moved to ensure that a California red-legged frog has not moved under the vehicle. Any parking areas must also be checked in advance by the biological monitor, qualified biologist, or trained crew member.

BMP Number	BMP Title	BMP Description
		▪ For vegetation removal on berms around ponds or other areas within or adjacent to wetted/perennial aquatic sites, if vegetation is too tall or dense to allow adequate detection of frogs, one of two approaches will be used to minimize the potential for impacts to individuals: – Vegetation will be mown with the blade set at least 6 inches above the ground. A qualified biologist or biological monitor will walk ahead of the mower to look for red-legged frogs and will move any detected frogs out of harm's way. – Vegetation will be initially cut down to three (3) inches by hand tools (weedwhacker, etc.). Once the ground is visible, a visual survey for California red-legged frogs will be conducted by a qualified biologist or biological monitor. If no sensitive species are found in the area, removal of vegetation may continue by mowing or mechanized equipment with a biological monitor present to observe. ▪ If vegetation is short or sparse enough that any frogs present can be detected by the qualified biologist or biological monitor without the need for removal of vegetation by hand tools, mowing can proceed after the biologist/monitor has thoroughly surveyed the areas to be mown. ▪ Vegetation removed shall be placed directly into a disposal vehicle and removed from the site. Vegetation shall not be piled on the ground unless it is later transferred, piece by piece, under the direct supervision of the biological monitor or qualified biologist or is going to remain on site for erosion control or slash and not be moved or disturbed. ▪ Soil shall not be stockpiled on the ground unless it is on a paved surface or staging area where there are not burrows.

		▪ General Avoidance if a California Red-legged Frog Enters the Project Area: – All work that may harm the frog shall stop until the animal is confirmed to have left on its own, or until personnel approved by USFWS under Midpen's 10(a)(1)(A) or any other project-specific approval (e.g., if a qualified consultant is assisting Midpen and is approved by USFWS to relocate California red-legged frogs for Program activities) has captured the individual. Midpen will coordinate with USFWS and CDFW prior to the start of work to identify acceptable relocation sites if California red-legged frogs are encountered within a work area. No California red-legged frogs will be held in captivity overnight without prior notification and written approval by the USFWS and CDFW unless the animal is in need of emergency medical assistance. Medical assistance will be provided to injured animals by a certified wildlife veterinarian familiar with amphibian and reptile care. When transporting individual California red-legged frogs, precautions will be taken to ensure that the animals are not over-stressed and are maintained in safety. Such measures include keeping animals in a cool, dark, and safe location (e.g., a terrarium), providing adequate hydration, maintaining a stable cool temperature to avoid over-heating, keeping animals isolated to prevent them from harming one another, and ensuring holding tanks or bags are kept clean to prevent the spread of any diseases. – All practicable measures will be taken to avoid killing or injuring any life stage of California red-legged frogs during work activities. – The biological monitor and/or qualified biologist shall have the authority to halt work activities that may affect California red-legged frog adults, tadpoles or egg masses until they can be moved out of harm's way. – Any project-related, human-caused injuries to California red-legged frogs will be reported to USFWS and CDFW. <u>Tier 3 BMPs</u> ▪ Prior to and within 48 hours of the planned start of Program activities, a focused survey for California red-legged frogs using an agency-approved protocol will be conducted by a qualified biologist or biological monitor to determine if they are in the area. ▪ A biological awareness training shall be provided to all persons prior to beginning work. This training will include a discussion of all practicable measures to be taken to avoid killing or injuring any life stage of California red-legged frogs during Program activities. ▪ A biological monitor or qualified biologist will be on the project site while Program activities are being conducted. ▪ Midpen generally limits the use of exclusion fencing for special-status species in order to limit habitat impacts. However, if Midpen's biologist determines that the benefits of installing wildlife exclusion fencing around the work area (i.e., in terms of reducing the potential for take of individuals and) outweigh any impacts on habitat, exclusion fencing will be installed around the work area prior to the initiation of maintenance. For example, California red-legged frogs will typically be excluded from the project site prior to Program activities at sites involving the use of

BMP Number	BMP Title	BMP Description
		large equipment for sediment removal. USFWS and CDFW-approved exclusion fencing will be installed around the sediment removal site, staging areas, and any areas where fill may be dumped. After installation of the fence barrier, a biological monitor or qualified biologist will inspect the project work area, staging and stockpiling areas daily prior to the commencement of activities. If the biological monitor or qualified biologist determines that California red-legged frogs are not within the work area, equipment or materials may be moved into the project site and Program activities may commence under the observation of the biological monitor. ▪ Any vehicle parked on site for more than 15 minutes will be inspected by the biological monitor or qualified biologist before it is moved to ensure that a California red-legged frog has not moved under the vehicle. Any parking areas must be checked in advance by the biological monitor or qualified biologist. ▪ For vegetation removal on berms or other sites, vegetation will be cut down to three (3) inches by hand tools (weedwhacker, etc.). Once the ground is visible, a visual survey for California red-legged frogs will be conducted. If no sensitive species are found in the area, removal of vegetation may continue by mowing or mechanized equipment very slowly with a biological monitor walking in front of the equipment to observe. California red-legged frogs can be relocated only if a person is permitted by the USFWS to handle the species. ▪ Vegetation removed shall be placed directly into a disposal vehicle and removed from the site. Vegetation shall not be piled on the ground unless it is later transferred, piece by piece, under the direct supervision of the biological monitor or qualified biologist or is going to remain on site for erosion control or slash and not be moved or disturbed. ▪ Soil shall not be stockpiled on the ground unless it is on a paved surface or staging area where there are not burrows. ▪ California Red-Legged Frog Measures for Work in Ponds – During the focused pre-activity survey within 48 hours of the planned start of Program activities, the pond will be sampled by a qualified biologist to ensure that all California red-legged frogs from that pond are in the post metamorphic stage and will be minimally affected by draining the pond. If a California red-legged frog is located during the pre-treatment surveys but escapes capture, the area where the frog was lost will be marked by flag and a 50-foot (15 meter) radius will be actively patrolled during the work. After the pre-project survey, an avoidance strategy will be devised and presented to all individuals involved in the pond enhancement prior to starting any activities. The number of California red-legged frogs encountered and transferred to safe areas or held in captivity by a permitted and qualified biologist during treatment will be reported to the Sacramento USFWS Office and CDFW.

BMP Number	BMP Title	BMP Description
		– The minimum number of qualified biological monitors required at each pond site will be determined in advance by a qualified biologist based on pond size, the amount and complexity of work to be performed, and the equipment to be used. – Corridors for travel of vehicles and heavy machinery to the pond site will be established at least 24 hours in advance of the proposed work. Corridors that are not established marked improved roads (paved or unpaved) require special consideration for use by any vehicle. During the use of these off-road corridors by vehicles and machinery, a monitor will proceed directly before the vehicle or machinery to ensure all California red-legged frogs and observable wildlife are cleared from the pathway of the oncoming vehicle. Monitors will signal vehicles to stop if a California red-legged frog is on the pathway, and will allow the animal to clear the pathway by its own direction. Any handling of the red-legged frog must only be done by a qualified permitted individual. Measures will be taken to minimize the number of vehicles allowed on the property. All vehicles involved with the site-specific work that are not transported to the work site will be retained in a prearranged, marked parking area in a clearing as close to the main road as possible. At least one monitor will ensure wildlife is clear from the parking area while vehicles are arriving and leaving. All vehicles must stay on designated roads. – Seasonal Work Period in Ponds. If California red-legged frogs are found in the pond and water is present in the pond, sediment removal and berm or outfall repair activities will be performed from August 15 to November 1. Midpen will coordinate with USFWS and CDFW prior to dredging or de-watering activities. Sediment will be removed from ponds by hand to the extent feasible. Sediment removal from ponds will occur as soon as the ponds are dry (if prior to August 15). – Vegetation Removal at Ponds. If California red-legged frogs are found, tule and emergent vegetation will be removed by hand when feasible. If mechanized equipment is used, one or more biological monitors or qualified biologists will be onsite monitoring the scoop bucket while scooping and watching each load unload. Midpen will coordinate with USFWS and CDFW during the annual project notification process regarding anticipated mechanized equipment use for vegetation removal at ponds. In areas where egg masses are known, Midpen and contractor personnel will not enter the channel/pond to avoid dislodging egg masses (except as noted in the following bullet to salvage egg masses for purposes unrelated to Program activities). Trimming activities shall be performed from the banks, if possible.

BMP Number	BMP Title	BMP Description
		– Inspection for Egg Masses. In work areas containing emergent vegetation (e.g., tules, cattails), vegetation will be inspected for California red-legged frog egg masses prior to Program activities. If work cannot be postponed, a buffer of vegetation at least ten (10) feet in diameter shall be left around any egg masses found. Midpen will keep a record of sites where egg masses are found and conduct vegetation removal at these sites prior to November 1 in subsequent years. In the course of monitoring associated with the activities, if egg masses are observed in ponds or wetted areas that are going to dry naturally before tadpoles develop (as determined by a qualified biologist), emergency salvage of egg masses by the qualified biologist is permitted to relocate egg masses into deeper waters that will not be affected by the proposed activities. USFWS shall be notified of the emergency salvage per the terms of the recovery permit. ▪ General Avoidance if a California Red-legged Frog Enters the Project Area: – All work that may harm the frog shall stop until the animal is confirmed to have left on its own, or until personnel approved by USFWS under Midpen's 10(a)(1)(A) or any other project-specific approval (e.g., if a qualified consultant is assisting Midpen and is approved by USFWS to relocate California red-legged frogs for Program activities) has captured the individual. Midpen will coordinate with USFWS and CDFW prior to the start of work to identify acceptable relocation sites if California red-legged frogs are encountered within a work area. No California red-legged frogs will be held in captivity overnight without prior notification and written approval by the USFWS and CDFW unless the animal is in need of emergency medical assistance. Medical assistance will be provided to injured animals by a certified wildlife veterinarian familiar with amphibian and reptile care. When transporting individual California red-legged frogs, precautions will be taken to ensure that the animals are not over-stressed and are maintained in safety. Such measures include keeping animals in a cool, dark, and safe location (e.g., a terrarium), providing adequate hydration, maintaining a stable cool temperature to avoid over-heating, keeping animals isolated to prevent them from harming one another, and ensuring holding tanks or bags are kept clean to prevent the spread of any diseases. – All practicable measures will be taken to avoid killing or injuring any life stage of California red-legged frogs during work activities. – The biological monitor and/or qualified biologist shall have the authority to halt work activities that may affect California red-legged frog adults, tadpoles or egg masses until they can be moved out of harm's way. – Any project-related, human-caused injuries to California red-legged frogs will be reported to USFWS and CDFW.

BMP Number	BMP Title	BMP Description
BIO-13	Foothill Yellow-Legged Frog Protection Measures	If foothill yellow-legged frog (FYLF) enters the project area, all work shall stop in that area until the animal leaves on its own. Midpen will coordinate with CDFW to develop site appropriate avoidance measures that will be implemented prior to resumption of Program activities at that location.
BIO-14	Western Pond Turtle Protection Measures	Within riparian habitat or Waters of the State and/or U.S. and one (1) mile of a known western pond turtle (WPT) occurrence: 1. Prior to and within 48 hours of the planned start of Program activities, a focused survey for WPT and WPT nests will be conducted by a qualified biologist or biological monitor to determine if they are in the area. In the event WPT are found in the project area, Midpen will exercise measures to avoid direct injury to WPT as well as avoid areas where they are observed to occur. If a WPT is observed, it shall be left alone to move out of the area on its own. If it does not move on its own, it can be relocated to a safe location at least 100 meters (m) distant from the project location. Relocation areas will be of suitable habitat, on shallow banks with slow moving water and will be far enough away so as not to be affected by Program activities. If a WPT nest is found, all activities will cease and Midpen will coordinate with CDFW to develop site appropriate avoidance and minimization measures.
BIO-15	California Giant Salamander, Santa Cruz Black Salamander Protection Measures	▪ In suitable habitat where Santa Cruz black salamander (SCBS) and/or California giant salamander (CGS) are known to occur: 1. A biological awareness training provided by a qualified biologist or biological monitor will be provided prior to starting work. 2. A qualified biologist and biological monitor will be available and on-call for the duration of the project. 3. A biological monitor will be present onsite when working within or immediately adjacent to wetted areas including stream channels, seeps, and springs. 4. For SCBS only, a biological monitor is also required in areas of talus slopes or areas having human stacked rocks and other suitable materials acting as talus. 5. The biologist and/or biological monitor has the authority to stop work at any time. 6. Dismantling of talus and human-stacked rocks and other suitable materials acting as artificial talus will be avoided and minimized whenever possible. If removal is required to meet project objectives, these materials will be dismantled by hand whenever possible. 7. Whenever possible individual SCBS and CGS shall be allowed to leave the area on their own.

BMP Number	BMP Title	BMP Description
		8. Individual SCBS or CGS (not with eggs) that are in harm's way or do not leave the work site on their own may be relocated by a qualified biologist or biological monitor to predetermined sites located outside of the work area but within the same subwatershed. 9. Work in wetted areas, talus slopes, or human stacked rocks or other suitable materials acting as artificial talus should be completed prior to July to avoid displacement of SCBS females laying eggs and attending to clutches. 10. If heavy equipment is required to remove talus, human stacked rocks or other suitable materials acting as artificial talus, this will be done in the presence of a qualified biological monitor. 11. If at any time, SCBS or CGS eggs are found, the area shall be flagged for avoidance. If the area cannot be avoided to meet project objectives, Midpen will coordinate with CDFW to determine the best course of action. ▪ In all other areas of suitable habitat for SCBS and CGS: 1. A pre-survey of the project site is required prior to starting work. If no SCBS or CGS are observed, work may proceed. 2. If an individual SCBS or CGS are observed at any time, all project work shall stop and the biologist and/or biological monitor will be notified and the above measures will be implemented.
BIO-16	San Francisco Dusky-footed Woodrat and Nest Protection Measures	▪ Projects occurring in suitable San Francisco dusky-footed woodrat (SFDFW) habitat, prior to project implementation, a qualified biologist or biological monitor shall survey the site for evidence of nesting SFDFW (i.e., large stick nests). ▪ Any SFDFW and/or nest that are found within project boundaries, will implement the measures listed below: 1. In natural areas: – All SFDFW nests will be flagged in the field and delineated on project site maps. In all instances, every effort should be made to avoid impacts to SFDFW nests. Avoidance, even with a small buffer area is considered preferable to relocation. Avoidance buffers of a minimum of 3-10 feet shall be implemented, flagged where appropriate, and avoided during project implementation. As evaluated by the project biologist, where appropriate to minimize impacts from Program activities, fencing will be installed around the nest and include the buffer area. Whenever possible, materials associated with an individual SFDFW nest will be left in place.

BMP Number	BMP Title	BMP Description
		– All SFDFW nests that cannot be avoided by Program activities (i.e., will require relocation), a qualified biologist shall live trap to determine if the nest is in use. Trapping activities should occur prior to April and after mid-July each year to prevent impacts to SFDFW rearing young or young SFDFW s. If a nest is found to be unoccupied or not in use for 3 full days (2 nights of trapping), then it may be removed. The nest shall be relocated or a pile of replacement sticks shall be placed outside of the project footprint for future colonization or re-use. If a lactating female is trapped, Program activities shall be postponed until young have become independent. Trapped SFDFW may be kept in captivity by a qualified biologist for the minimal time necessary until their nests are relocated to suitable habitat outside of the project footprint. The qualified biologist will complete and submit a CNDDB form to CDFW for any SFDFW trapped. Once trapped, nests shall be torn down and rebuilt surrounding a log-based structure, an inverted wooden planter, or similar structure that is slightly buried into the ground and has at least one entrance and exit hole. Cached food and nest material encountered shall be placed within the new structure during nest rebuilding. Whenever possible, the structure shall be "over-built" by adding larger branches for predator protection to create an area for the individual to safely emerge outside of the nest. One or more persons shall remain outside the release structure for up to 10 minutes to mimic a predator. Trapped woodrats should be released into the reconstructed nest by plugging the individual into the shelter using loose dirt over the entrance. Relocated SFDFW nests will be monitored (visual and/or wildlife camera) for one year following relocation, and the biologist will submit a monitoring report to CDFW. 2. In non-natural areas (e.g., structures, abandoned vehicles, human debris piles): – If individuals cannot be live-trapped consistently (especially if there is a risk to human health) and/or there is a lack of woody materials for nest reconstruction, live trapping is not required. Work at these locations must occur prior to April and after mid-July to prevent impacts to SFDFW rearing young. If SFDFW is observed, work at the location shall cease until the individual leaves the area on its own. If the SFDFW does not leave the area, work shall continue to cease at the location and the qualified biologist will be notified. If nests are present that cannot be trapped or removed, woody debris piles that look like woodrat houses can be constructed to provide opportunities for sheltering and colonization by displaced SFDFW under the direction of the qualified biologist or onsite biological monitor. Nest replacement ratios will be determined based on the number of SFDFW and/or nests observed, as well as the size and number of undisturbed nests in the surrounding area.

BMP Number	BMP Title	BMP Description
BIO-17	Migratory Bird Nest Protection Measures (excludes Marbled Murrelet)	▪ To avoid potential impacts to tree or shrub-nesting birds, any trimming or pruning of trees or shrubs will be conducted during the time period of September 1 to February 14 unless a preconstruction nesting bird survey has been conducted by a qualified biologist or biological monitor. Work will be done during the non-breeding season whenever possible. The bird nesting seasons are defined as follows: 1. March 15 to August 30 for smaller bird species such as passerines; and 2. February 15 to August 30 for raptors. 3. Earlier surveys may be needed for specific species such as owls, hummingbirds, herons and egrets and/or other species if nesting activity shifts due to climate change. ▪ If Program activities are scheduled during the nesting season of raptors and/or migratory birds, a focused survey for active nests of such birds will be conducted by the qualified biologist or biological monitor within 15 days prior to the beginning of project-related activities. Surveys will be conducted in all suitable habitat located at project sites and in staging and storage areas. The minimum survey radii surrounding the work area shall be the following: 1. 250 feet for passerines; 2. 500 feet for other small raptors such as accipiters; 3. 1,000 feet for larger raptors such as buteos and eagles. The bird survey methodology and the results of the survey shall be submitted to the CDFW prior to commencement of Program activities. ▪ If an active nest (i.e., a nest having eggs or chicks present, or a nest that adult birds have staked a territory and are displaying, constructing a nest, or are repairing an old nest) is found and work cannot be postponed, Midpen will designate active nest sites as “Ecologically Sensitive Areas” and protected (while occupied) during Program activities with the establishment of flagging or a fence barrier surrounding the nest site. No trees or shrubs that contain active bird nests will be disturbed until all eggs have hatched, and young have fully fledged (are no longer being fed by the adults, and have completely left the nest site). No habitat removal or modification shall occur within the Ecologically Sensitive Area fenced nest zone even if the nest continues to be active beyond the typical nesting season for the species, until the young have fully fledged and will no longer be adversely affected by the project. The minimum distances of the protective buffers surrounding each identified nest site will be the following, with some considerations depending on nest location and substrate: 1. 500 feet for large raptors such as buteos; 2. 250 feet for small raptors such as accipiters;

<table>
<tr><th>BMP Number</th><th>BMP Title</th><th>BMP Description</th></tr>
<tr><td></td><td></td><td>3. 250 feet for passerines; and
4. 1,000 feet for eagles.
A biological monitor or qualified biologist will monitor the behavior of the birds (adults and young, when present) at the nest site to ensure that they are not disturbed by project-related activities. Nest monitoring will continue during project-related construction work until the young have fully fledged, are no longer being fed by the parents and have left the nest site and surrounding area, as determined by a biological monitor. If a protective buffer must be modified, Midpen will coordinate with the CDFW and/or the USFWS as appropriate prior to resumption of Program activities.
▪ If a lapse in project-related work of 15 days or longer occurs, another focused survey will be conducted before project work is reinitiated.</td></tr>
<tr><td>BIO-18</td><td>Marbled Murrelet Nest Protection Measures</td><td>In areas within the range of marbled murrelet (MAMU) habitat as identified in the Midpen 2007 maps, Midpen will conduct a survey of habitats within ¼-mile of the project area for trees that meet the Pacific Seabird Group definition of potential MAMU nesting trees. If such trees are present within 300 feet of the project area or if a MAMU nest is detected, Midpen will coordinate with CDFW and USFWS before proceeding. If habitat trees are present within ¼-mile of the project site but are greater than 300 feet from the work area, Midpen will implement the following conditions:
▪ Work within the project area shall be confined to the period of September 16 to March 23. If maintenance activities cannot be conducted during this seasonal work period, Midpen will coordinate with CDFW and USFWS during the February 1 notification and implement the following conditions:
1. If construction activities occur during the marbled murrelet breeding season (March 24 to September 15), seasonal disturbance minimization buffers as listed in the table below and in the October 28, 2020 document, Revised Transmittal of Guidance: Estimation of the Effects of Auditory and Visual Disturbance to Northern Spotted Owls and Marbled Murrelets in Northwestern California (table below), shall be followed:
<table>
<tr><th></th><th colspan="4">Anticipated Action Generated Sound Level (decibels [dB])2</th></tr>
<tr><th>Existing Pre-Project (Ambient) Sound Level1</th><th>Moderate (71-80 dB)</th><th>High (81-90 dB)</th><th>Very High (91-100 dB)</th><th>Extreme (101-110 dB)</th></tr>
<tr><td>Natural Ambient (<=50 dB)[3]</td><td>165</td><td>500</td><td>1,320</td><td>1,320</td></tr>
<tr><td>Very Low (51-60 dB)</td><td>0</td><td>330</td><td>825</td><td>1,320</td></tr>
</table>
</td></tr>
</table>

BMP Number	BMP Title	BMP Description

Low (61-70 dB)	0	165	825	1,320
Moderate (71-80 dB)	0	165	330	1,320
High (81-90 dB)	0	165	165	500

1. Existing (ambient) sound level includes all natural and human-induced sounds occurring at the project site prior to the proposed action, and are not causally related to the proposed action.
2. Action-generated sound levels are given in decibels (dB) experienced by a receiver, when measured at 15.2 m from the sound source.
3. "Natural Ambient" refers to sound levels generally experienced in habitats not substantially influenced by human activities.

Midpen will conduct a sound level monitoring study to determine level of ambient and construction activity noise anticipated during construction activities to calculate seasonal disturbance minimization buffer widths. Disturbance distances listed in the table above apply to noise generating activities that are not within 2 hours of sunrise or sunset; project generated noise impacts will be calculated accordingly. Midpen will provide a description of methods and results of the study to USFWS and CDFW to coordinate site-specific avoidance measures 30 days prior to commencement of Program activities at the applicable location(s). In order to alert work crews to their presence, marbled murrelet seasonal disturbance buffers, as determined by the sound study and table above, shall be flagged in the field where they enter the project area. If Midpen chooses not to conduct the sound study, no maintenance activities shall occur within 0.25-mile of potential nest trees during the marbled murrelet breeding season (March 24 to September 15).

2. If noise generating construction activity takes place during the breeding season (March 24 to September 15) within suitable Redwood and Redwood/Douglas-fir forests, construction activities will be restricted to 2 hours after sunrise to 2 hours before sunset to minimize disturbance of potential nesting MAMU using forest habitat as a travel corridor between inland nesting and coastal habitat.
3. Midpen or its contractor will not conduct Program activities within a visual line-of-sight distance of 40 m or less from a suitable nest tree as designated by a qualified biologist or biological monitor. Additionally, Midpen or its contractors will not conduct Program activities within a visual line-of-site distance of 100 meters or less from a known or active nest tree confirmed by a qualified biologist.

BMP Number	BMP Title	BMP Description
		If MAMU protocol level surveys are conducted and do not indicate that the habitat is occupied by MAMU, the seasonal and distance work restrictions may be lifted with approval from CDFW and USFWS. Protocol level survey procedures and information can be found at: http://www.pacificseabirdgroup.org/publications/PSG_TechPub2_MAMU_ISP.pdf. If Midpen chooses to conduct marbled murrelet protocol level surveys, Midpen will coordinate with CDFW and USFWS regarding the survey stations to ensure all contiguous suitable habitat is covered and good visuals of the sky and nearby flyways, if present, are provided. If marbled murrelet protocol level surveys are conducted, Midpen will submit the report consistent with *Methods for Surveying Marbled Murrelets in Forests: A Revised Protocol for Land Management and Research*.
BIO-19	Bay Checkerspot Butterfly and Santa Clara Valley Dudleya Protection Measures	▪ For all ponds and wetland, creeks and rivers, prescribed fire and property clean up and building removal, sites will be pre-surveyed by a qualified botanist for Santa Clara Valley dudleya and Bay checkerspot butterfly host plants prior to implementing recovery actions. In certain cases, prescribed fire may be used to enhance a native species or to control nonnative species, but site-specific recommendations will be made based on the species composition and the objectives for the site. ▪ All prescribed grazing areas within Midpen have been mapped for sensitive status plant species and there are not currently any federally or State-listed plants within grazed properties. To ensure no newly listed species or previously undiscovered species are present, Midpen rangeland ecologist will perform annual monitoring and reporting to agencies. ▪ For all roads and trail maintenance activities, grassland areas will be surveyed by a qualified botanist for sensitive status plant species every 3 years. Woodland, hardwood, shrub and scrub, and forested areas will be mapped by a qualified botanist every 5 years. ▪ All areas having known occurrences of Santa Clara Valley dudleya or Bay checkerspot butterfly host plants for which recovery actions are proposed will be surveyed prior to treatment. Listed and host plants will be avoided either through timed activities (for example mowing after annuals set seed) or flagging individual plants for avoidance. In any areas in which host plants cannot be avoided, seed will be collected and the area reseeded under approvals from the USFWS and CDFW. ▪ Prior to conducting any manual, mechanical, or chemical IPM treatment in serpentine habitats, surveys will be conducted for dwarf plantain (*Plantago erecta*), purple owl's clover (*Castilleja densiflora*), and exserted paintbrush (*Castilleja exserta*) during the appropriate blooming period, and host plants containing eggs, larva, or pupa of Bay checkerspot butterfly will not be treated.

BMP Number	BMP Title	BMP Description
BIO-20	Bat Colony Protection Measures	▪ In areas of suitable habitat, preconstruction surveys are required for the following bat species: – Pallid Bat (*Antrozous pallidus*) – Townsend's Big-eared Bat (*Corynorhinus townsendii*) – Bat surveys should take place during the April 15 through August 31 maternity roost season whenever possible. Surveys may also take place between February 16 and April 14, or between September 1 and November 15. Findings during spring and fall surveys may indicate that a second summer survey is necessary ▪ Bats generally breed April through August; no building or tree work (over 16 inch dbh) is allowable during this time if surveys determine that special status bats or maternity roosts are present ▪ Bats may go into a deep torpor period November 16 through February 15; no building or tree work (over 16inch dbh) is allowable during this time if surveys determine that special status bats or hibernaculum roosts are present ▪ If individual nonbreeding and non-special status bats are present, a qualified biologist may be retained to remove the bats and work may proceed year round ▪ If maternity roosting or special status bat species are present at any time, no work is allowed without first excluding and providing alternate roost site(s), or identifying suitable nearby existing roosting sites, outside of the breeding season ▪ Alternate roost site(s) must be determined by District Natural Resources staff or a consulting biologist and submitted to CDFW before installation ▪ Whenever possible alternative roost site(s) will be provided 6 months to 1 year prior to the removal of maternity roosting habitat to allow bats adequate time to discover the new locations ▪ Alternative roost site(s) shall be monitored for occupancy by a qualified biologist within one year of installation ▪ Contractors, Midpen staff, and others working in areas known to support maternity roost site(s) and/or special status bat species will be provided biological awareness training by a qualified biologist prior to the commencement of work *Mitigation for impacts to maternity roost(s) and special status bat species:* Buildings and Other Human Structures: To mitigate for demolition activities, fumigation, or other activities that involve the removal or disturbance of roosting bats in buildings, bridges, outbuildings, dilapidated structures, old vehicles (buses, trailers etc.), or other human created structures (including debris piles):

BMP Number	BMP Title	BMP Description
		▪ If signs of bats are evident and removal or disturbance of bats is necessary, a qualified biologist will conduct surveys for roosting bats prior to beginning work. Surveys will consist of daytime pedestrian surveys to look for visual signs of bats (e.g., guano), and if determined necessary, evening emergence surveys to note the presence or absence of bats. If evidence of bat roosting is found, the number and species of roosting bats will be determined. If congregations of more than five bats are found within a single human-made structure during the maternity roosting season it may be assumed that the colony constitutes a maternity roost and the location will be recorded in the District's wildlife database. If no evidence of bat roosts is found, then no further study will be required. Bat detectors and/or infrared detectors may be used to supplement survey efforts, but are not required. ▪ When bat roosting sites are located in buildings, exclusion of bats from the building will occur outside of the April through August nursery season. ▪ If roosts of special-status bats are determined to be present and must be removed, a bat exclusion plan will be prepared and submitted to CDFW. The exclusion plan will describe the method of exclusion, which may include the use of one-way doors at roost entrances (bats may leave but not re-enter), or sealing roost entrances when the site can be confirmed by a bat expert to contain no bats. No bats will be excluded until the plan is approved by CDFW and alternative roosting habitat is approved. The bats will be excluded from the roosting site before the site is disturbed or modified in any way. <u>Tree Removal:</u> ▪ Avoid removal of trees greater than sixteen inches dbh during the April through August nursery season whenever possible. ▪ If removal of trees greater than sixteen inches dbh during the nursery season cannot be avoided, a qualified biologist will conduct surveys for roosting bats where suitable large trees are to be removed. Surveys will consist of daytime pedestrian surveys to look for visual signs of bats (e.g., guano), and if determined necessary, evening emergence surveys to note the presence or absence of bats. If evidence of roosting bats is found, the number and species of roosting bats will be determined. If no evidence of bat roosts is found, then no further study will be required. Bat detectors and/or infrared detectors may be used to supplement survey efforts, but are not required.

BMP Number	BMP Title	BMP Description
		▪ If roosts of special-status bats are determined to be present and must be removed during the April through August nursery season, a bat exclusion plan shall be prepared and submitted to CDFW. The exclusion plan will describe the method of exclusion, which may include the use of one-way doors at roost entrances (bats may leave but not re-enter), or sealing roost entrances when the site can be confirmed by a bat expert to contain no bats. The use of sonic bat deterrents may also be allowed when called for by a qualified biologist. No bats will be excluded until the plan is approved by CDFW and alternative roosting habitat is approved. Exclusion efforts may be restricted during periods of sensitive activity (e.g., during hibernation or while females in maternity colonies are nursing young). The bats will be excluded from the roosting site before the site is disturbed, closed or modified in any way. When possible, alternative roosting sites will be provided 6 months to a year prior to the removal of existing roosts. Once the replacement roosts are constructed and it is confirmed that bats are not present in the original roost site, the structures may be removed or sealed. <u>Work in or adjacent to areas known to support special status bats and/or maternity roosts:</u> ▪ Whenever possible work shall take place outside of the April through August nursing season. ▪ Natural Resources staff shall provide and/or consult with qualified biologists having knowledge specific to the bat species present at the site. Species specific noise tolerance levels (including high frequency noise) shall be established for work taking place within a determined buffer around the maternity roost. All equipment working within the site during the nursing season must be tested for high frequency noise outputs prior to use on the site. If equipment is determined to produce any noise that is expected to cause bats to abandon a maternity roost it will not be used on the site within the biologist established buffer during the nursing season. <u>Relocation of bat boxes:</u> ▪ Relocation requires the approval of the Natural Resources department and may be performed by a qualified biologist. ▪ Bat boxes may be relocated between mid-September to mid-October, or from mid-February to mid-March (during warm periods outside of the nursing season). Bat boxes may be relocated outside of these recommended time periods with sign off from a qualified biologist. ▪ Relocation of boxes that support special status bat species requires notification to CDFW before implementation.

BMP Number	BMP Title	BMP Description
		▪ If a bat box is determined to be unoccupied by a qualified biologist, it may be relocated at any time without modification. If occupied, a one-way door shall be installed on the entrance/exit of the bat box, preferably during a warm period when bats are likely to be active. The one-way door shall remain in place for a period of 3-7 days. After this period, a qualified biologist shall arrive on site and check the box for occupancy. If the box is still occupied then the one-way door shall remain in place for an additional 3-7 days. Once the box is determined to be unoccupied then it may be relocated with direction from Natural Resources or a qualified biologist to a nearby suitable habitat. The new location will be recorded and added to the Districts' Geographic Information System (GIS) database. The one-way door shall then be removed to allow bats to access the box. Relocated bat boxes shall be monitored for occupancy by a qualified biologist within one year of installation.
BIO-21	Salmonid (Coho and Steelhead) Protection Measures	▪ Dewatering will not occur in stream reaches where known occurrences of Coho salmon exist. Midpen will coordinate with USFWS and CDFW in the event that dewatering such a stream reach becomes necessary. ▪ Seasonal Work Period for Salmonids: Work within and around NOAA designated critical habitat for steelhead and Coho salmon streams that provide habitat for salmonids shall be limited to June 15 to October 31. Revegetation activities are not confined to this period. ▪ Alternative Seasonal Work Period. Work within and around creeks that do not provide habitat for salmonids and reaches that are 1,000 feet or more upstream of discharge points which do not discharge directly into such drainages will be limited to April 15 to October 31, or is permissible from November 1 to April 14 under the following conditions: 1. Work will not occur until the site has received no rainfall for a period of 10 days and there is no rain in the forecast for a period of 7 or more days, and work requires no greater than 5 days to complete. 2. Work started during this period must be at least 50% complete within 2.5 days of beginning work. 3. Winterization materials must be on hand and installed if unanticipated rainfall begins (defined as 0.5 inches of rain in a 24-hour period). 4. Corrective actions are allowable year-round for the following situations: – To correct improperly installed and/or unauthorized work on Midpen lands that occurred during the same calendar year that result in sediment delivery. – To correct damage from winter storms that threatens access to homes, ponds, water systems, and other critical infrastructure.

BMP Number	BMP Title	BMP Description
BIO-22	Biological Monitoring for Stranded Aquatic Life	▪ For all projects within watercourses that are known to support or have the potential to support threatened and/or endangered species, a qualified biologist or biological monitor shall conduct a pre-construction survey. ▪ A biological monitor or qualified biologist will check daily for stranded aquatic life as the water level in the dewatering area drops. All reasonable efforts will be made to capture and move all stranded aquatic life observed in the dewatered areas. Capture methods may include fish landing nets, dip nets, buckets and by hand. Captured aquatic life will be released immediately in the closest body of water adjacent to the work site. This measure does not allow for the take or disturbance of any state or federally listed species. ▪ Any aquatic nonnative invasive species found will be disposed of properly and will not be placed back into the creek where work is being conducted or any other drainages, creeks or streams. The Midpen Project Manager will send a list to CDFW of species found and the location they were found after completion of Program activities.
BIO-23	Large Woody Material Management	Large Woody Material management and removal will be undertaken only as a last resort to mitigate ongoing or imminent damage. Large wood is defined as logs with a diameter of 6 inches or greater and a length of 10 feet or longer, rootwads and stumps. Locations will be assessed for sensitive species prior to beginning any work at the site. Smaller pieces of large woody material shall be removed to above the OHWM of the channel, and will be stacked or spread for terrestrial habitat
BIO-24	Riparian Avoidance	▪ Riparian trees shall be protected from damage to the greatest extent possible during repair and replacement. ▪ Vegetation management activities will not adversely impact the riparian zone, shade, canopy coverage, or habitat.
BIO-25	Riparian Restoration	▪ **Restoration Area.** Where feasible, restoration will take place in the same Preserve and preferably on the same waterway or watershed and adhere to the conditions below. Planting or seeding of riparian vegetation may be done at any time provided there is no erosion and sedimentation that may cause an adverse impact to water quality. ▪ **Tree Replacement**. In suitable areas, trees shall be replaced at the following ratios (replacement trees to removed trees) to mitigate for permanent net loss of habitat and canopy cover: 1. For non-native trees that provide canopy cover to the creek: 1:1 (compensation to impact) ratio 2. For native trees: 2:1 ratio unless approved otherwise by CDFW. In certain areas where regeneration will occur or overcrowding is an issue, a 1:1 ratio is acceptable. ▪ **Re-vegetation Ratio**. In suitable areas, other vegetation shall be replaced with the following ratios: wetlands, 1:1; general riparian vegetation, 3:1; sycamore alluvial woodland or other rare habitat types: 5:1; other general habitat types, 1:1.

BMP Number	BMP Title	BMP Description
		▪ **Native Species for Re-vegetation**. Replacement trees and vegetation will be local native species adapted to the lighting, soil and hydrological conditions at the replanting site, except in cases where non-native trees are considered culturally significant. In these areas, non-native trees may be replaced with the same species of non-native tree to preserve the cultural landscape in ongoing maintenance to prevent the spread of the non-native is provided. If replanting within the work area is infeasible due to lack of space, slope steepness or other physical constraints, replacement trees and vegetation may be planted at an alternate location along the stream corridor. Vegetation will be replaced by December 31 of the year impacts occur in a location that is not subject to future maintenance or construction work. ▪ **Re-vegetation Plan**. Where active restoration is warranted, Midpen will submit a re-vegetation plan to CDFW with the annual February notification. The plan will describe the project site and vegetative community, including the conditions warranting active re-vegetation. Proposed restoration measures will be described, including location, number, size and type of replacement plantings, installation specifications and irrigation specifications if warranted. ▪ **Re-vegetation Survivorship**. Any re-vegetation plan will include success criteria specific to the circumstance. The re-vegetation effort will replace or improve on the habitat value of the impacted area in a reasonable amount of time. The term 'Reasonable amount of time' means a return to the pre-project baseline in approximately the same period of time that the pre-existing habitat took to establish naturally. For habitats where this is not feasible (such as oak woodland), success criteria should focus on attributes that will provide a reasonable assurance that the re-vegetation will eventually result in the required replacement value. These attributes could include plant vigor, establishment of minimal species diversity, cover, lack of limiting factors and others. ▪ **Re-vegetation Success Criteria**. For every project where habitat is removed, whether active re-vegetation is removed or not, the annual February notification should provide an estimate of the time necessary to re-establish the baseline habitat value lost. Midpen will monitor the site for that period (as modified by CDFW where warranted). If the site reaches the pre-project habitat baseline prior to the end of the projected monitoring period and keeps that habitat value for two consecutive years, Midpen can request CDFW to waive further monitoring. For sites requiring longer terms to reasonably reach a pre-project baseline and which are clearly doing well and therefore can reasonably be considered likely to reach the site habitat goals (such as oak woodland or redwood forest), Midpen can request CDFW to reduce or end the monitoring after five years.

BMP Number	BMP Title	BMP Description
		▪ **Re-vegetation Remediation**. If re-vegetation success criteria requirements do not meet established goals, Midpen is responsible for replacement planting, additional watering, weeding, invasive exotic eradication, or any other practice, to achieve these requirements. All plants that die within the monitoring period will be replaced during the fall the year the plant was determined to have failed, or as soon as replacement nursery stock can be grown, on site seed collected, or whichever propagation method is most effective, as necessary to satisfy success criteria. Replacement plants will be monitored with the same goal as initial planting until habitat goals are met. If the problem(s) is/are larger in scope, are likely to recur and cannot be corrected, Midpen will coordinate with CDFW to develop a modified plan for the site. ▪ **Sedimentation**. Primary sedimentation control will be provided by implementation of the best management practices under *Sediment/Water Quality Control* and *Erosion Control*. For any project where erosion and sedimentation cannot be completely controlled by these measures (such as clearing a plugged culvert in a live channel), additional measures will be implemented, as necessary. Midpen will identify any projects where this condition occurred during the preceding calendar year and estimate the amount of sediment that bypassed protective measures, if any. To compensate, as part of the annual February notification, Midpen will propose sufficient erosion control projects to halt chronic sedimentation from other sources of a similar or greater amount. This annual quantity of erosion control projects will be determined through coordinate between Midpen and CDFW.
Cultural Resources Measures		
CUL-1	Review Sensitivity Maps	During the early phases of Annual Work Plan development, for all locations where ground-disturbing activities are proposed where excavation would be required beyond the facility's as-built design or otherwise reach previously undisturbed soils beyond existing engineered depths or extent, Midpen will review the Cultural Sensitivity Maps (Appendix C of the Open Space Maintenance and Restoration Program Manual [Manual]). If the foregoing conditions are not applicable to the maintenance activity being performed, only BMP CUL-5 and CUL-6 will be required. Based on the location of projects, and whether or not excavation or ground disturbance will occur beyond existing engineered depths or extent, BMPs CUL-2 through CUL-4 shall be implemented as follows: ▪ High Sensitivity: BMPs CUL-2, CUL-3, and CUL-4 ▪ Moderate Sensitivity: BMP CUL-2 and CUL-3 ▪ Low Sensitivity: BMPs CUL-2 through CUL- 4 not required ▪ Unknown Sensitivity: BMP CUL-2 and CUL-3

BMP Number	BMP Title	BMP Description
		▪ BMPs CUL-6 is applicable to all ground-disturbing activities in natural channels or native soils, regardless of the sensitivity level of the work area.
CUL-2	Record Search and Field Inventory for Highly or Moderately Sensitive Areas, and Areas of Unknown Sensitivity	▪ Midpen will retain a qualified cultural resources specialist to conduct a review and evaluation of locations that involve soil disturbance/excavation in natural channels or native soils identified as Highly to Moderately Sensitive to determine the potential for these activities to affect significant cultural resources. ▪ The initial evaluation will be based on a review of archival information maintained by Midpen. If there is no information in Midpen's archives that indicates Midpen ever received comprehensive cultural resources data on the project area, or that the project area has previously ever been subject to pedestrian archaeological survey, the qualified cultural resources specialist will request a record search by the Northwest Information Center (NWIC) of the California Historical Resources Information System to cover the project area and on a 0.25-mile search radius. This initial archival review will be completed by the professional archaeologist who will be able to view confidential site location data and literature to arrive at a preliminary sensitivity determination. ▪ It is recommended that Midpen conduct a review of the Sacred Lands Inventory of the Native American Heritage Commission (NAHC) and due diligence outreach with individuals identified by the NAHC and/or local historical societies or groups. This outreach would involve sending a letter with a request for pertinent information about cultural resources within the project area and to identify any concerns. This outreach is in addition to notification under PRC 21080.3.1 (i.e., CUL-3), and may be appropriate for projects that would not otherwise require Assembly Bill 52 notification. Such outreach is also encouraged under Section 106 implementing regulations at 36 Code of Federal Regulations (CFR) 800.4(a)(3) for identification of historic properties. ▪ The qualified archaeologist will conduct field inventory of the project area to determine the presence/absence of surface cultural materials. The results, along with any mitigation and/or management recommendations, will be presented to Midpen in an appropriate report format that includes any necessary maps, figures, and correspondence with interested parties. The report will also include a summary of the records search and archival research data, and pertinent geoarchaeological overviews and studies, and regional research designs, as appropriate. ▪ A summary table indicating appropriate management actions (e.g., monitoring during construction, presence/absence testing for subsurface resources, and data recovery) will be developed for each project work area reviewed. ▪ The maintenance activities will be implemented to avoid significant impacts to cultural resources, if possible.

BMP Number	BMP Title	BMP Description
		▪ **EXCEPTIONS:** After the Midpen archival search, NWIC record search, and NAHC sacred lands search have been conducted, the qualified archaeologist may determine that a field review is not necessary under the following circumstances: – Locales that have previously been subject to cultural resource studies where no previously identified cultural resources or historical resources were documented. – Locales that have previously been subject to cultural resources studies, but identified cultural resources have been determined by a qualified archaeologist/resource specialist as not eligible for listing in the California Register of Historical Resources (CRHR) or the National Register of Historic Places (NRHP). – A short report would be required to document the decision not to conduct a field study.
CUL-3	Consult with Native American Tribes	Midpen, as the lead California Environmental Quality Act (CEQA) agency, has notified Native American tribes about the Program according to PRC 21080.3.1 (also referred to as Assembly Bill 52); *only Native American tribes that have previously requested notification from Midpen pursuant to PRC 21080.3.1(b) require notification*. For tribes that request consultation under PRC 21080.3.1(b)(2), Midpen will consult with those tribes pursuant to PRC 21080.3.2 for projects in areas of high, moderate, and unknown sensitivity.
CUL-4	Construction Monitoring	▪ Midpen will retain a qualified archaeologist to be present on-site during ground-disturbing activities within areas identified as highly sensitive for cultural areas unless the qualified archaeologist determines otherwise after the field inventory conducted under CUL-2. Similarly, after conducting the field study under CUL-2, the qualified archaeologist may determine that areas originally identified as moderately sensitive for cultural resources warrant monitoring during construction. The reasons for conducting monitoring in areas initially considered of moderate sensitivity would be discussed in the inventory report. ▪ The qualified archaeologist will have the authority to stop work if cultural resources are discovered. ▪ If any cultural resources are discovered during construction monitoring, BMP CUL-7 would be implemented as appropriate.
CUL-5	Conduct Pre-Maintenance Educational Training	At the beginning of each maintenance season, and in concert with implementing BMP BIO-1, as well as before conducting activities subject to BMP CUL-2 through BMP CUL-5, all maintenance personnel will participate in an educational training session conducted by a qualified cultural resources specialist. This training will include instruction on how to identify historic and prehistoric resources that may be encountered, and will describe the appropriate protocol to be followed if resources are discovered during maintenance work.

BMP Number	BMP Title	BMP Description
CUL-6	Address Discovery of Cultural Remains	Unanticipated discoveries of cultural and paleontological resources may occur during maintenance construction activities. Examples of prehistoric Native American cultural remains are obsidian and chert flaked-stone tools (e.g., projectile points, knives, scrapers) or significant areas of tool-making debris; culturally darkened soil ("midden") containing heat-affected rocks, artifacts, or shellfish remains; stone milling equipment (e.g., mortars, pestles, handstones, or milling slabs); and battered stone tools, such as hammerstones and pitted stones. Historic-period artifacts may include stone, concrete, or adobe footings, foundations, and walls; filled wells or privies; and deposits of metal, glass, and/or ceramic refuse. Paleontological resources are fossilized remains of plants and animals. Work will be restricted or stopped in areas where remains or artifacts are found until proper protocols are met, as described below. <u>Protocol for treatment of prehistoric or historic cultural resources, or human remains:</u> 1. Work at the location of the find will halt immediately within 50 feet of the find. A "no work" zone will be established utilizing appropriate flagging to delineate the boundary of this zone, which will measure at least 50 feet in all directions from the find. 2. Midpen will retain the services of a consulting archaeologist, who will visit the discovery site as soon as practicable and perform minor hand excavation to describe the archaeological resources present and assess the amount of disturbance. 3. The consulting archaeologist will provide to Midpen and U.S. Army Corps of Engineers (USACE), at a minimum, written and digital-photographic documentation of all observed materials, utilizing the CRHR and NRHP guidelines for evaluating archaeological resources. Based on the assessment, Midpen and USACE will identify the CEQA and Section 106 cultural resources compliance procedures to be implemented. 4. If the consulting archaeologist determines that the find appears not to meet the CRHR or NRHP criteria of significance, and a USACE archaeologist concurs with the consulting archaeologist's conclusions, construction may continue while monitored by the consulting archaeologist. The authorized Program work will resume at the discovery site only after Midpen has retained a consulting archaeologist to monitor and the Program Manager has received notification from USACE allowing work to continue. 5. If the find appears significant, avoidance of additional impacts is the preferred alternative. The consulting archaeologist will determine if adverse impacts to the resources can be avoided.

BMP Number	BMP Title	BMP Description
		6. Where avoidance is not practical (e.g., maintenance activities cannot be deferred or must be completed to satisfy the Program objective), Midpen will develop an action plan (also known as a data recovery plan) and submit it to USACE within 48 hours of determining that maintenance activities cannot be deferred. The action plan will be submitted by email to the appropriate archeological/cultural resources contact at the USACE. The action plan is equivalent to a data recovery plan. It will be prepared in accordance with the current professional standards and state guidelines for reporting the results of the work, and will describe the services of a Native American consultant, if appropriate, and a proposal for curation of cultural materials recovered from a non-grave context. 7. The recovery effort will be documented in a report prepared by the consulting archaeologist in accordance with current archaeological standards. Any non-grave artifacts will be placed with an appropriate repository. 8. In the event of discovery of human remains (or if a find consists of bones suspected to be human), the field crew supervisor will take immediate steps to secure and protect such remains from vandalism during periods when work crews are absent.) 9. The maintenance crew supervisor will immediately notify the San Mateo County Coroner and provide any information that identifies the remains as Native American. If the remains are determined to be those of a prehistoric Native American or a Native American from the ethnographic period, the Coroner will contact NAHC within 24 hours of being notified about the remains. NAHC will designate and notify a most likely descendant (MLD) within 24 hours. The MLD will have 48 hours to consult and provide recommendations for the treatment or disposition, with proper dignity, of the human remains and grave goods. 10. Preservation in situ is the preferred option for human remains. Human remains will be preserved in situ if continuation of the maintenance work, as determined by the consulting archaeologist and MLD, will not cause further damage to the remains. The remains and artifacts will be documented, the find location carefully backfilled (with protective geo-fabric if desirable), and the information recorded in Midpen Program files. 11. If human remains or cultural items are exposed during maintenance that cannot be protected from further damage, they will be exhumed by the consulting archaeologist at the discretion of the MLD and reburied, with the concurrence of the MLD, in a place mutually agreed upon by all parties.
Geology/Paleontological Resources Measures		
GEO-1	Address Discovery of Paleontological Resources	<u>Protocol for treatment of paleontological resources:</u> 1. Work at the location of the find will halt immediately within 50 feet of the find. A “no work” zone will be established utilizing appropriate flagging to delineate the boundary of this zone, which will measure at least 50 feet in all directions from the find.

BMP Number	BMP Title	BMP Description
		2. Midpen will retain the services of a consulting paleontologist who meets the Society for Vertebrate Paleontology's criteria for a "qualified professional paleontologist" (Society of Vertebrate Paleontology 1995). The consulting paleontologist will follow the Society for Vertebrate Paleontology's guidelines for treatment of the find. Treatment may include preparation and recovery of fossil materials for donation to an appropriate museum or university collection, and may include preparation of a report describing the find. Midpen will be responsible for ensuring that the paleontologist's recommendations are implemented.
Erosion Control Measures		
EC-1	General Erosion Control Measures	▪ All exposed soils within a project site will be stabilized immediately following the completion of earthmoving activities to prevent erosion into the stream channel. Erosion control BMPs, such as silt fences, certified weed-free straw hay bales, gravel or rock lined ditches, water check bars, certified weed-free wattles, forest duff or mulches, and broadcasted certified weed-free straw will be used as necessary (Refer to Appendix D of the Manual for detailed descriptions of erosion control BMPs). Erosion control fabrics will be constructed of biodegradable materials, such as coir or jute. Erosion control products will not contain monofilament material. The effectiveness of erosion control BMPs will be monitored during and after each storm event. Modifications, repairs and improvements to erosion control BMPs shall be made as needed to protect water quality. At no time shall silt laden runoff be allowed to enter the stream or directed to where it may enter the stream. ▪ Soil accumulated behind erosion control features will be removed promptly to an erosionally safe location and controlled for erosion. Erosion control measures will be monitored following significant storm events and modifications, repairs, and improvements to erosion controls measures will be made whenever they are needed. ▪ Erosion control measures will be utilized throughout all phases of operation where sediment runoff from exposed slopes threatens to enter Waters of the State and/or U.S. This may require the construction at the toe of the slope below the construction site, of silt catch basins, silt fencing, certified weed free straw bale dikes, or other siltation barriers. At no time shall silt laden runoff be allowed to enter the stream or directed to where it may enter a stream.
EC-2	Slope or Bank Stabilization	▪ Implement bio-compatible bank stabilization methods such as brush layering (live cut branches interspersed between layers of soil wrapped in natural geotextile materials with branches in alternative crisscrossing or overlapping pattern), brush mattresses, and live siltation to stabilize slopes and banks where feasible. The finished slopes should be seeded with native seed and mulched with a biodegradable tackifier.

BMP Number	BMP Title	BMP Description
		▪ Riprap of proper size and weight to withstand high water flows, where necessary, will be set below grade and keyed into the bank such that it is above the OHWM to the extent feasible. Work will be confined to the damaged or failed sections and immediate adjacent bank area affected by the damage failure. No more than 40% of bank repairs in a given year will use "hard" or impervious structure design. Incorporate rootwad revetments, live stakes, and pole planting at suitable locations to encourage vegetation growth over rip-rap where feasible. The following measures will be implemented during Program activities. 1. Streambank areas receiving rock slope protection will be back-filled with appropriate native or clean imported topsoil. The topsoil will fill some portions of the voids in the rock slope protection above the normal high water mark and provide a substrate for revegetation efforts. This work will be done manually using hand tools and power tools such as a toter or mule for single-track trail environments or an excavator or dump truck when needed for multiuse trails or roads. 2. Other bank stabilization measures that may be employed include broadcast and hydro-seeding, riparian vegetation planting, slopes armored with rocks or sandbags staked with live willow and other bioengineering techniques such as willow staking, live willow pole drains, vegetated crib walls, log or rock weirs. 3. Riparian trees will be protected from damage to the greatest extent possible during repair and replacement.
EC-3	Road and Trail Drainage Maintenance	▪ Minimize fine sediment contributions from roads, cutbanks, and ditches through seasonal closures and installing a variety of surface drainage techniques including berm removal, road surface shaping (outsloping, insloping, or crowning), rolling dips, ditch relief culverts, water bars, and other measures to disperse road surface runoff and reduce or eliminate sediment delivery to streams. ▪ Implement "live pole drains" where feasible to prevent landslides, unstable slopes, and slumping. ▪ Cleaning roadside/trailside ditches will be limited to no more than 10 cubic yards of soil per 100-yard length of road/trail and allows associated vegetation removal. ▪ Sloughs and berms may be occasionally removed (every 3-5 years) from trails and roads, but material removed will not exceed 5 cubic yards per 100-yard length of trail and 10 cubic yards per 100-yard length of road. ▪ Up to two (2) cubic yards of accumulated sediment will be removed from rolling dips per 100-yard length of road/trail that is located within a drainage subject to CDFW jurisdiction. ▪ In the event of a landslide, up to five (5) cubic yards per event or up to two (2) cubic yards under any conditions will be removed per the following conditions: 1. Up to 2 cubic yards of material may be removed, using hand tools only, under any conditions.

BMP Number	BMP Title	BMP Description
		2. Removal of amounts greater than 2 cubic yards requires that the channel be dewatered first and heavy equipment may be used if submitted to CDFW in writing through annual notification process with written approval from CDFW and where no Coho salmon are present. 3. The total area of disturbance shall not exceed 150 feet of channel or 2,000 square feet of area, whichever is less. 4. The disturbed area shall immediately be treated with erosion control materials sufficient to control turbidity. 5. Nearby perched or otherwise unstable fill shall be removed as well, up to 5 cubic yards.
EC-4	Road and Trail Minor Relocation	<u>Narrow-width Trails:</u> ▪ The new location will be no more than 400 feet upslope or downslope of the existing location. ▪ New crossings shall be free span bridges in creeks providing salmonid habitat or free span bridges or mortar or concrete free fords in creek without salmonid habitat. ▪ Vegetation removal is limited to no more than a six (6) foot buffer around the new crossing and to trimming of no more than 20% of any individual tree canopy in that six-foot buffer. Vegetation removal shall be limited to the minimum amount necessary to provide access. ▪ All work will be done when the work area is dry and the work period is outside the rainy season. ▪ Work must be completed during the appropriate fish and aquatic habitat avoidance times (BMP DW-2). <u>Other Trails and Roads:</u> ▪ The new location must be no more than 400 feet upslope or downslope of the existing location ▪ The total amount of earthwork will not exceed 75 cubic yards per year. ▪ New crossings shall be free span bridges in creeks providing salmonid habitat or free span bridges or mortar or concrete free fords in creeks without salmonid habitat. ▪ All work is to be done when the work area is dry, during the appropriate fish and aquatic habitat avoidance times (BMP DW-2). When work will be done within or around perennial streams or during wet weather years in which the channel does not dry, work will be scheduled during periods of low flow and will adhere to the dewatering BMPs (DW-1, DW-2, and DW-3). ▪ Vegetation removal is limited to no more than a five-foot buffer around the new crossing and to trimming of no more than 20% of any individual tree canopy with the five-foot buffer.

BMP Number	BMP Title	BMP Description
EC-5	Revegetation of Disturbed Areas	Disturbed areas shall be re-vegetated according to Midpen's BMPs for Revegetation (Refer to Appendix E for detailed descriptions) and will use native plants whenever possible. If locally collected native plants are not available, sterile revegetation plants shall be used (e.g., cereal barley, Regreen, Trios). Disturbed areas shall be protected with correctly installed erosion control measures (e.g., jute, certified weed free straw, coconut fiber, or coir logs). Materials containing monofilament or plastic shall not be used.
Sediment/Water Quality Control Measures		
SWQ-1	Water Body Protection Measures	▪ Midpen will divert any flow at the project around the active maintenance site in a nonerosive manner. ▪ Limit work activities outside of a stream channel to the extent feasible to minimize stream disturbance and turbidity. ▪ If work within an inundated water body is necessary, conduct applicable dewater procedures to minimize water body disturbance and turbidity. ▪ During Program activities, silt control measures will be used during all phases of the project to prevent silt or earthen fill from entering the aquatic environment. In addition, exposed or disturbed areas within the project site will be stabilized to the greatest extent possible. ▪ BMPs will be used on temporarily stockpiled excavated sediment prior to disposal or reuse to protect water quality and beneficial uses. The excavated sediment may be stockpiled onsite so that it can be loaded into trucks for off-site disposal within three (3) working days. The excavated sediment may also be temporarily stockpiled at an off-site location so that runoff, sediment, or decant water from the excavated materials will not contact waters of the State and/or U.S. ▪ Implement a debris catchment system (e.g., nets, tarping) during bridge work to avoid the introduction of materials into a water way.
SWQ-2	Turbidity Monitoring	▪ When working within wet channels there will be a designated water quality monitor to monitor and document turbidity entering and exiting the work site. ▪ During Program activities in wetted stream channels or other aquatic habitat, Midpen or their contractor will monitor turbidity levels up and downstream of the project area before and during Program activities, and shall keep a log of turbidity data. Maintenance activities will not result in increases in turbidity of the stream of more than 20 percent of upstream sampling locations, as measured visually or by Nephelometric turbidity units (NTUs) as approved by the Regional Water Quality Control Board Waste Discharge Requirements and Water Quality Certification covering the project.

BMP Number	BMP Title	BMP Description
		▪ Upon Midpen's determination that turbidity/siltation levels resulting from project-related activities constitute a threat to aquatic life, activities associated with the turbidity/siltation will be halted until effective approved control devices are installed or abatement procedures are initiated.
SWQ-3	Sediment Filtering Measures	Midpen or their contractor will deploy silt curtains or other appropriate silt filtering devices, such as straw bales, around the excavation site to prevent heavily silted water from impacting areas around the project area. The silt curtain or silt filtering devices shall be maintained throughout all phases of the excavation and construction activities.
Dewatering Measure		
DW-1	Stream/Aquatic Habitat Isolation	▪ If repair activities affect the active channel, the work area shall be isolated from flowing stream segments using silt fences, wattles, and/or cofferdams and restored to pre-project conditions after maintenance is complete. All stream diversions shall be closely maintained and monitored. Pumped diversions shall be continuously monitored (24-hours). Upon completion of work in diverted channels, the stream diversion shall be removed and flow shall be re-directed through the new culvert or back into the original stream channel. ▪ Stream or aquatic habitat diversion systems will maintain as much instream or aquatic habitat connectivity as possible to allow for movement of aquatic organisms. Diversion will be conducted such that water at the downstream end does not scour the channel bed or banks. Coffer dams, if used, will be constructed upstream and downstream of the work area as close as practicable to the work site. Coffer dams shall be constructed of a non-erodible material which does not contain soil or fine sediment and shall be constructed with clean gravel and bags, and may be sealed with sheet plastic. All materials shall be removed from the stream or aquatic habitat upon project completion. Normal flows shall be restored to the affected stream immediately upon completion of work at that location. Coffer dams and the stream diversion system will remain in place and functional throughout the construction period. If, the coffer dams or stream diversion fail, they shall be repaired immediately. ▪ During dewatering of the channel, the decrease in water surface elevation (WSE) shall be controlled such that WSE does not change at a rate that increases turbidity to the creek that could be deleterious to aquatic life and the likelihood of stranding aquatic life up- and downstream of the creek. Flows shall be provided to downstream reaches during all times the natural flow would have supported aquatic life. Said flows shall be sufficient quality and quantity, and of appropriate temperature to support fish and other aquatic life both above and below the diversion.
DW-2	Pond Dewatering	When pond draining is required, work will occur between August 15 and November 1, prior to the beginning of California red-legged frog breeding season.
DW-3	Pumps	All pump intakes will be fitted with ¼ inch mesh screens to prevent aquatic species injury, mortality, or impingement.

APPENDIX B.

Midpeninsula Regional Open Space District Open Space Maintenance and Restoration Program Manual

Open Space Maintenance and Restoration Program Manual

August 2021

Midpeninsula Regional Open Space District

Open Space Maintenance and Restoration Program Manual

Prepared for: **Midpeninsula Regional Open Space District**
330 Distel Circle
Los Altos, CA 94022

Contact: Aaron Hébert, Senior Resource Management Specialist

Prepared by: **Horizon Water and Environment, LLC**
266 Grand Avenue, Suite 210
Oakland, CA 94610

Contact: Jeff Thomas, Principal

August 2021

Horizon Water and Environment. 2021. Midpeninsula Regional Open Space District – *Open Space Maintenance and Restoration Program Manual.* August. (18.041) Oakland, CA.

Table of Contents

Chapter 1. Introduction 1-1
1.1 Program Purpose and Background 1-1
1.1.1 Midpen Vision Plan and Measure AA 1-3
1.1.2 Programmatic Permitting Need 1-3
1.2 Program Objectives 1-5
1.3 Conservation Outcomes 1-5
1.4 Program Area 1-6
1.5 Summary of Program Activities 1-13
1.6 Projects or Activities Not Included in the Program 1-16
1.7 Natural Resource Protection and Impact Avoidance 1-17
1.8 Example Typical Activity within the Program 1-18

Chapter 2. Regulatory Framework 2-1
2.1 Regulatory Background 2-1
2.1.1 Permitting History 2-1
2.1.2 Activities Covered Under Existing Permits 2-5
2.2 Regulatory Guidance for Program 2-7
2.3 Tiered Approach Based on Activities and Resource Conditions 2-7
2.4 Permits and Authorizations Required for the Program 2-10
2.4.1 U.S. Army Corps of Engineers 2-10
2.4.2 U.S. Fish Wildlife Service 2-20
2.4.3 National Marine Fisheries Service 2-21
2.4.4 Regional Water Quality Control Board 2-22
2.4.5 California Department of Fish and Wildlife 2-25
2.4.6 California Coastal Commission and San Mateo County's Local Coastal Program 2-29
2.4.7 National Environmental Policy Act 2-29
2.4.8 California Environmental Quality Act 2-29

Chapter 3. Physical Setting 3-1
3.1 Watersheds and Creeks 3-1
3.1.1 Skyline Region 3-7

3.1.2 Foothill Region 3-8
3.2 Ponds 3-9
3.3 Geology and Soils 3-10
3.3.1 Skyline Region 3-15
3.3.2 Foothill Region 3-15
3.4 Hydrologic and Geomorphic Conditions 3-16
3.5 Water Quality 3-20
3.5.1 Beneficial Uses of Surface Waters 3-20
3.5.2 Impaired Waterbodies 3-24
3.5.3 Total Maximum Daily Loads 3-26
3.6 Groundwater Hydrology 3-28

Chapter 4 Biological Resources 4-1
4.1 Natural Communities and Habitats 4-1
4.1.1 Chaparral 4-5
4.1.2 Coastal Scrub 4-6
4.1.3 Conifer Forest 4-7
4.1.4 Grassland 4-8
4.1.5 Hardwood Forest 4-12
4.1.6 Oak Savanna 4-13
4.1.7 Riparian Communities 4-13
4.1.8 Aquatic and Wetland Communities 4-15
4.1.9 Non-Native/Ornamental Woodland 4-17
4.1.10 Urban 4-18
4.2 Fish Resources 4-19
4.3 Special-Status Plant and Animal Species 4-19
4.1.11 Special-Status Plants 4-21
4.1.12 Special-Status Animals 4-59
4.4 Invasive Animals and Plants, Noxious Weeds, and Pathogens 4-111
4.1.13 Invasive Plants 4-111
4.1.14 Invasive Animals 4-118
4.1.15 Pathogens 4-120

Chapter 5. Culvert, Bridge, Channel Pond, and Other Facility Maintenance 5-1
5.1 Culvert and Bridge Maintenance 5-1
5.1.1 Culvert Repair or Replacement 5-1
5.1.2 Bridge Maintenance and Replacement 5-4
5.2 Road and Trail Drainage Feature Maintenance 5-5
5.2.1 Unpaved and Paved Road and Trail Ditches 5-6
5.2.2 Ditch Relief Culverts 5-6
5.2.3 Armored Fords and Swales 5-7
5.2.4 Rolling dips 5-8
5.3 Sediment and Debris Removal 5-8
5.3.1 Sediment Removal 5-9
5.3.2 Debris Removal 5-11
5.4 Streambank Stabilization 5-12
5.5 Water Supply Structure Maintenance 5-15
5.6 Ponds 5-16
5.7 Minor Maintenance Activities 5-17

Chapter 6. Vegetation Management 6-1
6.1 Brushing and Mowing 6-3
6.2 Tree and Shrub Pruning 6-5
6.3 Tree Removal 6-5
6.3.1 Downed Tree Management 6-7
6.4 Aquatic Vegetation Removal 6-7
6.5 Fuel Management 6-8
6.5.1 Prescribed Burns 6-9
6.5.2 Disclines 6-10
6.5.3 Shaded Fuelbreaks 6-10
6.5.4 Maintaining Defensible Space around Buildings, Emergency Helicopter Landing Zones, Driveways, and Water Supply Infrastructure 6-11
6.6 Invasive Plant Removal 6-11
6.6.1 Pesticide Application 6-12
6.6.2 Compliance with Pesticide Injunctions Concerning Special-Status Species 6-18

6.7 Conservation Grazing 6-20
6.8 Traditional Ecological Knowledge Practices (Indigenous Stewardship). 6-21

Chapter 7. Road and Trail Maintenance 7-1
7.1 Paved Road Surface Maintenance Activities 7-1
7.2 Unpaved Road Surface Maintenance Activities 7-2
7.3 Trail Maintenance and Repair 7-4
7.4 Roadway or Trail Slip-outs and Slide Repairs 7-5

Chapter 8. New Small-Scale Facilities Improvements 8-1
8.1 Existing Buildings and Structure Repairs and Utility Improvements 8-1
8.2 Recreational Facility Improvements 8-2
8.2.1 New Trails/Roads and Re-Routes 8-2
8.2.2 New Bridges, Replacements, and Relocations 8-3
8.2.3 New Interpretative Facilities and Signage 8-5
8.2.4 Wildlife Crossings 8-6
8.3 Conservation Grazing Infrastructure Improvements 8-7
8.3.1 New Water Infrastructure 8-8

Chapter 9. Restoration and Enhancement Projects 9-1
9.1 Aquatic Habitat Restoration 9-1
9.1.1 Pond and Wetland Restoration 9-2
9.1.2 Creek and River Restoration 9-3
9.2 Native Vegetation Plantings 9-5
9.3 Invasive Species Removal 9-6
9.4 Road Decommissioning 9-8
9.5 Other Restoration Activities 9-9
Case Study – Hendry's Creek Restoration Project 9-11

Chapter 10. Impact Avoidance and Minimization, BMPs, and Mitigation 10-1
10.1 Introduction 10-1
10.2 Using Impact Tier Categories to Classify Potential Effects 10-1
10.3 Program Triggering Criteria 10-6
10.3.1 Maintenance Triggers for Culverts, Channels, Bridges, and Other Facilities 10-7

10.3.2 Maintenance Triggers for Roads and Trails 10-8
10.4 Work Limits 10-10
10.5 Best Management Practices (BMPs) 10-10
10.6 Mitigation Opportunities 10-17
10.6.1 Summary of Impacts to Wetlands, Waters, and Riparian Resources and the Federally or State Listed Species They Support 10-19
10.6.2 Timing of Mitigation 10-19
10.6.3 Mitigation Approaches 10-20
10.6.4 On-Site Mitigation Approach 10-20
10.6.5 Off-Site Mitigation Approach 10-21
10.6.6 Partner with Local Watershed Organizations 10-23
10.6.7 Mitigation Monitoring 10-23

Chapter 11. Program Administration and Reporting 11-1
11.1 Introduction 11-1
11.2 Annual Maintenance and Facilities Improvements Cycle 11-1
11.3 Project Site Definitions 11-2
11.4 Annual Work Plan Notification 11-3
11.5 Tier 1 Program Activities 11-4
11.6 Tier 2A, 2B and 3 Program Activities 11-6
11.7 Special Review Process 11-7
11.8 Projects on Properties Not Under Fee Ownership of Midpen 11-8
11.9 New Lands 11-8
11.10 Develop Mitigation Plan 11-8
11.11 Project Implementation 11-9
11.12 Annual Maintenance Summary Report 11-10

Chapter 12. Acronyms and Abbreviations 12-1

Chapter 13. Reference 13-1

Appendices

Appendix A Biological Resources Information
Appendix B Meeting Notes and Guidance from Regulatory Agencies
Appendix C Cultural Resource Sensitivty Maps
Appendix D Midpen's BMPs for Routine Maintenance Activities in Water Courses
Appendix E Midpen's Details and Specifications Guidelines

List of Tables

Table 1-1. Existing Midpen Open Space Preserves 1-9
Table 1-2. Summary of Program Activities by Facility or Feature 1-13
Table 2-1. Routine Maintenance Activities Completed (2013- 2019) 2-5
Table 2-2. Small Facility Infrastructure Improvements and Restoration Projects Completed (2016- 2020) 2-6
Table 2-3. Federal Endangered Species Act Coverage Mechanism for Potentially Affected, Federally Listed Species 2-17
Table 3-1. Major Watershed Areas and Surface Waters in the Skyline Region 3-7
Table 3-2. Major Watershed Areas and Surface Waters in the Foothill Region 3-8
Table 3-3. Designated Beneficial Uses of Surface Waters Potentially Affected by Activities 3-21
Table 3-4. 2014-2016 Clean Water Act Section 303(d) List of Impaired Waterbodies in the Program Area 3-24
Table 4-1. Special-Status Plant Species with Potential to Occur in the Program Area. 4-31
Table 4-2. Special-Status Animal Species with Potential to Occur in the Program Area. 4-77
Table 4-3. Invasive and Pest Plant Species Treated on Midpen Preserves 4-113
Table 6-1. List of Approved Pesticides Used for Vegetation Management on Midpen Lands 6-14
Table 6-2. Summary of Pesticide Used for Vegetation Management in Midpen Lands 6-15
Table 8-1. Midpen Projected New Small-Scale Facility Improvements 8-9
Table 9-1. Restoration and Enhancement Activities 9-13
Table 10-1. Summary of Midpen's Qualified Monitoring Requirements 10-5
Table 10-2. Program Activity Work Limits Per Activity Type 10-11

Table 10-3. Program Best Management Practices 10-25
Table 11-1. Timeline for Tier 1 Program Activities 11-4
Table 11-2. Timeline for Tier 2A, Tier 2B, and Tier 3 Program Activities 11-4

List of Figures

Figure 1-1. Program Area 1-7
Figure 1-2. Skyline and Foothill Regions 1-11
Figure 1-3. La Honda OSP Culvert Replacement Project 1-19
Figure 3-1. Watersheds in the Program Area 3-3
Figure 3-2. Soils in the Program Area 3-11
Figure 3-3. Impervious Surfaces in the Program Area 3-17
Figure 4-1. Vegetation Communities Map 4-3
Figure 4-2. Special-Status Plants Map 4-23
Figure 4-3. Special-Status Animals Map 4-61
Figure 4-4. Designated Critical Habitat 4-69

This page intentionally left blank

Chapter 1. Introduction

1.1 Program Purpose and Background

Midpeninsula Regional Open Space District (Midpen) was founded in 1972 and protects over 64,000 acres of open space in the South Bay and San Francisco Peninsula. Most of these lands are located within 26 open space preserves (OSPs or Preserves) that form a connected greenbelt in the greater Santa Cruz Mountains region for plants and animals to thrive while also providing ecologically-sensitive low-impact recreational opportunities for local residents to enjoy the forests, baylands, ridgelines, and mountains of the South Bay Area. These diverse and scenic landscapes, from bay wetlands to redwood forests and coastal grasslands, host an incredible diversity of life, making Midpen's region one of the world's biodiversity hotspots. Midpen OSPs have long and complex histories of human use prior to becoming public open spaces. Midpen actively manages the land and waterways to restore their health and function, helping the local ecosystem become more resilient in a time of climate change. By caring for the land, the land in turn takes care of Midpen, providing tangible and intangible benefits like clean air and water, flood protection, and the opportunity for restorative experiences in nature. Midpen's Open Space Maintenance and Restoration Program (OSMRP or Program) Manual (Manual) describes the ongoing, regular stewardship activities within Midpen Preserves for the purpose of obtaining state and federal environmental permits.

MIDPEN MISSION STATEMENT

To acquire and preserve a regional greenbelt of open space land in perpetuity, protect and restore the natural environment, and provide opportunities for ecologically sensitive public enjoyment and education.

Midpen boundaries enclose an area of approximately 227,900 acres in northern Santa Clara and southern San Mateo counties, and a small portion of Santa Cruz County. Midpen's Sphere of Influence includes an additional 8,333 acres near its southernmost boundary, of which most of this land is held within Midpen's Sierra Azul OSP. In 2004, Midpen's boundaries were expanded

MIDPEN COASTSIDE MISSION STATEMENT

To acquire and preserve in perpetuity open space land and agricultural land of regional significance, protect and restore the natural environment, preserve rural character, encourage viable agricultural use of land resources, and provide opportunities for ecologically sensitive public enjoyment and education.

to include more than 140,000 acres of the San Mateo County coast, from the Pacific Ocean to the Santa Cruz Mountain ridgeline, between Montara to the north and the San Mateo and Santa Cruz County line to the south (also referred to as Midpen's Coastside Protection Area or Coastal Annexation Area[1]). The Midpen's Coastside Protection Area has an added mission focused on protecting workable agricultural lands and coastal watersheds and preserving the rural character of the region. Midpen partners with small-scale local ranchers to use conservation grazing as a land management tool for enhancing native coastal grasslands and providing wildland fire protection.

Midpen manages land primarily to preserve a regional greenbelt of open space land. There are generally few improvements, other than parking areas, some restrooms, and informational signs. Relevant guidance documents that have described and directed Midpen's Preserve management approach include:

- Ordinance for Use of Midpeninsula Regional Open Space District Lands (July 1993, as amended)
- Resource Management Policies (February 2021)
- Vision Plan (February 2014a)
- Top 25 Open Space Projects Identified in Midpen's Vision Plan (2014b)
- Integrated Pest Management (IPM) Program Guidance Manual (September 2014c)
- Service Plan for the San Mateo Coastal Annexation Area (June 2003)
- Draft Wildland Fire Resiliency Program (as of January 2021)
- Individual Open Space Preserve Plans or Master Plans (Midpen 2012, 2017)

[1] Note that approximately three-fifths of Midpen's Coastside Protection Area is located within the Coastal Zone Boundary. Thus, all lands within the Coastal Zone are subject to local coastal policies adopted by San Mateo County pursuant to the California Coastal Act.

1.1.1 Midpen Vision Plan and Measure AA

In 2014, voters passed Measure AA, a 30-year, $300 million general obligation bond funding open space projects, including land conservation, restoration, and public access projects, described in Midpen's Vision Plan (2014a). The bonds will be used over the next 25 years to:

- Protect natural open space lands;
- Open preserves or areas of preserves that are currently closed to low-intensity public enjoyment and education;
- Construct public access improvements, including new trails and staging areas; and
- Restore and enhance open space land (i.e., forests, streams, watersheds, and coastal ranch areas).

During the first five years of funding (2014-2019), Midpen preserved an additional 2,000 acres, restored open space lands (i.e., forests, watersheds, and grasslands), opened the Bear Creek Redwoods Open Space Preserve (OSP) and La Honda Creek OSP to public access, added new trails on the Mount Umunhum summit and Mindego Hill, and re-introduced over 300 acres of land to conservation grazing as a land management tool to protect grassland habitat. In 2018, Midpen's Board of Directors adopted a new list of Measure AA projects that focused on opening additional public access areas and restoring habitat in Bear Creek Redwoods OSP and La Honda OSP. Measure AA funds will only be used for the 25-key project portfolios first identified in the 2014 Vision Plan (2014a) and further described in the Top 25 Open Space Projects (2014b).

With Measure AA funding, Midpen has more resources to acquire land for conservation and preservation purposes, improve public access by adding new unpaved trails and other amenities to existing Preserves, open areas of Preserves that are currently closed, and restore and enhance natural habitats.

1.1.2 Programmatic Permitting Need

Midpen annually conducts a few large-scale capital improvement and dozens of smaller maintenance projects on its OSPs to ensure proper care of the land and provide for ecologically sensitive public access opportunities. To date, many of these activities have been developed and permitted individually with state and federal environmental regulators, like the U.S. Army Corps of Engineers (USACE), the U.S. Fish and Wildlife Service (USFWS), the San Francisco Regional Water Quality Control Board (RWQCB), and the California Department of Fish and Wildlife (CDFW). Midpen also permits small scale work through 'programmatic' permits that cover many projects annually. Midpen has a Routine Maintenance Agreement (RMA) with CDFW, a maintenance-focused Waste Discharge Requirements (WDRs) and a 401 certification from the RWQCB, and species-specific recovery permits for the San Francisco Garter Snake and California Red-Legged Frog (CRLF) with the USFWS and for San Francisco Garter Snake and

California Tiger Salamander with CDFW. All of these permits together represent the state and federal permits needed to steward Midpen's open spaces, protect the environment, and restore important habitats.

Without a broadly applicable and consistent permitting strategy, small and large maintenance and construction projects take significantly longer to plan, permit, and construct. These delays create scheduling uncertainty and are costly to the public taxpayer. The purpose of developing the OSMRP is to streamline the permitting process and provide a more strategic and integrative approach to the planning and scheduling of Preserve maintenance, low-impact facility improvements, and habitat enhancement and restoration that are the core of both Midpen's overall mission and coastside mission, mentioned above. Administering Midpen's maintenance and restoration as a Program, versus a series of individual activities, allows Midpen to establish and follow a consistent set of maintenance methods, best management practices (BMPs), and impact avoidance approaches. Midpen conducts projects that protect and enhance the natural environment. The purpose of this Manual is to describe those activities that comprise the Program. This includes routine maintenance projects, habitat enhancement and restoration projects, and new small-scale construction activities that facilitate access for natural resource management and species recovery, such as improved or new unpaved trails.

This Manual provides guidance and practices that avoid and minimize potential environmental impacts during implementation of Program activities. The Manual describes impact mitigation approaches and monitoring and reporting activities. In addition, this Manual serves as a basis for Midpen to comply with the California Environmental Quality Act (CEQA) and other resource agency permitting requirements.

While the standard operating procedures and guidelines described in this Manual are intended to provide the Program with consistent approaches, the Program is also envisioned to be flexible and subject to periodic updates to reflect improved understanding of resource conditions, new technologies, and adaptive management practices within Preserves over time. Midpen acquires new lands each year and new challenges from climate change also drive the need for adaptation. This Manual will be submitted for review and comment to the following resource agencies: CDFW, USFWS, San Francisco Bay RWQCB, the Central Coast RWQCB, and USACE.

1.2 Program Objectives

The objectives of the Program include:

- Streamlining the regulatory permitting process by obtaining comprehensive long-term permits that improve work planning and implementation, and reduce delays.
- Utilizing existing and planned Midpen restoration and enhancement efforts in a strategic manner to ensure that the overall Program has a net benefit to regulated habitats and special-status species.
- Protecting and enhancing the natural environment and improving low-intensity public access throughout Midpen open space preserves.
- Avoiding and minimizing potential impacts to the natural environment when conducting activities by assessing habitat, species, and resource conditions.
- Identifying and prioritizing maintenance and facilities needs by weighing potential impacts vs. permitting requirements and timelines.

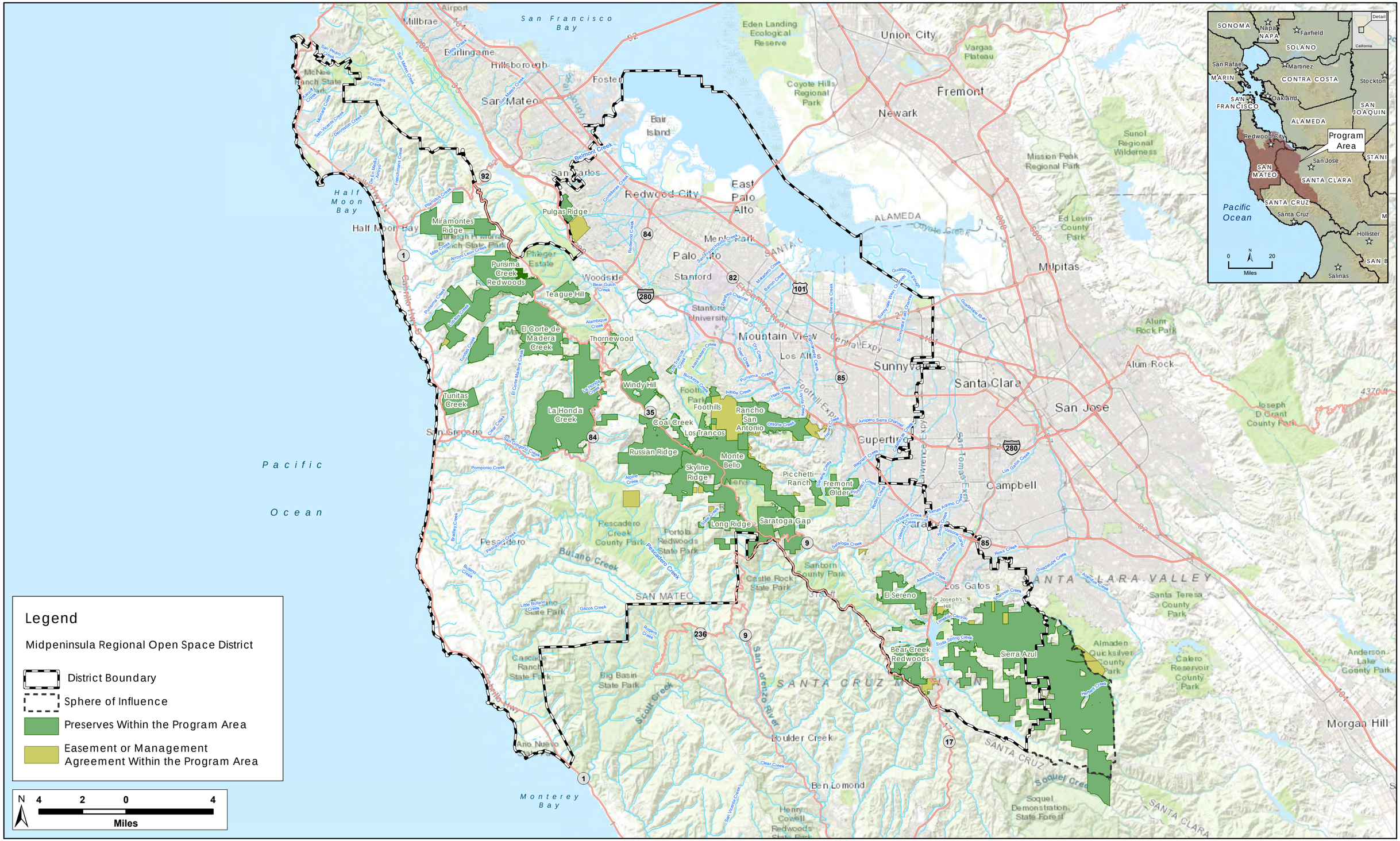
1.3 Conservation Outcomes

Conservation outcomes of the Program, which were derived and modified from Midpen's Resource Management Policies, IPM Guidance Manual, and Wildland Fire Resiliency Program, include:

- Reduce soil disturbances, erosion, and water quality impacts associated with maintenance activities through careful planning combined with implementation of best management practices (BMPs) that provide erosion control and protect water quality.
- Promote growth of native vegetation and protect and restore special-status species and sensitive habitats, and rehabilitate areas disturbed prior to Midpen ownership.
- Acquire and provide public access to lands while also protecting and restoring natural resources.
- Remove and manage invasive species while protecting natural resources and public health.
- Reduce fire fuels that contribute to the risk of catastrophic wildfire and restore ecosystems by removing invasive plant species and/or dead and excessive accumulated vegetation due to past fire suppression.

1.4 Program Area

The Program area currently consists of nearly 64,000 acres of protected open space in the Counties of San Mateo, Santa Clara, and Santa Cruz (refer to Figure 1-1). Most of these lands are located in 26 OSPs (refer to Table 1-1) within either the Skyline region or Foothills region (refer to Figure 1-2). Existing conditions within each open space preserve are described in Chapters 3 and 4.



H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 1-1: Program Area

Midpeninsula Regional Open Space District - Open Space Maintenance and Restoration Program

April 2021

This page intentionally left blank

Table 1-1. Existing Midpen Open Space Preserves

Open Space Preserve	Size (Acres)	Miles of Existing Trail	Grazing	Foothill or Skyline Region	County/ Community
1. Bear Creek Redwoods	1,437	7.2	No	Foothill	Los Gatos
2. Coal Creek	508	3.7	No	Skyline	Palo Alto Foothills
3. El Corte de Madera Creek	2,906	34.8	No	Skyline	La Honda
4. El Sereno	1,430	6.5	No	Foothill	Los Gatos/ Monte Sereno
5. Foothills	212	0.2	No	Skyline	Palo Alto/ Los Altos
6. Fremont Older	739	12.1	No	Foothill	Cupertino
7. La Honda Creek	6,144	10.6	Yes	Skyline	La Honda
8. Long Ridge	2,226	14.1	No	Skyline	Skyline
9. Los Trancos	274	6	No	Skyline	Los Altos
10. Miramontes Ridge	1,716	--	No	Skyline	Half Moon Bay
11. Monte Bello	3,537	18	No	Skyline	Palo Alto/ Los Altos
12. Picchetti Ranch	308	3.1	No	Foothill	Cupertino
13. Pulgas Ridge	366	6.2	No	Foothill	San Carlos
14. Purisima Creek Redwoods	4,798	28.9	Yes	Skyline	Half Moon Bay
15. Rancho San Antonio	3,988	25.2	No	Foothill	Los Altos Hills
16. Ravenswood*	374	1.3	No	Foothill	East Palo Alto
17. Russian Ridge	3,491	13.1	Yes	Skyline	Skyline
18. Saratoga Gap	1,613	1.4	No	Skyline	Saratoga
19. Sierra Azul	18,939	25.8	No	Foothill	San Jose

Open Space Preserve	Size (Acres)	Miles of Existing Trail	Grazing	Foothill or Skyline Region	County/ Community
20. Skyline Ridge	2,143	12.4	Yes	Skyline	Skyline
21. St. Joseph's Hill	270	4.2	No	Foothill	Los Gatos
22. Stevens Creek*	55	0.7	No	Foothill	Mountain View
23. Teague Hill	626	.2	No	Skyline	Woodside
24. Thornewood	167	1.6	No	Skyline	Woodside
25. Tunitas Creek	1,660	--	Yes	Skyline	Half Moon Bay
26. Windy Hill	1,414	13.6	No	Skyline	Portola Valley

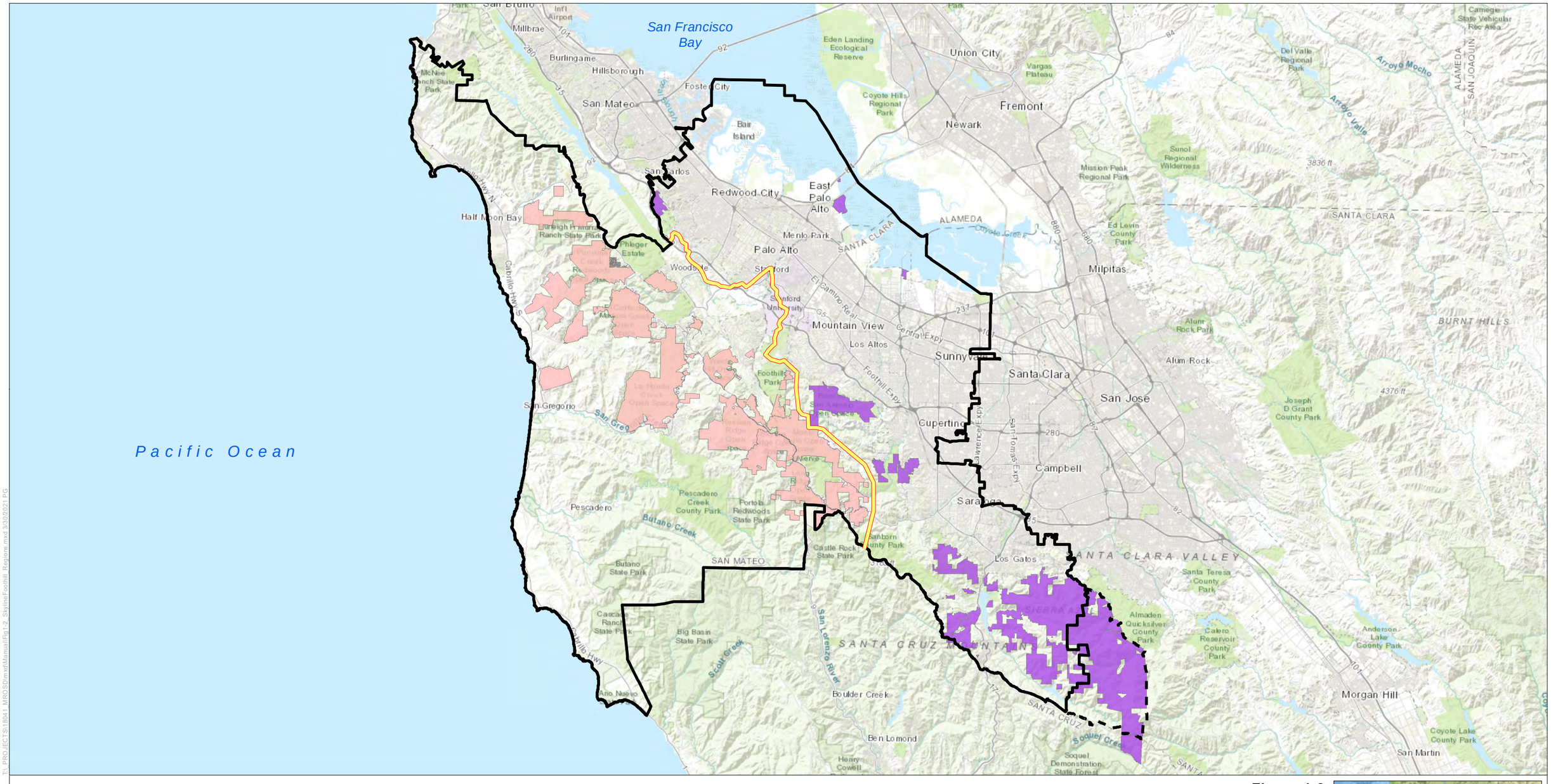
*Program activities would not be conducted at Preserves along the Bayside.

The Program area contains over approximately 900 culverts (including ditch relief and stream crossings), 150 trail bridges (including fords, puncheons, and boardwalks), 25 vehicle bridges, approximately 230 miles of streams (excluding many unmapped seasonal drainages and tributaries), 100 waterbodies (mostly ponds), 115 miles of single-track maintained unpaved trails, and 230 miles of maintained roads (including paved, unpaved seasonal, and unpaved all-season).

Midpen acquires several hundred acres across multiple properties each year within their Sphere of Influence and sometimes thousands of contiguous acres at once from private landowners. Newly acquired properties often come with a number of environmental issues needing attention, including:

- permitted and unpermitted structures built in sensitive environmental areas,
- unpermitted ponds or water diversions,
- invasive species,
- poorly designed and maintained roads, and
- generally degraded infrastructure and disturbed and/or degraded habitat.

Midpen undertakes comprehensive planning processes for these properties; however, urgent items such as road repairs, invasive species, or other critical natural resources issues must be addressed rapidly and would be addressed as part of this Program. Larger scale projects on new lands take longer to fund and develop and therefore fit well within the individual permit process and are not a subject of this proposed Program.


San Francisco Bay
Pacific Ocean
San Bruno
Millbrae
Burlingame
Hillsborough
San Mateo
Foster City
Bair Island
San Carlos
Redwood City
East Palo Alto
Menlo Park
Palo Alto
Stanford
Stanford University
Mountain View
Los Altos
Sunnyvale
Cupertino
Santa Clara
San Jose
Campbell
Saratoga
Los Gatos
Milpitas
Fremont
Newark
Union City
Eden Landing Ecological Reserve
Coyote Hills Regional Park
Vargas Plateau
Mission Peak Regional Park
Sunol Regional Wilderness
Ed Levin County Park
Del Valle Regional Park
Arroyo Mocho
Arroyo Valle
Camegie State Vehicular Rec Area
ALAMEDA
SAN JOAQUIN
SANTA CLARA
ALAMEDA
Coyote Creek
3836 ft
4376 ft
BURNT HILLS
Alum Rock Park
Alum Rock
Joseph D Grant County Park
Half Moon Bay
Pescadero
Pescadero Creek County Park
Portola Redwoods State Park
Butano Creek
Butano State Park
SAN MATEO
Castle Rock State Park
Sanborn County Park
Cascade Ranch State Park
Big Basin State Park
Scott Creek
San Lorenzo River
Boulder Creek
Ben Lomond
Henry Cowell
Soquel Demonstration State Forest
SANTA CRUZ MOUNTAINS
SANTA CLARA VALLEY
Almaden Quicksilver County Park
Calero Reservoir County Park
Santa Teresa County Park
Anderson Lake County Park
Morgan Hill
Coyote Lake County Park
San Martin
Año Nuevo
San Gregorio
Foothills Park
Phleger Estate
Portola Valley
Woodside
Foothill Expy
El Camino Real
Central Expy
San Tomas Expy
Lawrence Expy
Cabrillo Hwy
Pescadero Rd
Alpine Rd
Skyline Blvd
Page Mill Rd
Sand Hill Rd
Junipero Serra Fwy
Bayshore Fwy
Dumbarton Bridge
Coyote Creek
Guadalupe River
Los Gatos Creek
Saratoga Creek
San Francisquito Creek
Permanente Creek
Stevens Creek
Matadero Creek
Adobe Creek
Barron Creek
Hale Creek
Corte Madera Creek
Purisima Creek
Tunitas Creek
Pilarcitos Creek
Arroyo de en Medio
Arroyo de la Laguna
Alamitos Creek
Calero Creek
Guadalupe Creek
Los Alamitos Creek
Almaden Reservoir
Lexington Reservoir
Lake Elsman
Lake Cunningham
Lake Almaden
Lake Cascade
Lake Vasona
Lexington Reservoir
Stevens Creek Reservoir
Upper Crystal Springs Reservoir
Lower Crystal Springs Reservoir
San Andreas Reservoir
Pilarcitos Reservoir
Searsville Lake
Felt Lake
Huddart Park
Edgewood Park
Natural Preserve
Windy Hill Open Space Preserve
Russian Ridge Open Space Preserve
Monte Bello Open Space Preserve
Rancho San Antonio Open Space Preserve
Foothills Park
Arastradero Preserve
Los Trancos Open Space Preserve
Skyline Ridge Open Space Preserve
Purisima Creek Redwoods Open Space Preserve
Thornton Beach State Park
McNee Ranch State Park
Montara State Beach
Gray Whale Cove State Beach
Half Moon Bay State Beach
Francis State Beach
Pomponio State Beach
Pescadero State Beach
Bean Hollow State Beach
Año Nuevo State Park
Año Nuevo State Reserve
Waddell Creek Beach
Davenport Landing Beach
Greyhound Rock
Scott Creek Beach
Natural Bridges State Beach
Wilder Ranch State Park
Twin Lakes State Beach
Capitola City Beach
New Brighton State Beach
Seacliff State Beach
Manresa State Beach
Sunset State Beach
Zmudowski State Beach
Moss Landing State Beach
Salinas River State Beach
Marina State Beach
Monterey State Beach
Del Monte Beach
Asilomar State Beach
Carmel River State Beach
Point Lobos State Reserve
Carmel River State Beach
Garrapata State Park
Point Sur State Historic Park
Andrew Molera State Park
Pfeiffer Big Sur State Park
Julia Pfeiffer Burns State Park
Limekiln State Park
Big Sur River
Carmel River
Salinas River
Pajaro River
Elkhorn Slough
Moss Landing
Monterey Bay
Santa Cruz
Capitola
Watsonville
Aptos
Scotts Valley
Felton
Ben Lomond
Boulder Creek
Davenport
Bonny Doon
Big Sur
Carmel
Pacific Grove
Monterey
Seaside
Marina
Salinas
Castroville
Prunedale
Aromas
Hollister
San Juan Bautista
Gilroy
Coyote
Alum Rock
Berryessa
Evergreen
Silver Creek
Edenvale
Almaden Valley
Willow Glen
Rose Garden
Japantown
Downtown San Jose
Alviso
Milpitas
Fremont
Newark
Union City
Hayward
San Leandro
Oakland
Alameda
Berkeley
Albany
Richmond
San Pablo
El Cerrito
Kensington
Piedmont
Emeryville
Oakland International Airport
San Francisco International Airport
Mills College
Lake Merritt
Lake Temescal
Chabot Regional Park
Redwood Regional Park
Anthony Chabot Regional Park
Joaquin Miller Park
Sibley Volcanic Regional Preserve
Tilden Regional Park
Wildcat Canyon Regional Park
Point Pinole Regional Shoreline
Miller/Knox Regional Shoreline
Eastshore State Park
Crown Memorial State Beach
Robert W Crown Memorial State Beach
Arrowhead Marsh
Bay Farm Island
Coyote Hills Regional Park
Ardenwood Historic Farm
Quarry Lakes Regional Recreation Area
Shoreline Park
Sunnyvale Baylands Park
Ravenswood Open Space Preserve
Bair Island
Redwood Shores
Foster City
Belmont
San Carlos
Redwood City
Menlo Park
Palo Alto
East Palo Alto
Atherton
Woodside
Portola Valley
Los Altos Hills
Los Altos
Mountain View
Sunnyvale
Cupertino
Santa Clara
Saratoga
Los Gatos
Campbell
San Jose

This page intentionally left blank

Midpen also oversees and facilitates work on neighboring lands or partner properties within their Sphere of Influence such as lands of the Peninsula Open Space Trust (POST), State Parks, the San Mateo Resource Conservation District (RCD), San Francisco Public Utilities Commission, or the rights-of-way of local, County, and State roads, bringing expertise, sometimes funding, and permitting to activities that are consistent with the approved Program permitting framework.

1.5 Summary of Program Activities

The vast majority of Midpen's proposed Program activities benefit listed species and their habitats, consistent with Midpen's mission statement. Table 1-2 summarizes activities that are covered by the Program, which generally includes: (1) routine maintenance activities; (2) small-scale facility improvements and new low-intensity/small footprint facilities; and (3) restoration and enhancement projects. Facility improvements and new facility projects will be included in the Program when they are necessary to maintain Preserve facilities and amenities in good condition and can simultaneously reduce the threat of, or correct degradation of, natural environments, particularly where sensitive species will benefit.

Table 1-2. Summary of Program Activities by Facility or Feature

Facility or Feature	Typical Examples of Activity Type
Routine Maintenance Activities	
Ponds/lakes	Berm repair/maintenance Outlet, inlet, and pipe repair Trash and woody debris removal Vegetation removal Sediment removal (may include some recontouring) Invasive plant treatment Wildlife structure install (basking platforms/logs) Livestock exclusion fencing and gate repair Trash rack clearing
Water supply structures	Spring box and/or water tank maintenance or replacement Water line replacement, extensions, or realignments Instream diversion intake clearing Vegetation removal
Roads	Grading and shaping (may include rocking) Culvert repair and replacement Removal of asbestos from culverts and other structures

Facility or Feature	Typical Examples of Activity Type
	Sediment and debris removal at inboard ditches and stream crossings (including culvert inlets, outlets, and rocked fords)
	Fords and swales repair and replacement (including new culverts in place of fords)
	Bank stabilization
	Repair of gabion rock or riprap
	Road brushing/mowing
	Vegetation management
	Minor relocation of road segments (unpaved) to correct resource concerns (e.g. erosion, rutting)
	Installation of new roadside and trailside ditch relief culverts at non-stream crossings
	Repair and replacement of driveways
Bridges	Replace decking and handrails
	Minor structural repairs
	Repair and fortify bridge abutments
	Sediment and debris removal
	Addition of surface material to puncheons
	Vegetation management/removal
	Bridge removal or replacement (e.g., increasing span to outside ordinary high water mark [OHWM])
	Removal of lead paint
	Repainting bridges
Roadside/trailside ditches	Replace culverts and ditches
	Install new rolling dips and fords
	Replace and repair fords
	Sediment and debris removal
	Vegetation management
	Cleaning ditches
Trails	Grading and shaping
	Culvert repair and replacement
	Repair and replace fords and swales (including with new culverts)
	Bank stabilization
	Repair of gabion rock, riprap, or retaining wall
	Boardwalk repair

Facility or Feature	Typical Examples of Activity Type
	Trail brushing/mowing
	Vegetation management
	Minor relocation/ reroute
	Sediment and debris removal at channel/trail crossings
	Maintenance of rolling dips
	Fence, gate, and signage repair
Creeks	Vegetation management
	Sediment and debris removal
	Downed tree management and large woody material removal
	Bank stabilization
	Trash rack clearing
Other Midpen Parks and Open Space features (picnic or rest areas, natural areas, rangeland, staging areas, parking lots, tenant structures, field offices, etc.)	Invasive species removal (e.g. manual, mechanical, chemical, and biological) in natural lands
	Fire fuel management (e.g. manual, mechanical, grazing, and chemical) for disc lines and fuel breaks
	Maintenance/clearing of defensive space buffers around buildings, staging areas, roads, trails, water supply infrastructure, and use areas
	Mechanical and chemical treatment of vegetation at helicopter landing zones
New Facilities and Improvements	
Bridges	Bridge relocation or new installation to reduce resource/water quality impacts
Interpretive facilities and signage	Installation of new low-intensity, small-footprint interpretative facilities and signage at existing preserves
Ranching infrastructure	Improve existing ranching infrastructure, including fences, corrals, stock water
Utilities	Maintenance of septic, telephone, telecommunications, and other utilities etc.
Trails	Reroute existing unpaved trails, provide new trail connections and public access, and single-track trail resurfacing for Americans with Disabilities Act (ADA) compliance
Wildlife crossings	Construct wildlife crossings some of which may also provide public access
Existing buildings and structures	Repair existing structures to provide habitat for wildlife species

Facility or Feature	Typical Examples of Activity Type
Water infrastructure	Replace or remove degraded water infrastructure facilities
Restoration and Enhancement Activities	
Removal of in-stream infrastructure (i.e., impoundments) and collapsed structures (i.e., bridges or culverts) or upsizing of culverts	Creation of aquatic habitat and/or improvement of fisheries habitat, flows, sediment transport
Native vegetation plantings and seeding	Habitat enhancement
Traditional ecological knowledge practices (indigenous stewardship)	Plant gathering, seed collection, and plantings
Wildlife friendly spring box/troughs	Habitat enhancement to prevents wildlife entrapment
Pond and stream restoration	Improve ponds and streams to restore aquatic habitat
Treatment of invasive species	Habitat enhancement
Exclusion fencing	Habitat enhancement to exclude cattle and protect species
Prescribed burns	Habitat enhancement, fuels management, and cultural fire
Conservation grazing	Fuels and species/grassland management
Road decommissioning	Restored hydrology and watershed processes
Water well decommissioning	Entrapment hazard removal and water quality protection
Structural demolitions in riparian or other sensitive areas	Habitat enhancement

1.6 Projects or Activities Not Included in the Program

The Program does not include large, complex projects, such as new paved parking areas, new ponds, new offices, or other projects that significantly increase visitor capacity to Midpen Preserves. These types of activities would be outside of the scope of the Program and thus, would be permitted separately (to the extent that permits are needed for those activities).

In addition, emergency maintenance actions or unplanned repair work are not included in the Program, nor addressed by Program CEQA compliance or permits and authorizations. A situation is considered an "emergency" if it is a sudden, unexpected occurrence involving a clear

and imminent danger that demands immediate action to prevent or mitigate loss of or damage to life, health, property, or essential public services (Public Resources Code Section 21060.3). An emergency situation could involve activities that would otherwise be considered routine maintenance as described in this Manual but may need to occur at an unplanned time. Although emergency situations are not covered by the permits authorizing Program activities described in this Manual, Midpen will make every effort to follow the impact avoidance and minimization guidance provided in this Manual when implementing activities under emergency conditions.

1.7 Natural Resource Protection and Impact Avoidance

Midpen's lands were acquired and managed to improve habitat. As urban development has intensified in the Bay Area, Midpen's lands have been a refuge for a variety of protected and important species. The unintended result of this is that the environmental protections given to those species bear especially on Midpen's land management. Most of Midpen's Preserves contain special status species or their habitats. Midpen's projects almost always have the potential to impact these species if not for the close observation of biologists or the carefully timed construction to avoid them. Various portions of the Program area have sensitive habitat for special-status species, including but not limited to, critical habitat for California red-legged frog, San Francisco garter snake, marbled murrelet, and Bay checkerspot butterfly (refer to Figure 4-5 in Chapter 4, *Biological Resources*). Midpen values these natural resources and aims to minimize impacts to these species and their habitats and other sensitive resources by implementing impact avoidance and minimization measures. In addition, the Program is designed to be self-mitigating; habitat enhancement and restoration activities offset Program impacts. Chapter 4 of this Manual, *Biological Resources*, describes the sensitive natural resources in the Program area. Chapter 10, *Impact Avoidance and Minimization, BMPs, and Mitigation*, further describes the Program's approach to reduce potential environmental impacts and includes a comprehensive table that identifies BMPs for the Program. Detailed BMPs including those implemented for specific biological resources and cultural resources are presented in Chapter 10.

Each permitting agency has its own enabling laws and statutes that drive how they evaluate the individual and cumulative effects of Midpen's land management; a potentially negative effect to one agency may be a beneficial change to another. For the USFWS, a project must have a reasonably direct benefit to a listed species to be a 'recovery' action and benefit from a recovery permit. Much of Midpen's restoration program are recovery actions. Other activities, like roads maintenance, do not directly benefit a listed species like CRLF and are therefore analyzed differently under a different permit. Even so, improving watershed conditions supports CRLFs and in many cases helps manage sediment in watersheds that are impaired under the Clean Water Act. Midpen's program often blurs the line between maintenance and restoration because of its mission to restore the environment. Activities that may be initiated for an operational or maintenance reason are often modified to better serve a restoration purpose or may be combined with a nearby restoration project for efficiencies.

Throughout this Program Manual, the temporary, permanent, and potential impacts to the environment are discussed in light of each maintenance and restoration activity. The concluding chapters look at program as a whole, assessing the overall or net effect of Midpen's stewardship. The program as a whole is 'self-mitigating' in that any impacts are more than offset by the measurable, beneficial actions Midpen takes.

1.8 Example Typical Activity within the Program

Unpaved dirt roads sometimes lack proper drainage and introduce excess sediment into streams and watersheds. Midpen seeks to improve road drainage through maintenance of its roads. These roads provide trail access, emergency response, and help Midpen steward natural resources. A common problem is an undersized culvert, which conveys water underneath a road to and from a natural stream channel. When these pipes are too small, they sometimes become plugged with tree limbs and other natural material. When plugged, the water levels rises and erodes the road, eventually moving parts of the road into the stream system. The water quality is then impacted and habitats for aquatic species are harmed. To prevent this from happening, Midpen replaces undersized culverts with larger culverts or bridges. The construction of properly designed culverts causes "temporary" and "permanent" impacts to the environment (as described through the lens of the Clean Water Act), even though the project itself improves the environment overall. Temporary impacts could include fine dusty soil entering the creek, noise disturbances to nesting birds, or the removal of vegetation necessary to physically access the culvert. Permanent impacts would be a longer culvert, which reduces the amount of natural channel length, but prevents erosion and better mimics the natural channel slope. Midpen uses BMPs for roads and trails to protect the environment (such as those in the California Salmonid Stream Habitat Restoration Manual).

The culvert pictured below is conveying water from a small tributary to Harrington Creek, which flows to San Gregorio Creek, home to some of the best salmonid habitat in the region. The old culvert (top photo) extends just beyond the road and juts into the air, causing water to plunge into the stream below and erode. If not for the replacement culvert, sediment from this erosion would eventually flow downstream and may harm eggs laid by salmon by covering them, depriving them of oxygen. In the photos below, the replacement culvert is angled down to match the natural angle of the creek and then rock is placed below the outlet to dissipate the energy and reduce the potential for erosion. From a permitting standpoint, there are temporary and permanent impacts, but this project results in an overall benefit to the environment. This culvert replacement and many others in La Honda OSP were funded by the Fisheries Restoration Grant Program.

Existing old culvert that extends beyond the road and juts into the air, resulting in erosion

Replacement culvert installed to match the natural angle of Harrington Creek

Replaced culvert outlet and energy dissipater installed to reduce the potential for erosion

Figure 1-3. La Honda OSP Culvert Replacement Project

This page intentionally left blank

Chapter 2. Regulatory Framework

This chapter describes environmental regulations and permitting processes that apply to the Open Space Maintenance and Restoration Program (OSMRP or Program). Before describing the relevant regulations and permits, this chapter begins by summarizing past maintenance activities conducted by Midpeninsula Regional Open Space District (Midpen) and associated regulatory permits.

Agencies with regulatory authority over Program activities include the U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service (USFWS), State Historic Preservation Officer (SHPO), California Regional Water Quality Control Board (RWQCB) Region 2 – San Francisco Bay and RWQCB Region 3 – Central Coast, California Department of Fish and Wildlife (CDFW), and the California Coastal Commission (CCC). In addition, local city and county permits will be obtained as needed for Program activities.

This chapter also describes compliance with California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA).

2.1 Regulatory Background

2.1.1 Permitting History

Midpen annually conducts a wide range of capital improvement and maintenance projects on its open space preserves (OSPs or Preserves) that are covered by a variety of regulatory agreements and permits. A description of Midpen's existing permits, agreements, and approvals is described below.

U.S. Fish and Wildlife Service

Federal Endangered Species Act 10(a)(1)(A) Recovery Permit

The USFWS issued a Federal Endangered Species Act (FESA) 10(a)(1)(A) Recovery Permit (dated December 22, 2016, expiring December 21, 2021) to Midpen for habitat enhancement and management activities and prepared a Biological Opinion (BO) (dated December 9, 2016) for the issuance of the Recovery Permit. This permit authorizes Midpen to take (i.e., harass by survey, capture, handle, transfer, mark, collect tissue, and release) the San Francisco garter snake (SFGS; *Thamnophis sirtalis tetrataenia*; state and federally listed as endangered) and the California red-legged frog (CRLF; *Rana draytonii*; federally listed as threatened and a California species of special concern) in conjunction with habitat management activities (e.g., prescribed fire, invasive species removal, pond restoration and creation, road and trail maintenance, removal of dilapidated structures, and cattle grazing) for the purpose of enhancing their survival. These activities are authorized on any Midpen holdings in San Mateo and Santa Clara counties, excluding Ravenswood OSP and Stevens Creek Shoreline Nature Study Area OSP (where these two species do not occur anyway). By March 31 of each year, Midpen is required to submit an annual workplan that includes a description of each site-specific recovery activity to be performed in that calendar year. This workplan incorporates recovery activities reflected in other Midpen activity lists, such as the Routine Maintenance notification and Action Plan, and it may also describe non-construction activities such as pond monitoring that are part of Midpen staff's "core function" and are not generally described elsewhere. No activities requiring the Recovery Permit can proceed within 30 days after the annual work plan is submitted without USFWS approval. The Recovery Permit also requires that the work plan be submitted to CDFW for review.

During the USFWS review of the annual work plan, the USFWS will verify that a proposed site-specific activity benefits SFGS and/or CRLF. Only those activities with a clear benefit to these species can be performed under the take authority granted by the Recovery Permit. Activities covered by the Recovery Permit include pond enhancement, such as vegetation removal, basin deepening and sediment removal, dam repair and strengthening, and planting of vegetation; prescribed burns; invasive pest management and hazardous fuel reduction; grazing management; trapping surveys for SFGS; and surveys for CRLF. The existing Recovery Permit includes some activities, such as road and trail maintenance, that provide an indirect benefit to listed species, such as by avoiding excessive sedimentation of streams or maintaining access for Midpen personnel to perform management, restoration, and monitoring activities that directly benefit these species. However, the USFWS is moving toward excluding any activities that do not have a direct recovery benefit, so some road and trail maintenance may no longer be covered by the Recovery Permit when it is renewed in 2021.

The Recovery Permit includes a number of conditions for covered activities. For example, approved Midpen biologists have to perform an educational program for work crews prior to the start of work; monitor work activities that could result in take; relocate individuals out of harm's

way as necessary; establish travel corridors for vehicles and heavy machinery; and notify the USFWS and CDFW if any CRLF or SFGS are injured or killed during enhancement or management activities. The Recovery Permit also includes a number of conditions on the timing of various enhancement and management activities, restrictions on allowable herbicides and fungicides, and other conditions. The existing Recovery Permit authorizes up to one adult or juvenile CRLF and one larval CRLF per locality to be injured or killed each year; no injury or mortality of SFGS is authorized. Although Midpen has never detected injury or mortality of CRLF during its recovery activities, the take levels in the amended Recovery Permit may be higher to encompass potential take from the vast extent of Midpen's recovery activities.

In addition to addressing potential effects of recovery activities on the SFGS and CRLF, the BO issued for the Recovery Permit also evaluated effects of habitat management and enhancement activities on the marbled murrelet (*Brachyramphus marmoratus*; federally threatened and state endangered), Bay checkerspot butterfly (*Euphydryas editha bayensis*; federally threatened), and Santa Clara Valley dudleya (*Dudleya setchellii*; federally endangered), as well as on designated critical habitat for the CRLF, marbled murrelet, and Bay checkerspot butterfly.

The USFWS typically does not provide take approval for federally listed plants, as take of plants by Midpen on its own lands is not a violation of FESA (although Midpen may implement measures to avoid or minimize take of such species).

California Department of Fish and Wildlife

Routine Maintenance Agreement

Currently, Midpen conducts routine maintenance activities in compliance with a Section 1602 Routine Maintenance Agreement (RMA), which is a programmatic, long-term permitting mechanism under the Lake and Streambed Alteration Program. The original RMA (Notification No. 1600-2012-0444-R3) was issued in 2012 and amended in 2018. The extension is valid through December 2022. RMAs are commonly 5-year agreements and cover a set list of maintenance activities to maintain channel capacity. The current RMA provides guidance, terms, and conditions for implementation of culvert, bridge, and ford and swale replacement, repair, and maintenance; sediment removal; bank stabilization; road and trail maintenance; ponds and lakes maintenance; vegetation management and removal; fire control; and habitat enhancement activities. The RMA also identifies required avoidance and minimization measures, including seasonal work restrictions, wildlife pre-work surveys, stream diversion techniques, revegetation requirements, and notification responsibilities.

Memorandum of Understanding

On April 6, 2017, CDFW issued a California Endangered Species Act (CESA) 2081(a) MOU authorizing Midpen to take SFGS and California tiger salamander (CTS) (*Ambystoma californiense*; state and federally listed as threatened) for scientific research and habitat creation, enhancement, and maintenance activities related to the conservation and recovery of

these species. The Memorandum of Understanding (MOU), which expires December 21, 2021, authorizes Midpen to handle and trap these species during surveys, collect tissue samples, salvage dead or dying individuals, and relocate SFGS over short distances. This MOU does not authorize Midpen to move individuals out of harm's way during project activities, and does not allow any injury or mortality beyond that approved by the federal Recovery Permit.

In addition, Midpen has a Scientific Collecting Permit (SCP) from CDFW, valid November 14, 2017 through November 14, 2020 that authorizes handling of CRLF, SFGS, CTS, foothill yellow-legged frog (*Rana boylii*; listed as threatened under CESA), and four additional California species of special concern: the western pond turtle (*Actinemys marmorata*), Santa Cruz black salamander (*Aneides niger*), California giant salamander (*Dicamptodon ensatus*), and coast horned lizard (*Phrynosoma blainvillii*). The SCP also authorizes the capture and sacrifice of bullfrogs (*Lithobates catesbeianus*). CDFW has temporarily extended the SCP as Midpen moves through the permit renewal process.

All CDFW authorizations include detailed reporting requirements as well.

Streambed Alteration Agreements

Streambed Alteration Agreements (SAAs) issued by CDFW for Midpen's individual activities typically contain conditions to avoid and minimize impacts to sensitive species. These SAAs often include authorization for CDFW-approved biologists to relocate individuals out of harm's way for the specific project for which the SAA has been issued. Species for which measures may involve relocation or exclusion measures include most of those mentioned above, as well as the San Francisco dusky-footed woodrat (*Neotoma fuscipes annectens*; a California species of special concern), roosting bats, and stranded aquatic life (i.e., fish and amphibians). Active nests of native birds, including the marbled murrelet, as well as active bat maternity colonies, must be avoided while breeding is occurring. SAAs may also contain project-specific measures to avoid or minimize take of state-listed plants; Midpen has no existing permits (such as an Incidental Take Permit [ITP]) allowing programmatic take of any state-listed plant species.

Regional Water Quality Control Board

Midpen conducts routine maintenance activities in compliance with a Section 401 Water Quality Certifications (WQCs) and Waste Discharge Requirements (WDRs) from the San Francisco Bay RWQCB, (Order No. R2-2010-0083, adopted in June 2010).The issuance of the Section 401 permit authorizes Midpen to conduct the following routine maintenance activities for the purposes of maintaining and enhancing water quality, protecting fish and wildlife habitat, and maintaining trail, road, and drainage infrastructure: facilities maintenance such as roads, trails, bridges, culverts, and water supply facilities; vegetation management such as large wood debris management; and bank stabilization. In addition, the permit identifies general provisions and measures for avoiding and minimizing impacts to waters of the State and notification requirements. The San Francisco Bay RWQCB has granted waiver letters to allow Midpen to

continue conducting work under Section 401 permit while they apply for a new Section 401 permit.

2.1.2 Activities Covered Under Existing Permits

Through multiple existing permits, Midpen conducts routine maintenance activities, new facility improvements and development projects, restoration projects, vegetation and pest management, monitoring, and other types of projects on its OSPs.

Routine Maintenance Activities

Routine maintenance activities are defined as activities that occur repeatedly over time and are covered under an existing CDFW RMA and RWQCB WDRs. These types of activities include:

- Repair and maintenance of trails, roads, culverts, bridges, ponds, lakes, staging areas, parking lots, and water supply facilities;
- Sediment and debris removal;
- Bank stabilization;
- Drainage and erosion improvements;
- Fire control;
- Habitat enhancement activities; and
- Graffiti and trash and litter removal.

Table 2-1 summarizes the annual number of completed routine maintenance activities by repair type from 2013 to 2019. As shown in Table 2-1, the majority of maintenance activities from 2013-2019 involved culvert repair and replacement and road and trail maintenance. Midpen also conducts unplanned maintenance work as needed in response to unforeseen changed conditions or imminent threats to public safety.

Table 2-1. Routine Maintenance Activities Completed (2013- 2019)

Routine Maintenance Repair Type	2013	2014	2015	2016	2017	2018	2019
Culvert Repair/Replacement and Maintenance	5	4	7	2	5	18	15
Roads and Trail Drainage Maintenance	2	1	4	2	4	14	5
Bridge Repair	0	0	0	0	1	1	1
Vegetation Management Activities*	0	1	1	0	2	79*	66*

Routine Maintenance Repair Type	2013	2014	2015	2016	2017	2018	2019
Debris and Trash Removal, Woody Debris Removal, and Other Drainage Maintenance	0	1	2	0	0	0	1
Water Supply Facility Repair	0	0	4	0	2	2	0

*In the past, vegetation management activities near riparian areas were not documented separately. However, with implementation of the Integrated Pest Management (IPM), Midpen is better able to track its vegetation management activities, which is why there is a large increase in the number of activities between years 2014-2018 and 2019.

Other Projects

Midpen also conducts a variety of other projects that are forecasted in Midpen planning documents and implemented in Midpen work/action plans, including the Capital Improvement Plan (CIP), adopted Measure AA project list, and specific OSP plans.

With Measure AA funding, Midpen is focused on improving public access and restoring habitats throughout its Preserves, and acquiring new lands in the next 25 years. Measure AA projects include new facility improvement and development projects, such as installing new trails, trail connections, parking lots, improved roads, and other visitor service amenities, as well as facility infrastructure projects such as fiber optic installation, well drilling, etc. Species restoration activities include salmonid barrier removal, reduction in sedimentation from old roads, pond habitat restoration for CRLF, provision of wildlife crossing structures, and other improvements. Table 2-2 summarizes the annual number of completed small facility infrastructure and restoration projects from 2016 to 2020. Measure AA funding has increased Midpen's capacity to complete more land conservation, public access, and restoration projects.

Table 2-2. Small Facility Infrastructure Improvements and Restoration Projects Completed (2016- 2020)

Type of Project	2016	2017	2018	2019	2020
Infrastructure Improvement Projects (i.e., water pipelines/systems, trails, restrooms, signs, gates, fencing, etc.)	10	7	7	1	1
Restoration Projects (i.e., demolitions, large woody debris placement, revegetation, debris removal)	5	6	8	0	3

Type of Project	2016	2017	2018	2019	2020
Habitat improved by invasive species management (acres)	800	2,093	1,400	1,030	1,000

One of the goals of Midpen is to protect and enhance the natural environment within its Preserves while undertaking system-wide facility improvements. Restoration projects improve the natural environment and include removing non-native vegetation, planting and seeding native vegetation, and eradicating invasive non-native species. Midpen enhances ponds and streams on its properties to improve habitat for sensitive amphibians and aquatic species. Vegetation and pest management projects are conducted according to Midpen's Integrated Pest Management (IPM) Program and include both large- and small-scale vegetation management projects on natural lands to maintain native vegetation and manage ignitable fuel loads. Midpen also conducts water quality monitoring and species monitoring.

2.2 Regulatory Guidance for Program

Prior to the Program, individual project permitting was very time consuming and resulted in permitting uncertainty and delays. In 2019, Midpen met with regulatory agency representatives to discuss approaches for obtaining programmatic permits. Midpen met with staff from the RWQCB, CDFW, USACE, USFWS, and the National Oceanic Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS). General topics discussed at these meetings included the applicability of a USACE Regional General Permit, mitigation approaches, the possibility of not needing Section 7 coverage for listed fish species, and the need to evaluate structures over 50-years old if they will be impacted. Based on the 2019 meetings, Midpen received guidance from regulatory agencies on how best to proceed with developing the Program to obtain long-term permits. Refer to Appendix B for detailed meeting notes and guidance received from the regulatory agencies.

2.3 Tiered Approach Based on Activities and Resource Conditions

Based on regulatory agency recommendations for other similar programs in the region, Midpen's Program incorporates a tiered approach for addressing potential effects on special-status species and habitats based on site-specific resource sensitivity. The tiered approach will help Midpen and regulatory agency staff identify resource and site sensitivity and thereby prioritize impact avoidance and minimization measures and/or best management practices (BMPs) accordingly. The Program includes the following three project tiers:

- Tier 1 – No Effect. There is no potential for a special-status species to be present in the maintenance area at any time. Tier 1 is appropriate if the biologist determines that Program activities would occur in creek reaches inaccessible to special-status fish or, for terrestrial special-status species other than birds, in areas where no suitable breeding habitat is present and there is no connectivity between the site and known or potential breeding habitat (so that non-breeding individuals can also be presumed to be absent). Because foraging or roosting birds could easily fly away before being impacted by Program activities, the implementation of Program activities in non-breeding habitat for special-status bird species would also be considered a Tier 1 because such activities would not result in impacts on individuals that rise to the level of "take". No qualified biologist or biological monitor would need to conduct pre-activity surveys or to be present during the performance of Tier 1 activities. Tier 1 activities would not result in take of individuals or habitat, even if permanent impacts to habitat conditions occur.

- Tier 2 – A special-status species could occur, at least at times, at a site, but take will not occur. Tier 2 is applicable if the biologist determines that one or more special-status species are known to occur or could possibly occur on-site either because (1) suitable breeding habitat is present, or (2) for terrestrial species and fish, suitable non-breeding habitat is present and there is connectivity between the work site and suitable breeding habitat.

    - Tier 2A (Not Likely to Adversely Affect) – The activity will not result in take of special-status species based on the location and timing of work; although a special-status species could occur at the location at times, none would be present when the work will occur. For example, CRLFs could potentially occur in numerous work areas during nighttime and wet-season dispersal but are not expected to occur far from (e.g., more than 100 feet) aquatic and wetland habitats during daytime, dry-season activities. During numerous pre-activity surveys and performance of Program activities (including associated biological monitoring), Midpen has not observed any CRLFs under such conditions. Pre-activity surveys and monitoring by a qualified biologist or biological monitor are not required for this tier, though either may be conducted (e.g., they may pre-check a work location and/or monitor as a precautionary measure). Examples are dry-season, daytime brushing, minor facility improvements, mowing, pesticide application consisting of spot-application, or fencing installation or repair that takes place more than 100 feet from wetland or aquatic habitat. During all work, Midpen's personnel (who are well-trained on the biology of special-status species, appropriate avoidance measures, and procedures to follow when they are encountered) will keep an eye out for special-status species and contact the Midpen biologist immediately if any animal that could potentially be a special-status species is observed. If any such individual is encountered, maintenance activities that could potentially affect the species will cease until the species is

confirmed to have left the work area on its own, or until a qualified biologist or biological monitor visit the site to determine whether it is a special-status species and whether it is in harm's way from the activity. If so, avoidance and minimization measures will then be implemented as described below for Tier 2B activities.

- Tier 2B (Not Likely to Adversely Affect for individuals, but may be considered Likely to Adversely Affect if permanent habitat impacts occur) – The activity will not result in take of special-status species with implementation of BMPs , such as pre-activity surveys, exclusion of individuals from the site, and/or implementation of non-disturbance buffers around active nests of special-status birds. Such BMPs would be implemented or overseen as necessary by a qualified biologist or biological monitor. Depending on the sensitivity of the work area and the likelihood that individuals may move into the work area after the pre-activity surveys are conducted, some of these activities may require a biological monitor. Though a qualified biologist would not necessarily be on-site, they would be assigned to each project and would determine when pre-activity surveys and monitoring are necessary, and would oversee any avoidance and minimization measures implemented by biological monitors. In addition, as discussed for Tier 2A, trained Midpen maintenance personnel will keep an eye out for special-status species and contact the Midpen biologist immediately if any animal that could potentially be a special-status species is observed.

  Some Tier 2B activities may result in a permanent loss of habitat. If permanent habitat loss occurs in holdings where special-status species occur in higher densities and/or with a higher frequency of occurrence, the USFWS would likely consider this loss of habitat to constitute take under FESA, in which case the FESA determination for that activity would be "Likely to Adversely Affect". Permanent habitat loss in holdings where special-status species occur in lower densities and/or with a lower frequency of occurrence and temporary habitat loss in any holding would be considered "Not Likely to Adversely Affect" the species.

- Tier 3 (Likely to Adversely Affect) – The activity may result in take of special-status species, even with implementation of BMPs. Tier 3 is applicable if the biologist determines that (1) a special-status species are known to occur or may occur on site either because suitable breeding habitat is present or suitable non-breeding habitat with connectivity between the site and suitable breeding habitat is present; (2) the special-status species may be present at the time of day/season in which the Program activity occurs; and (3) special-status species cannot be effectively excluded from the work area, pre-activity surveys cannot definitively determine the absence of the species, and/or "take" in the form of permanent loss of habitat cannot be avoided. An example Tier 3

project might include culvert replacement activities on streams known for salmonid habitat or pond maintenance activities in CRLF habitat. For these types of activities, Midpen anticipates that BMPs, avoidance and minimization measures, and possibly an on-site qualified biologist would be needed to minimize construction-related effects. Compensatory mitigation may be needed to offset permanent effects on sensitive species and/or habitat. However, for CRLF and SFGS, because the Program will have a net beneficial effect on these species' populations, compensatory mitigation for permanent impacts from one activity (or set of activities) may simply consist of the identification and implementation of enhancement and management activities that offset those permanent impacts. In short, the Program as a whole will be self-mitigating with respect to CRLF and SFGS.

More detailed descriptions of the Program's activities are provided in Chapters 5-9 and discussion of impact avoidance, minimization, and mitigation approaches are provided in Chapter 10.

2.4 Permits and Authorizations Required for the Program

The following sections describe each agency's regulatory authority and permitting process for the Program. This chapter also describes compliance with CEQA and NEPA.

2.4.1 U.S. Army Corps of Engineers

Clean Water Act - Section 404

Section 404 of the Clean Water Act (CWA) prohibits the discharge of dredged and fill materials into waters of the United States (U.S.), including wetlands, without prior USACE authorization. "Discharge of dredged material" and "discharge of fill material" are defined in Title 33, Section 323.2 of the Code of Federal Regulations (33 Code of Federal Regulations [CFR] Section 323.2). "Waters of the U.S.," including "wetlands," are defined in 33 CFR Section 328.3. USACE jurisdiction in wetlands and other waters of the U.S. is briefly summarized below.

Wetlands

USACE regulates wetlands, which are defined as those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. USACE jurisdiction extends to the limits of wetlands, which are delineated following the methodologies outlined in USACE's 1987 *Wetland Delineation Manual* and its 2008 *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region*. Wetlands are present in many portions of the Program area where activities may occur.

Non-wetland "Other" Waters of the U.S.

In non-tidal waters without wetlands present, USACE jurisdiction extends to the ordinary high-water mark (OHWM); when non-isolated wetlands are present, the jurisdiction extends beyond the OHWM to the boundary of those wetlands. In the Program area, non-tidal, non-wetland waters include creeks, channels, ditches, ponds, and lakes. These jurisdictional waters are categorized as "other" waters by the USACE.

Non-regulable Discharges of Dredge Material

As described in 33 CFR Section 323.2, "incidental fallback" is not considered a discharge of dredge material for the purposes of the CWA. While no regulatory definition of incidental fallback currently exists, in general, it refers to the small volumes of dredge material that become redeposited within waters of the U.S. during dredging or excavation activities. For instance, when using a clamshell dredge, some small portion of the sediment collected by the clamshell falls out of the clamshell and becomes redeposited within waters of the U.S.

As a result, the incidental fallback associated with excavating sediment from an earthen channel using long-reach excavators or similar equipment from a top-of-bank location or within the channel would not be regulated by USACE under CWA Section 404. This assumes that the removed sediment would not be stockpiled in the channel or within waters of the U.S. In contrast, equipment that moves dredged material from one place to another within waters of the U.S. before removal of the dredged material (for instance, a bulldozer) would be subject to regulation under CWA Section 404.

As described in 33 CFR Section 323.4, other discharges that are not subject to CWA Section 404 include normal farming, silviculture and ranching activities (e.g., plowing, seeding, minor drainage, and harvesting) for the purposes of food production, forest products or upland soil, and water conservation practices. In addition, emergency reconstruction of currently serviceable structures including dikes, dams, levees, groins, riprap, bridge abutments, and other transportation structures may be exempt from regulation under CWA Section 404. In order to qualify for this emergency reconstruction exemption, construction must occur within a reasonable period of time after the damage occurs. Other exemptions include construction or maintenance of farm roads or forest roads where such roads are constructed and maintained in accordance with BMPs to assure that flow and circulation patterns and chemical and biological characteristics of waters of the U.S. are not impaired.

Clean Water Act Section 404 Regional General Permit

USACE will issue a Regional General Permit (RGP) for activities conducted under the Program, under the authority of CWA Section 404 (33 U.S. Code [USC] Section 1344) and in accordance with provisions of "Regulatory Programs of the Corps of Engineers" (33 CFR Section 323.2[h]) for activities that are substantially similar in nature and cause only minimal individual and

cumulative environmental impacts. The RGP will be valid for five (5) years from the date of issuance and may be renewed at USACE's discretion.

Compliance with additional regulations, including consultations with other federal and state agencies, may be required by USACE before its issuance of the RGP. These regulations may include the following:

- Federal Endangered Species Act (FESA)
- Fish and Wildlife Coordination Act (FWCA)
- Migratory Bird Treaty Act (MBTA)
- Bald and Golden Eagle Protection Act (BGEPA)
- Section 106 of the National Historic Preservation Act (NHPA)
- Section 401 of the CWA
- NEPA

USACE will initiate ESA and NHPA consultations with the appropriate federal agency partners as part of the RGP permit process. ESA compliance will be achieved through a Section 7 consultation process as requested by USACE with USFWS (as described below under the heading "Federal Endangered Species Act – Section 7 Consultation"). FWCA compliance will be achieved through an FWCA report, such as a Biological Opinion, prepared by USFWS. NHPA compliance (as described below under the heading "National Historic Preservation Act – Section 106") will be achieved through adherence to BMPs CUL-1 through CUL-6 (described in Chapter 10). CWA Section 401 compliance will be completed through programmatic 401 WQCs from the San Francisco Bay and Central Coast RWQCBs (as described in Section 2.3.4, under the heading "Clean Water Act Section 401".) NEPA compliance will be achieved by USACE's preparation of an Environmental Assessment (EA) as part of the RGP process. A finding of no significant impact (FONSI) is anticipated for the EA.

In April 2008, U.S. Environmental Protection Agency (USEPA) and USACE issued regulations governing compensatory mitigation for activities authorized by USACE permits (40 CFR Part 230, 33 CFR Parts 325 and 332). The 2008 "Mitigation Rule" adopted standards to improve the planning, implementation, and management of compensatory mitigation projects through several means:

- emphasizing a watershed approach in selecting locations for those projects;
- requiring measurable, enforceable ecological performance standards and regular monitoring;

- stipulating timing requirements for mitigation project implementation; and
- specifying the components of a complete compensatory mitigation plan (including assurances of long-term protection of compensation sites, financial assurances, and identification of the parties responsible for specific project tasks).

The 2008 "Mitigation Rule" advised that compensatory mitigation projects (i.e., permittee-responsible compensatory mitigation, mitigation banks, and in-lieu fee mitigation) require written mitigation plans with the following components: objectives; site selection criteria; site protection instruments (e.g., conservation easements); baseline information (for impact and compensation sites); credit determination methodology; mitigation work plan; maintenance plan; ecological performance standards; monitoring requirements; long-term management plan; adaptive management plan; and financial assurances. The USACE requires compensatory mitigation for permanent impacts, such that there is no net loss of wetlands. Depending upon the nature of the impacts and the resources, higher mitigation ratios then an even replacement can sometimes occur (e.g. 2:1 to 3:1). However, the USACE does not require compensatory mitigation for temporary impacts. The final ratio will be determined using USACE's Attachment 12501.6 – SPD Mitigation Ratio Checklist. Mitigation for impacts due to dredging or filling of USACE jurisdictional waters may be achieved through one or more options, including (but not limited to) onsite or offsite habitat restoration or creation. Midpen will provide compensatory mitigation for impacts to waters of the U.S. in accordance with the Mitigation Rule, as described in Chapter 10. Given the extent of Midpen's land holdings, it is anticipated that any necessary compensatory mitigation will be performed on its own lands or in rare instances in conjunction with partners within its Sphere of Influence.

National Historic Preservation Act – Section 106

NHPA of 1966, as amended, authorizes the Secretary of the Interior to establish and maintain a National Register of Historic Places (NRHP), and establishes an Advisory Council on Historic Preservation (ACHP) as an independent federal entity to advise the Secretary of Interior on preservation policy, as well as to work with state and local governments and Native American tribes on preservation issues. Section 106 of the NHPA requires federal agencies to consider the effects of their undertakings (i.e., projects) on historic properties (i.e., cultural resources that are determined eligible for listing in the NRHP). Such resources include prehistoric Native American and historic-era archaeological sites; traditional cultural properties; landscapes; buildings and structures; and districts. The implementing regulations of Section 106, found at 36 CFR Part 800, outline the responsibilities of federal governments for defining undertakings, consulting with Native American tribes and the public about resources that could be impacted by undertakings, identifying historic properties, and treating adverse effects to historic properties. The implementing regulations of Section 106 also require federal agencies to afford the ACHP a reasonable opportunity to comment before licensing or approving the expenditure of funds on any undertaking that may affect properties listed, or eligible for listing, in the

NRHP, and it requires federal agencies to coordinate with in the state where the proposed action will take place.

When issuing an RGP to Midpen to discharge fill into waters of the U.S. under the authority of CWA Section 404, USACE must comply with Section 106 of the NHPA because an RGP would be an undertaking by USACE as defined under Interim Guidance for Implementing Title 33, CFR Part 325, Appendix C, and under Title 36, CFR Part 800.16(y). Title 33, CFR Part 325, Appendix C establishes the procedures to be followed by USACE to fulfill NHPA requirements.

All earth-disturbing activities that are conducted under the Program within USACE jurisdiction will require compliance with Section 106 of the NHPA. USACE will ensure that Midpen meets its compliance requirements by conditioning the RGP to require the implementation of the relevant cultural resource avoidance measures and BMPs listed in Table 10-3 of Chapter 10. BMPs CUL-1 through CUL-6 and BMP GEO-1 include several measures to avoid and minimize potential impacts to cultural and paleontological resources. These BMPs describe the protocol for notification and response actions if cultural resources are encountered.

Federal Endangered Species Act – Section 7 Consultation

FESA was enacted in 1973 to protect plant and wildlife species as determined by USFWS and NMFS to be at risk of extinction. Species are protected through listing under FESA as either threatened or endangered. An endangered species is at risk of extinction throughout all or a significant portion of its range (FESA Section 3[6]). A threatened species is likely to become endangered within the foreseeable future (FESA Section 3[19]).

In Chapter 4 of this Manual, Table 4-1 lists special-status plants and Table 4-2 identifies special-status wildlife that may occur in the Program area, including those that are recognized by federal and state agencies as threatened or endangered.

FESA Section 9 prohibits the "take" of any fish or wildlife species listed under FESA as endangered. Take of threatened species is also prohibited under FESA Section 9 unless otherwise authorized by federal regulations. Take, as defined by the FESA, means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Harm is defined as "any act that kills or injures the species, including significant habitat modification." In addition, FESA Section 9 prohibits the "removal or reduction to possession" of any listed plant species "under federal jurisdiction" (i.e., on federal land).

The FESA includes three mechanisms that provide exceptions to the FESA Section 9 take prohibitions: FESA Section 7 consultation, FESA Section 10, and issuing FESA Section 4(d) rules. FESA Section 10 and FESA Section 7 consultation will be the most relevant to Midpen's activities.

As described above in Section 2.1.1, the USFWS issued a Recovery Permit to Midpen for habitat enhancement and management activities. Because the vast majority of Program activities

contribute directly to management or enhancement of habitat for special-status species either directly (e.g., pond berm repair, water supply maintenance, grazing management, and creek restoration), Midpen's USFWS Recovery Permit provides an appropriate mechanism for approving incidental take of USFWS-regulated, federally listed species for most Program activities. Because not all Program activities are explicitly listed in the Recovery Permit or its accompanying BO, the USFWS has some discretion regarding whether to allow performance of some activities that are not explicitly described in those documents. In that case, Midpen will pursue having those activities explicitly added to its Recovery Permit.

However, the USFWS is moving away from covering activities under Recovery Permits if their benefits to listed species are indirect, such as maintenance of roads to avoid excessive sedimentation of streams or to maintain access for Midpen personnel to perform management, restoration, and monitoring activities that directly benefit these species. Such activities, as well as activities that involve facilities that are constructed or maintained solely for uses that have no nexus to habitat management/ enhancement or other recovery actions (e.g., construction or maintenance of parking areas that are used solely for public access and that have no utility for habitat management or recovery purposes), will therefore not be covered by Midpen's Recovery Permit. Some of these activities, particularly those that do not occur near wetland or aquatic habitats that may support CRLF and SFGS, are unlikely to result in incidental take of listed species. Implementation of avoidance and minimization measures may be adequate to avoid take of listed species for some activities (e.g., simple maintenance on existing paved or gravel lots) and/or in some habitats (e.g., open ground with no burrows). Otherwise, FESA Section 7 will be the mechanism by which incidental take coverage is obtained to conduct activities that cannot be authorized through the existing USFWS Recovery Permit; no take of federally listed species regulated by NMFS is expected to occur as a result of Program Activities. FESA Section 7 provides a means for authorizing take of threatened and endangered species by federal agencies under certain circumstances, including actions that are conducted, permitted, or funded by a federal agency.

Under FESA Section 7, USACE will consult with USFWS to ensure that the proposed federal action (which is USACE's issuance of the RGP) will not jeopardize the continued existence of endangered or threatened species or result in adverse modification of designated critical habitat. Midpen will prepare a Biological Assessment (BA) for distribution to USFWS by USACE, evaluating the nature and magnitude of the expected effects. Federally listed wildlife species that may be covered in the BA include CTS, marbled murrelet (*Brachyramphus marmoratus*), Hickman's cinquefoil (*Potentilla hickmanii*), and Crystal Springs fountain thistle (*Cirsium fontinale* var. *fontinale*), as well as CRLF and SFGS if these species may be affected by activities that are not covered by the Recovery Permit. For projects that have no USACE nexus (i.e., activities that are not located within USACE jurisdiction and/or are not interdependent or interrelated with activities requiring coverage under the RGP), Midpen would carefully conduct such activities in a manner that avoids impacts to species through the implementation of avoidance and minimization measures.

Based on communication with the USFWS regarding the Program, it is anticipated that USFWS will issue a programmatic BO for the Program for activities that could result in take and that are not covered by the USFWS Recovery Permit.

Table 2-3 summarizes how FESA incidental take approval is expected to be obtained (Section 7 consultation vs. coverage under Midpen's USFWS Recovery Permit) for various Program activities. Most federally listed species have very limited geographic distributions or habitat associations within the Program area. However, the CRLF, and potentially the SFGS, are more widespread in the Program area. Therefore, these latter two species are addressed briefly in Table 2-3 and in much greater detail in Appendix A.

Table 2-3. Federal Endangered Species Act Coverage Mechanism for Potentially Affected, Federally Listed Species.

Species	Section 7	Section 10(a)(1)(A)
Santa Clara Valley dudleya, Metcalf Canyon jewel flower, San Mateo thorn-mint, San Mateo woolly sunflower, Marin western flax white-rayed pentachaeta	Due to the terrestrial nature of these listed plant species, it is unlikely that any Section 7 consultation between the USACE and USFWS (during CWA Section 404 permitting) would include these species. The USFWS typically does not provide take approval for federally listed plants under Section 7, as take of plants by Midpen on its own lands is not a violation of FESA.	Take of federally listed plants by Midpen on its own lands is not a violation of FESA, and therefore no take approval is necessary (although Midpen would implement measures to avoid or minimize take of such species).
Bay checkerspot butterfly	Due to the terrestrial nature of the Bay checkerspot, it is unlikely that any Section 7 consultation between the USACE and USFWS (during CWA Section 404 permitting) would include this species.	Although the Bay checkerspot is not covered by Midpen's Recovery Permit, the USFWS's BO for issuance of the permit addressed potential effects of Midpen's management activities on this species due to its presence at Edgewood Park, immediately adjacent to Midpen's Pulgas Ridge OSP. Potential habitat is present (and historically, the Bay checkerspot occurred) at Sierra Azul OSP. With implementation of conservation measures required by the Recovery Permit's BO, take of individuals of this species is not expected to occur, and any non-lethal take is covered by that BO. Should Midpen desire to expand its activities into areas where the species could be present (e.g., for grassland enhancement purposes), the USFWS may be amenable to amending the Recovery Permit to include this species and enhancement activities potentially affecting it.

Species	Section 7	Section 10(a)(1)(A)
California tiger salamander	If this species occurs on Midpen lands at all, it is most likely present along the northeastern edge of Sierra Azul OSP due to the species' known occurrence in the nearby Santa Teresa Hills and potential off-site breeding ponds in that area. If maintenance requiring a Clean Water Act Section 404 permit were to occur in areas where California tiger salamanders are potentially present, incidental take approval would be obtained via the BO prepared as a result of Section 7 consultation between the USACE and USFWS.	The California tiger salamander is not covered by Midpen's Recovery Permit, and it is not addressed by the USFWS's BO for issuance of that permit. If Program activities occur along the northeastern edge of Sierra Azul OSP, in upland areas that are not subject to Section 7 consultation between the USACE and USFWS, there is some potential for take of this species. Midpen will consider adding this species to its Recovery Permit to provide incidental take approval for management activities in that area.
California red-legged frog	As detailed in Appendix A, many Program activities are expected to be covered by Midpen's USFWS Recovery Permit. In the event that the USFWS does not allow for incidental take coverage of an activity under the Recovery Permit, take coverage would be provided under Section 7 (via the BO prepared as a result of Section 7 consultation between the USACE and USFWS) if the activity in question necessitates a Clean Water Act Section 404 permit or is interdependent/interrelated with 404 permitted activities.	Most Program activities directly contribute to habitat management or enhancement (e.g., pond berm repair, water supply maintenance, grazing management, and creek restoration). Therefore, most Program activities that could affect the CRLF should be covered by Midpen's USFWS Recovery Permit, either as that permit currently stands or with amendments to explicitly include more management and enhancement activities.

Species	Section 7	Section 10(a)(1)(A)
San Francisco garter snake	As detailed in Appendix A, many Program activities are expected to be covered by Midpen's USFWS Recovery Permit. In the event that the USFWS does not allow for incidental take coverage of an activity under the Recovery Permit, take coverage would be provided under Section 7 (via the BO prepared as a result of Section 7 consultation between the USACE and USFWS) if the activity in question necessitates a Clean Water Act Section 404 permit or is interdependent/interrelated with 404 permitted activities.	Most Program activities directly contribute to habitat management or enhancement either directly (e.g., pond berm repair, water supply maintenance, grazing management, and creek restoration). Therefore, most Program activities that could affect the San Francisco garter snake should be covered by Midpen's USFWS Recovery Permit, either as that permit currently stands or with amendments to explicitly include more management and enhancement activities.
Marbled murrelet	Where Program activities will occur near suitable nest trees, implementation of avoidance and minimization measures will avoid take of individuals, including disturbance of active nests, and Program activities are not expected to impact this species' nest trees. Nevertheless, Program activities within or very close to suitable habitat and that necessitate a Clean Water Act Section 404 permit or are interdependent/interrelated with 404 permitted activities will be addressed during Section 7 consultation between the USACE and USFWS. Any necessary incidental take coverage for such activities will be provided via the USFWS's BO.	Although the marbled murrelet is not covered by Midpen's Recovery Permit, the USFWS's BO for issuance of the permit addressed potential effects of Midpen's management activities on this species due to its presence at Purisima Creek Redwoods OSP (and possibly in other locations with or near old-growth redwood forest). With implementation of conservation measures required by the Recovery Permit's BO, take of individuals of this species is not expected to occur, and any non-lethal take is covered by that BO.

2.4.2 U.S. Fish Wildlife Service

Migratory Bird Treaty Act

The MBTA (16 USC 703-712), administered by USFWS, implements four treaties between the U.S. and Canada, Mexico, Japan, and Russia, respectively, to manage and conserve migratory birds that cross national borders. The MBTA makes it unlawful in any manner, unless expressly authorized by permit in accordance with federal regulations, "to pursue, hunt, take, capture, or kill, possess, offer for sale, offer to barter, barter, offer to purchase, deliver for shipment, ship, export, import, cause to be shipped, exported, or imported, deliver for transportation, transport or cause to be transported, carry or cause to be carried, or receive for shipment, transportation, carriage, or export, any migratory bird, any part, nest, or egg of any such bird, or any product, whether manufactured, which consists, or is composed in whole or part, of any such bird or any nest, or egg thereof..." The definition of "take" is any act to "pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture or collect." (50 CFR Section 10.12). This includes most actions, direct and indirect, that can result in take or possession, whether it is temporary or permanent, of any protected species. Although harassment and habitat modification do not themselves constitute as take under the MBTA or the California Fish and Game Code (F&G Code), such actions that result in the direct loss of birds, nests, or eggs, including nest abandonment or failure, are considered take under such regulations. A list of migratory birds protected under the MBTA is available in 50 CFR Section 10.13. On December 8, 2004, the U.S. Congress passed the Migratory Bird Treaty Reform Act (Division E, Title I, Section 143 of the Consolidated Appropriations Act, 2005, PL 108–447), which excludes all migratory birds that are non-native or have been human-introduced to the U.S. or its territories. It defines a native migratory bird as a species present within the U.S. and its territories as a result of natural biological or ecological processes. USFWS published a list of the bird species excluded from the MBTA on March 15, 2005 (70 Federal Register 12710).

All native bird species occurring in the Program area are protected by the MBTA. Activities, such as vegetation management, may require the removal of vegetation at work sites where migratory birds are nesting. Compliance with the MBTA will be met through the implementation of BMPs requiring pre-activity surveys before any breeding-season maintenance activities are implemented so that take of migratory birds is avoided.

Bald and Golden Eagle Protection Act

The BGEPA of 1940 protects eagles from commercial exploitation and safeguards their continued survival in the U.S. This law provides for the protection of the bald eagle (*Haliaeetus leucocephalus*) (the national emblem) and the golden eagle (*Aquila chrysaetos*) by prohibiting, except under certain specified conditions, the taking, possession, and commerce of such birds. USFWS, which enforces the Bald and Golden Eagle Protection Act, can issue permits for the take of eagles under limited circumstances. However, no such permit will be needed for Midpen's activities, which will avoid any such impacts through implementation of BMP BIO-17.

Federal Endangered Species Act

As described under heading Federal Endangered Species Act – Section 7 Consultation, FESA protects plant and wildlife species determined by USFWS and NMFS to be at risk of extinction. USFWS is responsible for protection of listed plants and wildlife other than marine species and anadromous fishes, which are protected by the NMFS. Chapter 4, Section 4.3 describes listed species and critical habitat that may occur in the Program area. In addition, refer to Figure 4-5 for a graphic depicting critical habitat in the Program area.

As described under heading "FESA 10(a)(1)(A) Recovery Permit", the USFWS issued Midpen a Recovery Permit for habitat enhancement and management activities and prepared a BO (dated December 9, 2016) for the issuance of the Recovery Permit. This permit authorizes Midpen to take (i.e., harass by survey, capture, handle, transfer, mark, collect tissue, and release) SFGS; state and federally listed as endangered and CRLF; federally listed as threatened and a California species of special concern in conjunction with habitat management activities (e.g., prescribed fire, invasive species removal, pond restoration and creation, road and trail maintenance, removal of dilapidated structures, and cattle grazing) for the purpose of enhancing their survival. Midpen will be applying for an amendment to the Recovery Permit to add new species, such as CTS that is already covered by the CDFW under the state MOU, and new activities as needed, as outlined in Table 2-2. Because all the activities covered under the Recovery Permit would be associated with habitat enhancement, maintenance, and management, no compensatory mitigation for those activities should be necessary.

2.4.3 National Marine Fisheries Service

The Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) establishes a national program to manage and conserve the fisheries of the U.S. through the development of Federal Fishery Management Plans (FMPs), and the federal regulation of domestic fisheries under those FMPs, within the 200-mile U.S. Exclusive Economic Zone. The 1996 amendments to the MSA established a new mandate for NMFS, regional fishery management councils, and other federal agencies to identify and protect important marine and anadromous fish habitat (essential fish habitat or EFH), including wetlands. The EFH provisions of the MSA support one of the Nation's overall marine resource management goals – maintaining sustainable fisheries. Federal action agencies which fund, permit, or carry out activities that may adversely affect EFH are required to consult with NMFS with respect to the potential effects of their actions on EFH. When NMFS concludes that an action may adversely affect EFH, NMFS is required to provide the action agency with conservation recommendations to protect EFH. The Program is not expected to result in impacts to EFH. If a maintenance need arises that could affect EFH, Midpen will consult with NMFS separately (i.e., outside the Program) regarding that activity.

Federal Endangered Species Act

It is not anticipated that Program activities will have effects on protected marine and aquatic fish species or their habitat or on any federally listed fish regulated by NMFS. If a maintenance need arises that could affect federally listed, NMFS-regulated species, Midpen will consult with NMFS separately (i.e., outside the Program) through USACE permitting regarding that activity.

2.4.4 Regional Water Quality Control Board

Porter-Cologne Water Quality Control Act

California's Porter-Cologne Water Quality Control Act (Porter-Cologne Act) was enacted in 1969, and together with the federal CWA, provides regulatory guidance to protect water quality and water resources. The Porter-Cologne Act established the State Water Resources Control Board (SWRCB) and divided California into nine regions, each overseen by a RWQCB. The Porter-Cologne Act established regulatory authority over "waters of the State," which are defined as "any surface water or groundwater, including saline waters, within the boundaries of the State" (California Water Code, Division 7, Section 13050). More specifically, the SWRCB and its nine RWQCBs have jurisdiction over the bed and banks of a stream channel, its riparian corridor, and its beneficial uses.

The Porter-Cologne Act also assigns responsibility for implementing CWA Sections 303, 401, and 402 to the SWRCB and RWQCBs. Under Section 303, the RWQCBs, in conjunction with USEPA, are responsible for developing and implementing Total Maximum Daily Loads (TMDLs) to address water quality impairments.

The Porter-Cologne Act requires the development and periodic review of water quality control plans (basin plans) for the protection of water quality in each of California's nine regions. A basin plan is unique to each region and must identify beneficial uses, establish water quality objectives for the reasonable protection of the beneficial uses, and establish a program of implementation for achieving the water quality objectives. To provide currency, basin plans must be updated every 3 years. The basin plans also must comply with Section 303 of the federal CWA, which requires states to establish their own water quality standards. Basin plans provide the technical basis for the RWQCBs to determine WDRs, take enforcement actions, and evaluate grant proposals.

As described the following section, under the heading "Clean Water Act – Section 401," regulatory compliance for projects occurring within waters of the U.S. is met through WQC, granted by the RWQCBs. For projects occurring within Porter-Cologne Act jurisdiction (i.e., State jurisdiction) but outside waters of the U.S. (in streams, this is the area above the OHWM, or "isolated" waters such as wetlands), WDRs or waiver of WDRs are required. WDRs are issued by the RWQCB that has jurisdiction over the region in which the project will occur.

The San Francisco Bay RWQCB (Region 2) has jurisdictional authority over the majority of Midpen lands. A small portion of the Program area in southwest San Mateo County is within the jurisdiction of the Central Coast RWQCB (Region 3). All waters of the U.S. in the Program area also are considered waters of the State and thus are subject to RWQCB jurisdiction under the Porter-Cologne Act. Program compliance with the Porter-Cologne Act will occur through establishment of WDRs, which will be combined with the CWA Section 401 WQC, as described below.

Clean Water Act - Section 401

Under CWA Section 401, applicants for a federal license or permit to conduct activities that may result in the discharge of dredged or fill materials into surface waters of the U.S. and State (including wetlands) must obtain Section 401 WQC so that any such discharge will comply with the applicable provisions of the CWA, including Sections 301, 302, 303, 306, and 307 and State water quality standards. Section 401 WQC is issued by the State in which the discharge will originate or, if appropriate, from the interstate water pollution control agency with jurisdiction over affected waters at the point where the discharge will originate. Therefore, all projects that have a federal component and may affect state water quality (including projects that require federal agency approval, such as issuance of a CWA Section 404 permit) also must comply with CWA Section 401. The goal of CWA Section 401 is to include evaluation of water quality when considering activities associated with dredging or placement of fill materials into waters of the U.S.

Because a majority of Midpen lands are located within the jurisdiction of the San Francisco Bay RWQCB, Midpen will apply for a Section 401 WQC to the San Francisco Bay RWQCB for activities affecting waters of the U.S. in both the San Francisco Bay and Central Coast Region. As the RWQCBs have discretionary approval authority, the San Francisco Bay RWQCB and Central Coast RWQCB are responsible agencies under CEQA (see further discussion in Section 2.3.8, California Environmental Quality Act). Therefore, projects must fully comply with CEQA before the RWQCB can finalize the WQC.

Clean Water Act - Section 303 and the Total Maximum Daily Load Program

Under CWA Section 303(d), states are required to identify "impaired water bodies" (those that do not meet established water quality standards); identify the pollutants causing impairment; establish priority rankings for waters on the list; and develop a schedule for development of control plans to improve water quality. Each RWQCB must update the Section 303(d) list every 2-4 years. Water bodies are placed on the list when they have no further assimilative capacity for the identified pollutant, and the Section 303(d) list identifies priorities to develop pollution control plans for each listed water body and pollutant. The pollution control plans required by CWA Section 303(d) List are TMDLs.

CWA Section 303 is overseen by USEPA and is administered by the SWRCB and its nine RWQCBs. Once a TMDL is developed and approved by USEPA, the SWRCB, and the relevant

RWQCB, the implementation plan (if included in the TMDL) can be enacted. The San Francisco Bay RWQCB has prepared, or is in the process of preparing, the following TMDLs that must be approved by USEPA before they can be implemented:

- Urban Creeks Pesticide Toxicity – Approved by USEPA in 2007 and in implementation.
- Pescadero and Butano Creeks Watershed Sediment – Approved by USEPA in June 2019.
- San Gregorio Creek Sediment – Currently being evaluated.

The San Francisco Bay RWQCB implements and enforces TMDLs, primarily through the National Pollutant Discharge Elimination System (NPDES), the Basin Plan, Waste Discharge Requirements, and Water Quality Improvement Plans. Additional information on TMDLs is available at the San Francisco Bay RWQCB's website: www.swrcb.ca.gov/sanfranciscobay/water_issues/programs/TMDLs.

The Central Coast RWQCB also implements and enforces TMDLs through the NPDES, Basin Plan, and Water Discharge Requirements, and Water Quality Plans. Additional information on TMDLs is available at the Central Coast RWQCB's website: www.waterboards.ca.gov/centralcoast/water_issues/programs/tmdl/303d_and_tmdl_projects.html. No TMDLs have been adopted in creeks or watersheds within Midpen's boundary in the southwestern portion of San Mateo County within the jurisdiction of the Central Coast RWQCB.

The Program would not contribute mercury, methylmercury, PCBs, diazinon, or pesticides to the San Francisco Bay or creeks; however, the Program will comply with applicable requirements detailed in adopted TMDLs for the Pescadero Creek, Butano Creek, and San Gregorio Creek Watersheds. Specifically, the Program will help reduce sedimentation issues and, in particular, help achieve targets established in the Pescadero and Butano Creeks Watershed Sediment TMDL and, if adopted, the San Gregorio Creek Sediment TMDL.

Clean Water Act – Section 402: National Pollutant Discharge Elimination System

CWA Section 402 regulates point-source discharges to surface waters (other than dredge or fill material) through the NPDES, which is administered by USEPA and some states. The NPDES program provides for both general permits (those that cover a number of similar or related activities) and individual permits for discharges to the waters of the U.S.

Under CWA, Section 402, the SWRCB and RWQCBs regulate stormwater discharges from municipal separate storm sewer systems (MS4s) through the Municipal Stormwater Permitting Program. Permits are issued under two phases, depending on the size of the urbanized area or municipality. Phase I MS4 permits are issued for medium (population between 100,000 and 250,000) and large (population of 250,000 or more) municipalities, and are often issued to a group of co-permittees within a metropolitan area. Phase II MS4 permits are issued to smaller

municipalities, and generally to any MS4 that is not already covered under a Phase I MSP permit.

Counties and other municipalities within the San Francisco Bay Area are permitted under the Phase I San Francisco Bay Municipal Regional Stormwater Permit, referred to as MRP, which was reissued in November 2015 (Order No. R2-2015-0049, NPDES Permit No. CAS612008). This MRP allows discharge of stormwater runoff from storm drains and watercourses. Under the MRP, municipalities including local flood control districts in the same County have joined together to locally manage stormwater runoff and implement appropriate BMPs to reduce pollution carried by stormwater into local creeks, the San Francisco Bay, and the Pacific Ocean. These programs assist municipalities to comply with the MRP by providing guidance and staff training, and aim to eliminate stormwater pollution in local creeks and flood control facilities through public education, inspection, and enforcement activities.

For the Central Coast Region, the City of Salinas holds the only Phase I permit; all other urban areas are covered by the Statewide Phase II Small MS4 Permit (Small MS4 Permit), Order No. 2013-0001-DWQ, NPDES Permit No. CAS000004, effective July 2013. The Small MS4 Permit regulates stormwater discharges and requires implementation of effective BMPs to reduce or eliminate the discharge of pollutants to receiving waters.

Because Midpen lands are located within various jurisdictions (i.e., San Mateo and Santa Clara counties, with a small area in Santa Cruz County), the applicable jurisdiction's MS4 permit requirements for a given site are dependent upon the location of the site. Thus, for OSPs located in San Mateo County and incorporated cities and towns, Midpen would be subject to the San Mateo Countywide Water Pollution Prevention Program. For OSPs located in Santa Clara County and incorporated cities and towns, Midpen would be subject to the Santa Clara Valley Urban Runoff Pollution Prevention Program or the Statewide Phase II MS4 Program. In addition, for the small portion of land within Santa Cruz County, Midpen would subject to the requirements of the Phase II MS4 Program. Note that when proposed activities are expected to result in impacts to waters of the state, as defined by the Porter-Cologne Act including areas above the OHWM on channel banks, compliance with Section 401 of the CWA is also required.

2.4.5 California Department of Fish and Wildlife

California Endangered Species Act

CESA is defined in the F&G Code Section 2080 *et seq.* CESA was originally enacted in 1970 to designate wildlife, fish, and plants as "endangered" or "rare." In 1984, CESA was amended and species were reclassified as "endangered" or "threatened." As of January 1985, all "rare" wildlife species were reclassified as "threatened" and the term "rare" was eliminated from the code. The classification of "rare" was maintained for plants listed under the California Native Plant Protection Act (Sections 1900-1913), but those plants are subject only to the protections of that act and not CESA.

CESA states that all native species of fishes, amphibians, reptiles, birds, mammals, invertebrates, and plants, as well as their habitats that are threatened with extinction and those experiencing a significant decline that, if not halted, will lead to a threatened or endangered designation, will be protected or preserved. The CESA sets forth procedures by which individuals, organizations, or CDFW can submit petitions to the Fish and Game Commission requesting that a species, subspecies, or variety of plant or wildlife be added to, deleted from, or changed in status on the state lists of threatened or endangered species.

Like FESA, the CESA also allows for incidental take of listed species. Take is defined under the F&G Code (Section 86) as to "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." The incidental take permit process is outlined in CESA (F&G Code Section 2081). Section 2081(b) provides a means by which agencies or individuals may obtain authorization for incidental take of state-listed species. Take must be incidental to, and not the purpose of, an otherwise lawful activity. Requirements for an F&G Code Section 2081(b) permit include the identification of impacts on listed species; development of mitigation measures that minimize and fully mitigate impacts; development of a monitoring plan; and assurance of funding to implement mitigation and monitoring.

Chapter 4, Section 4.3 describes listed species and critical habitat that may occur in the Program area. As described under heading "Memorandum of Understanding", Midpen is authorized to take SFGS and CTS for scientific research and habitat creation, enhancement, and maintenance activities related to the conservation and recovery of these species. In addition, Midpen is currently able to take foothill yellow-legged frog for scientific, educational, or propagation purposes under a letter from CDFW (dated July 2017). It is anticipated that the potential to take state-listed species other than SFGS, CTS, and foothill yellow-legged frog will be limited. If activities not eligible for coverage under an MOU, Midpen will implement avoidance and minimization measures to avoid take of CDFW-regulated species, so that no take approval is necessary. However, if take of state-listed species cannot be avoided, Midpen will obtain an ITP from CDFW for the set of activities that could result in take that cannot be covered under an MOU.

Because all the activities covered under the MOU would be associated with habitat enhancement, maintenance, and management, no compensatory mitigation for those activities should be necessary.

State-listed plant species potentially occurring in the Program area include San Mateo thorn-mint (*Acanthomintha duttonii*), Crystal Springs fountain thistle (*Cirsium fontinale* var. *fontinale*), San Mateo woolly sunflower (*Eriophyllum latilobum*), San Francisco popcorn-flower (*Plagiobothrys diffusus*), Marin western flax (*Hesperolinon congestum*), Dudley's lousewort (*Pedicularis dudleyi*), and White-rayed pentachaeta (*Pentachaeta bellidiflora*). If suitable habitat for those species would be impacted by a proposed activity, Midpen would conduct appropriately timed surveys for those species. In the event that any state-listed plants are found,

Midpen will design the activity to avoid impacts to any individuals if feasible (in which case no ITP would be needed), or obtain an ITP for such activities on a case-by-case basis.

Lake and Streambed Alteration Program

California's Lake and Streambed Alteration Program is regulated under F&G Code Section 1600 *et seq.* Under Section 1602, CDFW regulates projects that affect the flow, channel, or banks of rivers, streams, and lakes. F&G Code Section 1602 requires state or local governmental agencies, public utilities, and private individuals to notify CDFW and enter into a streambed or lakebed alteration agreement before construction of a project that will:

- substantially divert, obstruct, or change the natural flow or the bed, channel, or bank of any river, stream, or lake;
- substantially change or use any material from the bed, channel, or bank of any river, stream, or lake; or
- result in the disposal or deposition of debris, waste, or other material containing crumbled, flaked, or ground pavement where it can pass into any river, stream, or lake.

F&G Code Section 1602 may apply to any work undertaken within the 100-year floodplain of any body of water or its tributaries, including perennial, intermittent, and ephemeral rivers, streams, or lakes in the state. In general, however, this language is construed as applying to work within an active floodplain and/or associated riparian habitat of a wash, stream, or lake that provides benefit to fish and wildlife. F&G Code Section 1602 typically does not apply to drainages that lack a defined bed and banks, such as swales, or to wetlands, such as vernal pools.

CDFW has regulatory jurisdiction over the bed, bank, and channel of a stream, lake, or pond, as stated in F&G Code Sections 1600-1616. Under F&G Code Section 1602, CDFW administers the Lake and Streambed Alteration Program and may issue a SAA for projects within their jurisdiction. SAAs typically are issued through an application process (submittal of a notification package) and include restrictions on construction periods and locations, along with avoidance, minimization, and mitigation measures for potential impacts on habitat associated with waters of the State. Because CDFW has discretionary approval authority, it is a responsible agency under CEQA (see further discussion in Section 2.3.8, California Environmental Quality Act). As such, projects must fully comply with CEQA before CDFW can finalize a SAA.

All creeks, channels, and basins in the Program area, as well as associated riparian vegetation, are subject to CDFW jurisdiction under F&G Code Sections 1600-1616. As described under heading "Routine Maintenance Agreement", Midpen currently conducts routine maintenance activities under their existing RMA that is set to expire on December 31, 2022. Midpen may either amend the existing RMA or apply for a new RMA to cover any additional activities and projects included under the Program.

Migratory Bird Treaty Act

In California, the MBTA is regulated under F&G Code Sections 3503, 3503.5, and 3513. Section 3503 makes it unlawful to take, possess, or needlessly destroy the nests or eggs of any bird; Section 3503.5 makes it unlawful to take, possess, or destroy birds of prey or the nest or eggs of a bird of prey; Section 3503.5 prohibits the take, possession, or destruction of any nests, eggs, or birds in the orders of Falconiformes (New World vultures, hawks, eagles, ospreys, and falcons, among others) and Strigiformes (owls); and Section 3513 prohibits the take or possession of any migratory non-game bird or part thereof, as designated in the MBTA. As described above, disturbance that causes nest abandonment and/or loss of reproductive effort (killing or abandonment of eggs or young) is considered take by CDFW.

All native bird species other than upland game birds such as quail, grouse, and turkeys in the Program area are protected by the F&G Code. Midpen activities, such as vegetation management, may require the removal of vegetation in areas where migratory birds are nesting. Compliance with the F&G Code will be met through implementation of BMPs requiring pre-activity surveys before any breeding-season activities, which will be implemented before activities begin so that take of migratory birds is avoided.

Fully Protected Species

Species that are fully protected from all forms of take are listed in F&G Code Section 3511 (birds), Section 5515 (fish), Section 4700 (mammals), and Section 5050 (amphibians). Fully Protected species may not be taken or possessed at any time and no licenses or permits may be issued for their take except for collecting these species for necessary scientific research and relocation of the bird species for the protection of livestock. In addition, recent legislation allows Natural Community Conservation Plans (NCCPs) to provide take authorization for fully protected species covered by an NCCP.

Native Plant Protection Act

The Native Plant Protection Act (F&G Code Sections 1900–1913) requires permits for collecting, transporting, or selling plant species that are designated rare or endangered by the Fish and Wildlife Commission. The California Native Plant Society has developed a set of lists of native plants in California, categorized according to rarity. Plants on List 1A, List 1B, and List 2 meet the definitions of F&G Code Section 1901 and F&G Code Sections 2060 and 2067 (CESA) as rare or endangered species.

Table 4.1 in Chapter 4 lists native, special-status plant species occurring or potentially occurring in the Program area. Program measures to avoid, minimize, and mitigate impacts to these species are identified in Chapter 10.

2.4.6 California Coastal Commission and San Mateo County's Local Coastal Program

The California Coastal Act of 1976 requires new development (e.g., buildings, roads, pipe, and utility lines) that occur within the Coastal Zone to obtain a Coastal Development Permit (CDP) from either the CCC or the local government. While the CCC is the primary agency that issues these permits, once a local agency has a Local Coastal Program (LCP) that has been certified by the CCC, that local agency takes over the primary responsibility for issuing CDPs. All development planned in the Coastal Zone requires either issuance of a CDP or a CDP Exemption.

Midpen activities occurring within the Coastal Zone would be located within San Mateo County. In 1980, the San Mateo County Board of Supervisors and the CCC approved the San Mateo County's LCP. Development must comply with the policies in the LCP. In 1981, the County's Planning and Building Development assumed responsibility for implementing the State Coastal Act in the unincorporated area of the County, including issuance of CDPs. Thus, under the Program, activities that are planned within the Coastal Zone must either obtain a CDP or an exemption from these permit requirements. Activities that involve in-kind facility replacement (i.e., no expansion) are likely to be exempt; however, any upsizing or change in the location or size of infrastructure would require a CDP (e.g., a larger culvert would be considered an expansion and would require a CDP). In addition, activities occurring where sensitive species or habitat may occur would also require a CDP.

2.4.7 National Environmental Policy Act

NEPA requires federal agencies to include in their decision-making process appropriate and careful consideration of all environmental effects of a proposed action and its possible alternatives. Documentation of the environmental impact analysis and efforts to avoid or minimize the adverse effects of proposed actions must be made available for public notice and review. This analysis is documented in either an EA with a FONSI or an EA with a finding that preparation of an Environmental Impact Statement is required. NEPA compliance will be addressed for the Program by USACE through preparation of an EA as part of the RGP process. Issuance of a FONSI is anticipated.

2.4.8 California Environmental Quality Act

CEQA (Public Resource Code Section 21000 *et seq.*) is the cornerstone of environmental law and policy in California. CEQA requires public agencies to assess and publicly disclose the environmental implications of proposed actions through the preparation of appropriate documents. The primary objectives of CEQA include:

- ensuring that the potential environmental impacts of a project are disclosed to decision makers and the public;

- ensuring that environmental damage is avoided, reduced, or compensated for by the implementation of carefully designed mitigation measures;
- making the public aware of the reasons for an agency's approval of a project that is found to have significant, unavoidable, and unmitigable environmental impacts;
- fostering cooperation between agencies in the review of projects; and
- enhancing public involvement in the planning and review of projects that may affect local communities and their natural environment.

CEQA applies to discretionary activities proposed, implemented, or approved by California public agencies, including state, regional, county, and local agencies. The public agency with principal responsibility for carrying out or approving a project that may have a significant effect on the environment is the lead agency for CEQA compliance, and this agency is responsible for preparing the environmental documentation for that project.

For the Program, Midpen will serve as the lead agency for necessary environmental documents associated with Program activities.

CEQA and the CEQA Guidelines provide guidance in evaluating impacts of projects on biological resources and determining which impacts will be significant. CEQA defines "significant effect on the environment" as "a substantial adverse change in the physical conditions which exist in the area affected by the proposed project." Under CEQA Guidelines Section 15065, a project's effects on biotic resources are deemed significant where the project would:

- "substantially reduce the habitat of a fish or wildlife species"
- "cause a fish or wildlife population to drop below self-sustaining levels"
- "threaten to eliminate a plant or animal community"
- "substantially reduce the number or restrict the range of a rare or endangered plant or animal"

In addition to species listed on the federal and state lists of protected species, Section 15380(b) of the State CEQA Guidelines provides that a species not listed on these lists may be considered rare if the species can be shown to meet certain specified criteria. CDFW has produced three lists (amphibians and reptiles, birds, and mammals) of "species of special concern" that serve as "watch lists." Species on these lists are of limited distribution or the extent of their habitats has been reduced substantially, such that threat to their populations may be imminent. Thus, their populations should be monitored. They may receive special attention during environmental review as potential rare species, but they do not have specific statutory protection.

Chapter 3. Physical Setting

This chapter presents the physical environmental setting of the Open Space Maintenance and Restoration Program (OSMRP or Program) area. The physical setting in conjunction with the biological resources setting (Chapter 4) provide an important basis for determining how the activities (described in Chapters 5 through 9) may affect natural resources and what measures can be used to avoid and minimize potential environmental effects (described in Chapter 10).

3.1 Watersheds and Creeks

The Program area is located in the Santa Cruz Mountains on the San Francisco Peninsula, primarily within southern San Mateo and northwestern Santa Clara counties, with a small portion in Santa Cruz County. The peninsula separates the San Francisco Bay from the Pacific Ocean and extends from the Golden Gate south to the Santa Clara Valley and northern end of Monterey Bay. Runoff from the peninsula flows to the Pacific Ocean to the west and the San Francisco Bay and estuaries to the east.

The Program area is located within 25 watersheds[1] within the Santa Cruz Mountains, including the following from north to south: San Pedro Creek, Denniston Creek, Arroyo Leon, San Mateo Creek, Purisima Creek, San Francisquito Creek, Cordilleras Creek, Oakland Inner Harbor-San Francisco Bay, San Francisco Bay Estuaries, San Gregorio Creek, La Honda Creek, Adobe Creek, Permanente Creek, Stevens Creek, Calabazas Creek, Lower Pescadero Creek, Upper Pescadero Creek, Butano Creek, Gazos Creek, Waddell Creek, Saratoga Creek, San Tomas Aquino Creek, Los Gatos Creek, Guadalupe River, and Alamitos Creek (refer to Figure 3-1). Many of the Midpeninsula Regional Open Space District's (Midpen's) Open Space Preserves (OSPs or Preserves) are located within the headwaters or uppermost sections of these watersheds.

[1] Note that a Preserve is not necessarily located in each of the watersheds listed above; this is a comprehensive list of all watersheds within Midpen's Sphere of Influence or for purposes of this Program, the Program area identified herein.

Watersheds are land drainage areas that channel water flow to a single waterbody, typically a creek or stream. Most of these watersheds contain steep slopes and deep canyons, typical of the Santa Cruz Mountains. The elevation within the Program area ranges between approximately 200 feet and 3,500 feet above mean sea level (Midpen 2014).

The Program area encompasses a large portion of the San Francisco Peninsula and southern Bay Area and supports a wide variation of habitat quality throughout its boundaries. A majority of Midpen's OSPs are located in the Santa Cruz Mountains, in the upper watershed areas and upland transitional zones. Although high quality habitat occurs in and adjacent to Midpen's natural lands along major creek systems, work will typically not occur in those areas. The vast majority of the proposed work described in this Manual will occur along ephemeral and intermittent streams, at road and trail stream crossings.

For organizational purposes, the Program area is divided into two different regions: (1) the Skyline Region; and (2) the Foothill Region. The main watersheds and creeks included in these regions are discussed below.

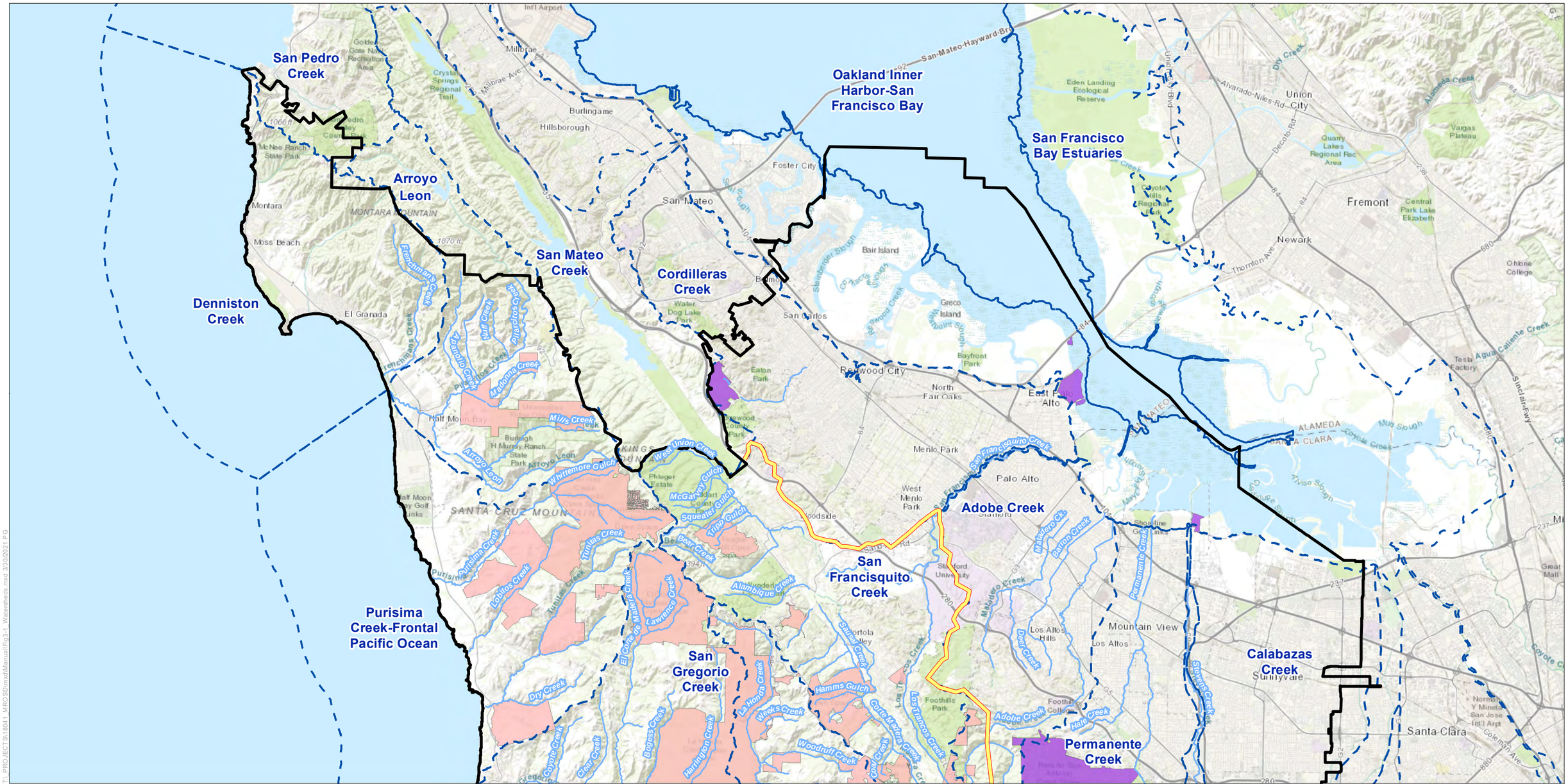
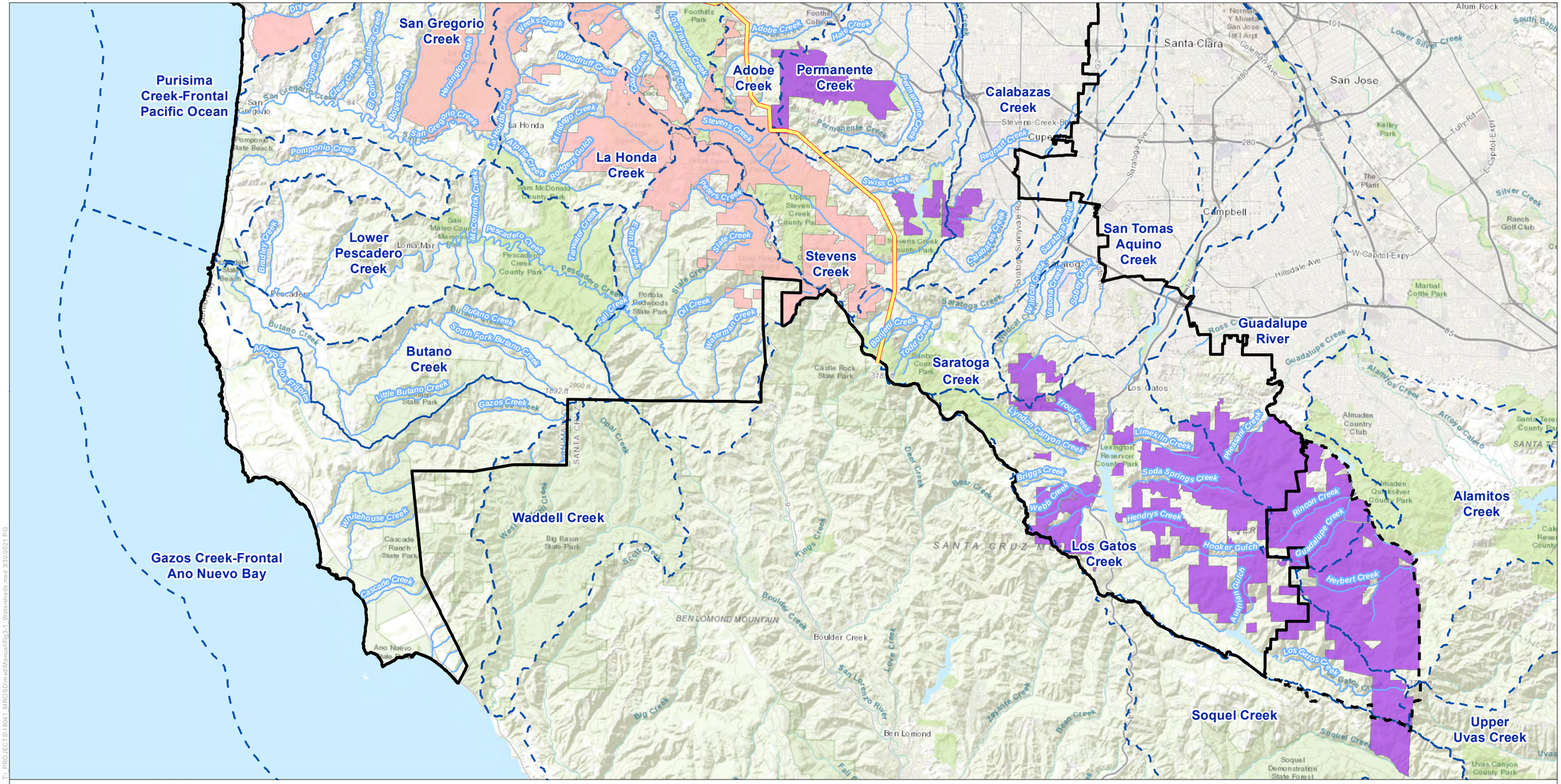


Figure 3-1
Watersheds in the Program Area

Sheet 1 of 2

Open Space Maintenance and Restoration Program Manual

Page intentionally left blank.



N

0 1 2 4

Miles

- MROSD Boundary
- Sphere of Influence
- Foothill and Skyline Region Boundary
- Foothills Field Office
- Skyline Field Office
- Watersheds
- Stream

Figure 3-1
Watersheds in the Program Area

Sheet 2 of 2

Open Space Maintenance and Restoration Program Manual

Horizon WATER and ENVIRONMENT

Data Source: ESRI 2020; MROSD 2020

T:_PROJECTS\18041_MROSD\mxd\Manual\Fig3-1_Watersheds.mxd 3/30/2021 PG

Page intentionally left blank.

3.1.1 Skyline Region

The Skyline Region encompasses the western portion of the Program area from Pedro Point just south of Pacifica to the San Mateo and Santa Cruz counties boundary, and the Pacific Ocean east to between Skyline Boulevard and I-280 (refer to Figure 3-1). Nearing the coast, the steep mountain slopes of the Santa Cruz Mountains transition into gradually sloped coastal terraces. Development in this region is minimal and primarily occurs along the coastline due to the presence of open space areas and steep topography. Many federal, state and county parklands, Midpen Preserves, and other natural lands owned by public agencies (e.g., San Francisco Public Utilities Commission [SFPUC]) and private companies (e.g., California Water Service Company) scattered throughout this region help preserve most of the region as natural lands. The lower alluvial valleys and coastal terraces support farming and ranching practices. Many small creeks drain the western hillslopes of the Santa Cruz Mountains, the largest of which are listed in Table 3-1 below.

Table 3-1. Major Watershed Areas and Surface Waters in the Skyline Region

Hydrologic Unit Code (HUC) Cataloging Units	Names of HUCs	Major Waterbodies within the HUC
180500060204	San Pedro Creek- Frontal Pacific Ocean	San Pedro Creek
180500060205	Denniston Creek – Frontal Pacific Ocean	Denniston Creek; Frenchman's Creek; San Vicente Creek
180500060201	Arroyo Leon	Pilarcitos Creek; Pilarcitos Reservoir; Mills Creek; Madonna Creek; Arroyo Leon Creek
180500060206	Purisima Creek – Frontal Pacific Ocean	Purisima Creek; Whitmore Gulch; Lobitos Creek; Pomponio Creek; Tunitas Creek
180500030404	San Francisquito Creek	San Francisquito Creek; Los Trancos Creek; Bear Gulch Creek; Bear Creek; Corte Madera Creek; West Union Creek; Coal Creek
180500060203	San Gregorio Creek	San Gregorio Creek; El Corte de Madera Creek; Lawrence Creek
180500060202	La Honda Creek	La Honda Creek; Alpine Creek; Mindego Creek
180500030407	Adobe Creek- Frontal San Francisco Bay Estuaries	Adobe Creek; Barron Creek; Matadero Creek; Deer Creek; Arastradero Creek
180500030403	Stevens Creek	Stevens Creek; Swiss Creek

Hydrologic Unit Code (HUC) Cataloging Units	Names of HUCs	Major Waterbodies within the HUC
180500030402	Saratoga Creek	Saratoga Creek
180500060101	Upper Pescadero Creek	Pescadero Creek; Peters Creek; Slate Creek
180500060103	Lower Pescadero Creek	Bradley Creek; Pescadero Creek
180500060102	Butano Creek	Butano Creek
180500060303	Gazos Creek – Frontal Año Nuevo Bay	Gazos Creek; Año Nuevo Creek; Arroyo de Frijoles
180500060301	Waddell Creek	Waddell Creek; Berry Creek

3.1.2 Foothill Region

The Foothill Region encompasses the eastern portion of the Program area, covering the area just southeast of Upper Crystal Springs Reservoir to the Santa Clara and Santa Cruz County boundary at Loma Prieta Avenue and extending east from the Santa Cruz Mountains to San Francisco Bay (refer to Figure 3-1). The topography of the Foothill Region is defined by the Santa Cruz Mountains in the upper watershed areas to the west and a relatively flat estuarine plain and the San Francisco Bay to the east. The lowlands adjacent San Francisco Bay are highly developed and include the cities of Redwood City, Palo Alto, Mountain View, Sunnyvale, Santa Clara, and San Jose. Due to this development, most creeks, drainages and water courses have been highly modified and/or redirected in this area. Residential and mixed urban development extend into the foothills of the Santa Cruz Mountains adjacent to either side of I-280; however, the western portion of the upper watershed, west of I-280, remains largely undeveloped due to the presence of Midpen's Preserves, State parklands, and other protected natural lands. Major waterways in this region are listed in below in Table 3-2. In addition, the San Francisco Bay shoreline supports an elaborate system of sloughs, estuarine marshes, and salt ponds. Please note that Midpen Preserve areas located along the Bay margin are not currently included in this Program.

Table 3-2. Major Watershed Areas and Surface Waters in the Foothill Region

Hydrologic Unit Code (HUC) Cataloging Units	Names of HUCs	Major Waterbodies within the HUC
180500041002	Oakland Inner Harbor- San Francisco Bay	San Francisco Bay
180500040902	Cordilleras Creek	Cordilleras Creek

Hydrologic Unit Code (HUC) Cataloging Units	Names of HUCs	Major Waterbodies within the HUC
180500040901	San Mateo Creek	San Mateo Creek
180500030407	Adobe Creek	Adobe Creek; Barron Creek
180500030406	Permanente Creek	Permanente Creek; Stevens Creek; Hale Creek
180500041001	San Francisco Bay Estuaries	San Francisco Bay
180500030403	Stevens Creek	Stevens Creek; Stevens Creek Reservoir; Swiss Creek
180500030405	Calabazas Creek	Calabazas Creek
180500030402	Saratoga Creek	Saratoga Creek; Bonjetti Creek
180500030401	San Tomas Aquinas Creek	San Tomas Aquinas Creek
180500030303	Los Gatos Creek	Los Gatos Creek; Vasona Reservoir; Lexington Reservoir; Soda Springs Creek; Lyndon Canyon Creek; Hendrys Creek; Webb Creek
180500030304	Guadalupe River	Guadalupe Creek; Pheasant Creek; Guadalupe Reservoir; Los Capitancillos Creek; Rincon Creek; Ross Creek
180500030301	Alamitos Creek	Alamitos Creek; Arroyo Calero; Calero Reservoir; Almaden Reservoir; Herbert Creek; Barrett Canyon Creek

3.2 Ponds

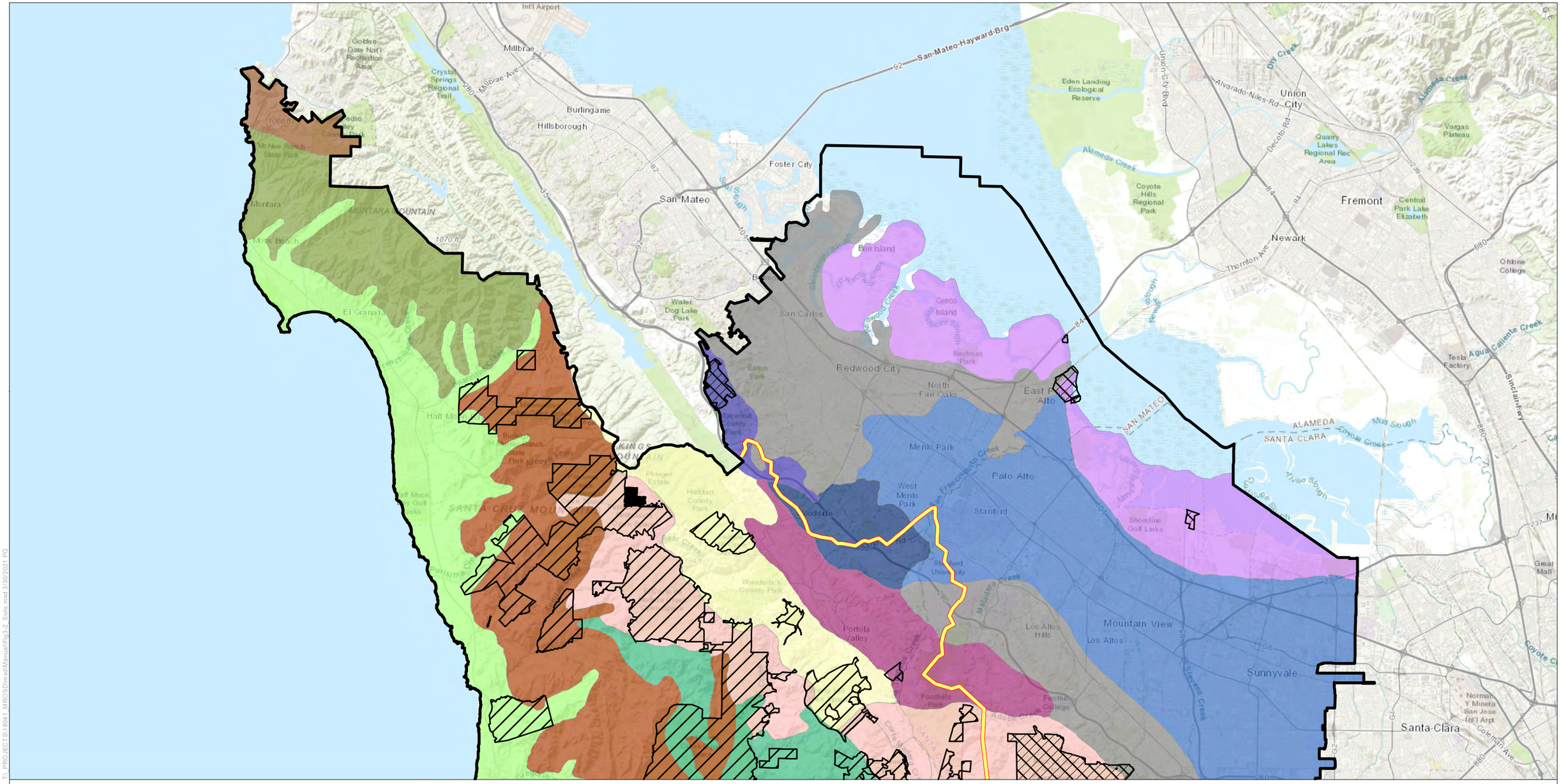
Over 100 natural and humanmade ponds are located on Midpen Preserves. A majority of these ponds are either humanmade or have been heavily modified from their natural condition. Ponds have many uses, including providing valuable habitat for rare plants and special-status amphibians and reptiles, such as Western pond turtle, California red-legged frog, and San Francisco garter snake; supplying clean water for livestock in support of current or historic grazing operations; protecting water quality of creeks and streams; supporting fire suppression needs; and providing aesthetic value to visitors. Ponds are generally located in the Skyline Region in support of conservation grazing operations, but also provide habitat for California red-legged frog. Typically, ponds are spring fed year-round, approximately 6 feet deep, and range from 0.10 acre to 0.40 acre in size. Vegetation along the perimeter of ponds generally consists of narrow bands of emergent freshwater marsh vegetation, as well as invasive plant

species, such as purple star thistle (*Centaurea calcitrapa*) and milk thistle (*Silybum marianum*). Cattails (Typha sp.) and duckweed (*Lemnoideae* sp.) or azola (aquatic fern) are also common species occurring in ponds.

Habitat quality in ponds for native species may be compromised due to siltation, invasive vegetation, and the presence of non-native fish and crayfish, which pray on larval and young amphibians. Known species of non-native fish include black bass (*Micropterus* sp.), sunfish (*Lepomis* sp.), catfish (*Ameiurus*/*Ictalurus* sp.) and mosquitofish (*Gambusia* sp.). Several species of non-native turtles are also known to occur in ponds including red-eared slider (*Trachemys scripta elegans*) and eastern snapping turtle (*Chelydra serpentina serpentina*). American bullfrog (*Rana [Lithobates] catesbeiana*) may also be present in Midpen ponds. These non-native species are generally found in human made stock ponds but may also occur in natural ponds.

3.3 Geology and Soils

Geologic conditions throughout the Program area are driven by tectonic movements along the San Andreas Fault Zone. Tectonic forces along this right-lateral strike-slip fault zone result in tremendous sheer stress and block faulting between the San Andreas and Hayward fault zones. Deformation and uplift of the restraining fault blocks created the Santa Cruz Mountains and East Bay Hills, while releasing or dropping blocks resulted in the San Francisco Bay Basin between the two ranges. Local cycles of uplift, strike-slip motion, and resulting erosion in addition to coastal processes and estuarine processes, occurring over thousands of years formed the landscapes of today. Geology and soils for each region are described in more detail below and shown on Figure 3-2.



N

0 1 2 4
Miles

MROSD Boundary

Foothill and Skyline Region Boundary

Foothills Field Office

Skyline Field Office

Soil Series

- Alambique, Inceptisols
- Barnabe, Mollisols
- Baywood, Mollisols
- Ben Lomond, Mollisols
- Botella, Mollisols
- Colma, Mollisols
- Fagan, Mollisols
- Francisquito, Alfisols
- Montara, Mollisols
- Novato, Entisols
- Obispo, Mollisols
- Scarper, Mollisols
- Urban land

Figure 3-2
Soils in the Program Area

Sheet 1 of 2

Horizon WATER and ENVIRONMENT

Data Source: ESRI 2020; MROSD 2020; NRCS 2019

T:_PROJECTS\18041_MROSD\mxd\Manual\Fig3-2_Soils.mxd 3/30/2021 PG

Page intentionally left blank.

N

0 1 2 4
Miles

MROSD Boundary
Sphere of Influence
Foothill and Skyline Region Boundary
Foothills Field Office
Skyline Field Office

Soil Series

Alambique, Inceptisols
Baywood, Mollisols
Ben Lomond, Mollisols
Botella, Mollisols
Colma, Mollisols
Francisquito, Alfisols
Gaviota, Entisols
Montara, Mollisols
Urban land

Figure 3-2
Soils in the Program Area

Sheet 2 of 2

Open Space Maintenance and Restoration Program Manual

Horizon WATER and ENVIRONMENT

Data Source: ESRI 2020; MROSD 2020; NRCS 2019

T:_PROJECTS\18041 MROSD\mxd\Manual\Fig3-2_Soils mxd 3/30/2021 PG

Page intentionally left blank.

3.3.1 Skyline Region

Geology of this region is directly tied to different rate of movement, faulting, and folding along the San Andreas, Pilarcitos, Seal Cove, San Gregorio, La Honda, Butano and other thrust faults south along the Peninsula. The Santa Cruz Mountains are composed primarily of Franciscan Complex sandstone, shale, chert and serpentine with smaller amounts of Santa Clara, Purisima, San Lorenzo, Monterey, and Vaqueros formations of Tertiary age rock units. The Franciscan Complex was deposited in a deep marine trench off the California Coast. As a result of the Pacific and North American plates converging, those sediments were folded, faulted, and formed the Coast Ranges. During the Tertiary period, marine and non-marine sediments and volcanic rocks were deposited in portions of the Coast Ranges, creating the Tertiary formations (Midpen 2014). Along the Pacific coastline, west of La Honda Fault, younger, Pliocene-age marine sandstone and siltstone of the Purisima Formation make up the western flanks of the Santa Cruz Mountains. West of the foothills of the Santa Cruz Mountains, broad, flat coastal terraces, which originated as ancient beaches uplifted during the Pleistocene, lie adjacent to Highway 1. Holocene landslide deposits can be seen sporadically throughout the younger marine sedimentary units, with alluvium deposited in valley drainages (California Department of Conservation [DOC] 2019). Many of the soils within this region formed from weathered sandstone and shale, granitic rocks, quartz diorite, or marine sediments and consist primarily of gravelly loam, sandy loam, fine loam, and silt loam surface layers over silty clay and silty clay loam subsoils (Natural Resource Conservation Service [NRCS] 2019). Barnabe and Scarper soils underlie the hills and steep coastal upland slopes of the northern end of the Program area. Baywood soils are old sand dunes located along the coast that underlie the area from Moss Beach to Año Nuevo State Park. Colma, Ben Lomond, and Alambique soils underlie the foothills and mountainous upland areas of the Santa Cruz Mountains. Montara soils are weathered from serpentinite rocks and are located on rounded ridgetops and uplands near the La Honda area. Francisquito soils are located in southeastern San Mateo County, on the eastern side of the Santa Cruz Mountains on stream terraces (NRCS 2020). Boulders and cobbles derived from a conglomerate in the underlying geologic section are also present. Soils in the small coastal valleys along the major drainages are deep and moderately well drained and have developed on low terraces and alluvial fans along the stream channels (Midpen 2002). The Santa Cruz Mountains can experience extensive levels of precipitation and cause clay soils to expand when saturated.

3.3.2 Foothill Region

Similar to the Skyline Region, movement along faults in the region, including the San Andreas, Monte Vista, Berrocal, Sargent, and unnamed thrust faults that parallel the San Andreas, have shaped the geology and topography of the region. This region is primarily composed of Franciscan Complex marine sandstone, shale, chert, limestone and conglomerate with intertwined fingers of Eocene-aged marine sedimentary rock units and esozoic volcanic and

metavolcanics rock units. A few small areas of ultramafic, serpentine rock underlie the area near Edgewood County Park and in Sierra Azul Open Space Preserve (DOC 2019).

The eastern side of the Santa Cruz Mountains is more urbanized than the coastal Skyline Region. Many of the soils in this region also consist of loamy soils weathered from sedimentary rocks or sandstone (NRCS 2019). The undeveloped shoreline areas, salt marshes, and sloughs consist of Novato soils from mixed sources and consist of very poorly drained, fine clays that exhibit low to moderately susceptibility to erosion by water (NRCS 2019). Obispo soils located near Edgewood County Park are weathered from serpentinite rock adjacent to steep areas and are typically associated with rock outcrops. Fagan soils are located in small upland areas near the town of Woodside, while Francisquito and Ben Lomond soils underlie a large portion of the eastern side of the Santa Cruz Mountains and foothills. Botella soils underlie a majority of the eastern portion of the Foothill Region in valley bottoms and alluvial fans ranging from the city of Menlo Park to south of the town of Saratoga. Gaviota soils underlie the hills and mountainous area south of the town of Los Gatos and are commonly associated with rock outcrops (NRCS 2020).

3.4 Hydrologic and Geomorphic Conditions

The Program area exhibits a Mediterranean climate with mild, wet winters and warm, dry summers. Regional climatic conditions are moderated by a cooler, moist marine layer from the Pacific Ocean. The Santa Cruz Mountains influence the occurrence of frequent extreme storms with heavy precipitation that can be responsible for periodic flooding. Rainfall occurs mostly between November and April with seasonal rainfall totals varying depending upon topography, exposure, and elevation. The greatest rainfall quantities occur along the west facing slopes of the Santa Cruz Mountains near the summit of the mountain range where totals reach up to 40 to 50 inches per year. Typical average rainfall ranges from 20 to 30 inches per year (Midpen 2014). Many small creeks and streams are intermittent, which reflect the seasonal distribution of rainfall. Winter flows are higher, especially during and immediately following storms (Midpen 2014). Due to the open spaces and undeveloped lands within the Program area, rain is able to mostly percolate into the ground rather than rapidly run off the surface. As shown on Figure 3-3, approximately 280,000 acres of the Program area consists of less than 10% impervious surfaces, which indicates that a majority of the Program area consists of pervious surfaces.

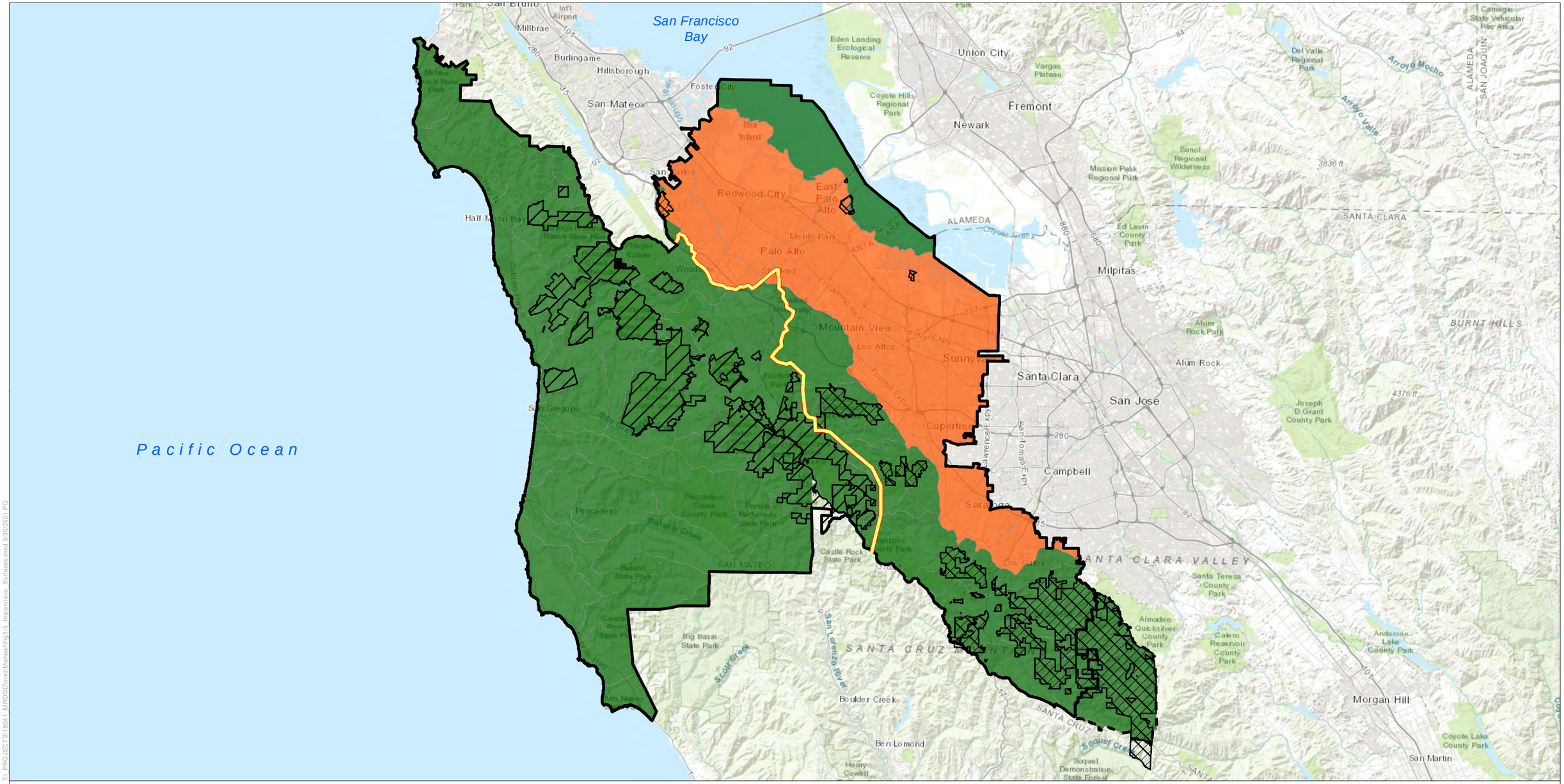


Figure 3-3
Impervious Surfaces in the Program Area

Open Space Maintenance and Restoration Program Manual

Horizon WATER and ENVIRONMENT

Data Source: ESRI 2020; MROSD 2020

T:_PROJECTS\18041_MROSD\mxd\Manual\Fig3-3_Impervious_Surfaces.mxd 3/30/2021 PG

Page intentionally left blank.

Several physical and biological conditions influence watershed processes, including geologic structure, tectonism, and properties; topography and slope; climate and precipitation; soils and vegetation; and the hydrologic conditions of infiltration, runoff, and streamflow. A range of sedimentary processes naturally occur as materials move from higher to lower elevations in individual watersheds. Sediments can be stored in place, eroded (i.e., mobilized into movement downslope or downstream), transported, or deposited. In general, sediment source areas are more typically found in upslope and watershed headwater areas. In addition to these physical influences, land modifications and intense historic land uses further influence erosion and sediment processes. The intensification of land uses through agricultural cultivation, grazing, logging, fire management, recreation, or roads by Midpen and other private and public property owners may significantly increase erosion. The conditions of the upper area of a watershed can influence the conditions of the land and water downstream.

In general, most of Midpen's lands are located in the upper watershed headwater areas in the Santa Cruz Mountains, some of which were once covered with old-growth conifer forests. As the population of the Bay Area grew, there was a high demand for lumber as a building material and most of the old-growth trees were felled. Past timber harvesting of these redwood-covered slopes in the upper watershed areas and construction of old logging roads has resulted in severe erosion and sediment loading to downstream surface waters. Changes to vegetative cover and removal of root structures that use to hold the soil in place has led to shallow landslides, slumps, gullying, gulching, and increased surface erosion from the flow of water draining down hillsides. Additionally, the old network of logging roads has altered the local drainage patterns; destabilized steep hillslopes; increased the rate or volume of runoff; intercepted and redirected groundwater to surface features, thereby increasing runoff volume; and created unstable fill or roadway surfaces. Erosion can be traced to undersized or failing culverts at the intersection of roads and streams resulting in overtopping or diversion of flows. Sedimentation in creeks impacts spawning habitat for fish species, such as Coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*Oncorhynchus mykiss irideus*). This Program aims to reduce sedimentation issues by properly maintaining and sizing roadside culverts; addressing deteriorated culverts in a timely manner; retaining large woody debris where possible in channels to promote salmonid spawning habitat; and replacing invasive vegetation with native plants to promote deeper root structures to hold soil in place. These activities are described in detail through Chapters 5 through 9 of this Manual. In addition to the Program, Midpen collaborates with many partners for ongoing stewardship of local watersheds. One of the longest-running watershed protection programs is at El Corte Madera Preserve in the San Gregorio Creek Watershed, which provides critical habitat for steelhead trout and Coho salmon. In order to reduce sedimentation issues and improve overall watershed health, Midpen is constructing bridges, repairing failing culverts, removing problematic trails (e.g., Steam Donkey Trail), and converting old roads to single-track trails or returning them to a natural state along 24 miles of roads and trails in the Preserve (Midpen 2019). Midpen's watershed protection programs balance the protection and restoration of watersheds' ecological integrity while providing public access opportunities for visitors. For

the San Gregorio Creek Watershed, less sediment has been entering streams and downstream fish habitat has improved through implementation of the watershed protection program.

3.5 Water Quality

This section presents an overview of water quality conditions within the Program area. Water quality information presented in this section is derived from the following sources: the Regional Water Quality Control Board (RWQCB) Water Quality Control Plan (Basin Plan) for the San Francisco Bay Basin (San Francisco Bay RWQCB] 2017); Water Quality Control Plan (Basin Plan) for the Central Coast Basin (Central Coast RWQCB 2019); the State Water Resources Control Board (SWRCB) Clean Water Act (CWA) Section 303(d) List (SWRCB 2019a); and RWQCB Total Maximum Daily Load (TMDL) Program.

Surface water quality is not uniformly distributed throughout all streams. Some reaches of some streams, especially, though not exclusively, in the upper undeveloped areas of the watersheds, have retained characteristics supporting fish and high-quality riparian habitat.

3.5.1 Beneficial Uses of Surface Waters

The Porter–Cologne Water Quality Control Act (known as the Porter–Cologne Act) established the SWRCB and divided the state into nine regions, each overseen by its own RWQCB. The SWRCB is the primary state agency responsible for protecting the quality of the state's surface water and groundwater supplies; however, much of the SWRCB's daily implementation authority is delegated to the nine RWQCBs. In general, the SWRCB manages water rights and regulates statewide water quality, whereas RWQCBs focus on water quality within their respective regions.

The Porter–Cologne Act requires that the RWQCB develop water quality control plans (also known as basin plans) that designate beneficial uses of California's major surface-water bodies and groundwater basins and establish specific narrative and numerical water quality objectives for those waters. Beneficial uses represent the services and qualities of a waterbody (i.e., the reasons that the waterbody is considered valuable). Water quality objectives reflect the standards necessary to protect and support those beneficial uses. Basin plan standards are primarily implemented by regulating waste discharges so that water quality objectives are met. Under the Porter–Cologne Act, Basin Plans must be updated every three years.

The Program area is primarily located in the San Francisco Bay RWQCB's jurisdiction, though the area from Gazos Creek south is within the Central Coast RWQCB's jurisdiction. The Basin Plans for the San Francisco Bay and Central Coast lists beneficial uses for major waterbodies in the Program area as provided in Table 3-3.

Table 3-3. Designated Beneficial Uses of Surface Waters Potentially Affected by Activities

Creek	AGR	MUN	FRSH	IND	COMM	SHELL	COLD	EST	MAR	MIGR	RARE	SPAWN	WARM	WILD	REC-1	REC-2	NAV	BIOL	GWR
Skyline Region																			
Pacific Ocean (San Mateo County)				E	E	E			E	E	E	E		E	E[1]	E	E		
San Pedro Creek		E					E			E	E	E	E	E	E	E			
Denniston Creek	E	E					E			E	E	E	E	E	E	E			
San Vicente Creek	E	E					E			E	E	E	E	E	E	E			
Frenchman's Creek	E						E			E	E	E	E	E	E	E			
Pilarcitos Creek	E	E					E			E	E	E	E	E	E	E			
Arroyo Leon Creek							E						E	E	E	E			
Mills Creek							E				E		E	E	E	E			
Pilarcitos Reservoir		E					E				E	E	E	E	E*	E			
Purisima Creek	E						E			E	E	E		E	E	E			
Lobitos Creek	E						E			E	E	E		E	E	E			
Tunitas Creek	E	E					E			E	E	E	E	E	E	E			
San Gregorio Creek	E						E			E	E	E	E	E	E	E			
La Honda Creek							E			E	E	E	E	E	E	E			
El Corte de Madera Creek							E			P	E	P	E	E	E	E			
Mindego Creek							E				E	E	E	E	E	E			
Alpine Creek							E			E	E	E	E	E	E	E			
Pomponio Creek	E						E			E	E	E	E	E	E	E			
Pescadero Creek	E	E					E			E	E	E	E	E	E	E			
Peters Creek							E				E	E	E	E	E	E			
Lambert Creek							E				E	E	E	E	E	E			
Slate Creek							E				E	E	E	E	E	E			

Creek	AGR	MUN	FRSH	IND	COMM	SHELL	COLD	EST	MAR	MIGR	RARE	SPAWN	WARM	WILD	REC-1	REC-2	NAV	BIOL	GWR
Butano Creek							E			E	E		E	E	E	E			
Gazos Creek	E	E	E		E		E			E		E	E	E	E	E			
Arroyo de Frijoles	E	E	E		E		E			E	E	E	E	E	E	E		E	E
Año Nuevo Creek	E	E	E		E		E	E		E	E	E		E	E	E		E	E
Waddell Creek	E	E	E	E	E		E			E	E	E		E	E	E		E	E
Berry Creek		E			E		E							E	E	E			E
San Francisquito Creek							E			E	E	E	E	E	E	E			
Los Trancos Creek							E			E	E	E	E	E	E	E			
Bear Creek							E			E	E	E	E	E	E	E			
West Union Creek							E			E	E	E	E	E	E	E			
Bear Gulch Creek		E					E			E	E	E	E	E	E	E			
Foothill Region																			
San Francisco South				E	E	E		E		E	E	E		E	E	E	E		
Cordilleras Creek													E	E	E	E			
Adobe Creek							E						E	E	E	E			
Barron Creek													E	E	E	E			
Matadero Creek							E			E	E	E	E	E	E	E			
Deer Creek							E				E		E	E	E	E			
Arastradero Creek							E				E		E	E	E	E			
Permanente Creek							E				E	E	E	E	E	E			E
Hale Creek							E						E	E	E	E			
Stevens Creek			E				E			E	E	E	E	E	E	E			E
Stevens Creek Reservoir		E			E		E			E		E	E	E	E	E			E
Swiss Creek			E				E						E	E	E	E			
Calabazas Creek	E						E						E	E	E	E			E
San Tomas Aquino Creek							E				E		E	E	E	E			

Creek	AGR	MUN	FRSH	IND	COMM	SHELL	COLD	EST	MAR	MIGR	RARE	SPAWN	WARM	WILD	REC-1	REC-2	NAV	BIOL	GWR
Saratoga Creek	E		E				E						E	E	E	E			E
Bonjetti Creek							E						E	E	E	E			
Los Gatos Creek		E	E				E			P	E	P	E	E	E	P			E
Vasona Reservoir		E			E		E					E	E	E	E	E			E
Lexington Reservoir		E			E		E					E	E	E	E	E			E
Soda Springs Creek			E				E						E	E	E	E			
Ross Creek													E	E	E	E			E
Guadalupe Creek			E				E			E	E	E	E	E	E	E			E
Pheasant Creek			E				E					E	E	E	E	E			
Guadalupe Reservoir		E					E					E	E	E	E	E			E
Los Capitancillos Creek			E				E						E	E	E	E			E
Rincon Creek			E				E			E	E		E	E	E	E			E
Alamitos Creek			E				E			E	E	E	E	E	E	E			E
Arroyo Calero			E				E			E	E	E	E	E	E	E			
Calero Reservoir		E										E	E	E	E*	E			E
Almaden Reservoir		E					E				E	E	E	E	E*	E			E
Herbert Creek			E				E						E	E	E	E			
Barrett Canyon Creek			E				E						E	E	E	E			

Notes:

E = Existing Beneficial Use: Indicates an existing beneficial use actually attained in the surface or ground water.

E*= Water quality objectives apply; water contact recreation is prohibited or limited to protect public health.

P= Potential Beneficial Use.

AGR = agricultural supply ; MUN= municipal and domestic water supply; FRSH = freshwater replenishment; IND = industrial service supply; COMM = commercial and sport fishing; SHELL = shellfish harvesting; COLD = cold freshwater habitat; EST = estuarine habitat; MAR = marine habitat; MIGR = fish migration; RARE = preservation of rare and endangered species; SPAWN = fish spawning; WARM = warm freshwater habitat; WILD = wildlife habitat; REC-1 = water contact recreation; REC-2= noncontact water recreation; NAV = navigation; GWR= groundwater recharge.

[1]REC-1 applies within a zone bounded by the shoreline and a distance of 1,000 feet from the shoreline or the 30-foot depth contour, whichever is further from the shoreline. This distance is consistent with the applicability of water-contact standards in the Water Quality Plan for the Ocean Waters of California.

Source: San Francisco RWQCB 2017; Central Coast RWQCB 2019

3.5.2 Impaired Waterbodies

The CWA is the primary federal law that protects the quality of the nation's surface waters, including lakes, rivers, and coastal wetlands. Under CWA Section 303(d), states are required to identify "impaired water bodies" (those that do not meet established water quality standards), identify the pollutants causing the impairment, establish priority rankings for waters on the list, and develop a schedule for developing control plans to improve water quality. Impaired waterbodies in the Program area identified on the 2014-2016 CWA Section 303(d) list (SWRCB 2019a) are shown in Table 3-4.

Table 3-4. 2014-2016 Clean Water Act Section 303(d) List of Impaired Waterbodies in the Program Area

Waterbody	Pollutant	Total Maximum Daily Load (TMDL) Completed
South San Francisco Bay	Mercury	U.S. Environmental Protection Agency (USEPA) Approved 2008
	Selenium	Est. 2021
	Polychlorinated biphenyls (PCBs)	UESEPA Approved 2010
	Dioxins	Est. 2019
	Furans	Est. 2019
	Invasive Species	Est. 2019
	Dieldrin	Est. 2013
	Chlordane	Est. 2013
	Dichlorodiphenyltrichloroethane (DDT)	Est. 2013
Calabazas Creek	Diazinon	UESEPA Approved 2007
Alamitos Creek	Mercury	2010; Addressed under *Guadalupe River Watershed Mercury TMDL*
Saratoga Creek	Trash	Est. 2029
	Diazinon	2007; Addressed under *Urban Creeks Pesticide Toxicity TMDL*
	Toxicity	Est. 2019

Waterbody	Pollutant	Total Maximum Daily Load (TMDL) Completed
Stevens Creek	Diazinon	2007; Addressed under *Urban Creeks Pesticide Toxicity TMDL*
	Trash	Est. Attainment 2029
	Water temperature	Est. 2021
Stevens Creek Reservoir	Chlordane	Est. 2019
	Dieldrin	Est. 2019
	Mercury	Est. 2013
	PCBs	Est. 2019
Corte Madera Creek	Diazinon	2007; Addressed under *Urban Creeks Pesticide Toxicity TMDL*
Matadero Creek	Diazinon	2007; Addressed under *Urban Creeks Pesticide Toxicity TMDL*
	Trash	Est. Attainment 2029
Permanente Creek	Trash	Est. Attainment 2029
	Selenium	2021; *Addressed under Permanente Creek Selenium TMDL*
	Toxicity	Est. 2021
	Diazinon	2007; Addressed under *Urban Creeks Pesticide Toxicity TMDL*
Los Gatos Creek	Diazinon	2007; Addressed under *Urban Creeks Pesticide Toxicity TMDL*
Guadalupe Creek	Mercury	2010; Addressed under *Guadalupe River Watershed Mercury TMDL*
Guadalupe Reservoir	Mercury	2010; Addressed under *Guadalupe River Watershed Mercury TMDL*
Almaden Reservoir	Mercury	2010; Addressed under *Guadalupe River Watershed Mercury TMDL*
Lexington Reservoir	Mercury	Est. 2029
San Francisquito Creek	Sediment/Siltation	In progress; Est. 2013
	Diazinon	2007; Addressed under *Urban Creeks Pesticide Toxicity TMDL*
	Trash	2029; Addressed under NPDES MS4

Waterbody	Pollutant	Total Maximum Daily Load (TMDL) Completed
		permit
San Tomas Aquino	Trash	Est. Attainment 2029
San Gregorio Creek	Sediment/Siltation	In progress; Est. 2013
	Indicator Bacteria	Est. 2019
Pomponio Creek	Indicator Bacteria	Est. 2019
Pescadero Creek	Sediment/Siltation	In progress; Est.2019
Butano Creek	Sediment/Siltation	In progress; Est. 2019

Source: SWRCB 2019a

3.5.3 Total Maximum Daily Loads

A total maximum daily load (TMDL) is developed by states, territories, or authorized tribes for constituents on the CWA Section 303(d) List to restore the quality of the waterbody. TMDLs identify the sources of pollutants and identify actions to restore water quality. Applicable TMDLs of waterbodies in the Program area are discussed in more detail below.

Sediment/Siltation

San Francisquito Creek, San Gregorio Creek, Pescadero Creek, and Butano Creek are listed as impaired for excessive sediment (SWRCB 2019a). Sediment sources remain unidentified but frequent sources can often be attributed to agricultural practices (e.g., grazing, crop production, and dairies are the primary sources) and land development activities (including residential/commercial development resulting in hydromodification, stream channelization, and reduced floodplain connectivity). The San Francisco Bay RWQCB is currently developing a TMDL and implementation plan to address sediment impact in the affected watersheds. A TMDL for the Pescadero-Butano Watershed was adopted by the United States (U.S.) Environmental Protection Agency (USEPA) in June 2019. A draft TMDL and implementation plan that addresses sedimentation issues in San Francisquito Creek and San Gregorio Creek is currently in development and will be implemented by the San Francisquito Watershed Joint Powers Authority. The Program would help address sedimentation issues in the upper watershed areas and particularly help achieve sediment reduction targets in the Pescadero-Butano Watershed Sediment TMDL and similarly in the San Francisquito Creek and San Gregorio Creek watersheds.

Toxicity in Urban Creeks

Many urban creeks in the Bay Area, including Calabazas Creek, Corte Madera Creek, Matadero Creek, Permanente Creek, Stevens Creek, Los Gatos Creek, San Tomas Aquino Creek, Saratoga

Creek, Alamitos Creek and San Francisquito Creek are currently identified as exceeding water quality standards for aquatic toxicity (SWRCB 2019a). This is primarily due to use of the common insecticide diazinon that was widely used in the Bay Area to manage pests in the 1990's. Although the USEPA phased out the use of diazinon in 2004, other pesticides, such as pyrethroid pesticides, used as replacements to diazinon also impair water quality. Thus, a TMDL was developed to addresses general pesticide-related aquatic toxicity, including not just waters impaired by diazinon. This TMDL was approved as a Basin Plan amendment by the USEPA in May 2007 for 30 urban creeks in the Bay Area (SWRCB 2020). In addition, a TMDL is currently being developed for toxicity in Stevens Creek (SWRCB 2019b).

The SWRCB regulates stormwater discharges from urban stormwater runoff and Municipal Separate Storm Sewer System (MS4s) through its Municipal Storm Water Permitting Program. County-wide municipal stormwater permits are issued under Phase I MS4 permits (for medium or large population municipalities or for co-permittees within a metropolitan area). In November 2015, the San Francisco Bay RWQCB re-issued these county-wide municipal stormwater permits as one Municipal Regional Stormwater National Pollutant Discharge Elimination System (NPDES) Permit (Order No. R2-2015-0049, NPDES Permit No. CAS612008) to regulate stormwater discharges from municipalities and local agencies in Alameda, Contra Costa, San Mateo, and Santa Clara counties, and the cities of Fairfield, Suisun City, and Vallejo. Under the Phase I MS4 permit, these Permittees effectively reduce toxicity and pesticides within surface waterbodies by adopting Integrated Pest Management policies, encouraging residents to avoid using pesticides, and sampling water and sediment for pesticide toxicity impairments (SWRCB 2020).

Selenium Impairment

Permanente Creek is listed as impaired for selenium, which is a micro-nutrient that is essential in maintaining cellular functions in trace amounts (SWRCB 2019a); however, at elevated concentrations, selenium is toxic to organisms, especially egg-laying aquatic organisms, such as fish and birds. The 13-mile long creek flows through a variety of land uses, including Midpen's Rancho San Antonio OSP, and has been highly modified over time to provide flood control functions. Recent data and studies found that discharges from the Lehigh Permanente Quarry located in the upper watershed area contribute most of the selenium to Permanente Creek. The RWQCB has required the quarry to evaluate selenium levels and degree of impairments to stormwater, groundwater, and the creek. This TMDL is currently under development by the San Francisco Bay RWQCB (SWRCB 2018).

Mercury in Guadalupe River Watershed

Waterbodies in the Guadalupe River Watershed including Guadalupe Creek, Guadalupe Reservoir, Almaden Reservoir, Lexington Reservoir, and Alamitos Creek are listed as impaired for mercury (SWRCB 2019a). High concentrations of mercury in fish tissue have been found to exceed USEPA human health levels and can pose a threat to wildlife, such as birds, amphibians,

and mammals. The main source of mercury in the watershed is the New Almaden Mining District, which is the largest-producing mercury mine in North America. Other sources of mercury include atmospheric deposition from global and local sources, soil erosion, urban stormwater runoff, seepage from landfills, and Central Valley water inputs to Calero Reservoir (SWRCB 2019c).

In June 2010, the USEPA approved the Basin Plan amendment adopted by the RWQCB to establish new water quality objectives and TMDLs and an implementation plan for mercury for waters in the Guadalupe River watershed. This TMDL is currently being implemented and includes implementation actions at mercury mine sites, including removing eroding mining waste; seismic strengthening of the Guadalupe Dam and Calero Dams; cleaning-up of mining waste features above Almaden and Guadalupe Reservoir; suppressing methylation of mercury in reservoirs and lakes through oxygenation; and monitoring of mercury loads. In 2014, Midpen and the San Francisco Estuary Partnership completed remediation of an eroding slope of mercury mining waste at Hicks Flat located in the Sierra Azul Open Space Preserve adjacent to Hicks Creek (SWRCB 2019c). Approximately 800 cubic yards of over-steepened mine waste was removed to prevent it from eroding into Hicks Creek (Timothy C. Best, CEG 2011). Currently, the Santa Clara Valley Water District (Valley Water) performs twice-monthly water quality monitoring of Almaden, Guadalupe, Calero, and Stevens Creek reservoirs as a responsible party in compliance with this TMDL. These TMDL implementation actions are also reducing the amount of mercury in the San Francisco Bay in accordance with the San Francisco Bay Mercury TMDL.

3.6 Groundwater Hydrology

A majority of the Skyline Region is not underlain by a groundwater basin as most of the area is within the Santa Cruz Mountains. In the Santa Cruz Mountains, groundwater conditions vary locally depending on geologic conditions. The occurrence of groundwater is dependent on the presence of porous, permeable rock capable of storing and transmitting water. Hard, fine-grained rock formations underlie most areas of the Santa Cruz Mountains; however, deep weathering, shearing and fracturing of the rock can create permeability and porosity in the rock units, allowing pockets of water to form. Groundwater can also occur locally in deep colluvial and landslide deposits (Midpen 2014). The primary source of groundwater recharge is infiltration of precipitation and streamflow. Smaller groundwater basins underlie the coastal portions of the region and from north to south include San Pedro Valley, Half Moon Bay Terrace, San Gregorio, Pescadero Valley, and Año Nuevo Area groundwater basins (California Department of Water Resources [DWR] 2020).

The Foothill Region is primarily located in the Santa Clara Valley Groundwater Basin. This groundwater basin is bounded on the west by the Santa Cruz Mountains and the San Andreas Fault, on the east by the Diablo Range and Franciscan Basement, on the north by the San Francisco Bay, and on the south by the Santa Clara Valley ground-water divide at Cochrane

Road in Morgan Hill. This ground-water divide separates the northerly flow of water toward the San Francisco Bay from the southerly flow of water towards Monterey Bay. Groundwater within this groundwater basin supplies approximately 50 percent of the potable water to residents in the Santa Clara Valley (Midpen 2014). Creeks and streams flow east from the Santa Cruz Mountains and naturally recharge the underlying basin (Midpen 2014).

Groundwater quality varies throughout the San Francisco Bay Peninsula; however, it is generally of high quality, particularly in deeper aquifer systems (Midpen 2014). The Priority Basin Project of the Groundwater Ambient Monitoring and Assessment (GAMA) study tested raw water samples for a variety of organic and inorganic constituents for the entire 620-square mile San Francisco Bay, including the Santa Clara Valley Groundwater Basin. Fourteen volatile organic compounds (VOCs) and six pesticides were detected in the wells sampled; however, all detections of VOCs and pesticides in study area wells were below established thresholds (Midpen 2014).

This page intentionally left blank

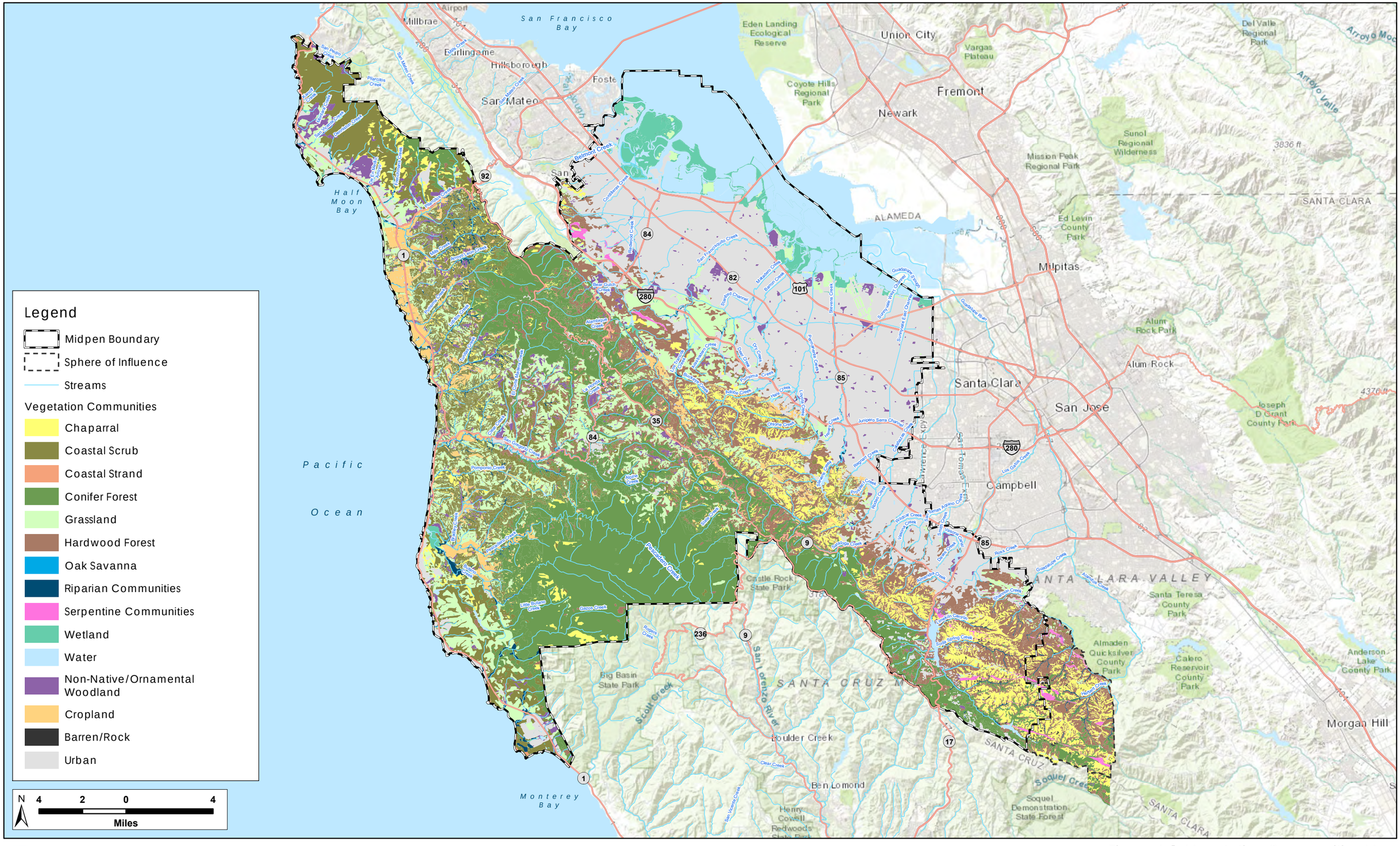
Chapter 4 Biological Resources

4.1 Natural Communities and Habitats

As described in Chapter 1, the Open Space Maintenance and Restoration Program (Program) area consists of approximately 64,000 acres of open space in the counties of San Mateo, Santa Clara, and Santa Cruz (refer to Figure 1-1 in Chapter 1) located in 26 open space preserves and a number of easements and/or areas of management agreement. However, the Ravenswood Open Space Preserve (OSP or Preserve) and Stevens Creek Nature Study Area, as well as similar areas along the edge of San Francisco Bay and along the immediate Pacific Ocean shoreline (e.g., west of Highway 1) are not included in the Program area. Biological resources unique to those areas are therefore not discussed further in this chapter. Otherwise, this chapter provides a regional and programmatic characterization of the Program area. Project-level analysis of biological resources present in the areas of specific maintenance activities cannot be conducted at this time because the Manual is designed for future covered activities that may occur in the Program area, rather than discrete maintenance sites.

Vegetation communities and habitats within the Program area are shaped by the ecological forces at work in the region. Precipitation, topography, soil, climate, the frequency of natural disturbance, and human management (including fire suppression) are all factors that affect the type and pattern of vegetation communities present. The topography encompassing the Midpeninsula Regional Open Space District (Midpen) boundary and Sphere of Influence is extremely varied, with elevations ranging from sea level to 3,476 feet above mean sea level atop Mt. Umunhum in Sierra Azul OSP. Overall, the Program area is characterized by dry, mild summers and moist, cool winters. Local temperatures are strongly influenced by the San Francisco Bay to the east, the Pacific Ocean to the west, and the Santa Cruz Mountains, which results in a variety of microclimates. The west side of the Santa Cruz Mountains experiences a marine climate, characterized by cool, foggy summers and relatively wet winters while the Bay side of the mountains is generally warmer and sunnier.

Vegetation communities within the Program area were mapped using Geographic Information System (GIS) vegetation data provided by Midpen, which is derived from Classification and Assessment with Landsat of Visible Ecological Groupings (CALVEG) data provided by the U.S. Forest Service (USFS) (U.S. Department of Agriculture [USDA] USFS 2004), and then further refined by vegetation mapping carried out by Midpen staff for individual projects. Figure 4-1 shows the general vegetation mapping, as provided by Midpen. Nomenclature of general vegetation types was provided by Midpen and is based on, but not identical to, that of the CALVEG classification system. In general, this mapping has a minimum mapping unit of 2.5 acres and captures general habitat conditions at a map scale unit larger than what would be appropriate for individual project-level analysis, because habitat features smaller than 2.5 acres are not included. Field surveys would be necessary to accurately delineate habitats at a specific maintenance site. Midpen is currently in the midst of collaborative project led by the Golden Gate National Parks Conservancy (GGNPC) and including other regional open space partners, to produce a fine-scale (minimum mapping unit of 0.1 to 0.5 acre) vegetation map for San Mateo County. When those spatial data are available, they will be used to update the information provided in this section.



H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 4-1: Vegetation Communities Map

Midpeninsula Regional Open Space District - Open Space Maintenance and Restoration Program
April 2021

Page intentionally left blank

Vegetation data provided by Midpen include 15 general vegetation communities or land use types within the Midpen boundary and Sphere of Influence (see Figure 4-1): chaparral, coastal scrub, coastal strand, conifer forest, grassland, hardwood forest, oak savanna, riparian communities, serpentine communities (described below as a subset of "grassland"), wetland, water (described below as "aquatic"), non-native/ornamental woodland, cropland, barren, and urban. The general distribution and dominant plant and animal species composition of each habitat/land use type is described below. Descriptions of the plant and animal species typically occurring in each community focus primarily on common (i.e., non-special-status) species. The potential occurrence of special-status species in the Program area is described in detail in Section 4.3, *Special-Status Plant and Animal Species*. Vegetation descriptions below are based on the following resources: Holland's system of classification (Holland 1986), the *California Manual of Vegetation* (Sawyer et al. 2009), and the California Wildlife Habitat Relationship System (California Wildlife Habitat Relationship System [CWHR]; Meyer and Laudenslayer 1988).

While shown on Figure 4-1 and present within the larger Midpen boundary and Sphere of Influence, coastal strand, cropland, and barren areas occur in minimal quantities within the Program area on which this biological resources evaluation focuses. Therefore, these communities or land use types are not discussed further below.

4.1.1 Chaparral

Coastal chaparral and redwoods in Purisima Creek Redwoods OSP (Karl Gohl)

Chaparral is a shrub-dominated vegetation, with few to no trees, composed primarily of drought tolerant species. The vegetation structure and species composition of chaparral varies throughout the Program area, and therefore different chaparral types are largely a function of elevation, distance from the coast, slope, and aspect. In the Program area, chaparral vegetation has been mapped variously in the preserves as mixed chaparral, mesic chaparral, chamise chaparral, manzanita chaparral, ceanothus chaparral, leather oak chaparral, and black sage chaparral. Annual grasses and forbs, perennials, and/or short-lived shrubs can occur in young stands of chaparral, but are often crowded and shaded out by larger shrubs such as chamise (*Adenostoma fasciculatum*) as the vegetation matures. The short-lived shrubs that occur early on include species of buckwheat (*Eriogonum* spp.), deerweed (*Acmispon glaber*), and various species of ceanothus (*Ceanothus* spp.). In the Program area, chaparral occurs on slopes and ridges with thin soils and may occur on serpentine sites (see discussion of serpentine communities below).

Chaparral communities are typically dry and provide relatively low and homogeneous structure. However, a variety of animal species do occur. Mammals that use chaparral and coastal scrub habitats for cover include the coyote (*Canis latrans*), mountain lion (*Puma concolor*), black-tailed deer (*Odocoileus hemionus columbianus*), bobcat (*Lynx rufus*), and brush rabbit (*Sylvilagus bachmani*), among others. Nests of San Francisco dusky-footed woodrats (*Neotoma fuscipes annectens*) are often present in abundance in chaparral. The Santa Cruz kangaroo rat (*Dipodomys venustus venustus*) occurs in limited areas where silverleaf manzanita chaparral is present on sandy soils of the Franciscan sandstone formation. Such specialized habitat occurs in the Program area only in Sierra Azul OSP, where this kangaroo rat is known to be present, and at Pulgas Ridge OSP, where the species occurred historically but is no longer present. Bats such as the pallid bat (*Antrozous pallidus*) and canyon bat (*Parastrellus hesperus*) forage over these arid scrublands. Bird species that nest in these habitats include the California scrub-jay (*Aphelocoma californica*), blue-gray gnatcatcher (*Polioptila caerulea*), Bewick's wren (*Thryomanes bewickii*), California thrasher (*Toxostoma redivivum*), California towhee (*Melozone crissalis*), spotted towhee (*Pipilo maculatus*), California quail (*Callipepla californica*), wrentit (*Chamaea fasciata*), and both Allen's (*Selasphorus sasin*) and Anna's hummingbirds (*Calypte anna*). Reptiles that occur here include the gopher snake (*Pituophis catenifer*), western rattlesnake (*Crotalus viridis*), southern alligator lizard (*Elgaria multicarinata*), and western fence lizard (*Sceloporus occidentalis*). Amphibians may be scarce due to the dry conditions, but during the wet season, amphibians such as California newt (*Taricha torosa*) disperse through chaparral.

San Francisco dusky-footed woodrats (Neotoma fuscipes annectens)

4.1.2 Coastal Scrub

Coastal scrub is a shrub-dominated vegetation, typically composed of low growing to moderate sized shrubs that occur closer to the coast in the Program area. Although precipitation is often limited, this community rarely experiences drought stress typical of inland habitats with similar levels of rainfall because of the high humidity and moderate temperatures typical of the coastal environment in which it is found. Coastal scrub differs from chaparral vegetation in that many of the shrubs have softer leaves with flexible branches. Shrub structure within the community can differ, and often depends on the degree of coastal influence. Along the coast, shrubs may be prostrate while further inland they may be several feet tall. The habitat supports a shrub overstory and an herbaceous, grassy understory. Common shrub species in coastal scrub include

coyote brush (*Baccharis pilularis*), blue blossom ceanothus (*Ceanothus thyrsiflorus*), California sagebrush (*Artemisia californica*), California blackberry (*Rubus ursinus*), poison oak (*Toxicodendron diversilobum*), and wooly sunflower (*Eriophyllum lanatum*). In the herb understory, bracken fern (*Pteridium aquilinum*) and sword fern (*Polystichum munitum*) are dominant and other associates include cowparsnip (*Heracleum maximum*), Indian paintbrush (*Castilleja* spp.), yerba buena (*Clinopodium douglasii*), and California oatgrass (*Danthonia californica*).

Wildlife species found in coastal scrub communities are very similar those found in chaparral communities and provide habitat for a diverse assemblage of bird species.

4.1.3 Conifer Forest

In the Program area, conifer forest communities are represented by redwood forest, montane hardwood-conifer, and mixed Douglas-fir forests, which are differentiated by the dominance of one or another conifer species. Forested communities in the Program area are structurally similar and support dense stands of mature trees that form overlapping canopies. These conifer forest types are differentiated by the relative dominance of different tree species, which is largely controlled by moisture gradients and soil characteristics. Conifer forests dominate much of the Program area, particularly at higher elevations in, and along the less developed western slope of, the Santa Cruz Mountains.

Conifer forest in El Corte de Madera OSP (Karl Gohl)

Redwood forest is a composite habitat name for a variety of conifer species that grow in the coastal influence zone, but which tend to be dominated in the tallest overstory by coast redwood (*Sequoia sempervirens*). The majority of redwood forests are second growth (i.e., they were previously logged). Old growth redwood forest stands occur but are scarce in the Program area. Redwood forests are largely restricted to areas of coastal influence with relatively stable temperatures and summer coastal fog. Montane hardwood-conifer is a habitat type that contains both hardwoods and conifers in a closed canopy forest setting. Characteristically, this habitat contains a mixture of small stands, either pure conifer stands or small pure broadleaf tree stands. Common trees are redwood, Douglas-fir (*Pseudotsuga menziesii*), tanoak (*Notholithocarpus densiflorus*), Pacific madrone (*Arbutus menziesii*), coast live oak (*Quercus agrifolia*), big leaf maple (*Acer macrophyllum*), California bay (*Umbellularia californica*), and

incense cedar (*Calocedrus decurrens*). Douglas-fir forests are typically more strongly dominated by Douglas-fir and tend to grow more inland and at higher elevations within the Program area.

Wildlife species that occur in conifer forest communities of the Program area are generally similar among the various conifer forest types. In the Program area, conifer forests provide foraging and nesting habitat for many bird species, including the Pacific wren (*Troglodytes pacificus*), chestnut-backed chickadee (*Poecile rufuscens*), Pacific-slope flycatcher (*Empidonax difficilis)*, Steller's jay (*Cyanocitta stelleri*), acorn woodpecker (*Melanerpes formicivorus*), brown creeper (*Certhia americana*), band-tailed pigeon (*Patagioenas fasciata*), and hermit warbler (*Setophaga occidentalis*). Marbled murrelets (*Brachyramphus marmoratus*) nest in forests of mature, especially old-growth, redwood and Douglas-fir. Winter residents of these forests include Townsend's warbler (*Setophaga townsendi*) and varied thrush (*Ixoreus naevius*). Mammals using conifer forests in the Program area include bobcat, mountain lion, black-tailed deer, and western gray squirrel (*Sciurus griseus*). Hollow trees and logs provide denning sites and nesting sites for many species including the coyote and raccoon (*Procyon lotor*), while cavities in mature trees are used by cavity-dwelling species such as the acorn woodpecker, pileated woodpecker (*Dryocopus pileatus*), northern saw-whet owl (*Aegolius acadicus*), and western screech-owl (*Megascops kennicottii*), as well as bats such as the Yuma myotis (*Myotis yumanensis*) and Townsend's big-eared bat (*Corynorhinus townsendii*). Common amphibians and reptiles found in coniferous forests include the California newt, California slender salamander (*Batrachoseps attenuatus*), western fence lizard, southern alligator lizard and California giant salamander (*Dicamptodon ensatus*).

4.1.4 Grassland

Grassland communities are dominated by grasses and may also contain a diverse set of forbs. These communities provide many important environmental functions for soil stabilization, increasing water infiltrations, and nutrient cycling. In addition, grasslands serve as habitat for many special-status species. In the Program area, both annual and perennial grasslands occur. Annual grasslands are defined as those typically dominated by non-native grasses, whereas perennial grasslands are those in which a significant component of vegetative cover consists of native perennial bunchgrasses. Some of the perennial grassland habitat types in the Program area occur within areas mapped as "serpentine communities" shown on Figure 4-1.

Annual Grassland

Annual grassland habitat occurs on flat plains and rolling hills, and is an open community composed mainly of annual plant species. Grasses begin to grow during the cool late fall and early winter months and by summer much of the biomass, although standing, is dead. Introduced annual grasses are dominant and include wild oats (*Avena* spp.) and non-native brome species (*Bromus* spp.). The forb community includes many non-native species such as filarees (*Erodium* spp.), mustards (*Brassica* spp. and *Hirschfeldia* spp.), and thistles such yellow star-thistle (*Centaurea solstitialis*) and Italian thistle (*Carduus pycnocephalus*). Native

species can be a significant component of the composition, including native grass species such as bromes (*Bromus* spp.) and needlegrasses (*Stipa* spp.), and native forbs such as yarrow (*Achillea millefolium*), common fiddleneck (*Amsinckia intermedia*), clarkias (*Clarkia* spp.), blue-eyed grass (*Sisyrinchium bellum*), soap plant (*Chlorogalum pomeridianum*), and California poppy (*Eschscholzia californica*). Annual grasslands are found throughout the Program area, primarily in lower and middle elevations.

White-tailed kite (Elanus leucurus)

In the more highly urbanized portions of the Program area, especially east of the Santa Cruz Mountain ridges, wildlife use of grasslands is limited by human disturbance, extent of the habitat in a specific area, abundance of non-native and invasive species, and isolation of grassland habitat remnants from more extensive grasslands. In more rural areas, large expanses of grassy open areas provide higher-quality habitat for these grassland-associated wildlife species.

California ground squirrels (*Spermophilus beecheyi*), where they are present, are an important component of grassland communities, providing a prey base for diurnal raptors and terrestrial predators throughout the Program area. The burrows of California ground squirrels also provide refugia for wildlife species including fence lizards, garter (*Thamnophis* spp.) and gopher snakes, and wintering and migrant burrowing owls (*Athene cunicularia*). Other rodent species present in grassland habitats include the California vole (*Microtus californicus*), Botta's pocket gopher (*Thomomys bottae*), and deer mouse (*Peromyscus maniculatus*). Diurnal raptors such as red-tailed hawks (*Buteo jamaicensis*), northern harriers (*Circus hudsonius*), white-tailed kites (*Elanus leucurus*), and American kestrels (*Falco sparverius*) forage for small mammals over grasslands during the day, and at night nocturnal raptors, such as barn owls (*Tyto alba*) and great horned owls (*Bubo virginianus*), forage for nocturnal rodents such as deer mice. Some bird species, such as western meadowlarks (*Sturnella neglecta*) and grasshopper sparrows (*Ammodramus savannarum*), breed and forage in the Program area solely in grasslands. Mammals such as the coyote, American badger (*Taxidea taxus*), black-tailed jackrabbit (*Lepus californicus*), and striped skunk (*Mephitis mephitis*) utilize grassland habitats in the Program area for foraging. Open grassland habitat with bare ground is important foraging habitat for the pallid bat and Mexican free-tailed bat (*Tadarida brasiliensis*). Amphibians occur in extensive grasslands in low numbers due to the relative lack of cover and the generally dry and hot microclimate; however, more mobile amphibians such as California red-legged frog (*Rana draytonii*) can traverse grasslands during the wet season. Reptiles present include western fence lizard, southern alligator lizard, western skink (*Eumeces skiltonianus*), western terrestrial garter snake (*Thamnophis elegans*), gopher snake, western rattlesnake, California kingsnake, and in some local areas, San Francisco garter snakes (*Thamnophis sirtalis tetrataenia*).

Perennial Grassland

Perennial grasslands are typically dominated by native species including native, perennial bunchgrasses. Perennial grasslands of two main types occur in the Program area: coastal prairie and serpentine bunchgrass grassland. Coastal prairie is unmapped by CALVEG, and would be restricted in the Program area to preserves such as Tunitas Creek OSP, Miramontes Ridge OSP, or Purisima Creek Redwoods OSP that experience coastal influence. Serpentine bunchgrass grassland occurs in areas mapped as "serpentine communities" on Figure 4-1.

Coastal Prairie

Coastal prairies occur on marine terraces near the Pacific Coast and have a dense herbaceous layer with grasses as a significant portion of the vegetation, including Pacific reedgrass (*Calamagrostis nutkaensis*), California oatgrass, tufted hairgrass (*Deschampsia cespitosa*), and sedges (*Carex* spp.). Wildflowers and native forbs are a component and include goldfields (*Lasthenia* spp.), lupines (*Lupinus* spp.), and clovers (*Trifolium* spp.).

Perennial bunchgrasses can be found in this habitat as well and can include needlegrasses (*Stipa* spp.), California oatgrass, Idaho fescue (*Festuca idahoensis*), one-sided bluegrass (*Poa secunda*), California brome (*Bromus carinatus*), and melic grasses (*Melica* spp.). Relic coastal prairies will often have native perennial bunchgrasses as a significant portion of the vegetation.

San Francisco garter snake (Thamnophis sirtalis tetrataenia)

The general vegetation structure of coastal prairie habitat is similar to that of non-native grassland habitat, and wildlife species composition in the Program area is similar between perennial and annual grasslands. However, small mammal abundance may be greater in areas dominated by perennial bunchgrasses, if such areas provide greater cover, and raptors may be more abundant in areas dominated by perennial bunchgrasses as a result.

Serpentine Communities

Serpentine grass and wildflowers in Sierra Azul OSP (Karl Gohl)

In the Program area, serpentine communities are found in four Midpen preserves in the Program area: Pulgas Ridge OSP, St. Joseph's Hill OSP, El Sereno OSP, and Sierra Azul OSP. Serpentine habitats in these preserves consist of serpentine bunchgrass grasslands, serpentine wildflower fields, serpentine chaparral, serpentine seeps, and serpentine barrens. Serpentine grasslands are grasslands dominated by perennial bunchgrass such as needlegrasses and melic grasses. Notably, non-native annual grasses are less abundant in serpentine communities than in annual grassland communities. The soils of serpentine communities have extremely high levels of iron and magnesium, making them inhospitable for many species of plants. Serpentine soils can also contain other metals such as chromium, cobalt or nickel that can cause plant toxicity. In addition, the nitrogen and water-holding capacity of the soils may also be low, making the soils less fertile. However, a unique group of vascular plant species, which can tolerate the relatively low calcium to magnesium ratio, has evolved in response to these conditions. As a result, serpentine grasslands generally support native plant communities, including a number of special-status plants (discussed in Section 4.3.1, *Special-Status Plant Species* below). Serpentine wildflower fields occur where the vegetation is dominated by native forb cover consisting of species indicative of serpentine substrates. These communities occur in a matrix with serpentine grassland and serpentine barrens (e.g., serpentine rock outcrops or thin soils where vegetation is sparse and limited to small pockets of herbaceous vegetation). Serpentine chaparral consists of fire-adapted shrub vegetation found on serpentine soils. Serpentine chaparral is generally more open than other chaparral types and shrubs tend to be shorter. A common dominant shrub species on serpentine chaparral in the Program area is leather oak (*Quercus durata*). As with serpentine grassland, serpentine chaparral supports special status plants that are specially adapted and restricted to the unique soil conditions.

Several invertebrate species, including the federally threatened Bay checkerspot butterfly (*Euphydryas editha bayensis*), which was extirpated from the Program area but recently reintroduced to Edgewood County Park and San Bruno Mountain State and County Park, depend on serpentine grasslands because their host-food plants are found primarily in this habitat. Although serpentine grassland habitats in the Program area provide unique habitat structure that may be attractive to certain grassland bird species, the relatively small size and of these habitat patches and their relative isolation from the few other patches of serpentine habitat limit their attractiveness to grassland bird species. Within the Program area, serpentine grassland in general provides habitat for generalist species that do not require large tracts of

intact grassland, such as red-tailed hawks, American kestrels, savannah sparrows (*Passerculus sandwichensis*), grasshopper sparrows, and western meadowlarks.

Rock Outcrops

Rock outcrops are present in a variety of plant communities, including grasslands. These outcrops often support few plants due to the paucity of soil, but they provide unique habitat for some wildlife species. On large outcrops, white-throated swifts (*Aeronautes saxatilis*), common ravens (*Corvus corax*), barn owls, and other birds nest and roost in cavities or on ledges, and cliff swallows (*Petrochelidon pyrrhonota*) may attach mud nests under rock overhangs. Near-ground rock outcrops are used by western rattlesnake and other reptiles for thermoregulation. Outcrops may also provide roosting habitat for Pallid bat, big brown bat (*Eptesicus fuscus*), small-footed myotis (*Myotis ciliolabrum*), Yuma myotis, California myotis (Myotis californicus), little brown myotis (*Myotis lucifugus*), fringed myotis (*Myotis thysanodes*), long-legged myotis (*Myotis volans*), and canyon bat.

4.1.5 Hardwood Forest

In the Program area, hardwood forest communities are represented by closed-canopy forests dominated by hardwoods such as coast live oak or California bay. They generally occur in the transition zone between forests and woodland or scrub communities, and in the Program area occur in greatest abundance at somewhat lower elevations than much of the conifer forest. In the majority of the Program area, coast live oak tends to be the dominant canopy species in this forest type. Other co-occurring trees in the canopy include Pacific madrone, tanoak, and canyon live oak (*Quercus chrysolepis*). At drier sites, the co-occurring trees include valley oak (*Quercus lobata*), blue oak (*Quercus douglasii*), and gray pine (*Pinus sabiniana*). Depending on site moisture characteristics, the canopy tends to be closed on moister sites and open and widely spaced on drier sites. As with the overstory, the understory composition varies, including shade tolerant shrubs, ferns, and herbs. In the more open settings, grassland species typically occur. Where the hardwood forest intergrades with chaparral and coastal scrub, the understory may contain California sagebrush, sticky monkeyflower (*Diplacus aurantiacus*), or coyote brush.

Hardwood forest in Sierra Azul OSP (Karl Gohl)

Hardwood forests and woodlands produce mast crops that are an important food source for many birds and mammals, including wild turkey (*Meleagris gallopavo*), oak titmouse (*Baeolophus inornatus*), Bewick's wren, Hutton's vireo (*Vireo huttoni*), California scrub-jay,

Steller's jay, acorn woodpecker, California quail, black-tailed deer, and San Francisco dusky-footed woodrat. Dusky-footed woodrats can be quite abundant in this habitat type, and the deer mouse and California mouse (*Peromyscus californicus*) also commonly occur. As with coniferous forests, hollow trees and logs, as well as cavities in older mature trees, provide important denning sites for coyotes, raccoons, striped skunks, and bobcats. Cavities in mature trees are also used by cavity-dwelling species such as the oak titmouse, acorn woodpecker, hairy woodpecker (*Dryobates villosus*), and chestnut-backed chickadee, as well as bats such as the Yuma myotis, California myotis, hoary bat (*Lasiurus cinereus*), big brown bat, long-eared myotis (*Myotis evotis*), and occasionally pallid bat. Common amphibians and reptiles found in hardwood forests and woodlands include the California slender salamander, western fence lizard, gopher snake, southern alligator lizard, and California kingsnake.

4.1.6 Oak Savanna

Oak savanna vegetation is mapped where the tree canopy is open and generally has an open grassland understory. Oak savanna habitats generally occur in the transition zone between forests and scrub or grassland communities, and oak savanna is much less extensive in the Program area than those adjacent communities. Oak savanna types include coast live oak woodland, California buckeye (*Aesculus californica*) woodland, gray pine woodland, and valley oak woodland. The herbaceous understory is typically composed of the one of the grassland types described above in Section 4.1.5, *Hardwood Forest*.

Oaks in Monte Bello OSP (Karl Gohl)

Wildlife using oak savanna includes many species that occur in hardwood forests, such as wild turkey, California scrub-jay, Steller's jay, as well as species that are associated primarily with open habitats, such as red-tailed hawk, American kestrel, lazuli bunting (*Passerina amoena*), western bluebird (*Sialia mexicana*), mourning dove (*Zenaida macroura*), and California towhee.

4.1.7 Riparian Communities

Riparian communities occur at the interfaces between terrestrial and aquatic communities, particularly along streams. In California, riparian habitats generally support exceptionally rich animal communities even though they occupy a limited amount of the land cover. The importance of riparian areas in the Program area far exceeds their minor proportion of the total acreage because of their prominent location within the landscape and the intricate linkages between terrestrial and aquatic communities (Gregory et al. 1991). The presence of at least

seasonal (and often year-round) water and abundant invertebrates provide foraging opportunities for many species, and the diverse habitat structure provides cover and nesting opportunities. In the Program area, riparian communities are classified by habitat subcategories as riparian woodland or riparian shrubland, depending on whether a tree canopy is present or not.

Riparian woodland habitats are forest and woodland communities dominated by trees such as red willow (*Salix laevigata*), Fremont's cottonwood (*Populus fremontii*), western sycamore (*Platanus racemosa*), and valley oak in the tallest canopy layer. A lower subcanopy can occur that includes tree species such as white alder (*Alnus rhombifolia*), boxelder (*Acer negundo*), and black walnut (*Juglans hindsii*). Below the tree canopy is a shrub layer that can include native shrubs such as wild rose (*Rosa californica*), California blackberry, poison oak, and coyote brush. Understory herbs include grasses, miner's lettuce (*Claytonia perfoliata*), Douglas' sagewort (*Artemisia douglasiana*), poison hemlock (*Conium maculatum*), hoary nettle (*Urtica dioica*), rushes (*Juncus* spp.), and sedges (*Carex* spp. and *Cyperus* spp.). This habitat occurs along stream courses and rivers throughout the Program area.

Yellow warbler (Setophaga petechia)

Riparian shrubland habitats are those dominated by shrubs such as sandbar willow (*Salix exigua*), arroyo willow (*Salix lasiolepis*), dogwood (*Cornus sericea*), coast twinberry (*Lonicera involucrata*), and California wax myrtle (*Morella californica*), and in some areas currant (*Ribes* spp.). This habitat type often represents pioneer vegetation, which will colonize recently established sand or gravel bars within floodplains. Tall shrub vegetation may establish on gravel banks and terraces adjacent to the more active channels that are either open water or streambeds devoid of vegetation. If not cleared by either human or natural disturbance, this vegetation would, in many settings, develop into a tree-dominated riparian vegetation such as that described above. In some areas, particularly on channel banks and higher floodplain terraces, this vegetation consists of stands of coyote brush.

The maturity and structural diversity of the riparian habitats in the Program area support a high diversity and density of vertebrate species, particularly birds. The wider, more mature riparian corridors provide suitable foraging and breeding habitat for several functional groups of birds including insectivores (e.g., warblers, flycatchers), seed-eaters (e.g., finches), raptors, and cavity-nesters (e.g., swallows and woodpeckers) in addition to a variety of common amphibians, reptiles, and mammals. Among the numerous species of birds that use the riparian habitats for breeding are the Pacific-slope flycatcher, black-headed grosbeak (*Pheucticus melanocephalus*), warbling vireo (*Vireo gilvus*), and Wilson's warbler (*Cardellina pusilla*). The yellow warbler

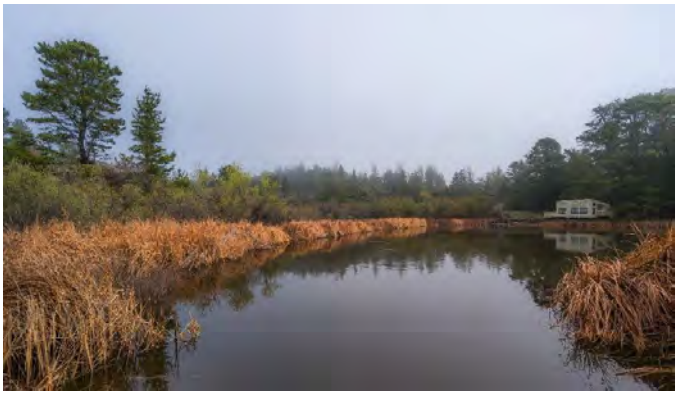
(*Setophaga petechia*) may breed in small numbers at a few locations, but is a much more abundant spring and fall migrant. Raptors such as red-shouldered hawk (*Buteo lineatus*) and Cooper's hawk (*Accipiter cooperii*) nest within riparian corridors and forage in adjacent habitats. Riparian habitats are also used heavily by migrants, including many passerine species, such as western tanagers (*Piranga ludoviciana*) and western wood-pewees (*Contopus sordidulus*) as well as wintering birds. Silver-haired bat (*Lasionycteris noctivagans*), western red bat (*Lasiurus blossevillii*), and hoary bat are all foliage-roosting species that may roost in riparian trees.

A number of species of reptiles and amphibians occur in riparian corridors within the Midpen lands. Leaf litter, downed tree branches, and fallen logs provide cover for the arboreal salamander (*Aneides lugubris*), California newt, and Sierran chorus frog (*Pseudacris sierra*) among others. Several lizards may also occur here, including the western fence lizard, western skink, and southern alligator lizard. Mammals such as the ornate shrew (*Sorex ornatus*), California vole, Audubon's cottontail (*Sylvilagus audubonii*), San Francisco dusky-footed woodrat, and raccoon also use riparian habitats.

4.1.8 Aquatic and Wetland Communities

Aquatic and wetland communities are those which are periodically to perennially saturated or inundated. These communities provide many important environmental functions, such as recycling nutrients, purifying water, attenuating floods, and recharging groundwater. In addition, they serve as habitat for many aquatic species. Aquatic and wetland communities present in the Program area include lacustrine habitats (shown as "water" on Figure 4-1), wetlands, and streams.

Lacustrine habitats contain standing water in areas that are flooded year-round or for the majority of the year. These habitats form from depressions where small ponds may form (man-made in the case of stock ponds), or from dammed stream and river channels. Ponds, lakes, and reservoirs are all examples of lacustrine habitats.



Alpine Pond in Skyline Ridge OSP (Karl Gohl)

Wetlands are communities vegetated with herbaceous plants and occurring in soils that are inundated or saturated either temporarily or permanently. Freshwater emergent wetlands in the Program area consist of emergent, herbaceous vegetation occurring in portions of drainages where the water source is perennial and slow-moving throughout most of the year, or in depressions where the groundwater table may be high.

Freshwater emergent wetlands in the Program area typically occur as dense growth of perennial, obligate wetland species such as cattail (*Typha* spp.), bulrush (*Schoenoplectus* spp.), sedges, water smartweeds (*Persicaria* spp.), and watercress (*Nasturtium officinale*). The exact composition of any wetland is variable and dependent on the hydrology of the landscape. Seasonal wetlands are dominated by hydrophytes (i.e., wetland-adapted plants) that will persist in channels or depressions that are only seasonally moist. These include ruderal, non-native species such as bristly ox tongue (*Helminthotheca echioides*), curly dock (*Rumex crispus*), Italian thistle (*Carduus pycnocephalus*), sheep sorrel (*Rumex acetosella*), rabbit's foot grass (*Polypogon monspeliensis*), Italian ryegrass (*Festuca perennis*), and cocklebur (*Xanthium strumarium*) and natives such as umbrella sedge (*Cyperus eragrostis*) and California mugwort (*Artemisia douglasiana*).

Streams are shown on Figure 4-1 as blue-line features and include perennial and intermittent drainages throughout the Program area. Streams within the Program area often have some riparian, described as a separate vegetation community above, natural communities associated with them. These aquatic features also commonly support wetland vegetation, and lacustrine features may also be associated with streams, particularly when channels are impounded. Vegetation in stream habitats is more likely associated with the adjacent wetlands and riparian communities than the streams themselves. Aquatic vegetation such as algae may grow on stream beds, and in slower moving waters duckweed (*Lemna* spp.) and other floating and submerged aquatic species may be present.

Aquatic and wetland habitats provide important habitat for a variety of wildlife species. Reservoirs and lakes, such as Lexington Reservoir, Howell Reservoir, and Lake Elsman, as well as other smaller lakes and bodies of water located throughout the Program area, provide habitat for waterbirds such as the double-crested cormorant (*Phalacrocorax auritus*), great blue heron (*Ardea herodias*), great egret (*Ardea alba*), Canada goose (*Branta canadensis*), and mallard (*Anas platyrhynchos*). Wintering ducks, such as bufflehead (*Bucephala clangula*) and ring-necked duck (*Aythya collaris*), also use reservoirs, lakes, and small ponds throughout the Program area. Small numbers of some species of shorebirds, such as the spotted sandpiper (*Actitis macularius*), forage and roost at the edges of small ponds and lakes during migration and winter. Bald eagles (*Haliaeetus leucocephalus*), ospreys (*Pandion haliaetus*) and terns (*Sterna* spp.) forage at larger reservoirs and lakes, such as at Lexington reservoir.

Aquatic and wetland habitats provide important foraging habitat for bats. Yuma myotis forage over open water habitat, almost exclusively. Silver-haired bats also forage over open water, while little brown myotis and western red bat often forage over woodland streams.

Amphibian species that breed in ponds and lakes throughout the Program area include the native Sierran chorus frog and western toad (*Anaxyrus boreas*) and the non-native American bullfrog (*Lithobates catesbeianus*). The California red-legged frog is a widespread breeder in ponds, streams with suitable egg mass attachment sites, and wetlands that support deeper water. Western pond turtles (*Actinemys marmorata*) are also present in some ponds and lakes.

California red-legged frog (Rana draytonii)

Despite the limited amount of freshwater marsh habitat available in the Program area, small numbers of sora (*Porzana carolina*) and Virginia rail (*Rallus limicola*) forage in freshwater marshes in the Program area during migration and in winter. American coots (*Fulica americana*), common gallinules (*Gallinula chloropus*), pied-billed grebes (*Podilymbus podiceps*), and several species of ducks breed in freshwater wetlands, channels, and ponds in and around emergent vegetation. Passerine species that breed in freshwater marshes include the marsh wren (*Cistothorus palustris*), song sparrow (*Melospiza melodia*), common yellowthroat (*Geothlypis trichas*), and red-winged blackbird (*Agelaius phoeniceus*).

Fish species present in aquatic habitats in the region are discussed below in Section 4.2, *Fish Resources*.

4.1.9 Non-Native/Ornamental Woodland

The ornamental woodland cover type in the Program area consists of vegetation that is dominated by one or more species of non-native, often planted, trees. The most common expression of this habitat type in the Program area is that of eucalyptus (*Eucalyptus globulus*) groves, some of which are remnant plantations, and some of which have established on their own. Other common tree species constituting ornamental woodland in the Program area include blackwood acacia (*Acacia melanoxylon*), cultivated Douglas-fir, non-native Monterey pine (*Pinus radiata*), and Monterey cypress (*Hesperocyparis macrocarpa*).

These trees may provide nesting habitat for birds, but generally the habitat value of homogenous stands of trees is lower than native forest communities described above due to the lower diversity of structural and food resources of monotypic stands and the paucity of understory vegetation and ground cover below dense canopies of species such as eucalyptus and cypress. However, certain eucalyptus species can provide foraging and nesting habitat for breeding, wintering, and migrant birds. Bird species that often frequent eucalyptus trees include the Anna's hummingbird, yellow-rumped warbler (*Setophaga coronata*), and migrant yellow warbler. Red-shouldered hawks, red-tailed hawks, and white-tailed kites often nest in mature eucalyptus trees.

Eucalyptus trees also provide roosting habitat for several bat species. The exfoliating bark provides roosting habitat for Yuma myotis and California myotis, while the foliage provides roosting habitat for silver-haired bat, western red bat, and hoary bat.

4.1.10 Urban

The urban land cover type as depicted in Figure 4-1 can be described as a "developed" habitat. Within the Program area, urban land uses consist primarily of urban and suburban areas; within preserves, urban land uses would include paved roads, parking lots, office and maintenance buildings, and maintenance yards and gravel lots associated with those areas, as well as landscaped areas around historical buildings and visitors' centers. Vegetation within urban land uses is dominated by turf grass, ornamental, non-native plants associated with landscaping and irrigation, or ruderal non-native species such as Italian thistle, yellow star thistle (*Centaurea solstitialis*), and upright veldt grass (*Ehrharta erecta*).

Urban habitats typically support a suite of relatively common wildlife species that are tolerant of periodic human disturbance. Some of the most abundant species in developed habitats, such as the Brewer's blackbird (*Euphagus cyanocephalus*), American crow (*Corvus brachyrhynchos*), Eurasian collared-dove (*Streptopelia decaocto*), European starling (*Sturnus vulgaris*), rock pigeon (*Columba livia*), Virginia opossum (*Didelphis virginiana*), house mouse (*Mus musculus*), eastern gray squirrel (*Sciurus carolinensis*), fox squirrel (*Sciurus niger*), Norway rat (*Rattus norvegicus*), and black rat (*Rattus rattus*), are non-native species that are well adapted to the cover, nesting/denning, and foraging conditions provided by developed areas. In addition, a number of native species have adapted to these conditions. Native bird species commonly found in urban habitats in the Program area include the black phoebe (*Sayornis nigricans*), house finch (*Carpodacus mexicanus*), northern mockingbird (*Mimus polyglottos*), Anna's hummingbird, and California towhee. Native mammals such as the deer mouse, raccoon, and striped skunk utilize these developed areas heavily as well.

Many bridges and other structures, such as old barns, sheds, and other buildings in the Program area, including those on Midpen preserves, provide important nesting and roosting sites for some species of birds and bats. Bats such as the Yuma myotis, California myotis, Mexican free-tailed bat, Townsend's big-eared bat, pallid bat, and big brown bat may roost in bridges, structures, unoccupied buildings, and/or large trees throughout the Program area, including other structures on Midpen preserves. Caves and abandoned mines, although not common on Midpen properties, also provide roosting habitat for Townsend's big-eared bat, pallid bat, small-footed myotis, little brown myotis, fringed myotis, long-legged myotis, and Mexican free-tailed bat. Birds such as the black phoebe, cliff swallow, barn swallow (*Hirundo rustica*), northern rough-winged swallow (*Stelgidopteryx serripennis*), and white-throated swift also use bridges and other structures in the Program area for nesting.

4.2 Fish Resources

Aquatic features in the Program area, including streams, sloughs, ponds, and lakes, provide habitat for both native and non-native fish species. Rivers, creeks, and streams within the Program area located on the west side of the crest of the Santa Cruz Mountains flow downstream to the Pacific Ocean, while those located on the east side of the crest of the Santa Cruz Mountains flow downstream to the San Francisco Bay. Perennial streams in the Program area support fish resources year-round, especially where wetland and riparian vegetation are present to provide cover, shade, and foraging opportunities. Intermittent drainages can provide habitat for fish species during wet periods, if fish are able to access these drainages from perennially wet areas, but typically dry out in the summer.

Native fish that inhabit waterbodies in the Program area include the Pacific lamprey (*Entosphenus tridentata*), threespine stickleback (*Gasterosteus aculeatus*), prickly sculpin (*Cottus asper*), staghorn sculpin (*Leptocottus armatus*), and coastrange sculpin (*Cottus aleuticus*) (Leidy 2007). Rainbow trout (*Oncorhynchus mykiss*) in the Program area include both resident individuals present in Program area streams throughout their lifetimes (including trout in stream reaches that are separated from marine and estuarine habitats by barriers such as dams) and anadromous Central California Coast steelhead that spawn in freshwater streams and forage as adults in marine habitats before returning to their natal streams to breed (Leidy et al. 2005). Central California Coast Coho salmon (*Oncorhynchus kisutch*) is another anadromous fish that spawns in limited coastal streams in the Program area. In addition, a number of non-native fishes have been introduced to the Program area, including the yellowfin goby (*Acanthogobius flavimanus*), common carp (*Cyprinus carpio*), white crappie (*Pomoxis annularis*), brown bullhead (*Ameiurus nebulosus*), mosquitofish (*Gambusia affinis*), largemouth bass (*Micropterus salmoides*), and bluegill (*Lepomis macrochirus*) (California Fish Website 2019, Leidy 2007).

4.3 Special-Status Plant and Animal Species

For the purpose of this Manual, special-status species have been defined as described below. Impacts on these species are regulated by some of the federal, state, and local laws and ordinances described in Chapter 2, *Regulatory Framework*.

"Special-status" plants are considered plant species that are:

- Listed under the Federal Endangered Species Act (FESA) as threatened, endangered, proposed threatened, proposed endangered, or a candidate species;
- Listed under the California Endangered Species Act (CESA) as threatened, endangered, rare, or a candidate species;
- Listed by the California Native Plant Society (CNPS) as California Rare Plant Rank (CRPR) 1A, 1B, 2A, 2B, 3, or 4; and

- Considered sensitive or locally rare by qualified botanists, and/or tracked and given special consideration by Midpen. Examples include (but are not limited to) Nature Serve ranked species and International Union for Conservation of Nature listed species.

The CNPS, a non-governmental conservation organization, has developed CRPRs for plant species of concern in California in the CNPS Inventory of Rare and Endangered Plants. The CRPRs include lichens, vascular, and non-vascular plants, and are defined as follows:

- CRPR 1A Plants considered extinct.
- CRPR 1B Plants rare, threatened, or endangered in California and elsewhere.
- CRPR 2A Plants considered extinct in California but more common elsewhere.
- CRPR 2B Plants rare, threatened, or endangered in California but more common elsewhere.
- CRPR 3 Plants about which more information is needed - review list.
- CRPR 4 Plants of limited distribution-watch list.

The CRPRs are further described by the following threat code extensions:

- .1—seriously endangered in California;
- .2—fairly endangered in California;
- .3—not very endangered in California.

"Special-status" animals, for the purposes of this document, are considered animal species that have been given one or more of the status designations below by the California Department of Fish and Wildlife (CDFW), U.S. Fish and Wildlife Service (USFWS), or National Marine Fisheries Service (NMFS).

- Listed under the FESA as threatened, endangered, proposed threatened, proposed endangered, or a candidate species
- Listed under the CESA as threatened, endangered, or a candidate threatened or endangered species
- Designated by CDFW as a California species of special concern
- Listed in the California Fish and Game Code (F&G Code) as a fully protected species (birds at Section 3511, mammals at Section 4700, reptiles and amphibians at Section 5050, and fish at Section 5515).

In addition, Midpen maintains its own lists of sensitive plant and animal species, which include a number of species that do not necessarily meet the "special-status" definitions below. These additional species include, but are not limited to, species classified or listed under designations such as USFWS Birds of Management Concern or CDFW Watchlist species. These additional sensitive species also include species such as the Santa Cruz kangaroo rat, which is very scarce and local and is being considered by CDFW for addition to its list of mammal species of special concern. Midpen takes those species into consideration during planning and implementation of

maintenance activities and may analyze impacts to these additional species under CEQA even if not strictly required or done by common practice. Therefore, Midpen may consider impacts of maintenance activities to selected sensitive plants and animals in addition to those listed in Tables 4-1 and 4-2.

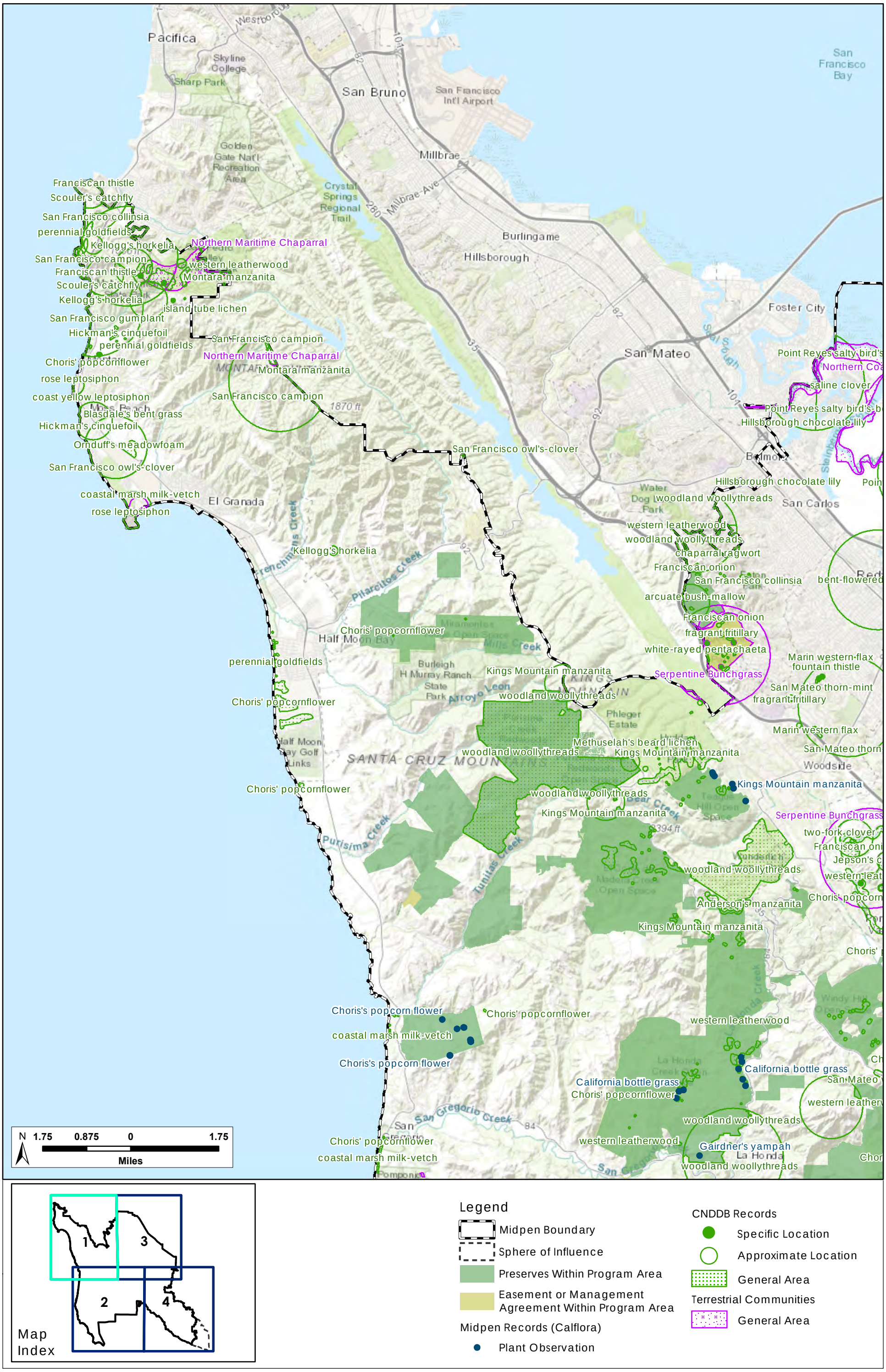
4.1.11 Special-Status Plants

A list of special-status plant species known to occur, or thought to have potential for occurrence, in the Program area was compiled using CNPS lists (CNPS 2019a); California Natural Diversity Database (CNDDB) records (CDFW 2019a) for San Mateo, Santa Clara, and Santa Cruz counties; data from CalFlora (CNPS 2019b) and the Consortium of California Herbaria (CCH) Portal 1 (CCH 2019); and occurrence records based on surveys by Midpen biologists. Special-status plant records from CNDDB and Midpen surveys are mapped on Figure 4-2.

Although the CNPS is not a regulatory agency, and the CNPS's CRPR designations confer no formal regulatory protection, plants appearing as CRPR 1B or 2 are, in general, considered to meet CEQA's Section 15380 criteria, and adverse effects on these species may be considered significant. Impacts on plants that are listed by the CNPS as CRPR 3 or 4 are also considered during CEQA review, although because these species are typically not as rare as CRPR 1B or 2, impacts on them are less frequently considered significant.

Table 4-1 identifies the 97 special-status plant species known to occur, or thought to have potential for occurrence, in the Program area and describes their distribution, legal status, general habitat requirements, and known occurrences in the Program area. Special-status plants that are restricted to coastal dune, coastal strand, and/or coastal or bay salt marsh habitats are not included in Table 4-1 or discussed further, as the Program area does not include these areas and habitat types.

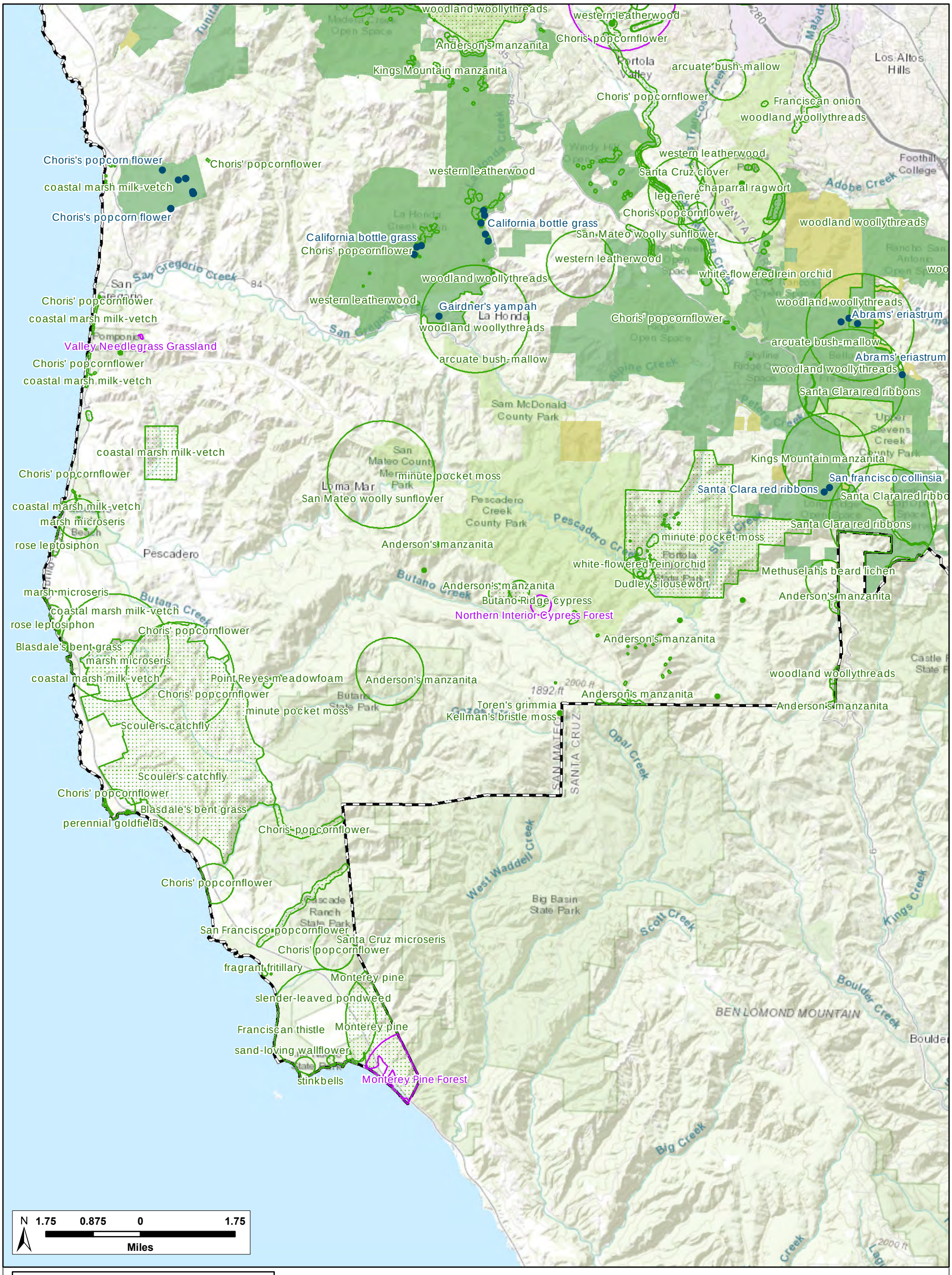
This page intentionally left blank



H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 4-**2**. Special-Status Plants Map
Midpeninsula Regional Open Space District - Open Space Maintenance and Restoration Program
April 2021

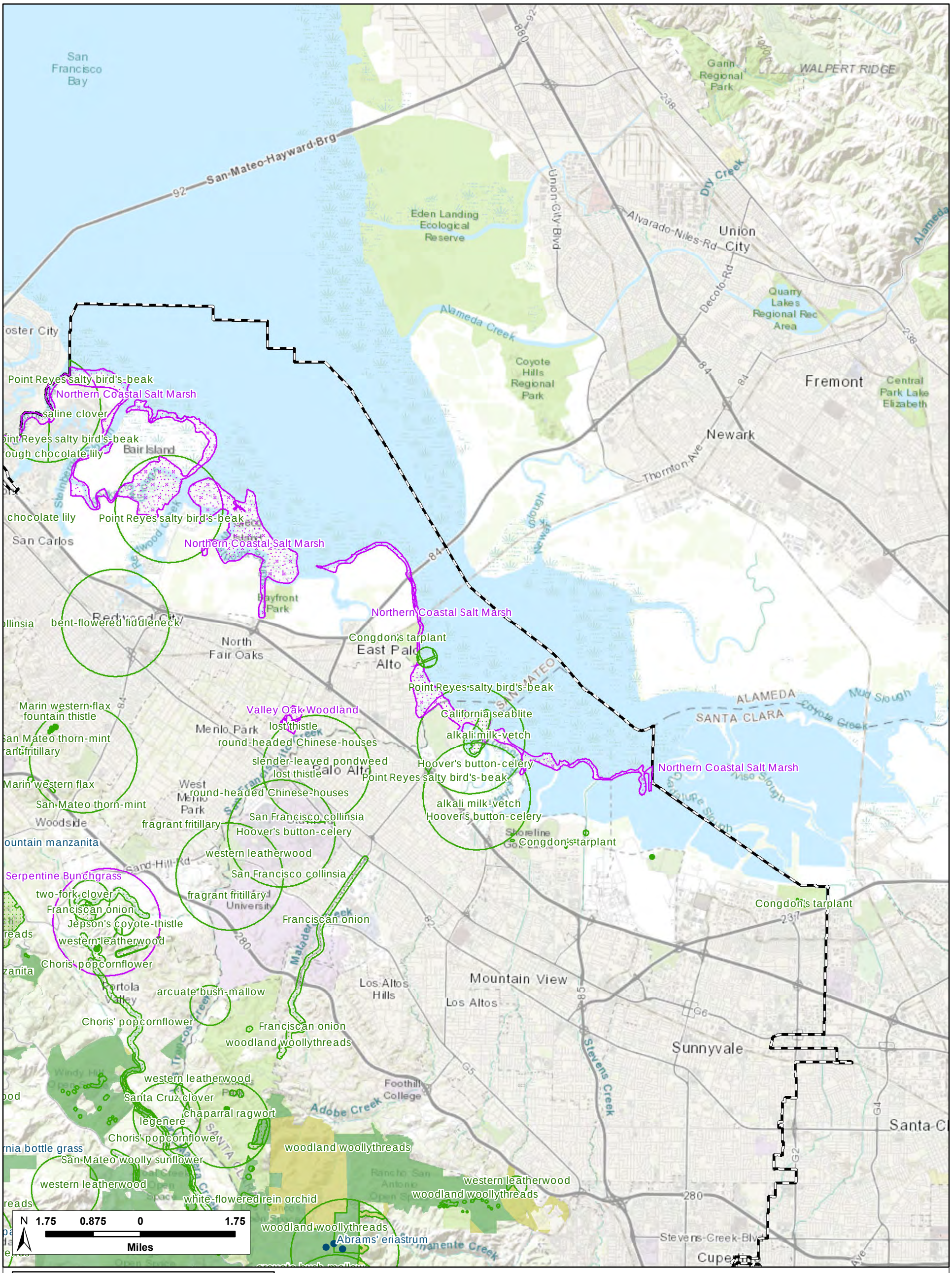
Page intentionally left blank.



H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 4-**2**. Special-Status Plants Map
Midpeninsula Regional Open Space District - Open Space Maintenance and Restoration Program
April 2021

Page intentionally left blank.



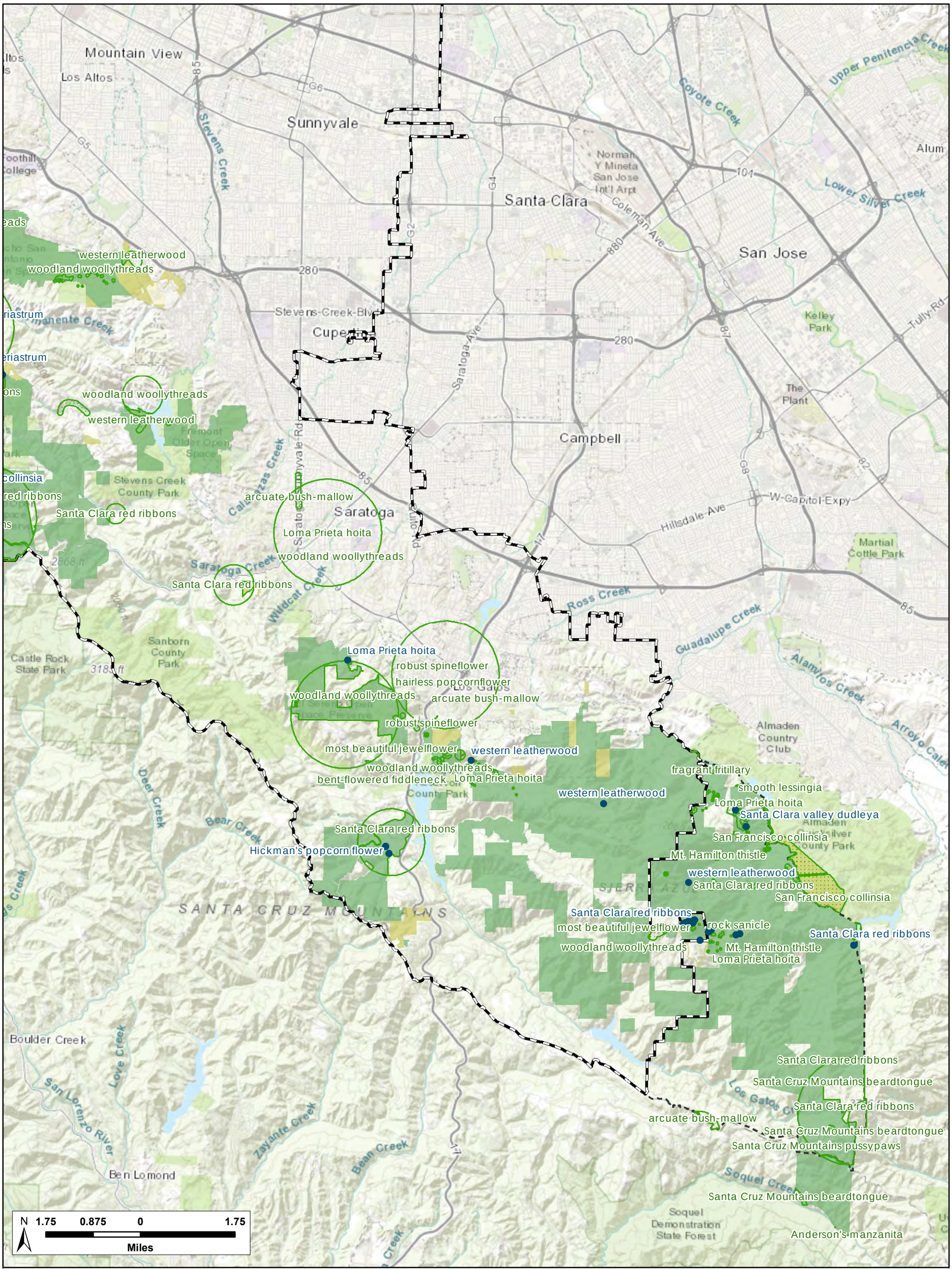
H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 4-2. Special-Status Plants Map

Midpeninsula Regional Open Space District - Open Space Maintenance and Restoration Program

April 2021

Page intentionally left blank.



H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 4-**2**. Special-Status Plants Map
Midpeninsula Regional Open Space District - Open Space Maintenance and Restoration Program
April 2021

Page intentionally left blank.

Table 4-1. Special-Status Plant Species with Potential to Occur in the Program Area.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Federally Listed or State-listed Endangered and Threatened Plant Species			
San Mateo thorn-mint (*Acanthomintha duttonii*)	FE, SE, CRPR 1B.1	Serpentine in grassland or chaparral.	May be Present. Suitable habitat for this species is present in preserves with serpentine grassland and/or chaparral, such as Pulgas Ridge OSP and Sierra Azul OSP. The closest known population is in Edgewood County Park just south of Pulgas Ridge OSP (CDFW 2019a).
San Bruno Mountain manzanita (*Arctostaphylos imbricata*)	SE, CRPR 1B.1	Rocky sites in chaparral or coastal scrub.	Not Likely to be Present. The range of this species is restricted to San Bruno Mountain (CDFW 2019a), which is outside the Program area.
Pacific manzanita (*Arctostaphylos pacifica*)	SE, CRPR 1B.2	Chaparral, coastal scrub.	Not Likely to be Present. The range of this species is restricted to San Bruno Mountain (CDFW 2019a), which is outside the Program area.
Marsh sandwort (*Arenaria paludicola*)	FE, SE, CRPR 1B.1	Sandy soils and opening in freshwater or brackish swamps and marsh.	May be Present. Though once much more widespread along the California coast, only one naturally-occurring population of this species is known to remain in California (in San Luis Obispo County). Marsh sandwort has also been re-introduced to sites in San Luis Obispo County, Santa Cruz County, and Marin County with mixed success. Midpen is in communication with USFWS about plans to attempt re-introducing this species in the Program area.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Robust spineflower (*Chorizanthe robusta* var. *robusta*)	FE, CRPR 1B.1	Sandy or gravelly areas in coastal chaparral, openings in woodlands, coastal scrub, coastal grassland.	May be present. A historical occurrence is known from CNDDB records, with the location information listed as the "general vicinity of Los Gatos (CDFW 2019a). The current known range of this species is centered on the Monterey Bay in Santa Cruz and Santa Cruz Counties. Suitable habitat is present for this species in preserves in the southern portion of the Program area such as El Sereno OSP, St. Joseph's Hill OSP, and Sierra Azul OSP, where the species could occur in microhabitats such as sandy openings, or gravelly barrens where competition from non-native plants is low.
Crystal Springs fountain thistle (*Cirsium fontinale* var. *fontinale*)	FE, SE, CRPR 1B.1	Serpentine seeps.	Present. The species is known to occur in Sierra Azul OSP. Suitable habitat is potentially present in other preserves with serpentine soils, such as El Sereno OSP and St. Joseph's Hill, if seeps are present.
Santa Clara Valley dudleya (*Dudleya abramsii* ssp. *setchellii*)	FE, CRPR 1B.1	Cismontane woodland, valley and foothill grassland on serpentine; rocky/serpentine outcrop.	Present. The species is known to occur in the Program area only in Sierra Azul OSP, where small numbers are present within approximately one mile south and west/southwest of Guadalupe Dam. Suitable habitat is potentially present in other preserves in the southern portion of the Program area with serpentine soils, such as St. Joseph's Hill OSP and El Sereno OSP.
San Mateo woolly sunflower (*Eriophyllum latilobum*)	FE, SE, CRPR 1B.1	Often on serpentine in montane hardwood, oak woodlands.	Present. The species is known to occur in Coal Creek OSP and Russian Ridge OSP. This species has potential to occur in other nearby preserves with suitable habitat such as Monte Bello OSP, Russian Ridge OSP and Windy Hill OSP.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Butano Ridge cypress (*Hesperocyparis abramsiana* var. *butanoensis*)	FE, SE, CRPR 1B.2	Sandstone derived soils in closed cone conifer, Montane hardwood.	Not Likely to be Present. The species is restricted to a few locations in the Santa Cruz Mountains on specialized sandstone-derived microhabitats that do not occur in the Program area.
Marin western flax (*Hesperolinon congestum*)	FT, ST, CRPR 1B.1	Serpentine in grassland or chaparral.	May be Present. This species has a limited range and is known primarily from serpentine outcrops in San Mateo and Marin Counties. The closest known existing population to preserves in the Program area is in Edgewood County Park just south of Pulgas Ridge OSP (CDFW 2019a). Suitable habitat for this species is present in other preserves with serpentine grassland and/or chaparral, such as El Sereno OSP, St. Joseph's Hill OSP, and Sierra Azul OSP, though these preserves would be south of known range of this species.
San Francisco lessingia (*Lessingia germanorum*)	FE, SE, CRPR 1B.1	Remnant dunes in coastal scrub.	Not Likely to be Present. The known present range of this species is outside the Program area. It is known from one location at Hillside Park in Daly City, and from several populations at the Presidio of San Francisco (CDFW 2020).
Coast yellow leptosiphon (*Leptosiphon croceus*)	SC, CRPR 1B.1	Coastal scrub on bluffs, coastal grassland.	May be Present. Suitable habitat for this species is potentially present in Tunitas Creek OSP. The closest recently recorded population of this species is in coastal prairie on bluffs near the town of Moss Landing (CDFW 2019a).

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Point Reyes meadowfoam (*Limnanthes douglasii* ssp. *sulphurea*)	SE, CRPR 1B.2	Coastal grassland, freshwater wetlands, vernal pools.	Not Likely to be Present. This species is primarily restricted to Marin County (Pt. Reyes peninsula); the only population recorded in San Mateo County was mapped in a wet meadow along Butano Creek approximately 4 air miles inland from the coast in the 1980s, but it was likely subsequently extirpated (CDFW 2019a). Due to the limited range of this species and lack of collections in the County, it is not likely to occur within the Program area.
Dudley's lousewort (*Pedicularis dudleyi*)	SR, CRPR 1B.2	Coastal chaparral, montane hardwood, montane hardwood conifer, oak woodlands, grassland. Found in deep, shady redwood forest.	May be Present. While it is known to occur from San Mateo County to San Louis Obispo County, recorded observations of this species are scarce. Where it has been found in the vicinity of the Program area (in Portola Redwoods State Park) it is known to occur in deep, shaded redwood forests (CDFW 2019a). This species has potential to occur in nearby preserves with similar habitat such as Purisima Creek Redwoods OSP, La Honda Ridge OSP, and Russian Ridge OSP.
White-rayed pentachaeta (*Pentachaeta bellidiflora*)	FE, SE, CRPR 1B.1	Oak woodlands, montane hardwood, often on serpentine in grassland.	May be Present. The closest known population of this species is in Edgewood County Park just south of Pulgas Ridge OSP (CDFW 2019a). Suitable habitat for this species is present in preserves with serpentine grassland and/or chaparral, such as Pulgas Ridge OSP, El Sereno OSP, St. Joseph's Hill OSP, and Sierra Azul OSP.
San Francisco popcorn-flower (*Plagiobothrys diffusus*)	SE, CRPR 1B.1	Coastal grassland.	May be Present. Suitable habitat for this species is potentially present in Tunitas Creek OSP. The closest recently recorded population of this species is present within the coastal zone in grassland just north of Año Nuevo (CDFW 2019a).

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Hickman's cinquefoil (*Potentilla hickmanii*)	FE, SE, CRPR 1B.1	Coastal bluff scrub, closed-cone conifer forest, freshwater wetlands, wet meadows.	May be Present. Suitable habitat for this species is potentially present in Tunitas Creek OSP and in Purisima Creek Redwoods OSP. Known population of this species are present on Montara mountain just to the north of Miramontes Ridge OSP (CNPS 2019c).
Metcalf Canyon jewel-flower (Streptanthus albidus ssp. albidus)	FE, CRPR 1B.1	Valley and foothill grassland (serpentinite)/serpentine bunchgrass grassland.	May be Present. The species is known to occur in Sierra Azul OSP. Suitable habitat for this species is potentially present in other preserves in the southern portion of the Program area with serpentine soils, such as St. Joseph's Hill and El Sereno OSP.
Two-fork clover (*Trifolium amoenum*)	SE, CRPR 1B.1	Bluffs in coastal scrub and sometimes on serpentine in coastal prairie (weak affinity to serpentine soils).	May be Present. The range of known extant populations is Marin and Sonoma counties. All populations in San Mateo are historical, with one population with a general locality of Colma on the south side of San Bruno Mountain being over 100 years old, and a record from the general area identified as "San Francisquito Creek near Searsville Lake" from 1950 (CDFW 2019a). Nevertheless, suitable habitat for this species is present in preserves with coastal chaparral or coastal scrub such as Tunitas Creek OSP or Miramontes Ridge OSP.
CNPS-Listed Plant Species (CRPR 1 and 2)			
Blasdale's bent grass (*Agrostis blasdalei*)	CRPR 1B.2	Bluffs in coastal scrub and coastal grassland.	May be Present. Suitable habitat for this species is present in preserves with coastal chaparral or coastal scrub such as Tunitas Creek OSP and Miramontes Ridge OSP. The nearest known population of this species to Midpen preserves is Bean Hollow State Beach to the south of Tunitas Creek OSP where it occurs in coastal bluff scrub (CDFW 2019a).

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Franciscan onion (*Allium peninsulare* var. *franciscanum*)	CRPR 1B.2	Volcanic or clay soils, often on serpentine, in grassland, oak woodlands, or montane hardwood woodlands.	Present. The species is known to occur in Pulgas Ridge OSP. This species has the potential to occur in other preserves throughout the Program area with serpentine habitats such as El Sereno OSP, St. Joseph's Hill OSP, and Sierra Azul OSP.
Bent-flowered fiddleneck (*Amsinckia lunaris*)	CRPR 1B.2	Grassland, bluffs in coastal scrub, montane hardwood, oak woodlands.	May be Present. This species has a wide geographic range, from Glenn to Monterey Counties, but is not abundant where it is found (CNPS 2019c). Throughout this range it occurs in wide variety of habitat types. Populations of this species are known to occur around Crystal Spring Reservoir just to the northeast of Pulgas Ridge OSP where it occurs in open grasslands as well in the deep shade of north-facing woodlands (CNPS 2019c, CCH 2019). Suitable habitat for this species is present in preserves with grasslands and woodlands.
Anderson's manzanita (*Arctostaphylos andersonii*)	CRPR 1B.2	Openings or edges in redwood, chaparral, montane hardwood.	Present. The species is known to occur in Saratoga Gap OSP, Long Ridge OSP, and Purisima Creek Redwoods OSP. Suitable habitat for this species is present in many of the preserves throughout the Program area, particularly those along the ridgetop of the Santa Cruz Mountains in San Mateo County.
Montara manzanita (*Arctostaphylos montaraensis*)	CRPR 1B.2	Coastal chaparral or coastal scrub.	May be Present. The known range of this species is restricted to Montara Mountain, which is north of the Program area (CDFW 2019a). However, suitable habitat for this species is present in preserves with coastal chaparral or coastal scrub near Montara Mountain such as Tunitas Creek OSP, Miramontes Ridge OSP, or Purisima Creek Redwoods OSP.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Kings Mountain manzanita (Arctostaphylos regismontana)	CRPR 1B.2	Granitic or sandstone derived soils in montane hardwood, chaparral, redwood.	Present. The species is known to occur in Pulgas Ridge OSP, Teague Hill OSP, Thornewood OSP, El Corte de Madera Creek OSP, and La Honda Creek OSP. Suitable habitat for this species is present in many of the preserves throughout the Program area, particularly those along the ridgetop of the Santa Cruz Mountains in San Mateo County.
Coastal marsh milk-vetch (*Astragalus pycnostachyus* var. *pycnostachyus*)	CRPR 1B.2	Salt marsh, coastal scrub, coastal grassland, saline wetlands.	May be Present. Suitable habitat for this species is present in Tunitas Creek OSP, and the species is known from just outside of the preserve (CDFW 2019a).
Big-scale balsamroot (Balsamorhiza macrolepis var. macrolepis)	CRPR 1B.2,	Chaparral, cismontane woodland, valley and foothill grassland sometimes in serpentinite/serpentine bunchgrass grassland, mixed serpentine chaparral, and oak woodland.	May be Present. The geographic range of this species is to the east of the Program area in the inner coast ranges (Diablo Range) as well as Sierra Nevada foothills (CNPS 2019c). The closest known populations of this species occur on Coyote Ridge to the southeast of Sierra Azul OSP (CNPS 2019c). However, this species has the potential to occur in preserves in the southern portion of the Program area with serpentine habitats, such as El Sereno OSP, St. Joseph's Hill OSP, and Sierra Azul OSP.
Santa Cruz Mountains pussypaws (*Calyptridium parryi* var. *hesseae*)	CRPR 1B.1	Sandy or gravelly soils, often in openings, in chaparral and cismontane woodland.	May be Present. The closest known populations of this species are historical populations in the Santa Cruz mountains near Eagle Rock approximately 4 miles south of Long Ridge OSP (CDFW 2019a). This species has the potential to occur in preserves along the ridgetop of the Santa Cruz Mountains with suitable microhabitats such as sandy openings, or gravelly barrens where competition from non-native plants is low.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Congdon's tarplant (*Centromadia parryi* ssp. *congdonii*)	CRPR 1B.1	California annual grassland habitat on alkaline soils, occasionally disturbed soils.	Not Likely to be Present. The species is known to occur in Stevens Creek Natural Study area and in the vicinity of Ravenswood OSP (though recent surveys of the Ravenswood population found only the common species), neither of which are included in the Program area. This species generally grows at a lower elevation and nearer to the Bay margin and is not expected to occur in preserves higher up in the Santa Cruz Mountains.
Pappose tarplant (*Centromadia parryi* ssp. *parryi*)	CRPR 1B.2	Coastal scrub, coastal grassland, bay margin, saline wetlands.	May be Present. Suitable habitat for this species is present in preserves with coastal chaparral or coastal scrub such as Tunitas Creek OSP and Miramontes Ridge OSP. Populations of this species are known to occur to the north of these preserves in the vicinity of Mori Point in San Mateo County (CDFW 2019a).
San Francisco Bay spineflower (*Chorizanthe cuspidata* var. *cuspidata*)	CRPR 1B.2	Sandy areas in coastal scrub, coastal grassland.	May be Present. The geographic range and precise habitat requirements of this species are not well known due to the limited, and mostly historical collections of this species (CNPS 2019c). All collections in the Program area are historical (CDFW 2019a). The closest occurrences records to the north in San Francisco County are also largely historical, though recent collections have been made on San Bruno Mountain and near Pacifica (CNPS 2019c). This species has potential to occur in suitable habitat coastal scrub habitat in Tunitas Creek OSP and Miramontes Ridge OSP.
Franciscan thistle (*Cirsium andrewsii*)	CRPR 1B.2	Sometimes on serpentine in coastal scrub, coastal grassland, montane.	May be Present. Suitable habitat for this species is present in preserves with serpentine grassland and/or chaparral, such as Pulgas Ridge OSP, El Sereno OSP, St. Joseph's Hill OSP, and Sierra Azul OSP.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
San Francisco collinsia (*Collinsia multicolor*)	CRPR 1B.2	Sometimes on serpentine in closed cone coniferous forest, coastal scrub.	Present. The species is known to occur in Sierra Azul OSP and Long Ridge OSP. Suitable habitat for this species is present in preserves serpentine soils such as Pulgas Ridge OSP, St. Joseph's Hill OSP and El Sereno OSP.
Western leatherwood (*Dirca occidentalis*)	CRPR 1B.2	Moist areas in closed cone pine, chaparral, oak woodland, montane hardwood, riparian forest, redwood.	Present. The species is known to occur in Windy Hill OSP, Rancho San Antonio OSP, Coal Creek OSP, Fremont Older OSP, La Honda Creek OSP, Pulgas Ridge OSP, and Los Trancos OSP. This species could occur in other nearby preserves with similar habitat, particularly those with more mesic, steep, brushy, north-facing slopes (CDFW 2019a).
Sand-loving wallflower (*Erysimum ammophilum*)	CRPR 1B.2	Sandy and openings in coastal chaparral or coastal scrub.	May be Present. The majority of recorded occurrences of this species are center around the Monterey Peninsula, though there is a recent CNDDB record from the Ano Nuevo Ranch State Park vicinity (CDFW 2019a). Suitable habitat for this species is present in Tunitas Creek OSP and Miramontes Ridge OSP.
Minute pocket moss (*Fissidens pauperculus*)	CRPR 1B.2	Damp coastal soil in redwood forest.	May be Present. The geographic range and precise habitat requirements of this species are not well known due to limit collections. The closest known population is in Portola Redwoods State Park just west of Long Ridge OSP (CDFW 2019a). Suitable habitat for this species is present in preserves with redwood forest.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Hillsborough chocolate lily (*Fritillaria biflora* var. *ineziana*)	CRPR 1B.1	Serpentine in grassland and oak woodland.	May be Present. The closest known population to preserves within the Program area is on SFPUC lands to the north of Pulgas Ridge OSP (CDFW 2019a). Suitable habitat for this species is present in preserves with serpentine grassland such as Pulgas Ridge OSP, El Sereno OSP, St. Joseph's Hill OSP, and Sierra Azul OSP.
Fragrant fritillary (*Fritillaria liliacea*)	CRPR 1B.2	Often serpentine in grassland, coastal scrub, oak woodland, montane hardwood.	Present. The species is known to occur in Sierra Azul OSP. Suitable habitat for this species is present in preserves with serpentine grassland and/or oak woodland such as Pulgas Ridge OSP, El Sereno OSP, St. Joseph's Hill OSP, and Sierra Azul OSP.
Toren's grimmia (*Grimmia torenii*)	CRPR 1B.3	On rocky, boulder and rock walls, carbonate, volcanic substrates in chaparral, cismontane woodland and lower montane coniferous forest.	May be Present. The closest known population of this species is Big Basin Redwoods State Park to the south Midpen preserves (CDFW 2019a). Suitable habitat for this species is present in preserves with suitable carbonate rock outcrops in oak woodland and forest, such as may occur in Bear Creek Redwoods OSP, Russian Ridge OSP, Skyline Ridge and La Honda Creek OSP.
Diablo helianthella (*Helianthella castanea*)	CRPR 1B.2	Montane hardwood, chaparral, oak woodland, coastal scrub, grassland.	May be Present. This species is primarily known from Contra Costa and Alameda counties around Mt. Diablo (CNPS 2019c). The closest known population is on San Bruno Mountain where it occurs in grassland (CDFW 2019a). Suitable habitat for this species is present in Tunitas Creek OSP and Miramontes Ridge OSP.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Short-leaved evax (*Hesperevax sparsiflora* var. *brevifolia*)	CRPR 1B.2	Coastal grassland, sandy areas in coastal scrub.	May be Present. The closest known populations to Midpen preserves are historical collections from the vicinity of Big Basin Redwoods State Park that have not been re-observed in over forty years (CDFW 2019b). Suitable habitat for this species is present in Tunitas Creek OSP and Miramontes Ridge OSP.
Loma Prieta hoita (*Hoita strobilina*)	CRPR 1B.1	Usually on serpentine soils in chaparral, cismontane woodland, and riparian woodland.	Present. The species is known to occur in El Sereno OSP, Sierra Azul OSP, and St. Joseph's Hill OSP. The range of this species is generally restricted to the southern end of the Santa Cruz Mountains, and it is therefore not expected to occur in other preserves.
Point Reyes horkelia (*Horkelia marinensis*)	CRPR 1B.2	Sandy areas in coastal scrub or coastal grasslands.	May be Present. Suitable habitat for this species is present in Tunitas Creek OSP and Miramontes Ridge OSP. The closest known populations are located along the coast near Davenport and on Ben Lomond Mountain in Santa Cruz County (CDFW 2019a). Historical populations are known from Montara Mountain and San Bruno Mountain to the north of the Program area (CDFW 2019a).
Perennial goldfields (*Lasthenia californica* ssp. *macrantha*)	CRPR 1B.2	Coastal scrub on bluffs.	May be Present. Populations are known from coastal bluffs near Bean Hollow State Beach (CDFW 2019a). Suitable habitat for this species is present in Tunitas Creek OSP and Miramontes Ridge OSP.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Legenere (*Legenere limosa*)	CRPR 1B.1	Vernal pools in grassland.	May be Present. The geographic range of this species is widespread from Tehama to Santa Clara County, though populations are small and rare in the regions where they do occur (CNPS 2019c). A historical population is known from a pond edge near Coal Mine Ridge in between Coal Creek OSP and Las Trancos OSP (CDFW 2019a). Suitable habitat for this species is present in preserves with vernal pools and seasonal wetlands around stock ponds, reservoirs or lakes.
Rose Leptosiphon (*Leptosiphon rosaceus*)	CRPR 1B.1	Coastal scrub on bluffs.	May be Present. The nearest known population of this species is present at Pillar Point bluff to the north of Tunitas Creek OSP. Suitable habitat for this species is present on coastal bluffs in Tunitas Creek OSP.
Crystal Springs lessingia (*Lessingia arachnoidea*)	CRPR 1B.2	Serpentine in oak woodland, coastal scrub, grassland.	May be Present. The range of this species is restricted to the serpentine outcrops in San Mateo County. Populations of this species occur in Edgewood County Park to the south of Pulgas Ridge OSP and in serpentine grasslands on San Francisco Public Utilities Commission lands to the north (CDFW 2019a). This species has potential to occur in Pulgas Ridge OSP. Given the restricted range of this species, however, it is not expected to occur in other preserves to the south.
Smooth lessingia (*Lessingia micradenia* var. *glabrata*)	CRPR 1B.2	Chaparral, cismontane woodland- on serpentinite, often roadsides/mixed serpentine chaparral and oak woodland.	Present. The species is known to occur in Sierra Azul OSP. Suitable habitat for this species is present in other preserves in the southern portion of the Program area with serpentine soils such as St. Joseph's Hill and El Sereno OSP.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Coast lily (*Lilium maritimum*)	CRPR 1B.1	Montane hardwood, closed cone conifer forest, coastal grassland, coastal scrub, freshwater wetlands, redwood.	Not Likely to be Present. The known range of this species is the north coast of California, from Marin County north to the Oregon border (CNPS 2019c). This species is presumed to be extinct in San Mateo County (CNPS 2019c).
Ornduff's meadowfoam (*Limnanthes douglasii* ssp. *ornduffii*)	CRPR 1B.1	Wet meadows in cropland.	May be Present. The geographic distribution and habitat preferences of this species are not well-known due to the limited number of collections. Populations are known from coastal areas to the north and south of the coastal Midpen preserves in San Mateo County (CDFW 2019a). This species has potential to occur in Tunitas Creek OSP and Miramontes Ridge OSP if suitable wet meadow habitat near the coast was present in those preserves.
Indian Valley bush-mallow (*Malacothamnus aboriginum*)	CRPR 1B.2	Rocky areas in chaparral, oak woodland.	May be Present. The range of this species is centered on the inner coast range to the south of the Program area; however, historical populations are known from areas just to the north of Foothills OSP and Windy Hill OSP (CCH 2019; CDFW 2019a). This species tends to occur in rocky granitic soils in chaparral, particularly after burns. It has the potential to occur in preserves with this microhabitat type, particularly those in the central and southern portions of the Program area with large areas of chaparral.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Arcuate bush-mallow (*Malacothamnus arcuatus*)	CRPR 1B.2	Chaparral, oak woodland.	Present. The species is known to occur in Skyline Ridge OSP, Pulgas Ridge OSP, and Rancho San Antonio OSP. Historical populations are known from near La Honda Creek OSP and Los Trancos Woods OSP. Like other special-status *Malacothamnus* species, this species tends to establish following fires, and its limited range and abundance is likely due to altered fire regimes (CNPS 2019c). This species has the potential to occur in other preserves throughout the Program area, particularly those along the ridgetop of the Santa Cruz Mountains in San Mateo County with chaparral habitats that have recently burned.
Davidson's bush-mallow (*Malacothamnus davidsonii*)	CRPR 1B.2	Chaparral, oak woodland, coastal scrub, riparian woodland.	May be Present. The range of this species based on current occurrences is well to the south of the Program area in Monterey County and south (CNPS 2019c). Historical populations are known from the hills just to the east of Pulgas Ridge OSP, as well as near Foothills OSP and Rancho San Antonio OSP (CDFW 2019a). As with the other special-status *Malacothamnus* species, this species has the potential to occur in preserves with chaparral habitats that have recently burned.
Hall's bush-mallow (*Malacothamnus hallii*)	CRPR 1B.2	Chaparral, coastal scrub.	May be Present. The range of this species based on current occurrences is centered in the Diablo Range in Santa Clara County to the south of the Program area (CDFW 2019a). A historical population is known from near Los Trancos Woods OSP and Monte Bello OSP (CDFW 2019a). As with the other special-status *Malacothamnus* species, this species has the potential to occur in preserves with chaparral habitats that have recently burned.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Marsh Microseris (*Microseris paludosa*)	CRPR 1B.2	Closed-cone pine, oak woodland, coastal scrub, grassland.	May be Present. This species occurs in the coastal zone from Mendocino to San Louis Obispo Counties. Extant populations are known from grassy opening in coastal scrub to the south of Tunitas Creek in the vicinity of Pescadero marsh (CDFW 2019a). Suitable habitat for this species is present in Tunitas Creek OSP.
Woodland woollythreads (*Monolopia gracilens*)	CRPR 1B.2	Serpentine areas in montane hardwood openings, chaparral openings, oak woodland, redwood openings, grassland.	Present. The species is known to occur in Los Trancos OSP, Rancho San Antonio OSP, Sierra Azul OSP, and St. Joseph's Hill OSP. The species has potential to occur in other preserves with serpentine soils including El Sereno OSP and Pulgas Ridge OSP.
Kellman's bristle moss (*Orthotrichum kellmanii*)	CRPR 1B.2	Sandstone or carbonate substrates in chaparral, oak woodland.	May be Present. Suitable habitat for this species is present in preserves with suitable sandstone or carbonate substrates in chaparral and oak woodland. The closest known population is in Big Basin Redwoods State Park to the south of the Program area (CDFW 2019a).
Santa Cruz Mountains beardtongue (Penstemon rattanii var. kleei)	CRPR 1B.2	Chaparral, lower montane coniferous forest, North Coast coniferous forest.	Present. The species is known to occur in Sierra Azul OSP. This species has potential to occur in other preserves in the southern portion of the Program area with suitable habitat such as El Sereno OSP, St. Joseph's Hill OSP and Bear Creek Redwoods OSP.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Monterey pine (*Pinus radiata*)	CRPR 1B.1	Closed cone pine, montane hardwood conifer, native populations restricted to three locations at Cambria (San Luis Obispo County), the Monterey Peninsula (Monterey County) and Año Nuevo (San Mateo and Santa Cruz Counties).	Not Likely to be Present. Native stands of Monterey pine are not known to occur within the Program area, the closest being at Año Nuevo (CNPS 2019c, CDFW 2019a).
White-flowered rein orchid (*Piperia candida*)	CRPR 1B.2	Sometimes on serpentine in montane hardwood conifer, redwood, montane hardwood.	Present. The species is known to occur in Los Trancos OSP. This species has potential to occur in other surrounding and nearby preserves such as Russian Ridge OSP, Coal Creek OSP and Skyline Ridge OSP.
Choris' popcorn-flower (*Plagiobothrys chorisianus* var. *chorisianus*)	CRPR 1B.2	Moist areas in chaparral, coastal grassland, coastal scrub.	Present. The species is known to occur in Russian Ridge OSP, Tunitas Creek OSP, La Honda Creek OSP, and Miramontes Ridge OSP (CDFW 2019a, CNPS 2019c). Many occurrences in San Mateo County are known only from herbarium collections over 50 years old and are known or presumed extirpated (CDFW 2019a). This species tends to occur along the coast, but many of the occurrences (including known occurrences in preserves within the Program area) are inland. This species has the potential to occur in other preserves where vernally-wet swales, vernal pools, and other seasonal wetlands are present.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Hairless popcornflower (*Plagiobothrys glaber*)	CRPR 1A	Alkali meadows and seeps, coastal salt marshes and swamps; 45 – 590 ft.	May be Present. The species was recorded in El Sereno OSP and St. Joseph's Hill OSP according to Midpen records, though all verified collections of this species in the California Consortium of Herbaria are historical (CCH 2019) and the species is still presumed to be extinct, or possibly just a variety of the more common *Plagiobothrys stipitatus* (CNPS 2019c; CDFW 2019a).
Chaparral ragwort (*Senecio aphanactis*)	CRPR 2B.2	Alkaline soils in chaparral, cismontane woodland, coastal scrub.	May be Present. The geographic range of this species is broad from the San Francisco Bay to Baja California, though the species is rare where it is found (CNPS 2019c). Historical populations of this species are known from Foothills Park (City of Palo Alto) and just outside of Pulgas Ridge OSP (CDFW 2019a) where it had been observed in recently burned chaparral. This species has potential to occur in preserves with chaparral that has recently burned.
Scouler's catchfly (*Silene scouleri* ssp. *scouleri*)	CRPR 2B.2	Coastal bluff scrub, Coastal prairie, Valley and foothill grassland.	May be Present. Suitable habitat for this species is present in Tunitas Creek OSP. Populations are known from coastal scrub to the south of Tunitas Creek in the Pescadero marsh area (CDFW 2019a).
San Francisco campion (*Silene verecunda* ssp. *verecunda*)	CRPR 1B.2	Sandy areas in coastal scrub, grassland, chaparral.	May be Present. Suitable habitat for this species is present in Tunitas Creek OSP and Miramontes Ridge OSP. Populations are known from coastal scrub and chaparral to north of these preserves on Montara Mountain (CDFW 2019a).

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Most beautiful jewel-flower (Streptanthus albidus ssp. peramoenus)	CRPR 1B.2	Chaparral, cismontane woodland, valley and foothill grassland in serpentinite/ serpentine bunchgrass grassland, mixed serpentine chaparral.	Present. The species is known to occur in Sierra Azul OSP and St. Joseph's Hill OSP (CDFW 2019a). This species has potential to occur in other preserves in the southern portion of the Program area with serpentine soils such as El Sereno OSP.
Slender-leaved pondweed (*Stuckenia filiformis* ssp. *alpina*)	CRPR 2B.2	Freshwater wetlands, shallow water on pond edges or in riparian zones.	May be Present. This species has a wide geographic range, which includes the Modoc plateau and high elevation areas of the Sierra Nevada (CNPS 2019c). The limited number of CNDDB occurrences in San Mateo, Santa Cruz and Santa Clara counties are all historical and have not been recently re-collected (CDFW 2019a). The collection from Ano Nuevo State Reserve was from a pond on a bluff (CDFW 2019a). Precise information on exact kinds of freshwater marshes or open water areas where this species could be found within the Program area is lacking due to the limited number of collections of this species.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Santa Cruz clover (*Trifolium buckwestiorum*)	CRPR 1B.1	Moist grassland, and/or gravelly margins in coastal prairie and mixed evergreen forest.	May be Present. The range of the species extends from Mendocino to Monterey County, where it is primarily found in areas with coastal influence (i.e. the outer coast ranges) (CNPS 2019c). An unspecified collection is known from an area long Skyline Boulevard near the convergence of Coal Creek OSP, Russian Ridge OSP, Los Trancos Ridge OSP and Skyline Ridge OSP, and there is no specific ecological information associated with this collection (CNPS 2019b, CDFW 2019a). The majority of the recent collections from Santa Cruz County occur closer to the coast. There is potential for this species to occur in preserves with more coastal influences such as Miramontes Ridge OSP, Purisima Creek Redwoods OSP, La Honda Creek OSP, and Tunitas Creek OSP.
Coastal triquetrella (*Triquetrella californica*)	CRPR 1B.2	Bluffs in coastal scrub.	May be Present. Suitable habitat for this species is present in Tunitas Creek OSP and Miramontes Ridge OSP. One population is known from coastal scrub to north of these preserves on Montara Mountain (CDFW 2019a).
CNPS-Listed Plant Species (CRPR 3 and 4) and Midpen Sensitive species			
California androsace (*Androsace elongata* ssp. *acuta*)	CRPR 4.2	Openings in chaparral, cismontane woodland, coastal scrub, and valley and foothill grassland; sometimes in meadows and seeps.	May be Present. This is a widespread species ranging from the Oregon border to San Diego County, though it tends to occur more inland than the Santa Cruz Mountains (CNPS 2019c). Historical populations of this species are known from the hills just to the north and east of Foothills OSP, Los Trancos OSP, and Rancho San Antonio OSP. This species has the potential to occur in these preserves and others along the ridgeline of the Santa Cruz Mountains in openings where cover of other species (particularly dense, non-native annual grasses) is low.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Brewer's calandrinia (*Calandrinia breweri*)	CRPR 4.2	Sandy or loamy, disturbed sites and burns in chaparral and coastal scrub.	May be Present. This is a widespread species ranging from Shasta County to the border with Mexico and into Baja California (CNPS 2019c). Historical populations are present in the vicinity of Teague Hill OSP where it grew in recently burned chaparral (CDFW 2019a). This species has potential to occur in preserves with chaparral that have recently burned or in sandy openings on edges of chaparral and/or coastal scrub.
Oakland star-tulip (*Calochortus umbellatus*)	CRPR 4.2	Often on serpentine substrates in broadleafed upland forest, chaparral, cismontane woodland, lower montane coniferous forest, and valley and foothill grassland.	May be Present. Suitable habitat for this species is present in preserves with serpentine soils. A historical population of this species is recorded from the ridge in between Purisima Creek Redwoods OSP and Teague Hill OSP along State Route 35 (CDFW 2019a).
Pink star-tulip (*Calochortus uniflorus*)	CRPR 4.2	Coastal prairie, coastal scrub, meadows and seeps, North Coast coniferous forest.	May be Present. Most populations of this species occur to the north of the San Francisco Bay or around the Monterey Bay (CNPS 2019c). Extant populations of this species are present on the east slopes of Montara mountain to the north of preserves in the Program area as well as in mixed conifer forest in Santa Cruz county to the south and west of preserves such as Sierra Azul OSP and Bear Creek Redwoods OSP (CNPS 2019b; CCH 2019).
Johnny-nip (*Castilleja ambigua* var. *ambigua*)	CRPR 4.2	Vernal pool margins in coastal bluff scrub, coastal prairie, coastal scrub, valley and foothill grassland.	May be Present. Populations are known from seasonal wetlands on coastal prairies to the south of Tunitas Creek OSP in the Pescadero area (CCH 2019). Suitable habitat for this species is present in Tunitas Creek OSP.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Seaside paintbrush (*Castilleja latifolia*)	CRPR 4.3	Sandy soils in closed-cone coniferous forest and cismontane woodland; coastal dunes and coastal scrub.	May be Present. Historical populations are known from the vicinity of Tunitas Creek OSP, but have not been observed in over one hundred years (CCH 2019; CNPS 2019b). Suitable habitat for this species is present in Tunitas Creek OSP and Miramontes Ridge OSP.
Clustered lady's-slipper (*Cypripedium fasciculatum*)	CRPR 4.2	Usually serpentine seeps and streambanks in lower montane coniferous forest, North Coast coniferous forest.	May be Present. Historical records are known from Purisima Creek Redwoods OSP and Monte Bello OSP, but these populations have not been encountered in over 100 years (CCH 2019). Suitable habitat is present in preserves with mature conifer forest, such as Bear Creek Redwoods OSP, La Honda Creek OSP and Russian Ridge OSP.
Mountain lady's-slipper (*Cypripedium montanum*)	CRPR 4.2	Broadleafed upland forest, cismontane woodland, lower montane coniferous forest, North Coast coniferous forest.	May be Present. Historical records are known from Purisima Creek Redwoods OSP and near Sierra Azul OSP, St. Joseph's Hill OSP and El Sereno OSP, but these populations have not been encountered in over 100 years (CCH 2019). Suitable habitat is present in preserves with mature conifer forest, such as Bear Creek Redwoods OSP, La Honda Creek OSP and Russian Ridge OSP.
California bottle-brush grass (*Elymus californicus*)	CRPR 4.3	Broadleafed upland forest, cismontane woodland, North Coast coniferous forest, riparian woodland. Occurs in seasonally wet areas in openings in the forest.	Present. This species is known to occur in La Honda Creek OSP. In addition, a historical population occurs just outside Russian Ridge OSP (CCH 2019). This current extent, range and abundance of this species is possibly limited by fire suppression (CNPS 2019c). This species has potential to occur in preserves that have suitable forest openings.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Abrams' woollystar (*Eriastrum abramsii*)	Midpen	Chaparral.	Present. The species is known to occur in Monte Bello OSP and Rancho San Antonio OSP. This species has the potential to occur in other preserves along the Santa Cruz Mountain ridgetop with chaparral habitat.
Jepson's woolly sunflower (Eriophyllum jepsonii)	CRPR 4.3	Chaparral, cismontane woodland, and coastal scrub, sometimes serpentinite.	May be Present. The closest known population occurs to the east of Sierra Azul OSP in Henry Coe State Park (CNPS 2019b). Suitable habitat for this species is present in preserves in the southern portion of the Program area with serpentine soils such as El Sereno OSP, St. Joseph's Hill OSP, and Sierra Azul OSP.
San Francisco wallflower (*Erysimum franciscanum*)	CRPR 4.2	Chaparral, coastal dunes, coastal scrub, Valley and foothill grassland (often serpentinite or granitic, sometimes roadsides).	May be Present. The known distribution of this species is not well known (CNPS 2019c). Populations are known to occur on SFPUC watershed lands just to the north of Miramontes Ridge OSP (CCH 2019; CNPS 2019b). Suitable habitat is present in preserves with chaparral, coastal scrub, rocky cliffs, and grassland particularly in the northern half of the program area such as Miramontes Ridge OSP and Purisima Creek Redwoods OSP.
Small leaved monkeyflower (*Erythranthe microphylla*)	Midpen	Seeps, streambanks, wet meadows in chaparral.	May be Present. Suitable habitat is present in preserves containing chaparral with seep, wet meadow, or streambank microhabitat.
Stinkbells (*Fritillaria agrestis*)	CRPR 4.2	Clay, sometimes serpentinite substrates in chaparral, cismontane woodland, pinyon and juniper woodland, valley and foothill grassland.	May be Present. This species occurs on a wide variety of habitats, including on and off of serpentine substrates (CNPS 2019c). Suitable habitat for this species is present in many preserves. A known population of this species occurs near Año Nuevo in similar habitat to that in Tunitas Creek OSP (CNPS 2019b).

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
San Francisco gumplant (*Grindelia hirsutula* var. *maritima*)	CRPR 3.2	Sandy or serpentine substrates in coastal bluff scrub, coastal scrub, and valley and foothill grassland.	May be Present. The taxonomic certainty of this species is in flux, as is it distribution and range (CNPS 2019c). This species is generally considered to occur in the coastal zone (CNPS 2019c). Suitable habitat for this species is present in the Tunitas Creek OSP.
Harlequin lotus (*Hosackia gracilis*)	CRPR 4.2	In wetlands and roadsides within broadleafed upland forest, Coastal bluff scrub, closed-cone coniferous forest, cismontane woodland, coastal prairie, coastal scrub, meadows and seeps, marshes and swamps, North Coast coniferous forest, valley and foothill grassland.	May be Present. Suitable habitat for this species is present in many Midpen preserves. Historical populations of this species are present in coastal bluff scrub and grassland habitats just south of Tunitas Creek OSP in the Pescadero area, and just west of Miramontes Ridge OSP in the Half Moon Bay area (CNPS 2019b).
Coast iris (*Iris longipetala*)	CRPR 4.2	Mesic sites (meadows and seeps) in coastal prairie and lower montane coniferous forest.	May be Present. Historical populations of this species are present just outside of Thornewood OSP and just to the west of Miramontes Ridge OSP in the Half Moon Bay area (CNPS 2019b). Suitable habitat for this species is present in preserves with more coastal influences such as Miramontes Ridge OSP, Purisima Creek Redwoods OSP, and Tunitas Creek OSP.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Bristly leptosiphon (*Leptosiphon acicularis*)	CRPR 4.2	Chaparral, cismontane woodland, coastal prairie, valley and foothill grassland.	May be Present. The current geographic range of this species is predominantly north of the Program area in the North Coast Ranges or in the East Bay area. Historical populations of this species occurred just outside of Windy Hill OSP and Coal Creek OSP where the species had been recorded in grassland (CNPS 2019b). Suitable habitat for this species is present in preserves in the central portion of the Program area with grasslands.
Serpentine leptosiphon (*Leptosiphon ambiguus*)	CRPR 4.2	Usually serpentine substrates in montane woodland, coastal scrub, valley and foothill grassland.	Present. Known to occur in Sierra Azul OSP. Suitable habitat for this species is present in other preserves in the Program area with serpentine substrates such as Pulgas Ridge OSP, El Sereno OSP and St. Joseph's Hill OSP.
Large-flowered leptosiphon (*Leptosiphon grandiflorus*)	CRPR 4.2	Usually sandy substrates in coastal bluff scrub, closed-cone coniferous forest, cismontane woodland, coastal dunes, coastal prairie, coastal scrub, valley and foothill grassland.	Present. Known to occur in Sierra Azul OSP. Suitable habitat for this species is present in other preserves in the Program area with serpentine substrates such as Pulgas Ridge OSP, El Sereno OSP and St. Joseph's Hill OSP.
Woolly-headed lessingia (*Lessingia hololeuca*)	CRPR 3	Clay or serpentine substrates in broadleafed upland forest, coastal scrub, lower montane coniferous forest, valley and foothill grassland.	May be Present. Historical populations of this species are present just outside of El Sereno OSP (CNPS 2019b). Suitable habitat for this species is present in preserves with serpentine soils such as El Sereno OSP, Sierra Azul OSP, and St. Joseph's Hill OSP.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
San Mateo tree lupine (*Lupinus arboreus* var. *eximius*)	CRPR 3.2	Chaparral and coastal scrub.	May be Present. Many recently recorded populations of this species are present just to the north of Miramontes Ridge OSP on Montara Mountain (CNPS 2019b). Identification of this species is considered to be very difficult, and further study on its taxonomic status is needed (CNPS 2019c). This species has the potential to occur in preserves with coastal scrub habitats such as Tunitas Creek OSP and Miramontes Ridge OSP.
Elongate copper moss (*Mielichhoferia elongata*)	CRPR 4.3	Metamorphic rock, usually acidic, usually vernally mesic, and often on roadsides (sometimes carbonate) in broadleafed upland forest, chaparral, cismontane woodland, coastal scrub, lower montane coniferous forest, meadows and seeps, and subalpine coniferous forest.	May be Present. Suitable habitat for this species is present in preserves with the appropriate acidic metamorphic rock substrates. The closest known populations of this species are in the vicinity of Big Basin Redwoods State Park (CNPS 2019b).
Gairdner's yampah (*Perideridia gairdneri* ssp. *gairdneri*)	CRPR 4.2	Vernal pools and vernally mesic sites in broadleafed upland forest, chaparral, coastal prairie, and valley and foothill grassland.	Present. The species is known to occur in St. Joseph's Hill OSP and at Teague Hill OSP. Suitable habitat is present in other preserves with seasonal wetlands and/or vernal pools.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Michael's rein orchid (*Piperia michaelii*)	CRPR 4.2	Coastal bluff scrub, closed-cone coniferous forest, chaparral, cismontane woodland, coastal scrub, and lower montane coniferous forest.	May be Present. The geographic range of this species is widespread occurring in both the coast ranges from Marin to Ventura County, as well as the Sierra Nevada foothills (CNPS 2019c). A historical population is known from Purisima Creek Redwoods OSP but has not been observed since 1907 (CCH 2019). Suitable habitat for this species is present in Tunitas Creek OSP, Miramontes Ridge OSP, Purisima Creek Redwoods OSP, La Honda Creek OSP and Russian Ridge OSP.
Hickman's popcornflower (*Plagiobothrys chorisianus* var. *hickmanii*)	CRPR 4.2	Vernal pools, marshes and swamps in closed-cone coniferous forest, chaparral, and coastal scrub.	Present. The species is known to occur in Bear Creek Redwoods OSP. Suitable habitat is present in other preserves with seasonal wetlands and/or vernal pools.
Lobb's aquatic buttercup (*Ranunculus lobbii*)	CRPR 4.2	Vernal pools and other mesic sites in cismontane woodland, North Coast coniferous forest, and valley and foothill grassland.	May be Present. Most of populations of this species in San Mateo and Santa Cruz Counties are historical and from collections that are over 100 years old (CNPS 2019b). Historical populations are known from the vicinity of Skyline Ridge OSP, Russian Ridge OSP, Monte Bello OSP, Coal Creek Preserve, and Windy Hill OSP where this species occurred on seasonally moist margins of stock ponds and reservoirs, or in wet meadows (CNPS 2019b). This species has the potential to occur in preserves with seasonal wetlands and/or vernal pool habitats.

Common Name (*Scientific Name*)	Status[1]	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Hoffmann's sanicle (*Sanicula hoffmannii*)	CRPR 4.3	Often serpentine or clay soils in broadleafed upland forest, coastal bluff scrub, chaparral, cismontane woodland, coastal scrub, and lower montane coniferous forest.	May be Present. Suitable habitat is present in many preserves, as this species is not restricted to serpentine soils. Known populations are present in Butano State Park in similar habitats to those present in La Honda Creek OSP to the north (CNPS 2019b).
Marsh Zigadenus (*Toxicoscordion fontanum*)	CRPR 4.2	Vernally mesic, often serpentine meadows, seeps, marshes, or swamps in chaparral, cismontane woodland, lower montane coniferous forest.	May be Present. The known geographic range of this species is broad, ranging from Mendocino to San Louis Obispo Counties. A known population occurs just outside of to the west (CCH 2019). Records within the Program area are limited to a single record from San Mateo County from just outside of Pulgas Ridge OSP, and a single record from Santa Cruz County on Empire Grade Road (CCH 2019). This species has potential to occur in preserves with serpentine soils such as Pulgas Ridge OSP, El Sereno OSP, St. Joseph's Hill OSP, and Sierra Azul OSP.
Methuselah's beard lichen (*Usnea longissima*)	CRPR 4.2	Growing on tree branches; usually on old growth hardwoods and conifers in broadleafed upland forest and north coast coniferous forest.	Present. The species is known to occur in Purisima Creek Redwoods OSP. The range and specific habitat requirements of this species is not well-known due to the limited number of collections. This species has potential to occur in preserves with mature conifer forest, and likely those with greater coastal influence.

Notes: [1]Status Codes:

Federal

FE Listed as endangered under the Endangered Species Act

FT Listed as threatened under the Endangered Species Act

State

SE Listed as endangered under the California Endangered Species Act

ST Listed as threatened under the California Endangered Species Act

SC Candidate for listing under the California Endangered Species Act

SR Listed as rare under the Native Plant Protection Act

CRPR = California Rare Plant Rank

1A Plants presumed extirpated in California and either rare or extinct elsewhere

1B Plants rare, threatened, or endangered in California and elsewhere

2B Plants rare, threatened, or endangered in California, but more common elsewhere

3 Plants about which information is needed-a review list

4 Plants of limited distribution-a watch list

_.1 seriously endangered in California

_.2 fairly endangered in California

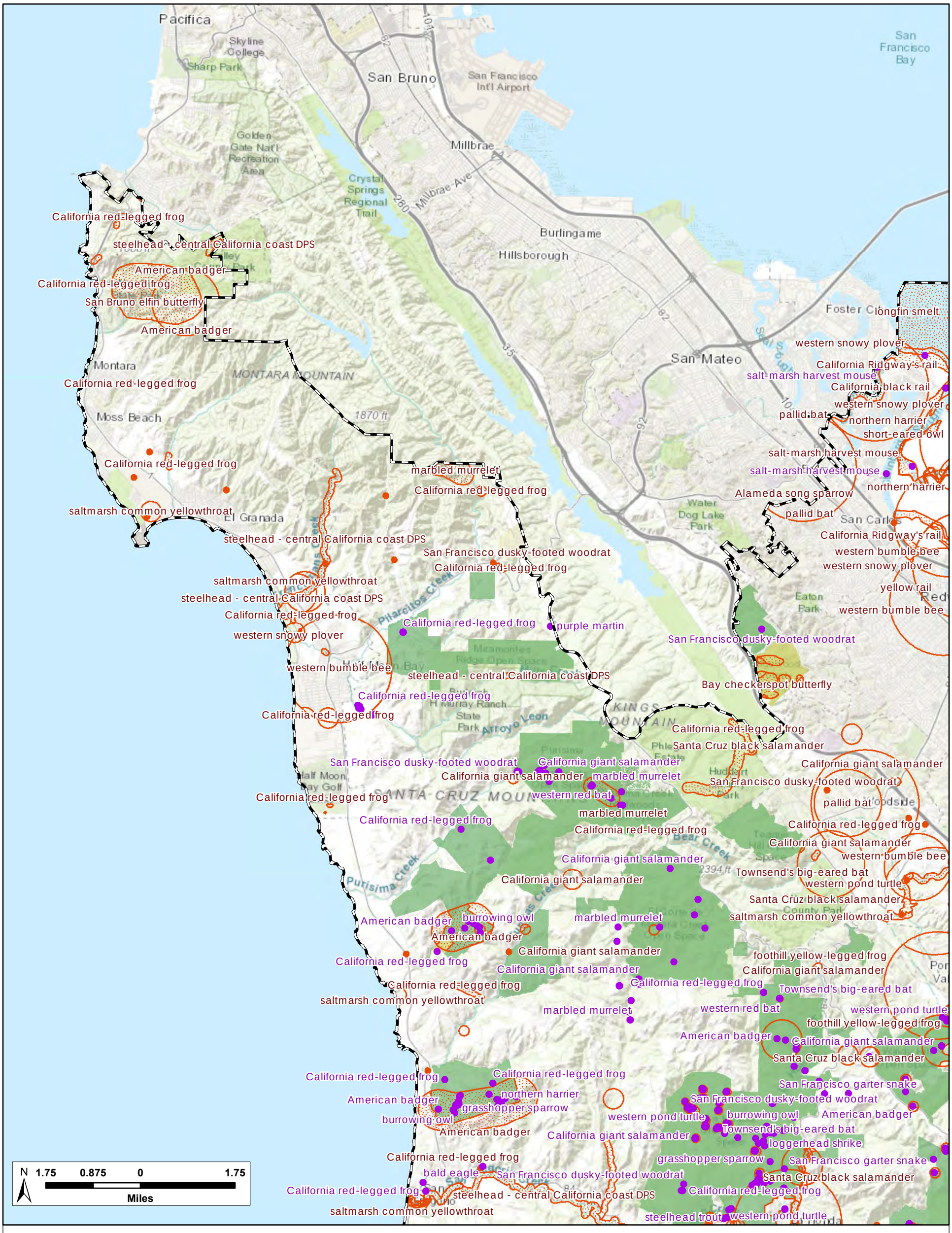
_.3 not very endangered in California

Midpen = Considered sensitive by Midpen

4.1.12 Special-Status Animals

Table 4-2 identifies 52 special-status animal species that are listed, proposed, or candidate species under the state or federal Endangered Species Act, designated as California species of special concern by CDFW, or listed as fully protected by the California F&G Code and that are known to occur or may occur within the Program area, and characterizes their potential to occur within Midpen preserves. Their distribution, legal status, general habitat requirements, and known occurrences within Midpen preserves are also provided. Known occurrence locations of special-status animals, based on CNDDB (CDFW 2019a) and observations by Midpen staff, are provided in Figure 4-3. Designated critical habitat of federally-listed species within the vicinity of the Program area and Sphere of Influence is shown in Figure 4-4.

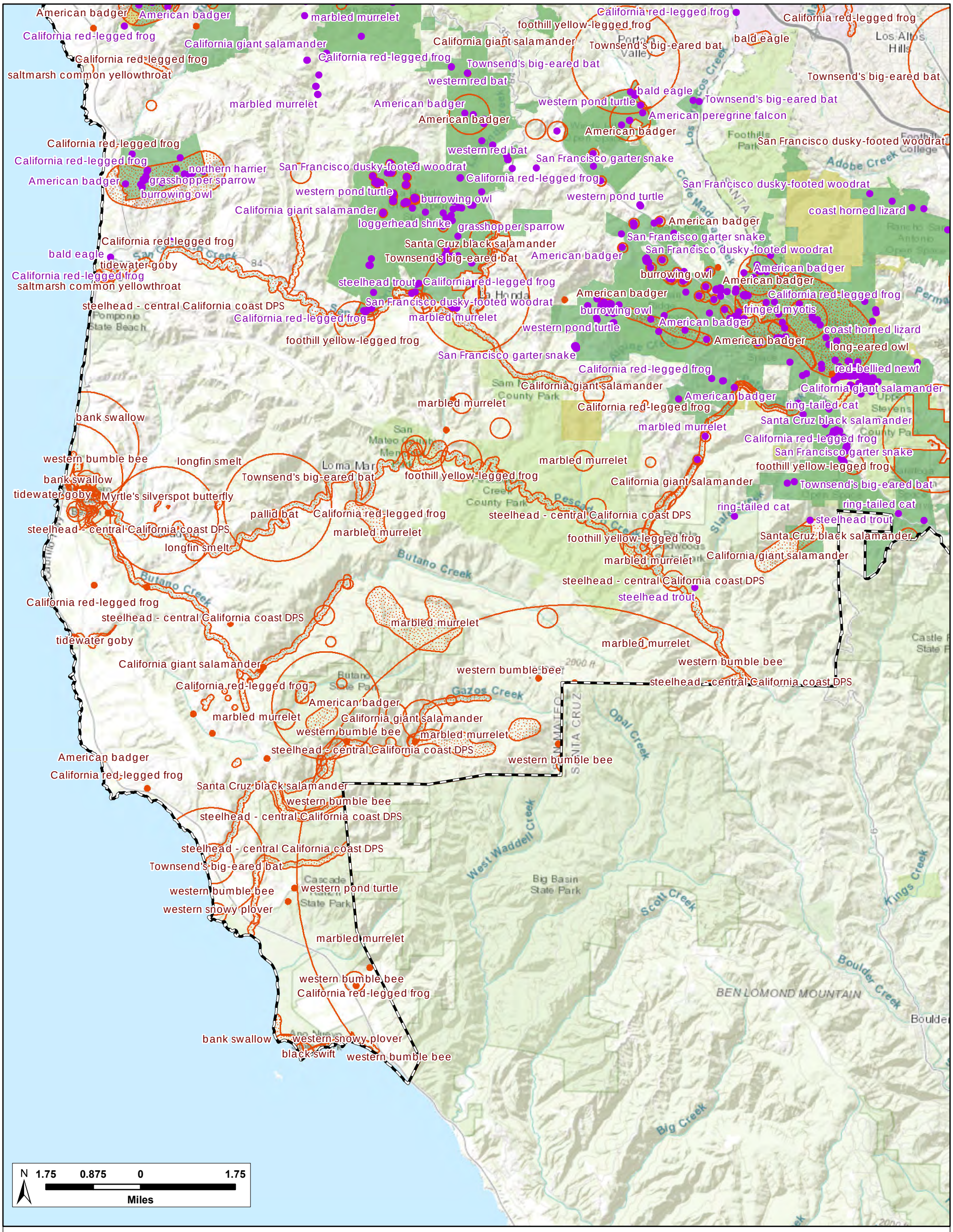
This page intentionally left blank



H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 4-**3**. Special-Status Animals Map
Midpeninsula Regional Open Space District - Open Space Maintenance and Restoration Program
April 2021

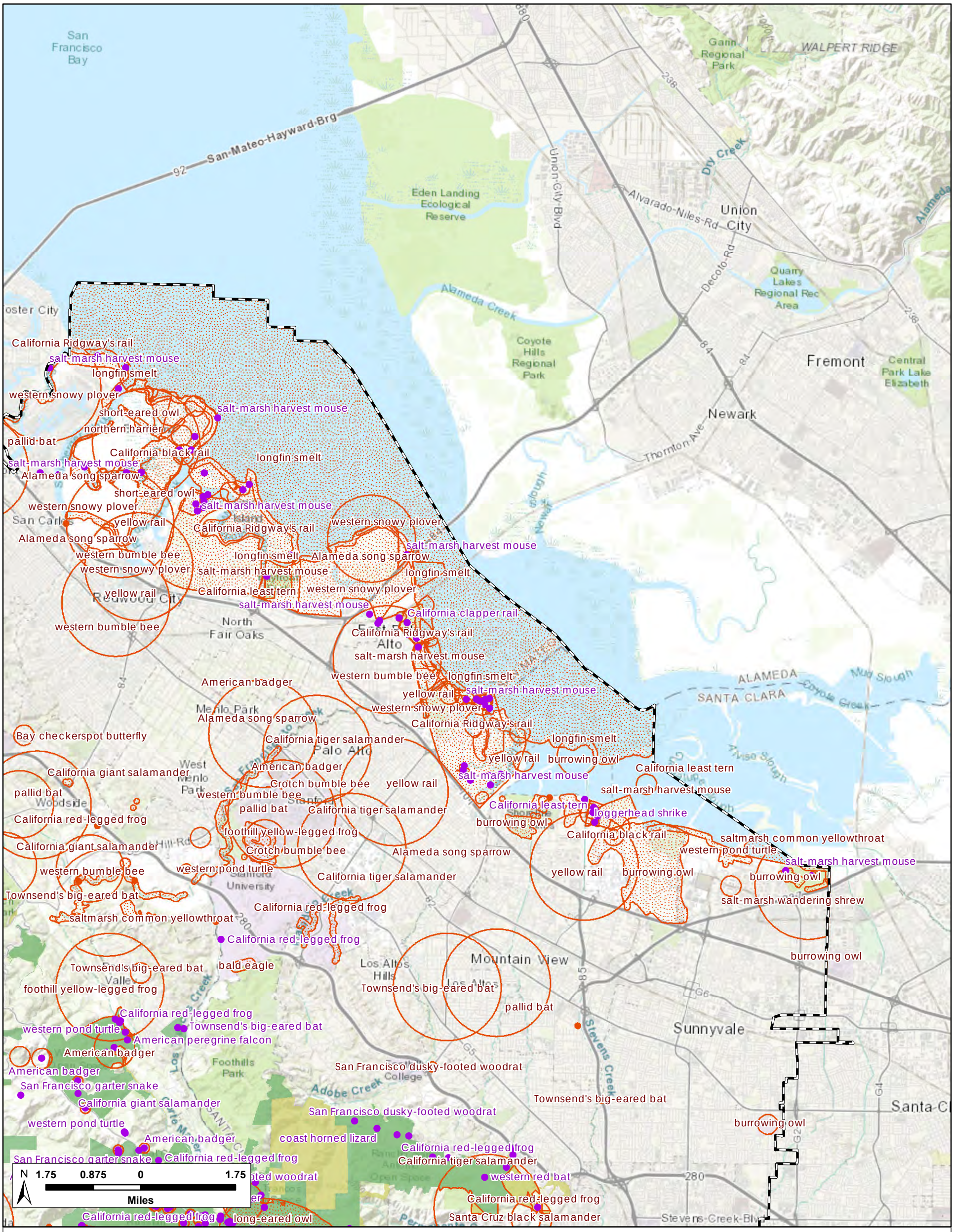
This Page intentionally left blank



H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 4-**3**. Special-Status Animals Map
Midpeninsula Regional Open Space District - Open Space Maintenance and Restoration Program
April 2021

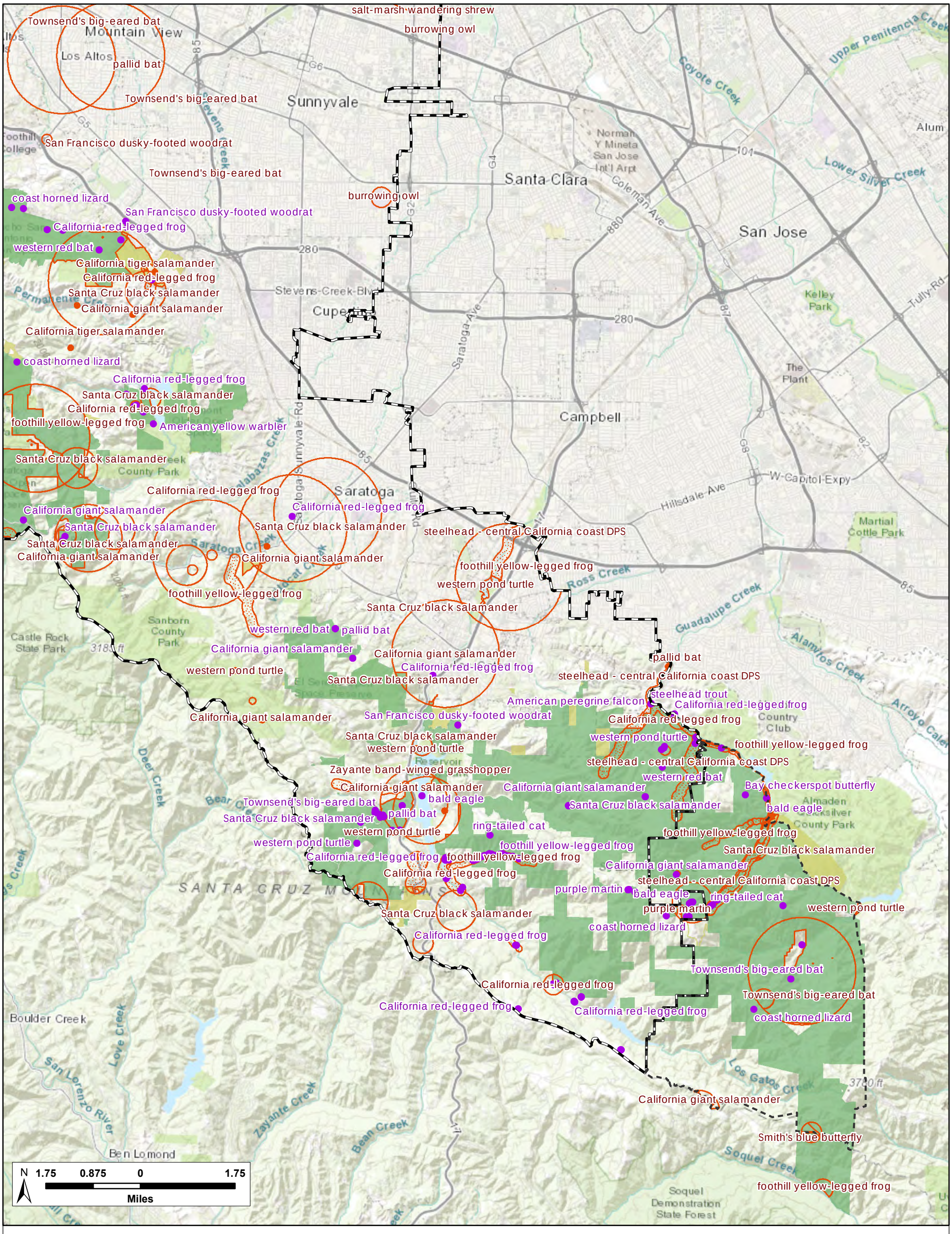
This Page intentionally left blank



H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 4-**3**. Special-Status Animals Map
Midpeninsula Regional Open Space District - Open Space Maintenance and Restoration Program
April 2021

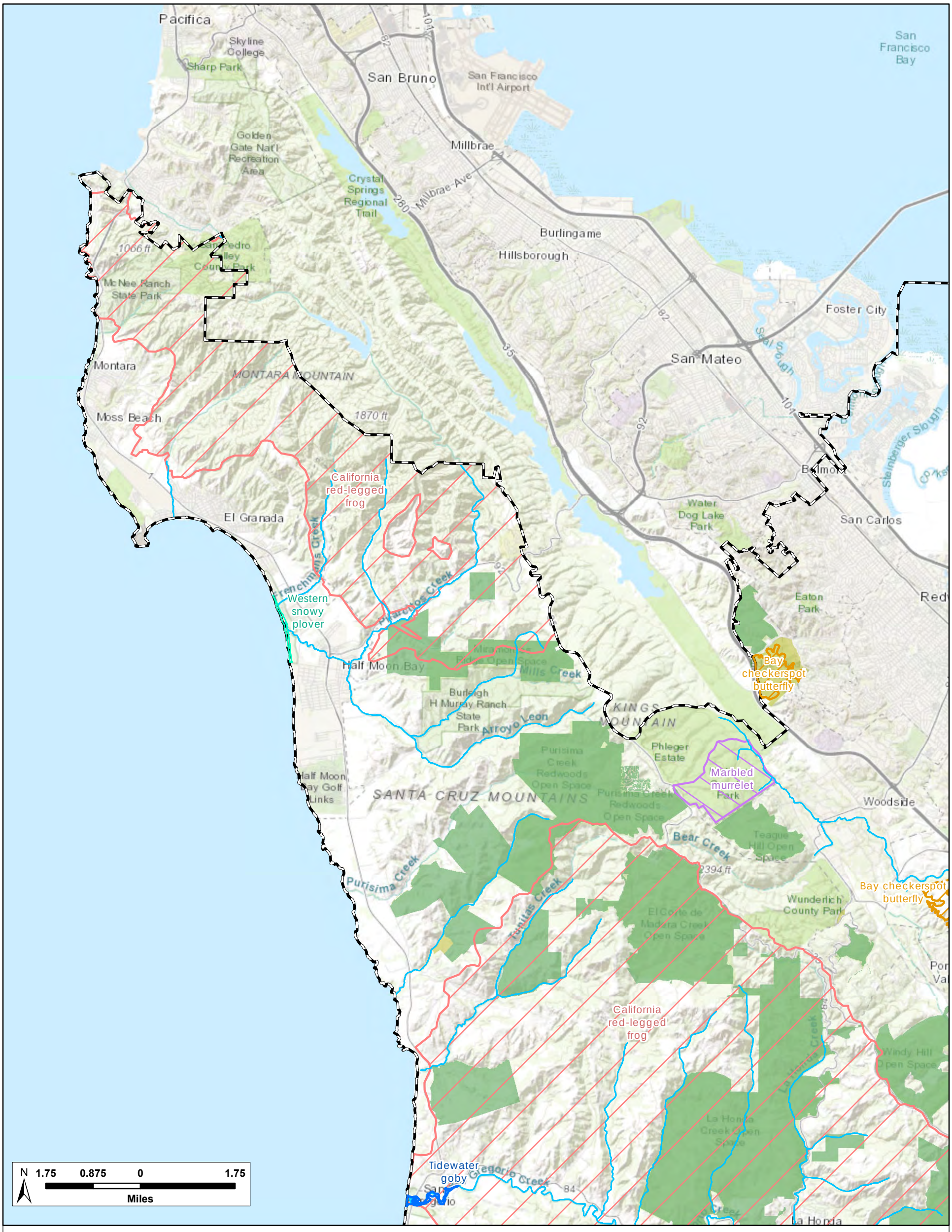
This Page intentionally left blank



H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 4-**3**. Special-Status Animals Map
Midpeninsula Regional Open Space District - Open Space Maintenance and Restoration Program
April 2021

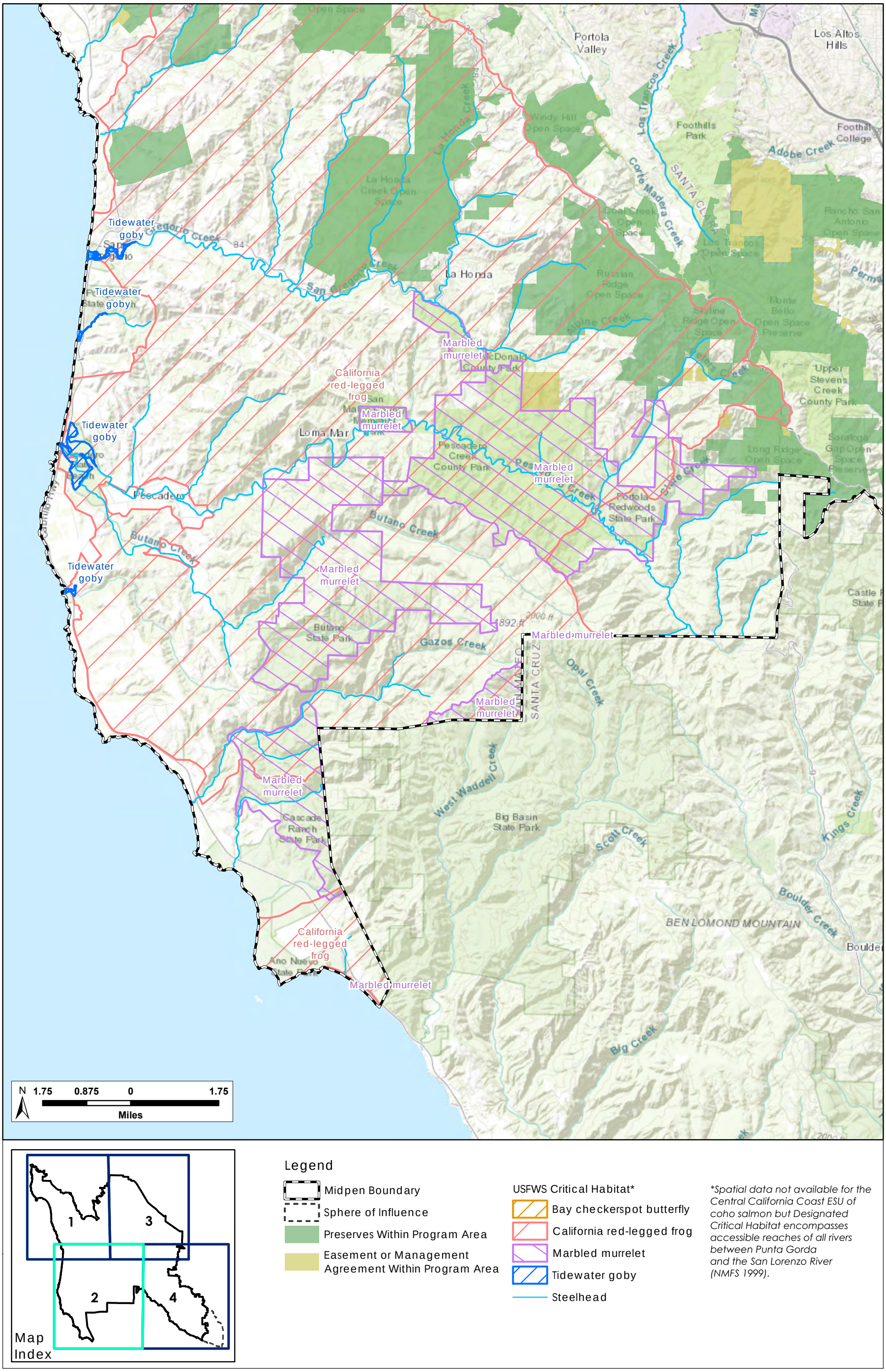
This Page intentionally left blank



H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 4-**4**. Designated Critical Habitat
Midpeninsula Regional Open Space District - Open Space Maintenance and Restoration Program
April 2021

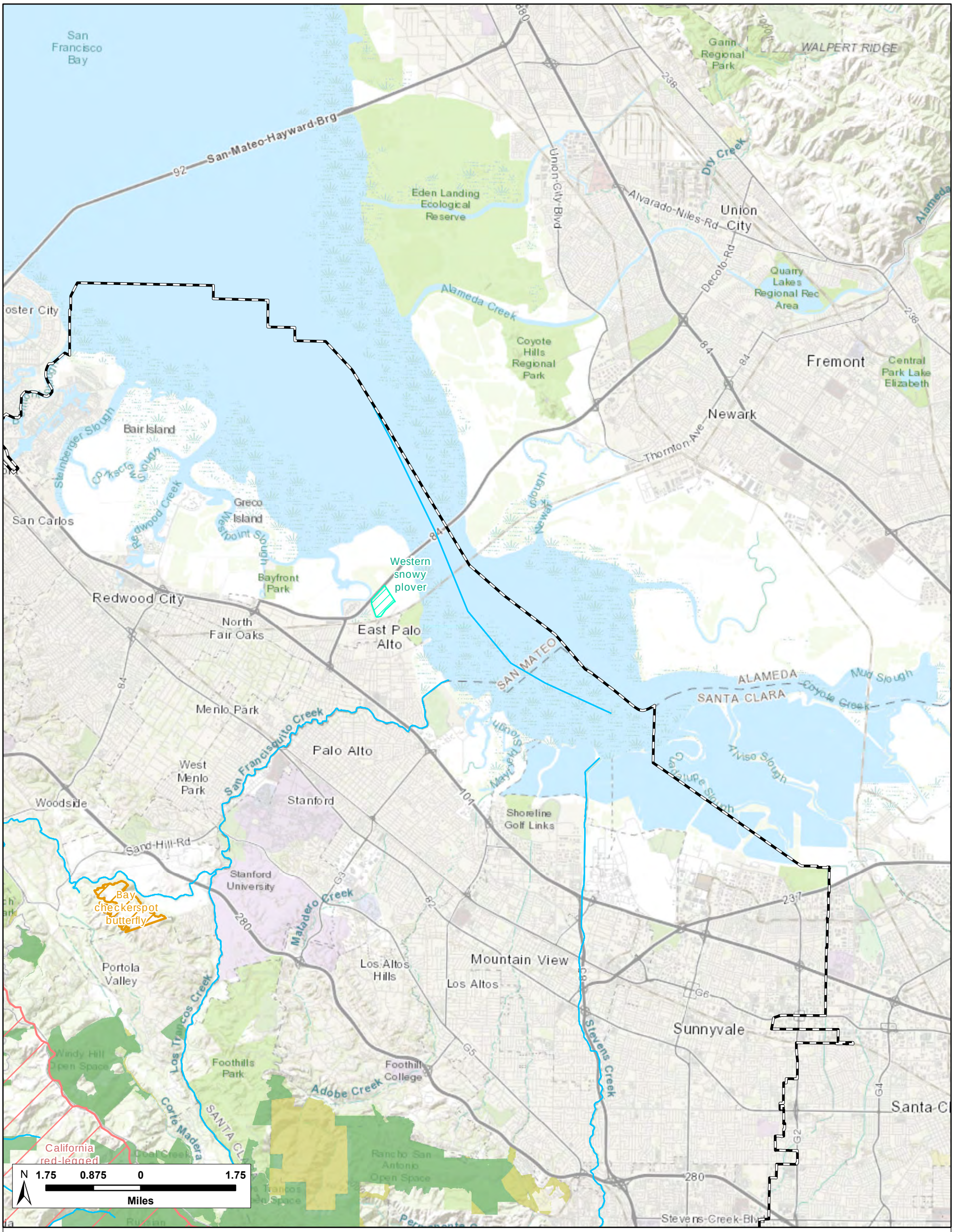
Page intentionally left blank.



H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 4-4. Designated Critical Habitat
Midpeninsula Regional Open Space District - Open Space Maintenance and Restoration Program
April 2021

Page intentionally left blank.



Legend

- Midpen Boundary
- Sphere of Influence
- Preserves Within Program Area
- Easement or Management Agreement Within Program Area

USFWS Critical Habitat*

- Bay checkerspot butterfly
- California red-legged frog
- Western snowy plover
- Steelhead

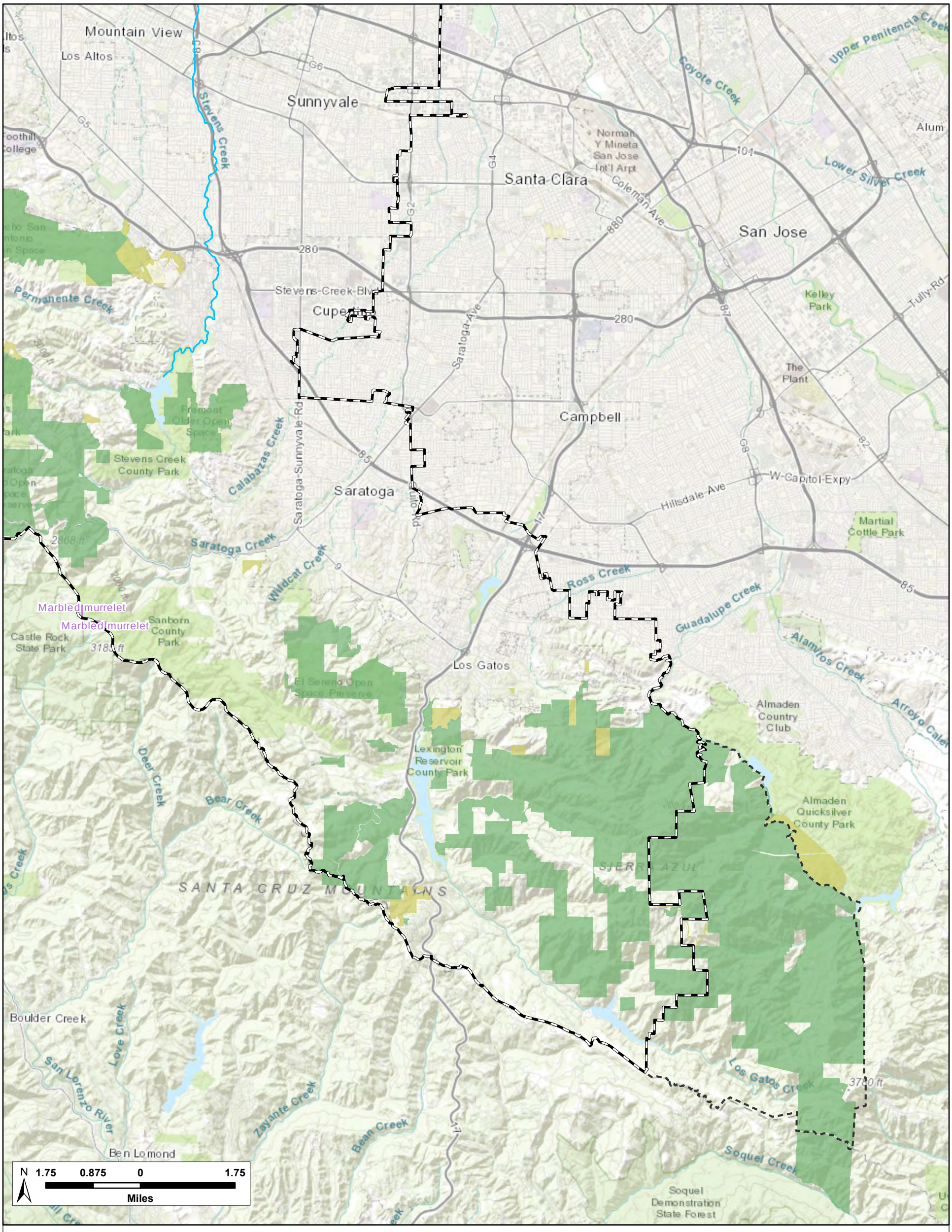
**Spatial data not available for the Central California Coast ESU of coho salmon but Designated Critical Habitat encompasses accessible reaches of all rivers between Punta Gorda and the San Lorenzo River (NMFS 1999).*

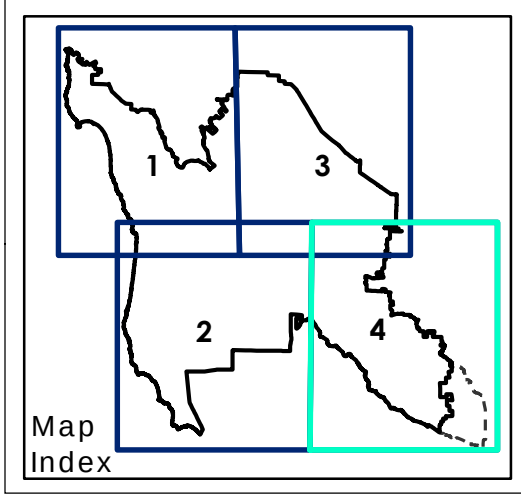
H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 4-4. Designated Critical Habitat

Midpeninsula Regional Open Space District - Open Space Maintenance and Restoration Program
April 2021

Page intentionally left blank.





Legend

- Midpen Boundary
- Sphere of Influence
- Preserves Within Program Area
- Easement or Management Agreement Within Program Area

USFWS Critical Habitat*

- Marbled murrelet
- Steelhead

**Spatial data not available for the Central California Coast ESU of coho salmon but Designated Critical Habitat encompasses accessible reaches of all rivers between Punta Gorda and the San Lorenzo River (NMFS 1999).*

H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 4-4. Designated Critical Habitat
Midpeninsula Regional Open Space District - Open Space Maintenance and Restoration Program
April 2021

Page intentionally left blank.

Table 4-2. Special-Status Animal Species with Potential to Occur in the Program Area.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Federal or State Endangered, Threatened, Proposed, or Candidate Species			
Mission blue butterfly (*Icaricia icarioides missionensis*)	FE	Found in coastal chaparral and coastal grasslands. Adults fly from late March to early July and feed on the nectar of hairy false goldenaster (*Heterotheca villosa*), bluedicks (*Dichelostemma capitatum*), and seaside buckwheat (*Eriogonum latifolium*) (Black and Vaughn 2005a). Larval host plants consist of three lupines – silver lupine (*Lupinus albifrons*), summer lupine (*Lupinus formosus*), and manycolored lupine (*Lupinus versicolor*), which grow in poor soils with little grass, on rocky outcrops, and in recently disturbed areas, such as road cuts and landslides (County of San Mateo 1982).	Absent. Remaining populations of the Mission blue butterfly are found in only a few locations around the San Francisco Bay area. Known populations are present on the ridgetops just east of Pacifica, including Milagra Ridge. These locations are just north of the Midpen Program area. Host plants for the Mission blue are present at some Midpen preserves, but the species is not known to occur on Midpen lands.

[1] Special-status species are listed in the following order: state or federally listed, proposed, or candidate species first, followed by California species of special concern, then species classified as fully protected. Within each of those groups, species are listed in the following order: invertebrates, fish, amphibians, reptiles, birds, then mammals.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Callippe silverspot butterfly (*Speyeria callippe callippe*)	FE	Native grasslands containing Johnny jump-ups (*Viola pedunculata*). Males seek hilltops and hillsides of native grasslands for mates. Females lay their eggs in the dead or dying larval food plant, *V. pedunculata*, or in nearby woody debris (Black and Vaughan 2005b).	Absent. Historically, the callippe silverspot butterfly occupied grasslands in much of the San Francisco Bay region. However, all known locations are currently restricted to San Francisco and San Mateo Counties, where several populations are known from San Bruno Mountain, Milagra Ridge, the San Francisco Peninsula Watershed, and Montara Mountain. Adults have one flight period, which is typically from mid-May to July (Black and Vaughan 2005b). Critical habitat has not been designated for this species (USFWS 2007). The host plant is in portions of the Program area (CNPS 2019c), but high-quality habitat containing large numbers of the host plant is absent, and there is no evidence that this species is extant in the Program area.

[2] Status Codes: FE = Federally Endangered; FT = Federally Threatened; FC = Candidate for Federal Listing; SE = State Endangered; ST = State Threatened; SC = Candidate for State Listing; CSSC = California Species of Special Concern; SP = State listed as Fully Protected

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Myrtle's silverspot butterfly (*Speyeria zerene myrtleae*)	FE	The Myrtle's silverspot butterfly was listed as endangered by the USFWS June 1992 (USFWS 1992). This species is found in coastal dune, prairie, coastal bluff scrub, and associated grasslands in areas protected from wind (Steiner et al. 1994, USFWS 1998a). Adults feed on nectar from gumplant (*Grindelia* spp.), sand verbena (*Abronia latifolia*), mints (*Mondardella* spp.), bull thistle (*Cirsium vulgare*), and seaside daisy (*Erigeron glaucus*). Females lay their eggs in debris and the dried stems of violets, typically hookedspur violets (*Viola adunca*), the larvae's host plant (Black and Vaughn 2005c, USFWS 2007).	Absent. No myrtle silverspot populations are currently present in existing Midpen preserves, and none are expected to occur given the fact that the species is not known to have occurred in San Mateo County in 70 years (CDFW 2019b). Although there are historical records from the vicinity of Pescadero and from Pigeon Point, this species has been extirpated south of the Golden Gate Bridge and is now restricted to 4 populations in northwestern Marin County and southern Sonoma County (Steiner et al. 1994, Black and Vaughn 2005c, USFWS 2007, CDFW 2019b, iNaturalist 2019). This species is found in association with host plants that occur in coastal dune, prairie, coastal bluff scrub, and associated grasslands, in areas protected from wind (Steiner et al. 1994, USFWS 1998a). Potentially suitable habitat for this species may be present at Tunitas Creek OSP and Miramontes Ridge OSP.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Bay checkerspot butterfly (*Euphydryas editha bayensis*)	FT	Native grasslands on serpentine soils. Larval host plants are *Plantago erecta* and/or *Castilleja* spp. High-quality habitat consists of extensive serpentine grassland in areas with variable slope aspects to sustain populations during periods of variable precipitation (USFWS 1998b, Black and Vaughan 2005d).	May be Present. No Bay checkerspot populations are currently present in existing Midpen preserves. However, the species was historically observed in the Sierra Azul OSP and has been reintroduced to Edgewood County Park (Friends of Edgewood 2015), located just south of Midpen's Pulgas Ridge OSP. There is some potential for very small numbers of individuals to occasionally disperse to Pulgas Ridge, though the species is not expected to breed there due to the absence of high-quality habitat. Designated critical habitat Unit 3 (Edgewood Park/Triangle) is present immediately adjacent to Midpen lands, and Midpen holds an easement over Edgewood Park. However, no critical habitat has been designated on existing Midpen preserves, and suitable habitat is not present at any other Midpen preserve.
Smith's blue butterfly (*Euphilotes enoptes smithi*)	FE	Coastal sand dunes and coastal sage scrub where sea cliff buckwheat (*Eriogonum parvifolium*) and coast buckwheat (*Eriogonum latifolium*) are present (Center for Biological Diversity 2019).	Absent. No Smith's blue butterfly populations are currently present in or very close to existing Midpen preserves. The species was historically reported from Loma Prieta Road in the Sierra Azul OSP, although the details associated within the record suggest that the identification was uncertain (CDFW 2019a). Moreover, the host plants that Smith's blue is associated with and dependent on, sea cliff buckwheat (*Eriogonum parvifolium*) and coast buckwheat (*Eriogonum latifolium*), are not present at the location (CNPS 2019c) where the butterflies were observed. This species is not expected to occur on current or future Midpen lands.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Zayante band-winged grasshopper (*Trimerotropis infantilis*)	FE	Restricted to the Zayante sandhills ecosystem – sand parkland found on ridges and hills, characterized by scattered ponderosa pines (USFWS 1998c).	Absent. No Zayante band-winged grasshopper populations are currently present in or near existing Midpen preserves. The species historically occurred, but is now locally extinct, in the area surrounding Lexington Reservoir near Bear Creek Redwoods and Sierra Azul OSPs. Designated critical habitat is located south of the Program area in the sandhills of the Santa Cruz Mountains (USFWS 1998c). This species is not expected to occur on current or future Midpen lands.
Western bumble bee (*Bombus occidentalis occidentalis*)	SC	Meadows and grasslands with abundant floral resources.	Absent. This species was historically found throughout much of central and northern California, including the Program area. For example, historical records include a 1953 record from Miramontes Ridge OSP (CDFW 2019b) as well as records from Johnston Ranch. However, this species is not expected to currently occur within the Program area due to recent range contractions. Its current range is believed to be restricted to northeastern California (iNaturalist 2019, Hatfield et al. 2019).
Crotch's bumble bee (*Bombus crotchii*)	SC	Open grassland and scrub habitats.	Absent. Although the historical distribution of this species included much of the Bay Area, it is not expected to occur in the Program area due to recent range contractions. Despite a recent observation at Santa Teresa County Park, approximately 4.0 miles from Sierra Azul OSP, this species' current range is believed to be restricted primarily to southern California (iNaturalist 2019; Hatfield et al. 2019). In the Program area, this species is considered absent and extirpated.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Monarch butterfly (*Danaus plexippus plexippus*)	FC	Overwinters along the Pacific coastline of California and move inland in the spring to reproduce. During the breeding season, require milkweed (*Asclepias* spp.) plants upon which to rear their larvae.	Present. Along the Peninsula and throughout the Program area, monarch butterflies occur primarily as migrating individuals in the fall and spring (CDFW 2019a). Wintering sites are mostly coastal or near the edge of San Francisco Bay. Purisima Uplands property within Purisima Creek OSP and perhaps Tunitas Creek OSP contain wintering habitat. There are also records of this species from Midpen preserves such as Foothills OSP and Rancho San Antonio OSP (iNaturalist 2019), and this species is expected to occur in small numbers at other preserves.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Central California Coast Coho salmon (*Oncorhynchus kisutch*)	FE, SE	Open ocean, estuaries, and rivers. Spawning habitat in medium to small coastal streams in heavily forested watersheds characterized by perennially-flowing reaches of cool, high-quality water; dense riparian canopy; deep pools with abundant overhead cover; instream cover consisting of large, stable woody debris and undercut banks; and gravel or cobble substrates (NFMS 2016). Juveniles rear in freshwater for one year, seeking out cool, deep (>3.2 feet) water with substantial overhead cover and instream cover such as woody debris (Moyle 2002). Juveniles do not persist in streams where summer temperatures reach 72.7 °F for extended periods of time (Moyle 2002).	May be Present. Central California Coast Coho salmon have recently been recorded spawning in the southwestern portion of the Program area in Pescadero Creek (Peninsula Open Space Trust [POST] 2019), and the species spawns in San Gregorio Creek, Pescadero Creek, and Gazos Creek, although it has not been recorded in Gazos Creek during annual monitoring since 2008 (Smith 2013 as cited in CDFW 2015, Midpen 2017). The species was historically collected from San Mateo Creek (Leidy 2007) and may have been present in the San Francisquito Creek watershed (Leidy et al. 2005). However, it has been extirpated from all San Mateo County streams flowing to the Bay (Leidy 2007). Designated critical habitat occurs in the Program area and includes all accessible reaches of all rivers including estuarine areas and tributaries between Punta Gorda and the San Lorenzo River (inclusive) in California. Designated critical habitat is present in or immediately adjacent to La Honda Creek OSP (NMFS 1999).

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Central California Coast steelhead (*Oncorhynchus mykiss*)	FT	Cool streams with suitable spawning habitat and conditions allowing migration between spawning and marine habitats.	Present. In the Program area, steelhead are known to occur in a number of coastal streams, as well as in a few streams entering San Francisco Bay, such as Stevens Creek, Guadalupe River/Creek, and San Francisquito Creek (including Los Trancos Creek) (Spence et al. 2008, CEMAR 2008). Designated critical habitat includes all river reaches and estuarine areas accessible to listed steelhead in coastal river basins from the Russian River to Aptos Creek, California (inclusive), and the drainages of San Francisco and San Pablo Bays (NMFS 2000, 2005). Designated critical habitat is present in or immediately adjacent to the following Midpen preserves: Tunitas Creek, La Honda Creek, Russian Ridge, Miramontes Ridge, Skyline Ridge, Long Ridge, Purisima Creek Redwoods, Fremont Older, Los Trancos, and Sierra Azul OSPs. Steelhead could therefore use those creek reaches for spawning, rearing, and/or migration.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Tidewater goby (*Eucyclogobius newberryi*)	FE, CSSC	Brackish water habitats along coast, fairly still but not stagnant water and high oxygen levels.	Absent. The species has been recorded in the lower mouths of creeks along the southern portion of the San Mateo County coast north to San Gregorio Creek, including San Gregorio Creek, Pescadero Creek, and Arroyo De Los Frijoles and Lake Lucerne at Bean Hollow State Beach (CDFW 2019a). However, an apparently natural gap in the species' distribution along the California coast occurs north of San Gregorio Creek to the San Francisco Bay (USFWS 2005). Four designated critical habitat units occur in the Program area. However, although the tidewater goby occurs in the Program area, it is not known or expected to occur on current or future Midpen lands due to the absence of suitable habitat.
California red-legged frog (*Rana draytonii*)	FT, CSSC	Uses streams, freshwater pools, and ponds with emergent or overhanging vegetation as breeding and nonbreeding aquatic habitat. It can disperse through a variety of habitats, such as grassland or woodland, particularly during the wet season.	Present. California red-legged frogs are fairly widespread in suitable habitat within the Program area, and occur in a number of Midpen preserves including Tunitas Creek OSP, La Honda Creek OSP, La Purisima Creek Redwoods OSP, Rancho San Antonio OSP, Pichetti Ranch OSP, Coal Creek OSP, Russian Ridge OSP, Long Ridge OSP, Monte Bello OSP, Skyline Ridge OSP, Bear Creek Redwoods OSP, and Sierra Azul OSP. California red-legged frog designated critical habitat units SNM-1 (Cahill Ridge) and SNM-2 (Pescadero) are located in the Program area, and El Corte de Madera Creek OSP, La Honda Creek OSP, Long Ridge OSP, Russian Ridge OSP, Miramontes Ridge OSP, and Skyline Ridge OSP, all contain designated critical habitat.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Foothill yellow-legged frog (*Rana boylii*)	SC, CSSC	Occurs in a variety of habitats in coast ranges, but all contain partially shaded shallow streams and riffles with a rocky substrate.	Present. Suitable habitat for the foothill yellow-legged frog is present at multiple locations in the Program area, but the species has essentially been extirpated throughout much of San Mateo County, at least east of the crest of the Santa Cruz Mountains, as there are no records from that area since 1960 (CDFW 2019a). Single records west of the crest of the Santa Cruz Mountains within the past 25 years, from Pescadero Creek County Park and Portola Redwoods State Park, suggest the species may persist west of the crest. In Santa Clara County, east of State Route 17, the species is extant in suitable habitat, including in creeks in Sierra Azul OSP – the only Midpen preserve where the species is likely to occur.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
California tiger salamander (*Ambystoma californiense*)	FT, ST	An endemic member of the California grassland community, the California tiger salamander's preferred breeding habitat consists of temporary ponded environments free of predators including exotic fishes, crayfish, and bullfrogs, surrounded by uplands that support small mammal burrows which provide refugia for juvenile and adult salamanders during the dry season. Adults are terrestrial, and spend most of their lives in widely dispersed, underground retreats.	May be Present. Southeastern San Mateo County represents the northernmost limit of the species' range on the San Francisco Peninsula. The last recorded occurrence in San Mateo County was located in the Palo Alto, California U.S. Geological Survey 7.5-minute quadrangle just west of San Francisquito Creek in 2002 (CDFW 2019a). This species occurs more widely in Santa Clara County, but it is not known to occur in any existing Midpen preserves. If the species occurs on Midpen lands, it is most likely to occur along the northeastern edge of Sierra Azul OSP, where some potentially suitable (nonbreeding) habitat exists, and due to the species' known occurrence in the nearby Santa Teresa Hills (Midpen 2017). Potentially suitable habitat also exists in Almaden Quicksilver County Park, immediately adjacent to Sierra Azul OSP. The closest known population to Sierra Azul is located at Calero County Park; designated critical habitat is also located at Calero County Park (CDFW 2019a), but not within any Midpen preserves.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
San Francisco garter snake (*Thamnophis sirtalis tetrataenia*)	FE, SP	Prefer freshwater habitats with dense herbaceous vegetation. May use upland burrows for aestivation, and uses grassland for dispersal and aestivation. Often suns itself in, or immediately adjacent to, dense vegetation along the edges of freshwater ponds.	Present. The San Francisco garter snake occurs on the San Francisco Peninsula from just north of the San Francisco–San Mateo County line south to approximately the San Mateo–Santa Cruz County line. An intergrade zone composed of hybrids between the San Francisco garter snake and red-sided garter snake (*Thamnophis sirtalis sirtalis*) occurs from Palo Alto north to the Pulgas region near Upper Crystal Springs Reservoir (Barry 1994). San Francisco garter snake have been historically documented in four Midpen preserves – Tunitas Creek, Russian Ridge, Skyline Ridge, and Long Ridge (USFWS 2016). The only Preserve with confirmed presence at this time is Russian Ridge. Midpen has implemented a San Francisco garter snake habitat management plan for the 1,047-acre Mindego Ranch (part of Russian Ridge OSP) to encourage the recovery of the species by improving habitat conditions for San Francisco garter snake and California red-legged frog, a primary food source for San Francisco garter snake. SFGS are also found in the Cloverdale property, currently owned by POST, but which Midpen intends to purchase in the coming years.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Marbled murrelet (*Brachyramphus marmoratus*)	FT, SE (nesting)	Requires dense, mature forests of redwood and Douglas-fir (especially old-growth) for breeding. Forages entirely in nearshore oceanic waters.	Present. In San Mateo County, the marbled murrelet is restricted to old-growth redwood forests and isolated patches of late-seral forest, where it breeds, and to coastal waters, where it forages (Sequoia Audubon Society [SAS] 2001, Cornell Lab of Ornithology 2019). This species is known to occur in at least one Midpen preserve, Purisima Creek Redwoods OSP, and it may occur in or near other preserves if old-growth redwood forests or late seral forest are present, such as in El Corte de Madera Creek OSP. However, most known breeding areas are further downslope from the crest of the Santa Cruz Mountains, and are centered in the area bounded by San Mateo County Memorial Park, Sam McDonald County Park, Pescadero Creek County Park, Portola Redwoods State Park, Butano State Park, and in adjacent Santa Cruz County, Big Basin State Park (CDFW 2019a). Four marbled murrelet designated critical habitat units are present in San Mateo County (CA-12, CA-13, CA14a, and CA14b), and a portion of the Long Ridge preserve is designated as critical habitat. Designated critical habitat is also located in Huddart County Park, immediately adjacent to Purisima Creek Redwoods OSP and Teague Hill OSP (CDFW 2019a).

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Bald eagle (*Haliaeetus leucocephalus*)	SE, SP	Occurs mainly along seacoasts, rivers, and lakes; nests in tall trees or in cliffs, occasionally on electrical towers. Feeds mostly on fish, but will also feed on large carcasses. Mature tall trees are used for roosting.	Absent as Breeder. In the Program area, the bald eagle occurs primarily as a migrant and winter visitor and is rare during the summer months (Cornell Lab of Ornithology 2019). Although there are no known nesting records from any Midpen preserve, this species has nested east of Lexington Reservoir, just north of Bear Creek Redwoods OSP, in recent years, and it has also nested at Crystal Springs Reservoir, from 2013 through 2015. Potentially suitable nesting habitat is present at Guadalupe Reservoir, immediately adjacent to Sierra Azul OSP. This species is currently known to occur in Midpen preserves only as a nonbreeding forager, but it could potentially nest in preserves, particularly those close to lakes, such as Bear Creek Redwoods, El Sereno, and Sierra Azul OSPs.
Willow flycatcher (*Empidonax traillii brewsteri*)	SE	Nests in dense willow thickets in riparian woodlands.	Absent as breeder. This species occurs in the Program area, but only during spring and fall migration. Although this species historically bred in the Program area, it was extirpated from the entire San Francisco Bay Area and central coast decades ago. Small numbers of birds from more northerly populations occur in the Program area (including Midpen lands) during spring and fall migration.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Swainson's hawk (*Buteo swainsoni*)	ST (nesting)	Swainson's hawks in California are strongly associated with riparian habitats, though they are also found in oak woodlands and other open habitats. Swainson's hawks build sturdy stick nests in low willows, box elders, oaks, or other trees. They forage in a variety of open habitats, such as grasslands and wetlands.	Absent as Breeder. This species occurs in the Program area only as a rare migrant (Cornell Lab of Ornithology 2019). The closest nesting pair(s) are located in Coyote Valley, approximately 4 mi from the Program area. Swainson's hawks could occur as a migrant at any Midpen preserve, although they are not expected to do so on a regular basis, and when they do occur, they are most likely to occur only as flyovers, rather than using the habitat within the preserve. This species has been observed at Sierra Azul OSP and on Tunitas Creek Road, not far from Tunitas Creek OSP (Cornell Lab of Ornithology 2019).
Bank swallow (*Riparia riparia*)	ST (nesting)	Colonial nester on vertical banks or cliffs with fine-textured soils near water.	Absent as Breeder. Bank swallows occur as rare migrants along the coast and South Bay, although they could potentially occur anywhere in the Program area. As breeders, they are very rare in the Program area, with the only known only known extant breeding colony occurring at Añõ Nuevo State Park (CDFW 2019a; Cornell Lab of Ornithology 2019); however, suitable habitat may also be present at Tunitas Creek Beach, located across State Route 1 from Midpen's Tunitas Creek property. There is a historical nesting record (1896) from Pescadero Beach (CDFW 2019a). This species is likely to occur on current or future Midpen lands only as a transient or nonbreeding forager, and then only in small numbers.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Tricolored blackbird (*Agelaius tricolor*)	ST (nesting colony)	Nests most commonly near fresh water in dense emergent vegetation, but also in grain fields, fallow fields, and extensive thickets of blackberry. Highly colonial in its nesting habits and forms dense breeding colonies that, in some parts of the Central Valley, may consist of up to tens of thousands of pairs.	May be Present. In the Program area, the tricolored blackbird occurs primarily along the coastal lowlands and in the San Francisco Bay lowlands. It occurs less frequently along the ridgeline of the Santa Cruz Mountains. It is an uncommon to common migrant and wintering visitor and a very rare breeder (SAS 2001, Cornell Lab of Ornithology 2019). Tricolored blackbirds form large, often multi-species flocks during the non-breeding period and range more widely than during the breeding season. Suitable breeding habitat for this species is absent from most Midpen preserves, and it is most likely to occur in preserves as a nonbreeding forager. However, potential nesting habitat may be present in ponds at some preserves, such as at Tunitas Creek OSP.
Mountain lion (*Puma concolor*)	SC (petitioned for state listing)[3]	Occurs in a wide variety of habitats, including woodland, forest, chaparral, and grassland, as long as rock outcrops or areas of dense vegetation providing cover are present.	Present. Mountain lions are present in low densities throughout much of the Santa Cruz Mountains. Although they typically tend to avoid areas of high human activity, they occasionally venture into suburban areas. Mountain lions have been recorded in numerous Midpen preserves and could potentially occur in any preserve within the Program area.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
California Species of Special Concern			
California giant salamander (*Dicamptodon ensatus*)	CSSC	Typically found in moist forests and riparian zones in or near clear, cold streams or seeps. Found under logs and debris, and occasionally in trees and shrubs near water. Breeds in clear, cold rivers, creeks, and ponds.	Present. Suitable habitat for the California giant salamander is present in the Program area, and the species has been observed at many Midpen preserves, including Tunitas Creek OSP, Skyline Ridge OSP, Sierra Azul OSP, Saratoga Gap OSP, Purisima Creek Redwoods OSP, Monte Bello OSP, Long Ridge OSP, La Honda Creek OSP, El Sereno OSP, El Corte de Madera Creek OSP, and Bear Creek Redwoods OSP (Midpen 2019, CDFW 2019a). It is most likely to occur near streams, but dispersing individuals could occur in nearby upland habitats.
Santa Cruz black salamander (*Aneides flavipunctatus niger*)	CSSC	Moist forests and riparian zones in or near clear, cold streams or seeps. This subspecies is mostly terrestrial, staying underground during dry periods and foraging for small invertebrates aboveground at night during wet weather.	Present. The Santa Cruz black salamander is endemic to California and is found in moist streamside habitats in woodlands and forests in the Santa Cruz Mountains in western Santa Clara, northern Santa Cruz, and southernmost San Mateo Counties. This species is found in moist forests and riparian zones in or near streams or seeps. This species has been observed at Sierra Azul OSP, as well as from Bear Creek Redwoods OSP, Long Ridge OSP, Monte Bello OSP, Russian Ridge OSP, and Saratoga Gap OSP (Midpen 2019, CDFW 2019a), and it likely occurs in suitable habitat at other Midpen preserves as well.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Red-bellied newt (*Taricha rivularis*)	CSSC	Moist forests and riparian zones, usually in or near clear, cold streams; range strongly associated with redwood (*Sequoia sempervirens*) forests.	Present. Suitable habitat for the red-bellied newt is present in the Program area, and the species is known to occur at Monte Bello OSP. However, because this recently discovered population is disjunct and isolated from the primary population, which is located in Humboldt, Mendocino, Lake, and Sonoma Counties by 80 miles (Reilly et al. 2014), this species is unlikely to occur at any other Midpen preserve.
Western pond turtle (*Actinemys marmorata*)	CSSC	Permanent or nearly permanent water in a variety of habitats. Preferred habitat features include partially submerged logs and branches for basking. Nests in uplands near waterbodies, particularly in grassland.	Present. Creeks, lakes, ponds, and freshwater marshes in the Program area provide suitable habitat for the western pond turtle. This species has been observed at La Honda Creek OSP, Bear Creek Redwoods OSP, Sierra Azul OSP, Russian Ridge OSP, Skyline Ridge OSP, Windy Hill OSP, and Long Ridge OSP (Midpen 2019; CDFW 2019a), and likely occurs in other preserves where suitable habitat is present.
Coast horned lizard (*Phrynosoma blainvillii*)	CSSC	Occurs in sandy, loose-textured soils interspersed with scattered shrubs in woodlands, grasslands, and shrublands.	Present. This species was historically known to occur throughout San Mateo County and the Program area. Although there are no recent records from San Mateo County, this species is known to persist in at least three Midpen preserves located in Santa Clara County, with recent records from Bald Mt in the Sierra Azul OSP (2009), Monte Bello OSP (2014), and five records from Rancho San Antonio OSP, including two recent records (2014 and 2018) (Midpen 2019; iNaturalist 2019).

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Northern harrier (*Circus hudsonius*)	CSSC (nesting)	Nests in marshes and moist fields, forages over open areas, including grasslands, marshes, and moist fields.	Present. In the Program area, during the breeding season the northern harrier occurs primarily in marshes and grasslands along the coast (Cornell Lab of Ornithology 2019). There is at least one breeding season occurrence at Tunitas Creek OSP, near potentially suitable habitat. Northern harriers observed during the summer in grassland habitat at Midpen preserves in the Santa Cruz Mountains, such as at Russian Ridge OSP, Skyline Ridge OSP, and La Honda Creek OSP are likely to only be foraging, as the San Mateo County Breeding Bird Atlas did not find this species nesting away from the coast or the San Francisco Bay (SAS 2001, Cornell Lab of Ornithology 2019).
Short-eared owl (*Asio flammeus*)	CSSC (nesting)	Nests on ground in tall emergent vegetation or grasses, forages over a variety of open habitats.	Absent as Breeder. In the Program area, the short-eared owl occurs primarily from October to March, with most records confined to coastal marshes, grasslands, and fallow fields and to tidal marshes of South San Francisco Bay (SAS 2001, Cornell Lab of Ornithology 2019). There are no known breeding season records from any Midpen preserves, and no breeding records away from the South Bay (SAS 2001, Cornell Lab of Ornithology 2019). This species may occur irregularly and in low numbers on current or future Midpen lands, but only as a nonbreeders.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Long-eared owl (*Asio otus*)	CSSC (nesting)	Riparian bottomlands with tall, dense willows and cottonwood stands; also dense live oak and California Bay along upland streams; forages primarily in adjacent open areas.	Present. There are scattered recorded of the long-eared owl throughout the Program area in appropriate habitat; based on known occurrences it is relatively scarce and local (SAS 2001, Cornell Lab of Ornithology 2019), but that impression may result at least in part from its very secretive nature. It is known to have nested at Monte Bello OSP, and there is at least one record of this secretive species from Russian Ridge OSP (CDFW 2019a, Cornell Lab of Ornithology 2019). There is some potential for this species to occur on almost any Midpen land, such as Coal Creek, Los Trancos, Monte Bello, Russian Ridge, Rancho San Antonio, and Sierra Azul OSPs, though due to its scarcity, it is likely present in only a small subset of Midpen lands.
Burrowing owl (*Athene cunicularia*)	CSSC	Open grasslands and ruderal habitats with suitable burrows, usually those made by California ground squirrels.	Absent as Breeder. In the Program area, the burrowing owl occurs as a rare winter visitor to more extensive grasslands. Most wintering records are from the coast, such as from Tunitas Creek OSP, but individuals have been detected in winter at Windy Hill OSP, Purisima Creek Redwoods OSP, and La Honda Creek OSP. At least one individual is known to have overwintered at Russian Ridge OSP (Cornell Lab of Ornithology 2019). A statewide survey conducted between 1991 and 1993 indicated that breeding owls had nearly been extirpated from San Mateo County where only one to two known breeding pairs remained (DeSante et al. 2007). Recent records in the Program area are all of wintering birds or migrants (CDFW 2019a, Cornell Lab of Ornithology 2019).

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Vaux's swift (*Chaetura vauxi*)	CSSC (nesting)	Nests in snags in coastal coniferous forests or, occasionally, in chimneys; forages aerially.	Present. In the Program area, Vaux's swift breeds in mature redwood forests and occasionally in chimneys in residential areas (SAS 2001, Rottenborn 2007a). There are numerous breeding season records from Midpen preserves along the crest of the Santa Cruz Mountains with records Monte Bello OSP, Skyline Ridge OSP, Windy Hill OSP, Rancho San Antonio, and Mt. Umunhum in Sierra Azul OSP, but no evidence of nesting at any Midpen preserve. It is possible that small numbers may nest in Midpen preserves in hollows in large redwoods or Douglas-firs, but this species occurs in the Program area primarily as a spring and fall migrant (Cornell Lab of Ornithology 2019).
Black swift (*Cypseloides niger*)	CSSC (nesting)	Nest behind waterfalls in the Sierra Nevada, and formerly at Big Basin State Park, and in sea caves along coastal bluffs in San Mateo County and Santa Cruz County. Forages aerially for insects.	Present. In the Program area, the black swift occurs primarily along the coast and coastal ranges, although it can forage and fly over virtually any area (Cornell Lab of Ornithology 2019). In the Program vicinity, the only known breeding location is at Anõ Nuevo State Park (SAS 2001, Cornell Lab of Ornithology 2019). Suitable nesting habitat is absent from Midpen preserves, but the species has been observed at Windy Hill OSP, Skyline Ridge OSP, Monte Bello OSP, and Russian Ridge OSP (Cornell Lab of Ornithology 2019). These birds could be either migrants or coastal nesters flying inland to forage.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Olive-sided flycatcher (*Contopus cooperi*)	CSSC (nesting)	Breeds in mature forests with open canopies, along forest edges in more densely vegetated areas, in recently burned forest habitats, and in selectively harvested landscapes (Altman and Sallabanks 2000, Robertson and Hutto 2007).	Present. The olive-sided flycatcher breeds in montane and coastal forests and woodlands in the Program area. During spring and fall migration, it can occur anywhere in the Program area (Cornell Lab of Ornithology 2019). Has been observed, and presumably breeds, at La Honda Creek OSP, Russian Ridge OSP, Skyline Ridge OSP, Long Ridge OSP, Rancho San Antonio OSP, Los Trancos OSP, Coal Creek OSP, and Monte Bello OSP (Cornell Lab of Ornithology 2019). Suitable habitat is present at most Midpen preserves, and small numbers may breed at nearly any preserve.
Purple martin (*Progne subis*)	CSSC (nesting)	Nest in abandoned woodpecker holes. Forages aerially for insects.	Present. Purple martins occur in San Mateo County as rare migrants along the coast and very rare and local breeders along the ridgeline of the Santa Cruz Mountains (SAS 2001, Rana Creek Habitat Restoration 2002, Cornell Lab of Ornithology 2019). Known summering and nesting locations include the southern edge of Sierra Azul OSP along Loma Prieta Road (Cornell Lab of Ornithology 2019). Suitable habitat may exist at other preserves, but this species is a scarce and very local breeder in the Program area, and it is expected to occur in Midpen preserves primarily as a scarce migrant.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Loggerhead shrike (*Lanius ludovicianus*)	CSSC (nesting)	Nests in tall shrubs and dense trees; forages in grasslands, marshes, and ruderal habitats.	Present. Grassland, ruderal, and marsh communities throughout the Program area provide potentially suitable nesting and foraging habitat for this species. However, it occurs primarily as a migrant and wintering visitor along the coastal and San Francisco Bay lowlands, and is generally absent from the crest of the Santa Cruz Mountains. Due to population declines, it is currently a rare breeder in the Program area, and only a few may nest in preserves (particularly those with extensive grassland). The few known recent nesting records from San Mateo County are all from the San Francisco Bay lowlands, outside the Program area (SAS 2001, Cornell Lab of Ornithology 2019).

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Yellow-breasted chat (*Icteria virens*)	CSSC (nesting)	Nests in a variety of habitats with low, dense vegetation without a closed tree canopy, including shrubby habitat along stream, swamp, and pond margins, forest edges, fencerows, and upland thickets of recently abandoned farmland.	Absent as breeder. This species has been recorded very infrequently in the Program area, with scattered records throughout San Mateo County and Santa Clara County, typically singing birds present for a single day in May or June. These birds are likely spring overshoots. There are at least two records from Midpen preserves, a historical record of a bird from La Honda Creek OSP in 1956, and a May 14, 2019 record from Alpine Pond at Russian Ridge OSP (Cornell Lab of Ornithology 2019). South of the Program area, in southern Santa Clara County and northern San Benito County, this species is a very scarce breeder, nesting almost exclusively in willow-dominated riparian habitats, often where thick clumps of willows are interspersed with or adjacent to weedy open areas. This species is not expected to occur in the Program area on a regular basis, and is not known to currently breed in the Program area; at most, an occasional pair might breed on Midpen lands.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Yellow warbler (*Setophaga petechia*)	CSSC (nesting)	Nests in riparian woodlands. Suitable breeding habitat consists of riparian corridors, often with an overstory of mature cottonwoods and sycamores, a mid-story of box elder and willow, and a substantial shrub understory (Bousman 2007).	Present. The yellow warbler is an uncommon to rare breeder in wooded riparian habitats throughout the Program area, occurring primarily in association with alders, cottonwoods, and willows, in both San Mateo County and Santa Clara County. Riparian woodlands provide suitable nesting and foraging habitat for this species, but the species is scarce and local, being particularly scarce as a breeder on the immediate coast (SAS 2001). It breeds in somewhat greater numbers in Santa Clara County. It is an abundant migrant during the spring and fall (Cornell Lab of Ornithology 2019). This species has been observed during the breeding season at Los Trancos OSP and Windy Hill OSP, and it likely breeds in small numbers in Midpen preserves providing suitable riparian breeding habitat (Cornell Lab of Ornithology 2019).

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
San Francisco common yellowthroat (*Geothlypis trichas sinuosa*)	CSSC	Nests in herbaceous vegetation, usually in wetlands or moist floodplains.	Present. Freshwater marsh habitat, as well as willow riparian habitat and even dense weedy vegetation throughout much of the Program area, provides suitable breeding and foraging habitat for this subspecies. This subspecies could nest at any Midpen preserve that contains potentially suitable habitat such as Mindego Lake at Russian Ridge OSP, Alpine Pond at Russian Ridge OSP, or farm ponds or weedy vegetation at Tunitas Creek. During the breeding season, the species has been observed at Skyline Ridge OSP, La Honda Creek OSP, Purisima Creek OSP, and Windy Hill OSP (Cornell Lab of Ornithology 2019). The approximate southern edge of the range of *G. t. sinuosa* is thought to be at approximately Lexington Reservoir. South of Lexington Reservoir, in Sierra Azul OSP, common yellowthroats present during the breeding season are likely of the subspecies *arizela*.
Grasshopper sparrow (*Ammodramus savannarum*)	CSSC (nesting)	Breeds and forages in grasslands, meadows, fallow fields, and pastures.	Present. Breeding grasshopper sparrows occur in relatively low numbers in extensive grasslands throughout the Program area (SAS 2001, Cornell Lab of Ornithology 2019, Unitt 2008). This species been observed at Tunitas Creek OSP, La Honda Creek OSP, Russian Ridge OSP, Miramontes Ridge OSP, Monte Bello OSP, Skyline Ridge OSP, and Windy Hill OSP (Midpen 2019, Cornell Lab of Ornithology 2019), and suitable habitat may exist at other preserves.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Alameda song sparrow (*Melospiza melodia pusillula*)	CSSC	Breeds and forages almost exclusively in tidally influenced salt marsh, dominated by cordgrass and gumplant, and is occasionally found in brackish marshes dominated by bulrushes (Rottenborn 2007b). However, this subspecies is not expected to disperse upstream into adjacent freshwater habitats.	Absent. Within San Mateo County, the Alameda song sparrow is known to occur only in tidally influenced salt and brackish marshes along San Francisco Bay (Chan and Spautz 2008). No Midpen OSPs in this Program Area include bayside tidal marsh habitat.
Bryant's savannah sparrow (*Passerculus sandwichensis alaudinus*)	CSSC	Outside the Program area, nests in pickleweed-dominant salt marsh and adjacent ruderal habitat. Within the Program area, nests in extensive grasslands in the Santa Cruz Mountains.	Present. Extensive grasslands in the Santa Cruz Mountains provides suitable breeding and foraging habitat for this species. Savannah sparrows have been observed during at La Honda Creek OSP, Windy Hill OSP, Monte Bello OSP, Russian Ridge OSP, Skyline Ridge OSP, Pichetti Ranch OSP, and Sierra Azul OSP (Cornell Lab of Ornithology 2019). Suitable habitat for this species may be present at other Midpen preserves as well, although this species appears to have declined in abundance in Santa Cruz Mountains grasslands in recent decades, and it is unlikely to be more than a scarce and local breeder. Larger numbers of savannah sparrows of multiple subspecies occur in grasslands throughout the Program area during migration and winter.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
San Francisco dusky-footed woodrat (*Neotoma fuscipes annectens*)	CSSC	Nests in a variety of habitats including riparian areas, oak woodlands, and scrub.	Present. Woodlands and scrub throughout the Program area provide suitable nesting and foraging habitat for this relatively common species, which can be abundant in some areas. Stick nests may be placed in trees, shrubs, or on the ground. This species may also nest in and around old structures.
Pallid bat (*Antrozous pallidus*)	CSSC	Forages over many habitats; roosts in caves, rock outcrops, buildings, and hollow trees.	Present. This species has been recorded in scattered locations in open areas and along roads of the Pacific coastal regions and the Santa Cruz Mountains within the Program area. While this species is apparently extirpated from the urban Santa Clara Valley floor, with no recent records, it is known to occur at several Midpen preserves, with multiple records in the past 20 years from La Honda Creek OSP, as well as recent records from El Sereno OSP, Pichetti Ranch OSP, Skyline Ridge OSP, and Bear Creek Redwoods OSP. There is also one relatively recent record and from Hicks Rd, near Sierra Azul OSP (Midpen 2019, CDFW 2019a). This species may occur in Midpen preserves with old buildings or large trees (especially oaks) with large cavities. However, pallid bats are expected to occur in low numbers and only in limited areas.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Western red bat (*Lasiurus blossevillii*)	CSSC	Roosts in foliage in forest or woodlands, especially in or near riparian habitat.	Present. The western red bat is a migratory species that occurs from Shasta County to the Mexican border, west of the Sierra Nevada (CDFG 2008). Both day and night roosts usually are located in the foliage of trees. This species day roosts and night roosts in the foliage of trees except during inclement weather periods in winter when it is expected to roost on the ground under leaf litter. Females typically give birth to twins in June and maternity roosts, sites where females give birth and raise young, occur in mature lowland riparian habitat in the Central Valley and some coastal valleys from Salinas Valley south. Western red bats do not raise young in the San Francisco Bay Area west of the Delta; however, males and females overwinter throughout forested and wooded areas of the Bay Area region, particularly along creek riparian habitats. Western red bats have been detected in a number of Midpen preserves, such as Rancho San Antonio, El Sereno, Skyline Ridge, Monte Bello, Bear Creek Redwoods, La Honda Creek, Pichetti Ranch, Monte Bello, Sierra Azul, Skyline Ridge, and Purisima Creek Redwoods OSPs (Midpen 2019).

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Townsend's big-eared bat (*Corynorhinus townsendii*)	SC, CSSC	Roosts in caves and mine tunnels, and occasionally in deep crevices in trees such as redwoods or in abandoned buildings, in a variety of habitats.	Present. This species is a scarce resident of the Program area, potentially roosting in old mines, caves, very large cavities in redwood trees, and barns and abandoned buildings in the Santa Cruz Mountains. Townsend's big-eared bats have been detected at several Midpen preserves, including Bear Creek Redwoods OSP, La Honda Creek OSP, Long Ridge OSP, Pichetti Ranch OSP, Russian Ridge OSP, Skyline Ridge OSP, Sierra Azul OSP, and Windy Hill OSP (Midpen data). This species has also been detected at Tunitas Creek Beach, less than 1/2 mile from Midpen's Tunitas Creek OSP. Many of these records are very recent, within the past three years, and in many instances, detections have occurred during the known breeding season for this species, which extends through August. In many cases, Townsend's big-eared bats detected in Midpen preserves have been found in buildings, such as sheds or barns. Therefore, this species may occur in a number of Midpen preserves, albeit in very small numbers.
American badger (*Taxidea taxus*)	CSSC	Burrows in grasslands and occasionally in infrequently disked agricultural areas.	Present. Badgers are present in low numbers in open habitats of the Program area, with many recent records from Midpen preserves along the crest of the Santa Cruz Mountains that have open grasslands, including Skyline Ridge OSP, Russian Ridge OSP, Windy Hill OSP, Tunitas Creek OSP, Monte Bello OSP, Coal Creek OSP, and La Honda Creek OSP. Suitable habitat may exist at other preserves. However, populations of this species in the Santa Cruz Mountains are likely low, and this species is expected to occur only in low numbers in any Midpen preserve.

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
State Fully Protected Species			
White-tailed kite (*Elanus leucurus*)	SP	Nests in tall shrubs and trees, forages in grasslands, marshes, and ruderal habitats.	Present. Grasslands within the Program area provide suitable breeding and foraging habitat. Has been observed at the following Midpen preserves — Russian Ridge OSP, Los Trancos OSP, Windy Hill, Monte Bello OSP, Coal Creek OSP, Pichetti Ranch OSP, La Honda Creek OSP, Purisima Creek Redwoods OSP, and Pulgas Ridge OSP (Cornell Lab of Ornithology 2019). Suitable habitat is present at other preserves, and this species may occur in relatively low numbers in any preserve with more than a minimal amount of grassland.
American peregrine falcon (*Falco peregrinus anatum*)	SP	Forages in many habitats; nests on cliffs and tall bridges and buildings.	Absent as breeder. American peregrine falcons may forage in suitable habitat throughout the Program area. Recently, the species has been documented nesting along the Devil's Slide Coastal Trail, within the Program Area in San Mateo County, and it is known to nest at Castle Rock State Park, just outside the Program area. It is possible that it may nest on cliffs elsewhere in the Program area. Although there are no known nest sites nor suitable nesting habitat in any Midpen preserve, small numbers of individuals can occur virtually anywhere while foraging. Has been observed at La Honda Creek OSP, El Corte de Madera Creek OSP, Purisima Creek Redwoods OSP, Thornewood OSP, Rancho San Antonio OSP, Monte Bello OSP, Skyline Ridge OSP, Long Ridge OSP, and Sierra Azul OSP (Cornell Lab of Ornithology 2019).

Common Name[1] (Scientific Name)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Golden eagle (*Aquila chrysaetos*)	SP	Breeds on cliffs or in large trees (rarely on electrical towers), forages in open areas.	Present. In the Program area, the golden eagle is an uncommon to rare permanent resident (Cornell Lab of Ornithology 2019). It occurs sparingly in open spaces throughout the Program area, primarily as a nonbreeder, although a few pairs may nest (SAS 2001). Has been observed at Sierra Azul OSP, La Honda Creek OSP, Russian Ridge OSP, Coal Creek OSP, Rancho San Antonio OSP, Pichetti Ranch OSP, Monte Bello OSP, Skyline Ridge OSP; Purisima Creek Redwoods OSP, and Windy Hill OSP. Suitable habitat for foraging may exist at other preserves. Although no nest sites are known to occur in any Midpen preserves, this species nests very nearby (e.g., at Almaden-Quicksilver County Park), and it is possible that very low numbers of pairs could nest in Midpen preserves.
Ringtail (*Bassariscus astutus*)	SP	Cavities in rock outcrops and talus slopes, as well as hollows in trees, logs, and snags that occur in riparian habitats and dense woodlands, usually in close proximity to water.	Present. The status of this species in Santa Clara and San Mateo County is not well known. Although this species' strictly nocturnal habits may be at least partially responsible for the lack of information on its distribution in these counties, it is likely very rare because of the lack of sightings and the scarcity of roadkill records (e.g., compared to the nocturnal American badger, which is much more frequently detected by roadkill). Suitable habitat is present in portions of the Program area that contain dense woodlands and/or rocky outcroppings. It is known to have occurred at Sierra Azul OSP, Saratoga Gap OSP, and Long Ridge OSP (Midpen 2019), and may be present at other Midpen preserves, although it is expected to be rare and local.

Notes:

[1] Special-status species are listed in the following order: state or federally listed, proposed, or candidate species first, followed by California species of special concern, then species classified as fully protected. Within each of those groups, species are listed in the following order: invertebrates, fish, amphibians, reptiles, birds, then mammals.

[2] Status Codes: FE = Federally Endangered; FT = Federally Threatened; FC = Candidate for Federal Listing; SE = State Endangered; ST = State Threatened; SC = Candidate for State Listing; CSSC = California Species of Special Concern; SP = State listed as Fully Protected

[3] The CDFW is currently considering a petition to list the Central Coast mountain lion population (which includes individuals in the Program area) and the Southern California population as threatened. For the purposes of this document, the mountain lion is considered a candidate for state listing until CDFW determines otherwise.

This page intentionally left blank

4.4 Invasive Animals and Plants, Noxious Weeds, and Pathogens

For over two centuries, humans have brought non-native plants and wildlife into the region, either accidentally (e.g., as stowaways in cargo shipments or in ballast water) or intentionally (e.g., imported for food, ornamental landscaping, sport, or as pets), and many of these species have now been introduced into the wild. Such species that cause ecological harm and, once established, spread quickly from their point of introduction are often called "invasive" species.

Invasive species affect native species and habitats in several ways, including by altering nutrient cycles and hydrologic cycles; by creating changes in sediment deposition and erosion; by dominating habitats and displacing native species; by competing with native species for resources, by preying on native species, by transmitting diseases, and by hybridizing with native species (Bossard et al. 2000). In California, approximately 3 percent of the plant species growing in the wild are considered invasive, but they inhabit a much greater proportion of the landscape (California Invasive Species Council [Cal-IPC] 2019). Their effects on natural communities also may lead to direct effects on human activities, such as clogging waterways and water delivery systems, weakening flood protection structures, damaging crops, and diminishing sport fish populations (CDFW 2019c).

Invasive species present complex management issues because they can continue to spread and invade new areas even when they are no longer being actively introduced. Common characteristics of invasive plant species that allow them to outcompete native vegetation and establish more quickly on newly exposed substrates (e.g., eroding river banks, wildfire scars, and flood-scoured floodplains and bars) include the following:

- More than one seed dispersal mechanism with prodigious quantities of seed production
- Longer season of viable seed release, dispersal, and germination potential
- Dormant seed or rhizome viability over many years
- Greater range of tolerance of inundation, scour, or dry season soil moisture deficits
- Fast growth rates, stump sprouting, and fast recovery from top removal
- Symbiotic relationships with nitrogen-fixing bacteria

4.1.13 Invasive Plants

Plant pests are defined by law, regulation, and technical organizations. The Cal-IPC (2019) ranks invasive plants across the state based on the magnitude of ecological impact in California, as well as the extent of the species' occurrence or impact, as follows:

High – Species has severe ecological impacts on physical processes, plant and animal communities, and vegetation structure

Moderate – Species have substantial and apparent ecological impacts on physical processes, plant and animal communities, and vegetation structure

Limited – Species are invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score

Alert – An Alert is listed on species with High or Moderate impacts that have limited distribution in California, but may have the potential to spread much further.

Invasive plants are also regulated by a number of sources, including the California Department of Food and Agriculture (CDFA) and the United States Department of Agriculture's Animal and Plant Health Inspection Service. The CDFA (2019) uses an action-oriented pest-rating system. The rating assigned to a pest by the CDFA does not necessarily mean that one with a low rating is not a problem; rather the rating system is meant to prioritize response by the CDFA and county agricultural commissioners. The Cal-IPC has developed a list of plant pests specific to California wildlands, based on information submitted by land managers, botanists, and researchers throughout the state and on published sources. The term "noxious weed" is used by government agencies for non-native plants that have been defined as pests by law or regulation.

The following CDFA designations reflect the importance of the pest:

A – A pest of known economic or environmental detriment and is either not known to be established in California or it is present in a limited distribution that allows for the possibility of eradication or successful containment

B – A pest of known economic or environmental detriment and, if present in California, it is of limited distribution

C – A pest of known economic or environmental detriment and, if present in California it is usually widespread

The Midpen Integrated Pest Management (IPM) Program was established in 2014 and is directed by the IPM Guidance Manual (Midpen 2014) with the stated goal to "Control pests by consistent implementation of IPM principles to protect and restore the natural environment and provide for human safety and enjoyment while visiting and working on Midpen lands" (Midpen 2014).

A number of invasive and pest plant species found on Midpen lands are treated on an on-going basis to control for asset-based protection and long-term management. Table 4-3 provides the list of these species along with their Cal-IPC and CDFA ratings. Midpen considers species with a CAL-IPC rating or CDFA rating to be invasive species, and those species in Table 4-3 without a rating to be pest species.

Table 4-3. Invasive and Pest Plant Species Treated on Midpen Preserves

Scientific Name	Common Name	Cal-IPC rating	CDFA Designation
Acacia baileyana	Cootamundra wattle	-	-
Acacia dealbata	Silver wattle	Moderate	-
Acacia melanoxylon	Blackwood acacia	Limited	-
Acacia pycnantha	Golden wattle	-	-
Aegilops cylindrica	Jointed goatgrass	-	Noxious Weed
Aegilops triuncialis	Goatgrass	High	Noxious Weed
Agrostis avenacea	Pacific bentgrass	Limited	-
Ailanthus altissima	Tree of heaven	Moderate	Noxious Weed
Aira caryophyllea	Silvery hairgrass	-	-
Allium vineale	Vineyard onion	-	Noxious Weed
Anthemis cotula	Dog fennel	-	-
Arctotheca prostrata	Prostrate cape weed	Moderate	-
Arundo donax	Giant reed	High	Noxious Weed
Avena barbata	Slim oat	Moderate	-
Avena fatua	Wildoats	Moderate	-
Bassia hyssopifolia	Fivehorn smotherweed	Limited	-
Bellardia trixago	Mediterranean lineseed	Limited	-
Brachypodium distachyon	Purple false brome	Moderate	-
Brachypodium sylvaticum	Slender false brome	Moderate	Noxious Weed
Brassica nigra	Black mustard	Moderate	-
Brassica rapa	Common mustard	Limited	-
Brassica rapa var. *rapa*	Turnip	Limited	-

Scientific Name	Common Name	Cal-IPC rating	CDFA Designation
Briza maxima	Rattlesnake grass	Limited	-
Bromus diandrus	Ripgut brome	Moderate	-
Bromus hordeaceus	Soft chess	Limited	-
Buddleja davidii	Butterfly bush	-	-
Carduus pycnocephalus	Italian thistle	Moderate	Noxious Weed
Carduus tenuiflorus	Slender flowered thistle	Limited	Noxious Weed
Carex pendula	Hanging sedge	-	-
Carthamus lanatus	Woolly distaff thistle	Moderate	Noxious Weed
Centaurea calcitrapa	Purple star thistle	Moderate	Noxious Weed
Centaurea melitensis	Tocalote	Moderate	Noxious Weed
Centaurea solstitialis	Yellow starthistle	High	Noxious Weed
Centaurea stoebe ssp. *micranthos*	Spotted knapweed	High	Noxious Weed
Cirsium vulgare	Bullthistle	Moderate	Noxious Weed
Clematis vitalba	Old man's beard	Moderate	-
Conium maculatum	Poison hemlock	Moderate	-
Convolvulus arvensis	Field bindweed	-	Noxious Weed
Cordyline australis	Cabbage tree	Limited	-
Cortaderia jubata	Andean pampas grass	High	Noxious Weed
Cotoneaster franchetii	Cotoneaster	Moderate	-
Crataegus monogyna	Hawthorn	Limited	-
Crocosmia x crocosmiiflora	Monbretia	Limited	-
Cynodon dactylon	Bermuda grass	Moderate	-

Scientific Name	Common Name	Cal-IPC rating	CDFA Designation
Cynosurus echinatus	Dogtail grass	Moderate	-
Cytisus scoparius	Scotch broom	High	Noxious Weed
Dactylis glomerata	Orchardgrass	Limited	-
Delairea odorata	Cape ivy	High	Noxious Weed
Digitalis purpurea	Foxglove	Limited	-
Dipsacus fullonum	Wild teasel	Moderate	-
Dittrichia graveolens	Stinkwort	Moderate	Noxious Weed
Ehrharta erecta	Upright veldt grass	Moderate	-
Elymus caput-medusae	Medusa head	High	Noxious Weed
Erodium cicutarium	Coastal heron's bill	Limited	-
Erodium moschatum	Whitestem filaree	-	-
Eucalyptus globulus	Blue gum	Limited[1]	-
Euphorbia lathyris	Gopher plant	-	-
Euphorbia oblongata	Eggleaf spurge	Limited	Noxious Weed
Festuca arundinacea	Reed fescue	Moderate	-
Festuca myuros	Rattail sixweeks grass	Moderate	-
Festuca perennis	Italian rye grass	Moderate	-
Ficus carica	Common fig	Moderate	-
Foeniculum vulgare	Fennel	High	-
Genista monspessulana	French broom	High	Noxious Weed
Geranium dissectum	Wild geranium	Limited	-
Geranium molle	Crane's bill geranium	-	-
Geranium purpureum	Herb robert	Limited	-

Scientific Name	Common Name	Cal-IPC rating	CDFA Designation
Geranium robertianum	Robert's geranium	-	-
Hedera canariensis	Canary ivy	High	-
Hedera helix	English ivy	High	-
Helminthotheca echioides	Bristly ox-tongue	Limited	-
Hesperocyparis macrocarpa	Monterey cypress	-	-
Hirschfeldia incana	Mustard	Moderate	-
Holcus lanatus	Common velvetgrass	Moderate	-
Hordeum murinum	Foxtail barley	Moderate	-
Hypericum perforatum	Klamathweed	Limited	Noxious Weed
Hypochaeris glabra	Smooth cats ear	Limited	-
Hypochaeris radicata	Hairy cats ear	Moderate	-
Ilex aquifolium	Holly	Limited	-
Kniphofia uvaria	Redhot poker	-	-
Lactuca serriola	Prickly lettuce	-	-
Lepidium draba	Whitetop	Moderate	Noxious Weed
Lepidium latifolium	Perennial pepperweed	High	Noxious Weed
Leucanthemum vulgare	Oxe eye daisy	Moderate	-
Ligustrum lucidum	Glossy privet	Limited	-
Lotus corniculatus	Bird's foot trefoil	-	-
Lythrum hyssopifolium	Hyssop loosestrife	Moderate	-

Scientific Name	Common Name	Cal-IPC rating	CDFA Designation
Marrubium vulgare	White horehound	Limited	-
Medicago polymorpha	California burclover	Limited	-
Melilotus albus	White sweetclover	-	-
Myosotis latifolia	Wide leaved forget me not	Limited	-
Nerium oleander	Oleander	-	-
Olea europaea	Olive	Limited	-
Oxalis pes-caprae	Bermuda buttercup	Moderate	-
Paspalum urvillei	Vasey's grass	-	-
Phalaris aquatica	Harding grass	Moderate	-
Phoenix canariensis	Canary island date palm	Limited	-
Pinus radiata	Monterey pine	-	-
Pistacia chinensis	Chinese pistachio	-	-
Pittosporum undulatum	Victorian box	-	-
Plantago coronopus	Cut leaf plantain	-	-
Plantago lanceolata	Ribwort	Limited	-
Polypogon monspeliensis	Annual beard grass	Limited	-
Prunus cerasifera	Cherry plum	Limited	-
Pyracantha coccinea	Scarlet firethorn	Limited	-
Robinia pseudoacacia	Black locust	Limited	-
Rubus armeniacus	Himalayan blackberry	High	-
Rumex acetosella	Sheep sorrel	Moderate	-
Rumex crispus	Curly dock	Limited	-

Scientific Name	Common Name	Cal-IPC rating	CDFA Designation
Rytidosperma penicillatum	Purple awned wallaby grass	Limited	-
Salsola soda	Alkali russian thistle	Moderate	-
Schinus molle	Peruvian pepper tree	Limited	-
Senecio minimus	Coastal burnweed	-	-
Silybum marianum	Milk thistle	Limited	-
Spartium junceum	Spanish broom	High	Noxious Weed
Stipa miliacea var. *miliacea*	Smilo grass	Limited	-
Taraxacum officinale	Red seeded dandelion	-	-
Torilis arvensis	Field hedge parsley	Moderate	-
Trifolium hirtum	Rose clover	Limited	-
Ulex europaeus	Gorse	High	Noxious Weed
Vicia villosa	Hairy vetch	-	-
Vinca major	Vinca	Moderate	-
Zantedeschia aethiopica	Callalily	Limited	-

Notes:
1: Although Cal-IPC rates this as "Limited", Midpen rates it as "Moderate."

4.1.14 Invasive Animals

As described above, the introduction of non-native animal species can be detrimental to native species assemblages. Non-native animal species distribution and abundance in the Program area is poorly known, but species known to occur include the American bullfrog, mosquitofish, crayfish (*Pacifastacus leniusculus* and *Procambarus clarkii*), red-eared slider (*Trachemys scripta elegans*). A few of the more common introduced/invasive wildlife and fish species present, or with a high potential to be introduced, are discussed below.

Mosquitofish have been introduced throughout the world, including the Program area, to control mosquito populations. Such introductions have been shown to have negative effects on amphibians in experimental studies, including decreased survival of larval Sierran chorus frogs

and California newts (Gamradt and Kats 1996), as well as tail injury, reduced metamorph size, and altered activity patterns of larval California red-legged frogs (Lawler et al. 1999).

Largemouth bass were first introduced into California at Lake Cuyamaca (San Diego County) in 1891 and are now found throughout California (CDFW 2019b). Two subspecies are recognized, the northern subspecies *M. s. salmoides*, and the Florida subspecies *M. s. floridanus*. Research suggests that the introduction of largemouth bass can negatively affect populations of small native fishes and ranid frogs, including California red-legged frogs, through predation. This species is known to occur at Alpine Pond at Skyline Ridge Open Space Preserve (iNaturalist 2019).

The American bullfrog has been accidentally and intentionally introduced (e.g., for food in the 1920s by commercial frog farmers) throughout the world and is now established throughout most of the western United States, including the Program area (CalHerps 2019). The species' large size, mobility, generalized eating habits (their prey includes native amphibians as well as other aquatic and riparian vertebrates [Graber 1996]), and aggressive behavior have made bullfrogs extremely successful invaders and a threat to biodiversity (AmphibiaWeb 2008). Bullfrogs are present in some Midpen preserves, and Midpen performs bullfrog management as necessary.

It has been suggested that where western pond turtles and non-native turtles co-occur there may be a negative impact on the western pond turtles (particularly by red-eared sliders) through competition and possibly the introduction of disease (Spinks et al 2003; Thomson et al. 2010). Spinks et al. (2003) observed that, where they co-occur, the larger red-eared sliders seem to dominate the more desirable basking spots (secluded areas with floating or protruding woody debris), whereas western pond turtles are more scattered and bask on the lesser desirable open banks. They attributed this to the ability of the larger red-eared sliders to displace western pond turtles from the more desirable basking spots. The extent to which non-native turtles impact the western pond turtle population has not been specifically studied, but it can be assumed that larger non-native turtles, specifically red-eared sliders, probably outcompete the smaller western pond turtle for resources required by both species.

Feral pigs (*Sus scrofa*) are also present on Midpen lands. This exotic species is the ancestor of European wild boars and domestic pigs, with which they freely hybridize (Frederick 1998); was intentionally introduced to North America for hunting; and is now the most abundant wild-living introduced ungulate in the United States (Mayer and Brisbin 1991). Feral pigs are highly adaptable, can inhabit a wide range of environments, are omnivorous and can survive on a great variety of food resources, and are capable of rapid increases in population (Baskin and Dannell 2003). Feral pigs can cause substantial environmental damage (Cushman et al. 2004) and present health, and safety concerns to humans, livestock, and wildlife in California (Kreith 2007, Barrios-Garcia and Ballari 2012). Feeding and rooting activities of feral pigs can damage ecosystems by disturbing soil, uprooting plants, and modifying physical characteristics and resources. Soil disturbance by pigs facilitates invasion by exotic plant species, increases exotic

plant species diversity, and can reduce vegetative soil cover (Cushman et al. 2004). In addition to damaging pastures and causing disturbance in riparian areas (Barrios-Garcia and Ballari 2012), rooting behavior and movements can damage fencing, gates, water troughs, and other infrastructure. Feral pigs feed not only on plants, but also on other animal species, potentially impacting other wildlife populations (Jolley et al. 2010, Barrios-Garcia and Ballari 2012).

Other non-native mammal species such as feral house cats (*Felis catus*), red foxes (*Vulpes vulpes*), Norway rats, and muskrats (*Ondatra zibethicus*), all of which are significant predators of native birds, are also known to occur in the Program area.

4.1.15 Pathogens

Phytophthora

Phytophthora are microscopic oomycetes (water molds). Almost all of the more than 120 *Phytophthora* species described to date are pathogenic to plants. Diseases caused by *Phytophthora* species include root rots, stem cankers, and fruit and leaf blight. Host ranges of *Phytophthora* species can be narrow or wide, but are mainly unknown for most California native plants. Several recent studies have addressed impacts on native plants in the San Francisco Bay Area and northern California native habitats. In particular, an astonishing number of *Phytophthora* species (over 40 Phytophthora species recovered from plants in 22 different host families) have been detected in nursery stock planted into habitat areas in restoration projects in California (Bourret 2018, Phytosphere Research 2018, Rooney-Latham et al 2015). Primarily spread via contaminated soil and water (some species are aerially dispersed), *Phytophthora* pathogens can affect plants in a variety of habitats, from dry chaparral and woodland to mesic wetlands and riparian plant communities. Once introduced into native habitats, *Phytophthora* persists in soil and infected host roots. Once *Phytophthora* infestations expand beyond very limited areas, they are very difficult to impossible to eradicate (Swiecki and Bernhardt 2014).

Perhaps the most well-known result of *Phytophthora* infestations is sudden oak death (SOD), a forest disease that attacks oaks and tanoak. This disease has caused widespread loss of oaks in coastal areas from Monterey County, California north to southwestern Oregon. Midpen has collected considerable data on the occurrence of SOD on its lands through monitoring and testing and has been working with plant nurseries to discourage the spread of SOD through planting of infected materials.

Chytrid Fungus

Batrachochytrium dendrobatidis (Bd) is a species of chytrid fungus that is only found in amphibians. It has been found in most of the world's approximately 6,000 amphibian species (AmphibianArk 2019). The Bd fungus infects the skin with large numbers of spores, and changes the structure of skin cells so that abnormal electrolyte levels occur in the Bd-damaged skin, and subsequently the animal's heart, which can lead to amphibian to die by causing the heart to stop

beating (Voyles et al. 2009). Moreover, chytridiomycosis (the disease caused by Bd) can cause very rapid and sharp declines in amphibian populations, sometimes in just a few weeks (Lips et al. 2006), and can disproportionately impact species that are rare, specialized, and endemic (Smith et al. 2009). Infection with Bd is spread by zoospores, a form of the fungus that moves through water or most environments, including on soil, equipment, or on the skin of infected amphibians themselves. It is possible that zoospores may also be transmitted via boots, invertebrates, or birds (AmphibianArk 2019).

B. dendrobatidis does not adversely affect all amphibian species that come into contact with it, and it does not kill all amphibian species. Some species, such as the introduced American bullfrog, are known to be resistant, and can serve as carriers of Bd. Multiple factors, including symbiotic bacteria that discourage the growth of Bd, "antimicrobial peptides" that discourage the growth of Bd, and genetic resistance likely play roles in whether amphibians become infected, and whether the infection is lethal (AmphibianArk 2019).

Midpen has developed, and implements, intensive decontamination protocols for all aquatic gear to inhibit the spread of Bd on its lands.

This page intentionally left blank

Chapter 5. Culvert, Bridge, Channel Pond, and Other Facility Maintenance

This Chapter identifies and describes Open Space Maintenance and Restoration Program (OSMRP or Program) activities at culverts, bridges, channels, water supply facilities, ponds, and other drainage features. Other minor maintenance activities conducted by Midpeninsula Regional Open Space District (Midpen) are described at the end of the chapter.

5.1 Culvert and Bridge Maintenance

5.1.1 Culvert Repair or Replacement

Corroded culvert requiring replacement along Ipiwa Trail in Skyline Ridge Open Space Preserve (OSP or Preserve)

Midpen maintains over 900 culverts, including ditch relief and stream crossings, which commonly require routine repair or replacement due to improper installation prior to Midpen land acquisition, material deterioration (e.g., bottom of a corrugated metal pipe (CMP) culvert is beginning to rust), damaged headwalls and energy dissipaters, or eroding outfalls. Culverts may be severely damaged, plugged, buried, or otherwise not functioning properly. Causes of culvert failures may include improper sizing, misalignment, and/or the age of materials. Culvert failure or deterioration typically reduces hydraulic capacity due to flow obstruction and blocking, sediment accumulation, or other debris that collects as a result of the damaged or failed culvert. Failure may also lead to increased erosion downstream of the culvert where concentrated flows may become more erosive. This can be particularly problematic if the erosive flows are directed immediately towards a stream bank. At road or trail crossings where either inadequately sized or poorly designed culverts exist, a large storm event could also damage or overwhelm the facility and cause scouring beneath the road or trail and culvert itself.

HDPE culvert replacement at La Honda OSP

A typical culvert replacement will involve replacing existing pipe with CMP, high-density polyethylene (HDPE), or other pipe material, such as concrete, as recommended by the Project engineer, and generally occur within the same footpint as the original culvert. However, some culverts need to be properly sized or re-aligned to improve fish passage along creeks, to reduce future culvert failures, to improve natural drainage patterns, and to reduce existing erosion and gullying at the repair site, thus improving water quality. Culverts may be relocated or replaced within 25 feet of the original culvert location. Undersized or improperly installed culverts may be replaced up to 48 inches inner diameter, or larger following a special request process from regulatory agencies. Where feasible, culverts will be replaced with new ones that are designed and constructed to accommodate the 100-year flow or the entire channel width. If this is infeasible due to topography or other physical constraints, culverts will be sized to accommodate the 50-year storm event and incorporate rock armoring, critical dips, overside drains, or other drainage features for planned overflow.

Plugged culvert at La Honda OSP

Culvert replacement entails trenching, installing shoring when necessary, removing the existing culvert, installing armored culvert outlet aprons prior to laying down the new pipe, replacing the culvert, backfilling the trench, and compacting the soil or fill material. Culverts that are greater than 30 inches in diameter will include armored culvert inlets and outlets. Rocks for armoring inlets and outlets will be large enough to prevent inlet/outlet erosion and dissipate water velocity as much as possible. Culvert replacements will be installed at or below stream grade. The slope and gradient of replacement culverts that are discharging to a ditch, creek, or channel will be aligned with the receiving water course to maintain stream course continuity and to avoid washout or erosion of the stream bed, stream banks, and/or other earthen material. New culverts will be designed to

Unplugged culvert at La Honda OSP

blend in with the surrounding environment and to not interfere with the movement of fish. Culverts in fish-bearing streams will be designed to provide sufficient depth and velocity of water for passage of native fish and other native aquatic species during high and low flow conditions. Midpen has collected data on 425 stream crossing culverts. More than 50% of culverts on Midpen lands are between 15 feet and 35 feet long, with an average culvert length of 30 feet. Typically, surface disturbance is limited to 150 linear feet of channel or 3,000 square feet. For culvert replacement projects, total earthwork will not exceed 100 cubic yards per culvert, not including the energy dissipator. For culvert repair projects, up to 10 cubic yards of perched fill may be removed. For larger culvert repair or replacement projects that would disturb more area, Midpen would seek approval on a case-by-case basis. Depending on where the culvert replacement takes place, equipment is generally operated from the roadway, roadway shoulders, or trail. However, for large culvert repair, replacement, or relocation projects, it may be necessary to operate equipment within the channel.

Rock armoring at a stream crossing culvert in La Honda OSP

Repair of improperly installed or deteriorated culverts includes repairing eroded outfalls and rock armoring, replacing broken energy dissipators, adding rock slope protection, improving compaction to prevent piping, and clearing clogged culverts. Sediment removal from culverts is discussed in detail under Section 5.3. In some instances, it may be more appropriate to replace culverts with rolling dips or rock fords to correct poor drainage conditions, improve sediment control, or limit disturbance. Adding rock material to reinforce or re-armor culverts at or below the streambed will be conducted by hand in remote areas or by using a bobcat or tractor in areas accessible by road or trail.

Culvert repair and replacement activities typically occur during the summer season between April 15 and October 31 when water levels are low or absent. Creek dewatering may be required depending on site conditions and water levels.

5.1.2 Bridge Maintenance and Replacement

Bridge maintenance at Rancho San Antonio OSP

Midpen maintains over 150 trail bridges, including fords, puncheons, and boardwalks, and over 25 vehicular bridges throughout its Preserves. Vehicular and trail bridge maintenance activities involve repairing or replacing guard or hand railings and decking on bridges, sealing joints, patching cracks on the bridge exterior, removing and re-applying paint, conducting general surface and deck treatments, adding surface material to low puncheons, clearing debris beneath the bridge abutments, and adding rock material to repair bridge abutments. Sediment and debris removal beneath bridges is also routine; however, a rare activity and is described below in Section 5.3.

These activities will be conducted on the bridge itself with electric power tools or heavy equipment, such as excavators and backhoes, placed outside of the channel, on dry stream banks and adjoining upland areas to minimize stream disturbance and turbidity. Nets, tarping or other suitable material will be installed on the underside of the bridge to catch any falling debris. Typically, bridge maintenance work will occur between April 15 and October 31; however, could occur between November 1 to April 14 if certain conditions are met such as no rain has been received at the site for 10 days or is in the 7-day forecast. If bridge works occurs within salmonid habitat, work would occur between June 15 and October 31. If the lower portion of the bridge requires maintenance, such as repair of erosion protection at bridge abutments, work may occur during periods of dry or low flow. If water is present with the channel, dewatering will be required to gain access. Water will either be temporarily diverted through a pipe, pump, flume, or excavated channel around the work area or Midpen will install an instream isolation structure consisting of rock, sandbags, wood, or water filed geotextiles to enclose the work area.

Bridge re-decking at La Honda OSP

Bridges may also be replaced if they are no longer passable by vehicles, are damaged or worn out, cannot

New puncheon at El Corte De Madera OSP

withstand sufficient weight loads to accommodate emergency response vehicles, or are necessary for drainage correction purposes. As part of the OSMRP, bridge replacements that involve the same size and location of the new bridge are allowed as long as limited in-channel work (such as placing a footing for scaffolding or installation of debris catchment system) is conducted. Bridge replacements that involve a different location or size of bridge (e.g., a bridge replacement that is located on the bank upstream or downstream from the original location) are allowed if the replaced bridge reduces impacts to habitats and/or removed the bridge structure from the stream bed, bank or channel (e.g., installs the new bridge above the ordinary high water mark [OHWM]). New bridges will be designed to blend in with the environment and to not interfere with the movement of fish. The original bridge site will be restored to improve or match surrounding habitat conditions.

5.2 Road and Trail Drainage Feature Maintenance

Ditch relief culvert on a road at La Honda OSP

Road and trail ditches, ditch relief culverts, fords and swales, rolling dips, and other drainage features collect runoff from the adjacent road and trail surfaces and control and direct stream flow. Maintenance of these drainage features is necessary to reduce flooding by providing flow carrying capacity; prevent erosion and scouring of the drainage feature, channel/stream, and adjacent roadway/trail and slopes; and reduce the delivery of pollutants, including sediment to streams. Installation and maintenance of these drainage features in combination with road and trail surface shaping (i.e., insloping and outsloping) are effective methods that Midpen practices to improve the overall drainage system. A description of maintenance activities by drainage feature is included below.

Road and trail drainage facilities are inspected year-round, and where necessary, removal of sediment, silt and debris impacting water quality and/or facilities is conducted when conveyance capacity is reduced by 10% to 30%. Typical equipment used for maintenance of

these drainage features includes hand shovels, backhoes, mini excavators, dozers and/or graders. In addition, where fallen trees and large woody debris have accumulated at road and trail drainage features, Midpen is responsible for removing the trees and woody debris. This type of work is typically conducted on an as-needed basis and is described in more detail in Chapter 6, *Vegetation Management*.

5.2.1 Unpaved and Paved Road and Trail Ditches

Ditches collect runoff from hillside areas, springs and seeps, and road and trail surfaces. Maintenance activities are conducted for both unpaved and paved road and trail ditches, described below.

Ditch relief culvert at Bear Creek Redwoods OSP

Unpaved Road and Trail Ditches

Unpaved roadside and trailside ditches are typically cleaned as-needed from spring to fall, as long as the ditches are dry (April through November). Rainy season ditch clearing may occur (November to April) but is usually limited to hand tools unless there is a large debris blockage that must be cleared (e.g., a driveway ditch is blocked with debris and access to the residence is disrupted). Unpaved ditches are cleaned to a depth that matches the existing grade to maintain a continuous slope for runoff to flow to the nearest outlet. Ditch maintenance typically involves limited vegetation removal and sediment and debris removal. Ditches are typically cleaned with hand tools or mechanical equipment such as dozers, excavators, backhoes, skid steers, box scrapers, and graders, depending on the scale and location of work.

Paved Road Ditches

Paved ditches are typically cleaned on an as-needed basis to preserve drainage capacity. Methods to remove debris, trash, or sediment include mechanical cleaning by use of dozer, grader, excavator, backhoe, skid-steer, box scraper, or similar equipment, depending on the scale of work and manual cleaning with hand tools. Removed spoils are hauled and disposed of in an area where they will not be discharged into a water body.

5.2.2 Ditch Relief Culverts

Ditch relief culverts are buried beneath the road or trail surface and provide drainage of roadside and trailside ditches. Ditch relief culverts are installed at the low point or dip, typically at a 30-degree angle from the road or trail line and 5% steeper than the road or trail. They

typically consist of 12-inch diameter HDPE pipe. Ditch relief culverts are used in highly erodible soils, where soils are not conducive to surface cross drainage or rapidly discharge water onto roads and trails, or in areas that stay wet for extended periods of time and experience winter visitor use. New ditch relief culverts may be installed in locations that experience drainage issues and to control erosion. In order to reduce flow velocity and the potential for erosion, rock or vegetation is installed at the outlet/discharge point. Maintenance of ditch relief culverts includes removal of sediment and debris as well as installation of new ditch relief culverts, as needed, to improve drainage. These culverts are inspected and cleaned as needed, typically with hand tools. Ditches can also be cleared with vacuum equipment or high pressure/volume water flow to flush out the ditch. Debris is then cleared by hand at the end of the pipe. Ditch relief culverts are typically cleared when they are 30% blocked; however, it can vary depending on conditions.

5.2.3 Armored Fords and Swales

Armored ford crossing along a trail in El Corte de Madera OSP

Ford crossings are typically located where a 4-foot or 6-foot-wide trail crosses a stream and are designed for the trail to dip through the watercourse. Swales are typically located where a 12-foot or 14-foot-wide road crosses a stream and assist in maintaining natural drainage patterns. These types of crossings are effective in reducing the risk of damage to road/trail infrastructure. These crossings are typically rocked/armored consisting of a coarse rock base with an apron. The stream channel width determines the size of the rock base and apron (i.e., streams with higher flows use larger rocks); however, the design typically includes rocking 50 feet on each side of the crossing. Fords and swales conform to the streambed or the desired crossing elevation above the streambed. For road crossings, the grades of the roadway approaches are tapered, less than 50% slope, to ensure vehicles are able to pass without difficulty. Fords are not recommended on roads that have a steeper than 15% grade due to the difficulty in installing an adequately sized dip. Fords may be installed at trail crossings where the drainage does not support salmonids.

Maintenance of these drainage features involves replacing rock at the dip and apron and occasionally removing sediment and woody debris. Midpen also installs new fords and swales in locations where gullying or erosion has resulted from the stream draining across the road/trail or may replace culverts with rock fords in cases where culverts frequently clog. Fords and swales are typically cleaned as-needed with hand tools for small work or mechanical equipment, such as a dozer, excavator, backhoe, skid-steer, or skip loader for larger projects.

5.2.4 Rolling dips

Rolling dips (i.e., grade dips) are designed to be self-cleaning and to convey sediment off of the side of the road/trail surface. Maintenance of rolling dips involves clearing sediment and debris and removing vegetation, as needed. Midpen also installs new rolling dips as necessary to provide drainage improvements to existing roads and trails. Rolling dips on roads are typically excavated with an excavator, bulldozer with rippers, or a grader. Rolling dips on trails are typically excavated with a mini excavator, skid steer, or hand tools. Rolling dips are cleared as-needed and are typically built to reduce maintenance to every 10-years or more.

Road surface rolling dip at La Honda OSP

5.3 Sediment and Debris Removal

Deposited or accumulated sediment and debris can reduce a channel's capacity to safely convey streamflow as well as a pond's capacity to hold water. Accumulated sediment or debris can also block culverts, bridges, ditches, and other drainage features, and direct flows into streambanks causing erosion, which could negatively impact water quality and the facility (i.e., road, trail, or bridge). In addition, sediment and debris accumulation could also flood and damage property or structures, thus threatening public safety. Sediment accumulation in ponds can result in loss of deep-water escape and/or breeding habitat for aquatic and semi-aquatic species. Sediment and debris removal primarily occurs in ponds and culverts, ditches, rolling dips and other drainage features at road/trail crossings and rarely occurs in channels, beneath bridges, and at trash racks and other minor facilities. Removing excess sediment and debris will improve water quality, decrease the risk of flooding and erosion, eliminate unpleasant odors, and improve aesthetic conditions. Unless otherwise noted, sediment and debris removal activities typically occur during the dry season, between April 15 to October 31; however, may be extended if needed.

Removed sediment is reused on Midpen lands either adjacent to the site, within the same watershed, or within the same Preserve. Sediment is typically spread on stable, upland areas outside of channel corridor, or over unpaved roads. In the rare occurrence that soil is contaminated, it will be hauled offsite and disposed of at an appropriate landfill facility. Excavated instream sediment/gravel can also be reused to improve fish spawning and rearing habitat by enhancing sedimentary materials within the channel bed. In the future, Midpen may reuse watershed specific gravels collected through instream activities as a source for gravel

augmentation projects to improve fish spawning and rearing habitat. Typically, this work is conducted with hand shovels, backhoes, mini excavators, dozers, and/or graders. Erosion control materials will also be installed to prevent erosion during sediment removal work. The following sections describe sediment and debris removal for each facility type in more detail.

5.3.1 Sediment Removal

Channels

Sediment removal from channels is rarely conducted as Midpen primarily relies on nature to clear channels within its OSPs. However, sediment removal from channels is performed when sediment volume has significantly reduced channel capacity or when localized sediment obstruction has the potential to divert flows, thereby resulting in erosion or flooding damage. In channels, sediment may accumulate at culverts, ditches, or bridges; thus, sediment removal in channels typically occurs at small, localized areas that experience sediment deposition or blockages associated with these features. It is anticipated that Midpen will work on up to one in-channel sediment removal project per year. The total work limits would not exceed 100 linear feet per site. Midpen also repairs road failures, slip outs, or landslides adjacent to channels that, if not maintained, may discharge sediment to channels directly or through a culvert. In locations where a road parallels a creek, the top of bank or riparian area is likely in the area of the road repair. Midpen reduces sedimentation associated with these types of sites approximately 10 to 20 times a year.

Sediment and debris are removed with mechanized equipment in creeks that do not support habitat for salmonids and with hand tools in creeks that do support salmonids. No equipment will be operated in standing or flower water within the channel. Work will generally occur under dry conditions; however, if maintenance is necessary where water is in the channel, the water will either be temporarily diverted through a pipe, flume, or excavated channel around the work area or Midpen will install an instream isolation structure consisting of rock, gravel bags, wood, or water filed geotextiles to enclose the work area.

Pond during de-sedimentation work at Russian Ridge OSP

Ponds

Over time, ponds may fill up with accumulated sediment and organic materials. This buildup of sediment decreases the depth of the pond, which reduces the water volume capacity of the pond and increases growth of aquatic vegetation, such as cattails (*Typha*

spp.). Cattails trap sediment and often further encourage sedimentation to occur. Cattails are often the climax community (the final stage in ecological succession) developed in ponds in need of sediment removal. When this growth expires at the end of the dry season, dead plant matter can settle and decompose in the pond, thus furthering the loss of water capacity and aquatic habitat. In order to restore the pond and return it to its previous depth and water capacity, sediment removal is required. Sediment removal work also provides access to the pond basin for re-contouring work to restore aquatic habitat. Pond restoration activities are described in more detail in Chapter 9, *Restoration.* Sediment removal from ponds would be limited to approximately 600 cubic yards per pond and total pond work would be limited to approximately one acre (or two to three ponds) per year.

Pond after de-sedimentation work at Russian Ridge OSP

Sediment removal from ponds will occur as soon as the ponds are dry (if prior to August 15), or if pond draining is required, work will occur between August 15 and November 1, prior to the beginning of California red-legged frog breeding season. A qualified biologist will be required to sample the pond two days before the start of work to ensure that all California red-legged frogs in the pond are in the post metamorphic stage and will be minimally affected. Refer to Chapter 9, *Restoration* for a further discussion on pond restoration activities.

Heavy equipment such as dozers, loaders, excavators, rollers, and compactors will be used for sediment and vegetation removal and recontouring. In some areas, hand tools and hand laborers will be utilized. Portable pumps, with ¼ inch mesh screens on the intakes, may be used for pond draining.

Culverts, Crossings, and Other Drainage Features

Midpen is also responsible for clearing sediment from culvert inlets and outlets, ditches, rocked fords, rolling dips, and beneath bridges at road, trail, and stream crossings. The work is necessary when the drainage feature is blocked with sediment or debris and conveyance capacity is reduced by 10% to 30%, or sediment or debris deposits are actively causing scour erosion of streambanks supporting bridges or other public facilities like roads and trails. Culverts that are blocked by more than 30% may fall under the United States Army Corps of Engineers'

(USACE's) definition of an "emergency situation"[1] and be cleaned immediately, at any time of the year, even when the channel is wet, to prevent flooding. Culverts with reoccurring blockages are cleaned annually, regardless of the percentage of blockage. Midpen removes sediment from blocked culverts approximately 3 to 8 times a year prior to the winter season and during and after storm events.

Prior to the onset of the winter season, Midpen staff typically investigate the condition of all roads and trails in the OSPs. Midpen staff hike the trails carrying hand tools and remove any sediment that has filled in rolling dips, culverts, rock fords, bridge approaches and other drainage features. Similarly, during and after large storm events, Midpen staff conduct "storm checks" by hiking the roads and trails with hand tools to identify and repair and storm-related damage or sedimentation of drainage features. Sediment that can be cleared by hand is completed during the storm-check.

Typically, sediment removal requires digging sediment out by hand. Mechanized equipment, such as push loaders and excavators, may be used for larger drainage features or where hand removal is infeasible. If water is present where mechanized sediment removal work is required and the capacity is blocked less than 30%, Midpen will divert the water around the work site or isolates the work site for sediment removal work, as described above for channels.

5.3.2 Debris Removal

Debris removal involves removing non-sedimentary materials (e.g., shopping carts, trash, tires, other substances) that are deposited into channels, lakes, or ponds as a result of high flows or through human activity. Prior occurpants on Midpen lands used tires and other debris to stabilize streambanks and berms. While sediment accumulation typically involves raising of the channel bed in a uniform manner and the development of in-channel depositional features such as bars; non-sedimentary debris typically occurs in the form of isolated objects or debris mounds or snags. Such debris can substantially reduce channel conveyance capacity and affect hydraulic conditions. For example, debris jams can divert and redirect flows into channel banks and thereby increase bank erosion downstream. Large debris is also problematic when caught against crossings and bridge abutments, which leads to raised water elevations and blocked culvert inlets and outfalls. Removing fallen trees and large woody debris is also a routine activity that is discussed in Chapter 6, *Vegetation Management.*

Midpen routinely removes debris that impairs hydraulic conditions and reduces conveyance capacity in channels, lakes, ponds, ditches, or other drainage features. Debris removal occurs on

1 USACE regulations define an "emergency situation" is present where there is sudden clear, sudden, unexpected, and imminent threat to life or property demanding immediate action to prevent or mitigate loss of, or damage to, life, health, property or essential public services

an as-needed basis, and is conducted by using hand tools, including come-along cable pullers. Vehicle mounted winches may also be used to remove collected or heavy materials from channels or other heavy equipment, including excavators to remove debris such as tires. Debris would be disposed at an appropriate site or landfill facility.

5.4 Streambank Stabilization

Streambank stabilization involves the repair and stabilization of eroded or eroding stream banks to minimize water quality and erosion impacts. Bank stabilization activities include replacement or repair of damaged or failed sections of perched fill, rock riprap, geogrid embankment, timber pile walls, wooden or log cribwall bank revetments, and retaining walls. Bank stabilization activities take place on an as-needed basis, based on the risk of flooding, erosion, or bank failure. The cause for a particular bank failure depends on the overall hydrologic conditions and flows in the watershed; however, it is also dependent upon site-specific hydraulic, soil, geomorphic, and other conditions that may promote bank instability. After storm events, bank failures may occur at channel beds where bank slopes are overly saturated. Bank failures are also a result of plugged or concentrated road drainage, redirected stream flow, road fill failure or bank seepage. This activity occurs most frequently in Purisima Creek Redwoods OSP where a road runs along a streambank for an extended length with no alternative road. In an average hydrologic year (based on average seasonal precipitation), Midpen may work on up to two streambank stabilization projects in a given year; however, the total work distance will not exceed 100 feet per site. Following a wet hydrologic year or period, Midpen may work on up to four streambank stabilization projects; however, the total work distance will not exceed 100 feet per site. If a streambank stabilization project is larger than 100 linear feet, the project would be conducted outside of the Program.

Prior to initiating bank stabilization repair work, Midpen first evaluates the type of bank failure that occurred (sheered slope, undercut bank, rotational slump, culvert failure, etc.). Second, Midpen evaluates site-specific conditions, including location, hydraulic conditions (i.e., bank height, bank slope, water surface elevations, etc.), bank materials (i.e., soil type, strength, saturation conditions, etc.), and geomorphic conditions (i.e., instream features, confluence, channel bends, etc.). Midpen then assess the upstream and downstream stream channel to determine overall stability of the channel and if elements that can improve habitat complexity, such as root wad revetments and brush layering, can be incorporated into the bank stabilization design. Lastly, and based on the site-specific conditions, Midpen develops an individualized bank stabilization design that minimizes long-term environmental impacts. Midpen prioritizes the use of earthen and biotechnical bank stabilization treatment solutions that minimize adverse environmental effects and help restore and increase complexity of habitat at stabilization sites.

Examples of biotechnical bank stabilization solutions include broadcast and hydro-seeding; riparian vegetation planting; armoring slopes with rocks or sandbags staked with live willows or

interplanted with riparian species; willow staking; live willow pole drains; vegetated crib walls; or log or rootwads. These methods are typically used in combination with vegetated riprap installations. Brief descriptions of these biotechnical solutions are provided below.

- Hydro-seeding and Broadcast Seeding is used to provide quick-growing grass cover for a disturbed area, and is typically better suited for gentle sloping areas above the top of bank. Hydro-seeding is the application of a water, amendment, and seed mixture designed to provide immediate erosion control, and is preferred for large areas above the top of bank. Hydro-seeding is typically applied from a vehicle trailer pump. Broadcast seeding is a method of seeding that involves scattering seed by hand, typically in conjunction with weed free straw and gentle surface compaction. Surface compaction establishes soil contact and is used for native grass revegetation and for temporary Regreen™ wheat cover which produces a sterile plant.

- Riparian Vegetation Planting consists of planting basins and cages with native plants of all types to re-establish ecological function over time, as opposed to near-term erosion control.

- Armoring Slopes with Rocks or Gravel bags Staked with Live Willows or Interplanted with Riparian Species is used where streambanks, pond banks, or other features require the geomorphic stability that harder elements provide while also providing riparian or pond vegetation habitat functions. Willows may be planted on steep slopes between hard elements, increasing natural channel roughness in a short period of time.

- Willow Staking involves inserting live, vegetative cuttings into the ground in a manner that allows the cutting (stake) to take root and grow. Willow staking can be applied in areas to repair small slips and slumps, to reinforce or enhance stream banks, and to anchor and enhance the effectiveness of erosion control materials. This method can also be used in combination with vegetated riprap installations.

- Live Willow Pole Drains are similar to French drains by providing a subsurface, natural conduit to dewater saturated slopes. Although not frequently used by Midpen, they may be placed in gullies before the gulley is backfilled for restoration purposes.

- Vegetated Crib Walls are used as part of small trail bridge footings or abutment wingwalls. Similar to armored slopes with interplanted riparian species, vegetated crib walls provide geomorphic stability for trail bridges while also providing appropriate, native vegetation. Old vehicle bridges were commonly built with redwood crib log walls that recruited native species over time.

- Log or Rootwad involves placing logs or rootwads in selective areas in and on streambanks. These provide effective streambank erosion control in high velocity streams, and trap sediment between components, support restoration of slope vegetation, and distribute flow velocities. This method is effective on meandering streams with out-of-bank flow conditions. Depending on site conditions, this solution can create instream structures.

If biotechnical bank stabilization solutions are determined to be unsuitable or have previously failed at a site, hardscape engineered solutions (e.g., riprap) may be used and keyed into the bank to provide stability.

Volunteers are installing willow staking to stabilize a failing gulley/bank above a California red-legged frog breeding pond

When bank stabilization projects occur, streambanks will be recontoured to match the adjacent bank slope and return to the pre-failed condition. If rock slope protection is used, streambanks will be backfilled with native or clean imported topsoil that will fill in portions of the voids in the rock slope protection and be planted with vegetation to minimize habitat loss. Work will be limited to the damaged or failed sections and adjacent bank areas.

Bank stabilization work is conducted with either hand and power tools (i.e., toter or mule) or with larger mechanized equipment such as excavators or dump trucks. Generally, these are small-scale projects and work can be conducted from the top of bank. However, for larger projects, work within the channel may be required. If water is present with the channel, dewatering will be required to gain access. Water will either be temporarily diverted through a pipe, pump, flume, or excavated channel around the work area or Midpen will install an instream isolation structure consisting of rock, sandbags, wood, or water filed geotextiles to enclose the work area. This work would typically occur between April 15 and October 31, however, may be extended if certain conditions are met (e.g., no rainfall is forecasted for 7-days).

5.5 Water Supply Structure Maintenance

Maintenance of grazing water system in La Honda OSP

Many of Midpen's OSPs contain numerous natural springs in upland locations along geologic contacts, faults, and landslides or in riparian or other low topographic areas that have often been developed to supply water to residences and for conservation grazing purposes. Water supply infrastructure primarily consists of spring boxes, wells, water tanks, waterlines, and livestock troughs. Maintenance of these facilities is necessary to maintain water supply storage and availability; provide accessible water for livestock and wildlife; and supply clean water to residences. Primary maintenance activities involve replacing, extending, or realigning water lines; repairing failed or dilapidated spring boxes or wells; cleaning out clogged spring boxes and pipes to improve the spring system; installing new spring boxes or troughs; removing minor amounts of vegetation to ensure water supply structures are functioning properly; and creating defensible space around water infrastructure per the Board of Forestry Fire Safety Regulations (2021).[2] These structures are inspected year-round on a regular basis and are generally maintained annually by hand, as needed (e.g., cleaning out clogged spring boxes and pipes typically occurs every year). Rebuilding water supply structures is done less frequently, typically once every 5-10 years. If extensive digging is required, such as for installation of new water line or spring box, small mechanical equipment may be used (i.e., bobcat or small backhoe). When servicing wells, larger mechanical equipment may be required. If mechanical equipment is required, activities would typically occur between April and November.

Maintenance of Big Dipper Spring in Skyline Ridge OSP

[2] As of July 2021, the Board of Forestry Fire Safe Regulations have not yet been approved.

5.6 Ponds

Ponds are important wetland features that serve as educational and aesthetic resources for Preserve visitors, habitat for rare, threatened, and endangered species, and in some cases, provide water sources for livestock. These ponds also provide fire suppression benefits by having available water on site. Maintenance work includes vegetation and sediment removal to maintain optimum water levels; shoring and filling in gaps or low spots on earthen berms; rocking berm tops in heavy use areas, and clearing outlets, inlets, pipes, and spillways for proper depth of ponds. Sediment removal in ponds is discussed above in Section 5.3. Midpen also develops and restores ponds for aquatic habitat. Pond restoration activities are described in more detail in Chapter 9, *Restoration and Enhancement Projects*.

Pond requiring vegetation and sediment removal at La Honda OSP

Heavy equipment such as dozers, loaders, excavators, rollers, and compactors will be used for repairing failing pond berms, improving inlets/ outlets, recontouring, and removing invasive vegetation. Excavators, chainsaws, brush cutters, mowers, and articulating arm mowers may be used for clearing and grubbing of vegetation to maintain a pond to the Division of Dam safety requirements, such as removing woody vegetation from a berm or aquatic vegetation from clogging a spillway. If pond draining is needed for berm stabilization or clearing work, portable pumps with ¼" mesh screens on the intakes, may be used. In some areas, hand tools and hand laborers will be utilized. Pond berm stabilization work is limited to a maximum length of 200 feet per pond berm. In addition, the amount of material (i.e., fill) is limited to 300 cubic yards per pond berm. Midpen anticipates working on up to three ponds per year.

Maintenance activities in ponds occurs as soon as the ponds are dry (if prior to August 15), or if pond draining is required and California red-legged frog are present, work will occur between August 15 and November 1, prior to the beginning of California red-legged frog breeding season.

5.7 Minor Maintenance Activities

Other minor maintenance activities conducted by Midpen include repair of fences, gates and signage and trash rack clearing. Fences and gates are repaired as needed to protect the public and Midpen's property. Trail signs are periodically kept clean from graffiti and repaired or replaced as needed. Graffiti removal involves painting by hand or mechanical sprayers on trail signs or bridges or other structures. Additional structures that require minor repair include scientific instrumentation (i.e., gages, sensors, etc.) and wildlife habitat structures (i.e., turtle platforms, exclusion screens, and spring box features). These are maintained with hand tools annually and are generally small in scale. For example, a staff plate in a stream requires annual scrubbing and possibly readjusting the post, among other minor activities.

Minor maintenance of trail signs

Trash racks are located upstream from culvert inlets on non-fish bearing streams, pond spillways, and other key locations designed to catch natural debris. Trash rack clearing typically involves the use of hand tools to remove the debris, which is typically disposed of locally in a stable location away from the stream. The amount of debris removed annually varies depending on the type of water year.

Fence repair at Skyline Ridge OSP

This page intentionally left blank

Chapter 6. Vegetation Management

This Chapter describes the specific types of vegetation management activities that are conducted routinely throughout Midpeninsula Regional Open Space District's (Midpen's) lands. Vegetation management activities are conducted consistent with the Integrated Pest Management (IPM) Guidance Manual (MidPen 2014a),Environmental Impact Report (EIR) (Midpen 2014b) and EIR Addendum (Midpen 2019). As of 2014, Midpen operates within the framework of the IPM, which guides Midpen staff in defining, preventing, and managing pests on Midpen lands while protecting human health and environmental quality.

Midpen also manages vegetation under its Wildland Fire Resiliency Program through the Vegetation Management Plan (VMP). The VMP has two components: Public Safety and Ecosystem Resiliency. The primary need for vegetation management for public safety is to reduce fuels that contribute to fire risks along critical roads that allow for ingress and egress and to provide a buffer from which fires can be fought. In addition, fuel reduction will help protect critical infrastructure and enable Midpen to be a good neighbor to private residents near Midpen lands. Vegetation management to reduce fuels can also restore ecosystems by removing invasive plant species and/or dead and excessive accumulated vegetation due to past fire suppression. In addition, impact from forest disease (e.g., Sudden Oak Death [SOD]) can be mitigated.

The purpose of the Public Safety VMP is to define and prioritize the vegetation management activities (e.g., fuelbreaks, defensible space) that Midpen can implement to increase vegetation management practices beyond what Midpen is already doing to reduce wildland fire risks, while also preserving biodiversity and minimizing effects on the environment. Vegetation management for fuels reduction will not stop a fire from spreading, but may allow additional time for responding fire personnel to arrive on scene and/or allow private residents in the wildland urban interface (WUI) to evacuate. Midpen manages vegetation to reduce the continuity of live and dead fuels both horizontally and vertically in fuelbreaks. Width varies depending on sensitive resources, the location of habitat transitions, slope, expected fire behavior, and the protected features or infrastructure.

The purpose of the Ecosystem Resiliency VMP is to maintain Fuel Reduction Areas (FRAs) where fuels are manually or mechanically removed for habitat enhancement reasons, but not to the same extent as fuelbreaks. FRAs are less permanent than fuelbreaks and are typically implemented in more natural areas where fuel load reduction will be performed to achieve a combination of wildland fire risk reduction and habitat enhancement goals. FRAs can be areas of managed vegetation adjacent to fuelbreaks, but can also occur in areas where fuel loading is particularly problematic such as areas affected by forest disease. Most riparian settings will be treated as FRAs in the VMP (i.e., even where a fuels project occurs along a road, the treatment in the riparian areas shift to a FRA standard and approach).

Any enhanced fire management activities that fall within or cross riparian areas would be modified such that the vegetation treatments performed would be limited to FRA-level management with a recovery intent. A Midpen-approved or professional biologist would evaluate any areas where enhanced fire management areas cross into riparian habitat and would design the treatments to avoid loss of riparian habitat function and retain or improve habitat functions. Considerations could include, but are not limited to:

- Retain at least 75%of the overstory and 50%of the understory canopy of native riparian vegetation within the limits of riparian habitat. Retain native riparian vegetation in a well distributed multi-storied stand composed of a diversity of species similar to that found before the start of treatment activities.

- Limit treatments to removal of uncharacteristic fuel loads (e.g., removing dead or dying vegetation), trimming/limbing of woody species as necessary to reduce ladder fuels, and select thinning of vegetation to restore densities that are characteristic of healthy stands of the riparian vegetation types characteristic of the region.

- Avoid removal of large, native riparian hardwood trees.

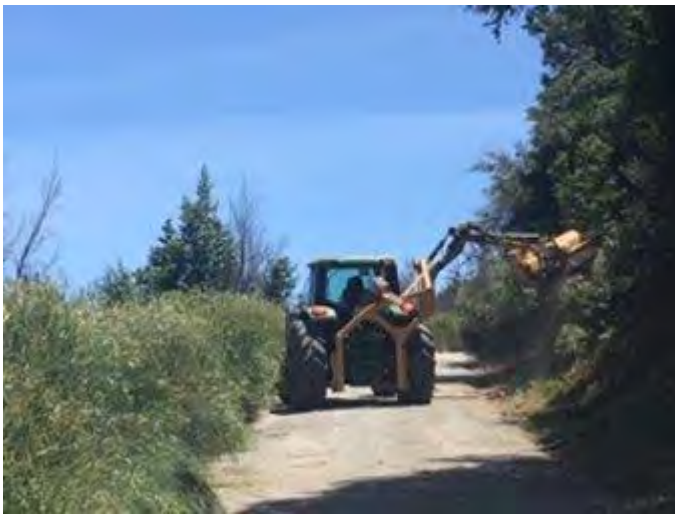
- Removed trees will be felled away from adjacent streams or waterbodies and piled outside of the riparian vegetation zone (unless there is an ecological reason to do otherwise that is approved by applicable regulatory agencies, such as adding large woody material to a stream to enhance fish habitat).

- Avoid vegetation removal that could reduce stream shading and increase stream temperatures.

Typically, all work in riparian corridors would be conducted by hand. Equipment use will be limited to reduce disruption and only be used if it is necessary to achieve habitat and fire management objectives. The Wildland Fire Resiliency Program is a separate program from the Open Space Maintenance and Restoration Program (Program) described herein. Environmental effects associated with the Wildland Fire Resiliency Program are analyzed in the Wildland Fire

Resiliency Program EIR(Panorama 2021b). The Wildland Fire Resiliency Program is anticipated to be adopted in spring or summer of 2021.

The primary vegetation management activities in this Program are similar to those in the IPM and Wildland Fire Resiliency Program, but are initiated as part of routine maintenance, habitat enhancement, or during new construction for small-scale facilities improvements. Vegetation management activities in this Program include: brushing, fuel management, pruning, tree removal, downed tree management, pesticide application, conservation grazing, and invasive plant removal. Traditional ecological knowledge practices (indigenous stewardship) include small-scale plant gathering, seedling collection, and plantings. Some of these vegetation management activities are conducted as part of the existing condition to maintain the status quo and would not result in any new effects (e.g., maintenance of established shaded fuel breaks on existing Midpen lands). Although each program has a different focus, similar best management practices (BMPs) and avoidance and minimization measures would be implemented for all vegetation management work (refer to Table 10-3 in Chapter 10). Midpen undertakes these types of vegetation management activities routinely and relatively consistently from year to year. Although the work locations may change yearly, the type of work remains consistent. Some facilities require annual vegetation management while others do not. This largely depends on the type of vegetation in, or adjacent to, the channel, road, trail, or other facility and other environmental factors including the degree of solar input, soil, and moisture conditions.



Road and trail brushing of overgrown vegetation with a tractor-operated mower

6.1 Brushing and Mowing

Overgrown vegetation along roads and trails can become a nuisance if it impedes road and trail access or creates a public safety or fire risk. Annual brushing (i.e., mowing and pruning of vegetation along roads and trails) is conducted along approximately 600 miles of roads and trails; around parking lots, gates and stiles; the Black Mountain campsite; and other recreational areas to maintain an open corridor for vehicular, horse, bicycle, and pedestrian use, maintain access to facilities, control vegetation, and to reduce fire and public safety risk. Clearing brush provides a buffer to separate recreationalists from pests (such as ticks, rattlesnakes, and poison oak) and decreases the amount of flammable vegetation reducing fire risk.

Road and trail brushing are conducted with brushcutters (e.g., weedwhips), hedgers, chainsaws, pole saws, chippers, and tractor-operated mowers (mowing decks either pulled by a tractor or attached to the tractor as part of an articulated arm) to maintain grass and shrubs in short stature. Single-track trails are typically mowed with handheld brushcutters, while road-width trails are mowed with tractor-mounted mowing equipment. Wider strips of brushing occur along certain roads to provide access for emergency vehicles. Midpen maintains guidelines for road and trail brushing that prescribe different treatments for different vegetation types and slope conditions based on the methods included in the 2015 version of the Marin County Biodiversity Management Plan (Marin County 2015).

Tree removal associated with annual brushing is limited to small diameter trees (less than 6" diameter at breast height [dbh]) that are growing within footprint of the road or trail. Trees overhanging the road or trail are pruned and limbed to prevent encroachment, but are typically not removed unless they pose a risk (See Sections 6.2 and 6.3 below).

Road and trail brushing can be conducted on annual or periodic basis and is typically conducted at specific times of the year to abate the risk before it becomes a problem. Most trails are mowed or brushcut on an annual basis. However, some trails may need to be brushed up to four times a year if it is a heavily used trail and if it is a high rainfall year. Some more remote trails may not require brushing every year. All roads are mowed or brushcut one to four times per year depending on the rainfall/vegetation growth in a given year. On an annual basis, a strip of land around parking lots, gates and stiles are brushcut or mowed. In addition, islands in the middle of parking lots, detention basins within parking lots, or parking lots with narrow grassy edges are mowed. The Black Mountain campsite is also mowed once a year for camping access and to reduce the risk of wildfire within the campground. Other recreational areas, including a model airplane field and three meadow areas at Rancho San Antonio Open Space Preserve (OSP or Preserve), the picnic table area at Windy Hill OSP, and the hang-gliding takeoff and landing areas at Windy Hill OSP, are mowed one to five times a year with a tractor pulling a mowing deck. In addition, other grassy areas are mowed due to the occurrence of special events in the preserves (e.g., volunteer events, summer camps, and other public gatherings). At Deer Hollow Farm in Rancho San Antonio OSP, pastures, animal pens and the Ohlone village are mowed four to five times per year with a tractor mower or brushcutters. Timed mowing is also used to control the reproductive spread and reduce populations of annual invasive plants. These activities typically occur between April and November, with the specific timing determined by the phenology of the target species. Timed mowing usually occurs when a certain percentage of the population reaches a phenological threshold (i.e., 5 percent of the population is flowering). Vegetation is mowed to a height of 4 to 6 inches, and may require multiple treatments in a given year. All mowing activities would be conducted in compliance with Midpen's IPM BMPs (September 2014).

The brushing work is unique in Midpen's Program due to its re-occurring, annual nature in the same places along roads and trails, year after year; new areas are not disturbed as part of the

activity except when new properties are acquired, old roads are opened, or incidentally part of a larger project. Midpen also brushes patches of Coyote brush that are impacting native grasslands or reducing forage for conservation grazing. For the purpose of this activity, old roads are those that have not been brushed/mowed within a five-year period and are more than 50% covered in vegetation. The annual notification for the Program will only submit new vegetation clearing and disturbance work.

6.2 Tree and Shrub Pruning

Pruning trees and shrubs are routine activities performed as a component of facilities maintenance and fuel management projects. Pruning is sometimes necessary to provide emergency, maintenance, and recreational access to Midpen facilities (e.g., roads, trails, water supply facilities, etc.); improve visibility to inspect Midpen facilities; provide adequate sight distance for safety and aesthetic reasons protect infrastructure; and to meet local fire codes. Vegetation is pruned within 3 feet of a trail and up to 12 feet for roads. Height clearance depends on the use of the trail or road (e.g. trails with equestrian use have a 12-foot height clearance).

Pruning is the partial removal of any individual plant and includes cutting of tree branches, and woody and herbaceous vegetation. No more than 20% of an individual riparian tree canopy may be pruned. Pruning is conducted with hand tools or mechanized equipment. Once work is completed, plant material that is free of exotic or invasive plant propagules may be chipped and re-used elsewhere on Midpen lands for other uses. However, in areas that are known to host SOD or other plant pathogens, all chipped material is left on-site.

In the event that a tree or vegetation requires removal per the reasons stated in Section 6.3, Midpen will remove the tree; however, Midpen will always try to first prune the tree to satisfy these requirements. Tree removal may be necessary, including root masses, where a road or trail or other surface or structure is being damaged or where plant growth is blocking the channel or reducing water flow (refer to Section 6.3 below).

6.3 Tree Removal

Native and non-native trees may be removed if the tree is creating a public safety risk along or near Midpen high-occupancy facilities (e.g., picnic areas, parking lots, buildings) or trails, is limiting stream capacity, or is threatening streams, ponds or bed and banks of streams, natural areas, or water quality. Tree removal may also be needed to provide or maintain stream crossings where they cannot otherwise be constructed and to implement restoration work such as pond reconstruction where tree removal is necessary to implement berm, basin, or inlet/outlet reconstruction. Trees are assessed by a licensed arborist to determine if they are a public safety risk where staff cannot make a determination. If a hazardous tree can be mitigated by pruning alone, the tree does not need to be removed. Discussion regarding removal of fallen trees is described below in Section 6.3.1, *Downed Tree Management*.

Identifying and removing hazardous trees is conducted on a continual basis. When assessing hazardous trees, Midpen staff take into consideration human residence time (i.e., the duration of exposure that the public or staff have around the potential risk). In general, trees at higher risk of failure in areas where human uses are expected to be low (e.g., in the interior portion of a forest community far away from any trails) are left as-is because they are an important component of the ecosystem. However, dead, dying or damaged trees in high human use areas such as major trails, trailheads, picnic areas, and parking lots and may be removed if deemed a high risk. Midpen is currently developing a hazardous tree assessment program that would identify high risk areas and require annual assessments in those locations. Hazardous trees are removed when they are within 1 ½ times of their height to a high use facility. An estimated 50 to 200 trees are limbed or removed every year along roads and trails and near facilities with chainsaws, pole saws and chippers to reduce the risk of tree failure in a high human residence time.

Riparian tree requiring removal

Trees in riparian areas that are limiting stream capacity, are threatening ponds or bed and banks of streams, natural areas, or water quality, or are preventing necessary vehicle access along roads may also be removed. Prior to removal, Midpen would conduct all necessary biological surveys in compliance with regulatory permits. No trees or vegetation greater than 6 inches dbh would be removed from within the stream unless they meet the conditions described above. Trees within the riparian area would be removed primarily with trimmers and chainsaws; heavy equipment operated from the streambank would be limited. In addition, trees would only be removed by excavation or cut below soil if they are within a graded area. For large trees, a licensed tree climber would use necessary equipment to climb and cut the tree into manageable sections and lower those sections to disturbed areas on the ground to prevent damage to nearby trees, vegetation or root zones. Stumps may be removed with a stump grinder; however, roots would be left in place to stabilization the slope. Mulch limbs and leafy materials would be left in place for site restoration and erosion control and larger sections would be stockpiled off site and be reused for future Midpen projects.

After riparian tree removal

Due to the presence of SOD on at least half of Midpen's preserves, Midpen is actively working on minimizing the spread of this disease. Midpen adopted a 10-year SOD work plan in 2006 to map trees that are potentially resistant to the SOD pathogen, treat a selected number of trees with a

fungicide, and establish a collaborative research fund for SOD research. In 2016, Midpen added an additional one million dollars to the fund for SOD and phytophthora research. Midpen tracks the effects of SOD and shares this information on the statewide SOD database, educates the public on how to stop the spread of SOD, removes select California bay trees or branches within 15 feet of high value oak trees, and uses targeted fungicide treatment of individual, large, mature high value oaks near high use facilities to reduce the potential for SOD infection. Midpen staff also follow field practices to limit the spread of SOD on preserves by thoroughly cleaning all equipment and preventing the relocation of potentially contaminated vegetation and soils (refer to BMP BIO-7 in Chapter 10).

6.3.1 Downed Tree Management

Midpen will remove downed trees in high visitor use areas if the downed tree presents a safety risk, is blocking a road, trail or other infrastructure, or if the fallen tree negatively affects hydrologic processes. Downed trees are an important part of the ecosystem as they provide cover and nesting sites for animals and nursey conditions for forest seedlings. If a fallen tree does not present a safety risk, the tree will be left in place.

When downed trees occur along streams, the downed tree may be a resource to provide habitat functions by encouraging pools to form. Along a stream course, the downed tree will be evaluated for its potential to cause or increase erosion, flooding, bank failure, or negatively impact a facility such as a bridge or culvert. If it is unlikely that the downed tree would increase any risks and there is adequate flood flow capacity, Midpen will seek opportunities to maintain the downed tree as a habitat feature (i.e., large woody material). Although downed tree management is generally a rare occurrence, downed trees typically occur in Purisima Creek Redwoods OSP due to the steep slopes and streamside road.

If it is likely that the downed tree would increase any risks or threatens infrastructure, the tree will be trimmed and repositioned with hand tools immediately. Equipment, such as a winch and cable, to remove the tree will be operated from the top of bank. Root structures will not be disturbed. In some instances, if there is an immediate serious threat, the project would constitute as an emergency. Downed tree management activities would occur during the winter months, typically following a large storm event. Midpen anticipates working on up to two locations in a year on average; however, a hydrologically wet year may result in additional sites.

6.4 Aquatic Vegetation Removal

Cattails (*Typha* spp.) and other aquatic plant species are commonly found in ponds on Midpen OSPs. Cattails generally establish in stagnant flow areas where sediment deposition has occurred. If not properly managed, cattails die and decompose and the vegetation can clog the spillway and other structures as well as eventually indirectly result in dam face erosion/failure.

Midpen removes tall cattails and other wetland vegetation in small select areas to maintain public viewing areas, public trails, and maintenance access, prevent sedimentation, improve habitat for special-status species, and for pond monitoring purposes. In addition, the California Division of Dam Safety requires all woody debris to be removed and tall herbaceous vegetation to be cut on both faces of certain pond dams to improve visibility to see possible areas of failure. Vegetation on the water side of the dam is trimmed with mowers and brush cutters. Vegetation on the dry side of the dam is trimmed with mowers and approved pesticides, when necessary to maintain a light grassy cover. Woody vegetation is trimmed in pond spillways to prevent the blockage of water. Duckweed, azola (aquatic fern), hydrocotyle and other dense vegetation removal may also be conducted to control overgrown plants from covering the entire surface of ponds.

6.5 Fuel Management

Managing fuel load and fire risk is one of Midpen's top priorities. Fuel management is the practice of removing or modifying vegetation to reduce the risk of wildfire ignitions, rates of wildfire spread, and fire intensity. Fuel management activities are required when vegetation becomes overabundant or decadent; or close to facilities, structures, and communities that people inhabit and use. However, fire is also a natural component of many local plant communities and helps maintain a diverse patchwork of native species and habitats, including, grasslands, shrublands, and forests. Midpen aims to manage fuels in a context that provides the maximum safety to adjacent communities while also allowing fire as a natural process to maintain native species diversity on its Preserves. When conducting fire management activities, Midpen considers public health and safety, and the regulatory requirements of local and state fire districts and balances those with their goals to protect natural resources.

Midpen typically conducts fuel management activities within the WUI, which is defined as where wildland vegetation and structures meet. The WUI area has the highest threat of damage to human life and property. Other areas where Midpen conducts fuel management activities include along access roads on and adjacent to Midpen lands that are necessary for emergency access, around structures, buildings, and other Midpen facilities. See the description below for a further discussion of fuel management activities, including prescribed burns, discing, shaded fuel breaks, defensible space around buildings, emergency helicopter landing zones, and driveways.

All fuel management activities would be conducted in accordance with the Vegetation Management Plan, Prescribed Fire Plan (components of the Wildland Fire Resiliency Program), and the Conservation Grazing Program. Midpen will select the safest, least toxic, and most effective approach to manage fuels and reduce fire risk. Midpen will work towards breaking the vertical fuel ladder between the ground and the canopy layer and creating physical separation between plants where possible. Low impact tools such as hand cutters and pruners will be utilized to minimize vegetation removal and soil disturbance, where feasible. Thinning and

removing of mature vegetation in established forests and woodlands will be avoided where possible to maximize shading and increase resistance to non-native plants. In addition, forest duff and organic soil layers will be left undisturbed.

Midpen also works to minimize fire risk by:

- Focusing fuel management activities in WUI areas adjacent to neighborhood communities, structures, evacuation routes, and other at-risk locations.
- Working with local fire organizations and residential and commercial neighbors to manage adjoining properties for fire within the WUI.
- Conducting visitor and neighbor outreach and education about wildfire dangers on and near OSPs.
- Eliminating redundant, unnecessary, or high maintenance roads and trails on OSPs.
- Continuing to control flammable invasive plants, such as French broom.
- Encouraging the establishment of native plant communities because they are more resistant to wildfires than invasive plants.
- Temporarily closing Preserves on red-flag days in the Coastal Zone and sometimes at the request of local fire agencies. For example, the Woodside Fire Department requests Midpen to close the Windy Hill, Thornewood, and Teague Hill OSPs on red-flag days.

6.5.1 Prescribed Burns

Prescribed burns help restore native upland habitats and control invasive exotic vegetation. Prescribed burns are generally conducted in coastal scrub and mixed grassland habitats, as well as in forested habitats to allow understory burns and pile burns. Prescribed burns are generally conducted every three to ten years to maintain a high diversity of plants. All burning is conducted according to California Department of Forestry and Fire Protection (CALFIRE) regulations and burn protocols. All participants involved in the prescribed burn will be briefed by the resource advisor and/or biological monitor on the potential endangered species present and appropriate protocols if one is sighted. Resource advisors will work with the ignition teams, who are in charge of their safety. Prescribed burns will be monitored to ensure burn prescriptions, including timing and frequency, are adhered to. Spot checks will be conducted until all fire from a burn is out. Cultural burns will also follow the same guidelines as prescribed burns conducted under the Wildland Fire Resiliency Program but will focus on the restoration of culturally significant plant and animal species (refer to Section 6.8 for additional information).

Prescribed burns will adhere to the conditions outlined in the Wildland Fire Resiliency Program, which identifies total allowable burn acreage by vegetation type. In addition, prescribed burns

will be conducted according to the prescribed burn plan for each site. Prescribed burn timing is to be determined based on permit conditions from the relevant agencies, the constraints of each site, climatic conditions, and species requirements.

6.5.2 Disclines

A discline is a mechanical fuel management technique that involves using tractor-mounted equipment to cut many small, parallel trenches 6 to 12-inch-deep in the soil along the perimeter of undeveloped land, ranches, and roadways. The purpose of discing is to create small swaths of barren soil that do not support fuel or conduct fire. Discing is only practical in grassland vegetation that do not contain many woody shrub or tree species. In addition, this technique is limited in reducing fire risk in natural areas because the soil disturbance associated with this technique is known to encourage establishment of invasive plants, which often exacerbate the fuel load problem.

Midpen annually maintains approximately 30 miles of disclines on its land as required by local fire agencies. Additional miles of disclines will likely be added under the Wildland Fire Resiliency Program as Midpen acquires new lands. A discline is cut with an agricultural cultivator attachment on a tractor. However, discing requires annual maintenance to be effective and to manage invasive weeds. Brush encroaching into disc lines along roads, trails, and borders is removed with chainsaws, boom flails, and mowing or masticator equipment. Occasional pruning of overhanging branches with a chainsaw or pole pruner is also undertaken along disclines where needed to allow passage of maintenance equipment. Midpen typically maintains disclines between April 1 and July 1. Discing generally takes place adjacent to major roads/highways (e.g., Highway 35), grasslands along the WUI, around buildings in grassland settings, and where required by a local fire agency.

6.5.3 Shaded Fuelbreaks

Shaded fuelbreaks are a forest management approach that involves selective thinning and removal of the more flammable understory vegetation and leaving the majority of larger, more fire tolerant tree species in place. Typically, fuelbreaks are maintained along roads, such as Monte Bello Road in Monte Bello OSP. Maintenance of fuelbreaks along roads includes annual mowing of vegetation 10 to 30 feet from the edge of the road, clearance of brush and all dead vegetation, and removal of ladder fuels in forested areas. Shaded fuelbreaks are also maintained along road-width trails, staging areas, and helicopter landing zones, described in more detail below. Shaded fuelbreaks are maintained as-needed, typically every 3 to 5 years. This work is conducted with both manual and mechanical tools, including tractors, brushcutters, chainsaws, chippers, masticators.

6.5.4 Maintaining Defensible Space around Buildings, Emergency Helicopter Landing Zones, Driveways, and Water Supply Infrastructure

Midpen or residential, commercial, or agricultural/rangeland tenants are responsible for maintaining defensible space around Midpen-owned occupied structures, unoccupied structures of significant value, and along Midpen property boundaries when directed by a fire agency regulation. Flammable vegetation is generally cleared annually within 100 feet to 300-feet of Midpen-owned structures/buildings, within 30 feet of a property boundary (where directed by a fire agency regulation), and 100 feet of water supply infrastructure. However, the amounts of clearance for defensible space can vary depending on the Fire District jurisdiction that a parcel is located within. Defensible space clearing would be conducted consistent with Midpen's Defensible Space Clearing Guidelines (Midpen 2011), Resource Management Policies related to wildfire (2021) (which will be updated in 2021 with the adoption of the Wildland Fire Resiliency EIR), Wildland Fire Resiliency Program (2021), Board of Forestry Fire Safe Regulations (2021)[1], and local or state defensible space requirements. For Midpen's buildings, as analyzed in the Wildland Fire Resiliency Program EIR, 0 to 5 feet from a building is a no combustion zone, 5 to 30 feet is a "lean and green" zone and 30 to 100 feet is maintained as a shaded fuelbreak. In addition, defensible space around structures is also regulated under the Uniform Building Code, Uniform Fire Code, Public Resources Code Section 4291/4119, and County and City municipal codes and ordinances.

This work consists of manual and mechanical clearing of flammable vegetation by mowing, brushcutting, chainsaw work, pole pruning, chipping, masticator and spraying, dependent upon the site conditions. Work is generally conducted between April and August.

Emergency helicopter zones are maintained annually or bi-annually by mowing with a tractor or brushcutter. Heavier vegetation/brush encroaching within the landing zone is mechanically removed with a chainsaw or JAWZ equipment

6.6 Invasive Plant Removal

As part of the California Floristic Province and recognized as one of twenty-five botanical hotspots in the world, the Santa Cruz Mountains contain an extraordinarily high biodiversity. The biodiversity of the region is threatened by non-native plant introductions to California that began in the 1500s with the first European settlers. By 1900, settlers introduced at least 34 non-native plants, largely as ornamentals, to California that are now listed by the California Invasive Species Council as having moderate or high impacts to wildlands. Other species introductions were for cattle forage or erosion control, or accidentally introduced via contamination of other

[1] As of July 2021, the Board of Forestry Fire Safe Regulations have not yet been approved.

materials (such as imported soils, food, or ballast water from ships). Non-native invasive plant species do not support as many native wildlife species, and do not provide the same resources or connectivity to the ecosystem as their native counterparts. Invasive plants can displace native ecosystems and replace diverse plant communities with plant communities dominated by one plant species. The truly alarming invasive plants are 'transformer' species that not only out-compete specialized rare species, but also alter the environment, ecosystem structure, or soil chemistry to make it uninhabitable for native plants and wildlife.

The presence of invasive plants can also negatively affect ecological stability. Three measures define ecological stability: (1) the ability of species populations to recover quickly after a disturbance (resilience);(2) low variance in total biomass over time; and (3) consistent species richness and abundance (biodiversity). Through the management of the most invasive species in high value habitats, Midpen can prevent the loss of important native plant communities and the wildlife species they support. Low abundance of certain species can lead to extirpation (localized extinction from the area) and in the case of rare species, possible extinction. Approximately 42%of threatened or endangered species are at risk due to impacts from invasive species. By protecting the region's biodiversity, Midpen works to preserve the resilience of local ecological systems, which is particularly critical at this time given the changing climate.

Midpen and/or conservation grazing tenants remove invasive plants with a combination of manual, mechanical, chemical, biological and cultural methods. Most invasive species would require repeated cutting throughout the growing season (generally late spring through mid-summer) or they could re-sprout from their base and continue to grow, flower, and produce seed. Conservation grazing may also be used to partially or fully control invasive plants by timing livestock grazing before an invasive species' seed can set. Although rare, there are occasions where coyote brush is treated as an invasive species in ungrazed, high-value grasslands and is targeted for removal. Currently, Midpen removes coyote brush at one small grassland restoration site in Rancho San Antonio OSP with hand tools and herbicide application. Invasive plant material will be removed from the maintenance sites and appropriately handled to avoid the spread of invasive species (see BMP BIO-6 in Chapter 10).

6.6.1 Pesticide Application

Midpen operates within the framework of the IPM Program and emphasizes the use of non-chemical vegetation management techniques, where feasible, prior to the consideration of pesticides. Consistent with Midpen's IPM Guidance Manual, the Program uses an integrated approach of chemical, manual and mechanical methods to manage vegetation along trails, roads, and wildlands. Pesticides are used in conjunction with manual and mechanical treatment methods to control invasive species, reduce fire risk, or to limit the spread of plant pathogens (e.g., SOD).

Midpen aims to reduce per-acre pesticides use at individual sites in natural areas over time. However, in some locations, pesticide use will initially increase, followed by a reduction once the

vegetation is eliminated or reduced. For example, as new properties are acquired or new invasive plant infestations are discovered, overall pesticide use may initially go up; however, pesticide use is anticipated to decrease over time as unwanted vegetation is controlled or eliminated at these sites.

The type and approach of pesticide application is dependent upon many factors, including the target species, location and the life stage of the vegetation. Most pesticides are applied during an active growth phase of the plant (post-emergent), and do not affect the seedbank in the soil. Pesticides with pre-emergent effects, such as Milestone, remain active in the soil after the pesticide has been applied, and can target and sterilize the seedbank of the target species.

Pesticides are also classified as either selective or non-selective. Selective pesticides control plants in specific plant families or life stages, while allowing other plants to survive. The use of selective pesticides can eliminate/reduce targeted vegetation without damaging desirable vegetation. Non-selective pesticides injure all plant species that are directly exposed to treatment, and will therefore only be directed and/or applied to the target species.

Midpen uses the most selective pesticide application method that can achieve the desired results for any given project. Pesticide application techniques include:

- *Foliar/Spot spray* – Depending on the size of the infestation, pesticide would be applied with a 5-gallon backpack sprayer or, for larger areas, a 14-gallon tank mounted on an all-terrain vehicle or 150-gallon truck with a hose that is directly controlled by an operator. All methods of spraying would be selective as the operator (who is trained in identifying plants) would be in direct control of the sprayer, would point the spray tip directly at the target weed or pest, and would manually turn the spray equipment on and off to control the amount and direction of spray.

- *Cut-stump* – Under this treatment, the woody plant would be cut close to the ground at a 90-degree or 45-degree angle with a chainsaw or pole saw. Debris would be removed from the cut stump and pesticide immediately applied to the circle of living cells. Cut-stump application would be used to selectively eliminate woody trees and shrubs. Woody plants tend to re-sprout frequently when cut unless treated with pesticide.

- *Basal bark application* – Using this treatment method, an oil mixture containing pesticide would be applied to the lower 12 to 15 inches of brush and tree trunks (including the entire stem, root collar area, and exposed roots) via low-pressure backpack sprayer. This method would be used to selectively control woody plants with basal stems less than 6 inches in diameter.

- *Wick/wipe application* – A wick or rope would be saturated in pesticide and attached to a reservoir containing a concentrated pesticide solution. The wick or rope is used to wipe pesticide directly onto target plants, typically weeds that are taller than

surrounding non-target plants. Wick applicators may range in size from hand-held to truck-mounted.

- *Frill/injection* – A drill or sharp tool such as a hatchet would be used to create holes or cuts through the exterior bark of a tree and into the sapwood. Each penetration point into the sapwood is then filled with the label-recommended amount of concentrated pesticide solution using an injection system, squirt bottle, or brush. This application method is often used for the control of trees that cannot be managed via basal bark application.

All pesticide applications conducted by Midpen occur in accordance with federal, state, local regulations, labeled specifications, and any court injunctions in place. Pesticide application is only conducted when the weather is dry and when wind speeds do not exceed 7 miles per hour. Pesticides are not used in or within 15 feet of any fish-bearing stream, lake, pond or other water bodies known to support special-status aquatic species without prior consultation with CDFW. For other water bodies, pesticide use is limited to control non-native plant species where excess vegetation is determined to be the cause of sediment deposition and/or debris accumulations that result in flooding or damage to facilities.

Table 6-1 lists the approved pesticides that may be used on Midpen lands for vegetation management, active ingredient of the pesticide, if the pesticide is nonselective or selective, and the purpose of application (i.e., the type of pest the pesticide controls). Note that Midpen uses other approved pesticides on their lands for purposes other than vegetation management such as controlling pests. Please refer to the IPM (Midpen 2014b) for additional information on other types of pesticide use.

Table 6-1. List of Approved Pesticides Used for Vegetation Management on Midpen Lands

Pesticide Active Ingredient	Pesticide Label Name	Non-Selective or Selective	Purpose of Application
Glyphosate IPA	Roundup Custom	Nonselective	Post-emergent broad-spectrum weed and tree control
Glyphosate K	Roundup ProMax	Nonselective	Post-emergent broad-spectrum weed and tree control
Aminopyralid TIPA	Milestone	Nonselective	Post-emergent broad-spectrum weed control
Clopyralid MEA	Transline	Selective	Broadleaf weed control
Imazapyr IPA	Polaris, Stalker	Nonselective	Pre-and post-emergent broad-spectrum weed control

Pesticide Active Ingredient	Pesticide Label Name	Non-Selective or Selective	Purpose of Application
Clethodim	Envoy Plus	Selective	Post-emergent grass weed control
Triclopyr BEE	Garlon 4 Ultra	Selective	Post-emergent woody plant, broadleaf weed, and tree control
Triclopyr TEA	Capstone	Selective	Pre- and post-emergent broadleaf weed, woody plant, and tree control

Source: Midpen 2014b

Table 6-2 summarizes the types of pesticides that are typically applied by season and identifies the typical application method, annual application and concentration (in some cases by acreage), and timing and frequency per pesticide. Overall, the timing of pesticide application will vary based on the targeted plant species and type of pesticide used.

Table 6-2. Summary of Pesticide Used for Vegetation Management in Midpen Lands

Pesticide Type	Method of Application[1]	Purpose	Annual Application/ Concentration[2]	Time of Year	Frequency of Application
Pesticide Use Around Recreational Facilities					
Glyphosate IPA	Cut stump, spot spray, wick, and frill/injection	Dam faces, parking lots, gates and stiles, facilities	0.3 gallon concentrate over 40 acres	Spring/ summer/ fall	1 time per year
Glyphosate K	Cut-stump, spot spray, wick, and frill/injection	Roads, trails, parking lots, gates and stiles, facilities	1 gallon concentrate over 54.6 acres	Spring/ summer/ fall	1 time per year
Clopyralid MEA	Spot spray, cut-stump, frill/injection	Parking lots, gates and stiles, facilities	0.3-gallon concentration over 22.9 acres	May through August	1 time per year
Imazapyr IPA	Cut-stump, spot spray, frill/injection	Roads and trails, parking lots, gates and stiles, facilities	0.4-gallon concentrate over 54.6 acres	Spring/ summer/ fall	As needed

Pesticide Type	Method of Application[1]	Purpose	Annual Application/ Concentration[2]	Time of Year	Frequency of Application
Pesticide Use for Fuel Management Activities					
Glyphosate K	Cut-stump, spot spray, wick, frill/injection	Defensible space, disc lines, fuel break	3.6 gallon concentrate over 14 acres	April through June	1 time per year
Triclopyr BEE	Spot spray, cut-stump, basal bark	Defensible space, disc lines, fuel break	3.6 gallon concentrate over 14 acres	Summer/ fall	1 time per year
Pesticide Use in Rangeland and Agricultural Properties					
Aminopyralid TIPA	Spot spray, cut-stump, basal bark, wick, frill/injection	Rangeland weeds, invasive plant control	2.1 gallon concentrate over 174 acres	Any time of year	1 time per year
Clopyralid MEA	Spot spray, cut-stump, frill/injection	Rangeland weeds, invasive plant control	1.6 gallons concentrate over 154 acres	Spring/ summer	1 time per year
Glyphosate IPA	Spot spray, cut-stump, wick, frill/injection	Rangeland weeds, brush control, agricultural weeds, invasive plant control	1 gallon concentrate over 100 acres	Spring/ summer	1 time per year
Glyphosate K	Spot spray, cut-stump, wick, frill/injection	Rangeland weeds, brush control, agricultural weeds, invasive plant control	57.6 gallon concentrate over 154 acres	Spring/ summer	1 time per year

Pesticide Type	Method of Application[1]	Purpose	Annual Application/ Concentration[2]	Time of Year	Frequency of Application
Triclopyr BEE	Spot spray, cut-stump, frill/injection	Rangeland weeds, brush control, agricultural weeds, invasive plant control	6.6 gallon concentrate over 154 acres	Spring/ summer/ fall	1 time per year
Triclopyr TEA/ Aminopyralid TIPA	Spot spray, cut-stump, frill/injection	Rangeland weeds, invasive plant control	20 gallon concentrate over 174 acres	Any time of year	1 time per year
Pesticide Use in Natural Lands					
Glyphosate IPA	Spot spray, cut-stump, wick, frill/injection	Invasive plant control	1 gallon concentrate over 100 acres	Spring/ summer	1 time per year
Glyphosate K	Spot spray, cut-stump, sick, frill/injection	Invasive plant control, sudden oak death	71.5 gallon concentrate over 955 acres	Spring/ summer	1 time per year
Clethodim	Spot spray	Invasive plant control	1.8 gallons concentrate over 243 acres	Spring/ summer	1 time per year
Aminopyralid TIPA	Spot spray, cut-stump, basal bark, wick, frill/injection	Invasive plant control	2 gallon concentrate over 174 acres	Any time of year	1 time per year
Clopyralid MEA	Spot spray, cut-stump, frill/injection	Invasive plant control	1.7 gallons concentrate over 164 acres	Spring/ summer	1 time per year
Imazapyr IPA	Spot spray, cut-stump, frill/injection	Invasive plant control, sudden oak death	0.35 gallon concentrate over 8 acres	Spring/ summer	1 time per year
Phosphite K Salts, mono-/ di-	Spraying or Injecting	Sudden oak death	45 gallons concentrate over 30 acres	April/May or October/ November	1 time per year

Pesticide Type	Method of Application[1]	Purpose	Annual Application/ Concentration[2]	Time of Year	Frequency of Application
Triclopyr BEE	Spot spray, cut-stump, basal bark	Invasive plant control	54.6 gallon concentrate over 955 acres	Spring/ summer/ fall	1 time per year
Triclopyr TEA/ Aminopyralid TIPA	Spot spray, cut-stump, frill/injection	Invasive plant control	17.5 gallon concentrate over 164 acres	Any time of year	1 time per year

[1]All applications are made according to product label instructions and may include methods not listed here.

[2]Pesticide quantities are expressed as volume of concentrate, i.e., volume of undiluted product.

Source: Midpen 2014b

Pesticide application in riparian areas is generally limited to one to five sites per year, and only occurs when manual or mechanical methods are not feasible or appropriate for the site. Per the BMPs of the IPM Program, shortly before treatment, a Midpen approved qualified biologist or other Midpen approved personnel will survey the treatment sites to determine whether any aquatic features are located onsite. Aquatic features are defined as any natural or manmade lake, pond, river, creek, drainage way, ditch, spring, saturated soils, or similar feature that holds water at the time of treatment or typically becomes inundated during winter rains. If during the survey it is found that aquatic features are present within 15 feet of the proposed treatment area, Midpen will either eliminate all treatment activities within 15 feet of the aquatic feature from the project (i.e., do not implement treatment actions in those areas) or if Midpen chooses to continue treatment actions in these areas, Midpen will use pesticides and adjuvants labeled for aquatic use in compliance with all special status wildlife species measures.

Pesticide application adjacent to high risk fire areas is necessary where perennial vegetation is not responding to manual or mechanical treatments. Flammable vegetation may be spot sprayed annually within 30 feet of a structure, in combination to mowing. Trees or large shrubs that require removal within 30 feet of defensible space are typically treated by cut-stump method to permanently remove them from this high risk zone. For example, some native re-sprouting brush species that are also known to be flammable, such as coyote brush and chamise, can be eliminated from proximity to buildings with cut-stump or spot spraying. Spraying around buildings further avoids having to run a brushcutter blade against or around buildings, fences, pipes, rocks, and other obstacles that can be a fire risk by causing sparks.

6.6.2 Compliance with Pesticide Injunctions Concerning Special-Status Species

Midpen uses pesticides in accordance with two Court-ordered injunctions. In 2006, a Court-ordered injunction resolved a case against United States (U.S.) Environmental Protection

Agency (USEPA) by the Center for Biological Diversity that involved California red-legged frog. This injunction put in place buffer areas around certain California red-legged frog habitats and disallowed use of certain pesticides within those habitats and buffer zones in certain 'geographic areas designated by the USFWS as critical habitat and specified non-critical habitat sections'[2]. The 2006 injunction generally applies to invasive plant species and noxious weed control but does not apply if the following conditions are met:

- Pesticide is being used for the purposes of controlling state-designated invasive species and noxious weeds under a program administered by a public entity;
- The pesticide is not used within 15 feet of aquatic breeding critical habitat or non-breeding aquatic critical habitat within critical habitat areas, or within 15 feet of aquatic features within non-critical habitat sections subject to the injunction;
- Application is limited to localized spot treatment using hand-held devices;
- Precipitation is not occurring or forecast to occur within 24 hours; and
- Pesticide is being applied by a certified applicator or person working under the direct supervision of a certified applicator.

In 2010, another Court-ordered injunction (Goby-11 injunction) went into effect restricting the use of pesticides in San Mateo and Santa Clara Counties (California Biological Diversity v. USEPA [No. C 07-02794 JCS (N.D. Cal)]). In May 2010, the U.S. District Court for the Northern District of California issued an Order and Stipulated Injunction that established interim protective measures for 11 federally listed threatened or endangered species[3] until the USEPA has completed its review and any necessary consultation with U.S. Fish and Wildlife Service (USFWS) regarding the potential effects of a pesticide active ingredient to the subject species. The interim protective measures are no-use buffer zones (shown on the San Francisco Bay Area – Interim Pesticide Use Limitations interactive map[4]) adjacent to certain features within certain geographic areas in the eight Bay Area counties. These buffer zones are different depending on the species at issue and the pesticide being used. Note that there is an exception to these no-use

[2] A map depicting California red-legged frog habitats subject to the 2006 injunction is available online at: https://www.epa.gov/sites/production/files/2015-07/documents/santaclara-jj.pdf

[3] Species identified in the lawsuit include Alameda whipsnake, bay checkerspot butterfly, California clapper rail, California freshwater shrimp, California tiger salamander, delta smelt, salt marsh harvest mouse, San Francisco garter snake, San Joaquin kit fox, tidewater goby, and valley elderberry longhorn beetle.

[4] Available online at: https://www.epa.gov/endangered-species/san-francisco-bay-area-map-tool-identify-interim-pesticide-use-limitations

buffer zones for invasive species management. Per this exception, no-use buffers shown on the interactive map for the San Francisco Bay Area are reduced to 20 feet for aquatic and non-aquatic uses to control state- or federally-designated invasive species and noxious weeds when such a program is administered by public entities. Under this exception, pesticide application must be:

- limited to localized spot treatments using hand-held devices;
- overseen by a certified applicator; and
- not made when precipitation is occurring or is forecast to occur within 24 hours after application.

In areas that provide habitat for California red-legged frog and other special-status species covered by the two injunctions, Midpen must limit pesticide application on invasive plants, noxious weeds, and stinging insects in accordance with the exceptions to the injunctions and comply with the above-described conditions.

6.7 Conservation Grazing

Conservation grazing is conducted on Midpen coastal rangeland and agricultural farms and fields to control growth of herbaceous weeds, brush, and non-native plants; enhance the diversity of native plants and animals; help sustain the local agricultural economy; foster the region's rural heritage; and manage fire fuel (i.e., flammable vegetation). Conservation grazing uses livestock to reduce the height and thatch build-up of non-native annual grasses, which benefits native grasses, and a variety of other native grassland species, supporting more diversity. In addition, the reduction of fuel loads reduces the intensity of wildfires.

Midpen's Conservation Grazing Program started in 2008. Currently, approximately 11,000 acres are grazed and managed by multiple ranching tenants. Typically, lands are grazed with cattle; however, in some instance's other animals such as goats or sheep may be more appropriate. Midpen works closely with grazing tenants to ensure grazing practices are compatible with or contribute to resource protection. Conservation grazing is used within portions of five OSPs, including La Honda Creek, Purisima Creek Redwoods, Russian Ridge, Skyline Ridge, and Tunitas Creek OSPs, and may be extended into additional areas as more lands are acquired. One future property that Midpen is currently acquiring that will be added to the Conservation Grazing Program is the Cloverdale property located in Pescadero. Midpen's Conservation Grazing Program is also compatible with the implementation measures for the Pescadero total maximum daily load (TMDL).

All conservation grazing activities would be conducted in accordance with the goals, policies, and implementation measures included in Midpen's Grazing Management Policy (Midpen 2008). In compliance with Policy GM-1, a certified rangeland manager would prepare site-

specific grazing management plans that incorporate BMPs for preserves where grazing will be utilized based on the unique features of each site. In addition, the rangeland manager would determine the appropriate class of livestock and stocking rates based on site-specific conditions, such as soil fertility, terrain, plant composition, water availability, and available infrastructure. For example, in locations with steep slopes or slopes partially vegetated with brush where cattle are not able to graze, goats may be a more effective alternative.

Before conservation grazing activities commence, a biologist will evaluate the area to be grazed to identify sensitive resources, including special-status plants, wildlife, and wetlands. In order to contain livestock grazing, wildlife-friendly fencing will be installed that allows for wildlife movement. Typical fencing includes four- or five-strand barbwire fencing with a barbless bottom strand 18 inches above ground level, wood rail fencing, and temporary electric fencing that can be installed to seasonally restrict livestock to target areas or exclude livestock from sensitive areas. Other types of fencing that are installed in sensitive areas such as around ponds or in flyways for birds and bats includes smooth bottom or top wire fences. Once fencing has been installed, cattle or other livestock, are put on parcels for a set amount of time and are monitored to ensure appropriate amounts of residual dry matter remains on the ground in order to accommodate new plant growth, prevent soil erosion, and maximize species richness. Conservation grazing is conducted either seasonally, typically in late spring or early summer when vegetation is palatable to the grazing animals, or year-round. Fence repair and installation and surveys and monitoring may occur year-round. To further enhance conservation grazing areas, Midpen removes coyote brush through mowing, mastication, spot spraying and burning to protect native grasses.

6.8 Traditional Ecological Knowledge Practices (Indigenous Stewardship).

Traditional ecological knowledge (TEK) practices are led by locally indigenous individuals and communities on the lands Midpen stewards. These practices include identifying culturally significant plants; assessing the phenology, growth, and abundance of plants that can support gathering or seed/fruit collection; harvesting and gathering native plant species; and cultivating, tending, or planting native species. TEK practices also include invasive plant removal (covered under the IPM program). Collection is generally limited to 5% of a plant population that has been determined to be locally extensive by a botanist. The plant species and their uses are considered sensitive cultural information. None of the species are listed or protected by California Native Plant Society (CNPS), state, or federal agencies. The small-scale hand collection and manipulation of native plants is currently a limited activity in upland settings. Riparian and wetland gathering follows the same principals but has not occurred to date. The proposed Prescribed Fire program (within the Wildland Fire Resiliency Program) includes cultural burns with general habitat restoration goals and specifically includes the restoration of culturally significant plant and animal species.

This page intentionally left blank

Chapter 7. Road and Trail Maintenance

This chapter identifies and describes Open Space Maintenance and Restoration Program (Program) activities along Midpeninsula Regional Open Space District (Midpen) roads and trails. Midpen's network of roads and trails is necessary for emergency access, recreational use, Midpen patrol and maintenance, and ranching operations. Maintenance of road and trails is a necessary activity in order to enhance human movement throughout Midpen lands while reducing impacts to water quality and aquatic habitat related to erosion and sedimentation. The maintenance of road and trails also reduces illegal trespass into other portions of open space preserves (OSPs or Preserves), aiding the protection and enhancement of listed species habitats.

7.1 Paved Road Surface Maintenance Activities

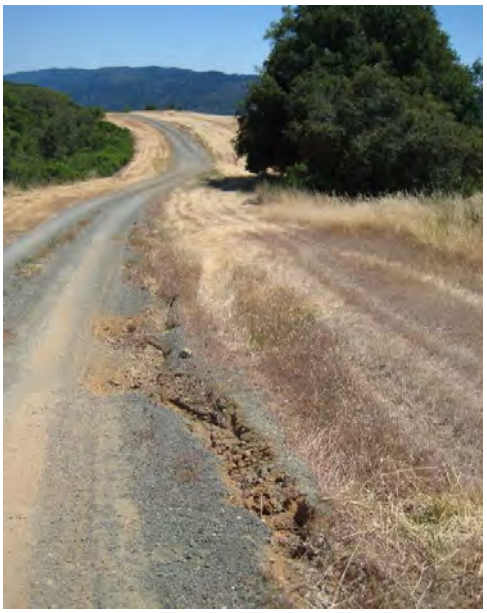
Paved roads allow access to Midpen lands. These roadways are typically 12 to 22 feet in width, and have either a base rock or natural 2-foot surface shoulder on each side. Midpen currently maintains 16 miles of paved roads, primarily consisting of Mount Umunhum Road, roads within Rancho San Antonio OSP, and driveways.

Primary road maintenance activities include repairing small potholes, repairing roadway base, repaving, sealing cracks, resurfacing, and installing oil screens. These activities are conducted to ensure a safe roadway surface for motorists and to prevent further roadway deterioration or failure. Most patching and resurfacing activities occur between April and October. Potholes are repaired shortly after they occur to prevent accidents and other traffic-related safety risk.

Paved road surface maintenance activities may require removing asphalt using either manual or mechanical methods. For small areas, asphalt would be removed manually by sawcutting, jack hammering, or by using sledgehammers, shovels and wheelbarrows. Depending on the size of the area and quantity of material to removed, material may be removed with a front-end loader or bobcat. For larger areas, asphalt will be ground down or pulverized and is either loaded directly into a dump truck or left in place and re-compacted as the base. A roller or a jumping jack will be used to compact the material. In some instances, asphalt grindings may be

incorporated into the base of the new pavement. Otherwise, asphalt materials will be hauled away from the site immediately and subsequently recycled.

For repaving work, the elevation of the finished edge of the paved roadway should meet or exceed the elevation of adjoining shoulder areas. Base materials are typically replaced where required to bring the finished road surface to grade with adjoining materials. Where possible, base materials are compacted to 95% minimum relative compaction where compaction testing is possible. Pavement striping and markings are also replaced where removed or damaged; this work is completed during the dry season. Re-paving efforts for small areas may be conducted by hand, spreading and compacting a hot mix with wheelbarrows, shovels and tampers. For larger areas, a paver box with a hopper and a dump truck that holds the hot mix would be used to repave the site.



Unpaved rural road requiring maintenance in Monte Bello OSP

On occasion, Midpen clears paved roads to remove soil, organic material, and dust and debris to keep sediment from entering waterways and to provide a safe roadway for motorists. Paved road clearing typically occurs in the winter in response to debris and material being deposited onto the road but may occur year-round to maintain public safety.

7.2 Unpaved Road Surface Maintenance Activities

Unpaved roads within Midpen preserves are typically up to 16-feet wide and consist of natural surfaces or base rock. Midpen maintains numerous natural surface roads throughout its preserves to ensure adequate access for emergency and maintenance vehicles, ranching tenants, and patrol services; prevent further roadway deterioration; minimize adverse water quality effects from erosion and sedimentation to nearby water bodies; and for public safety purposes. Midpen currently maintains approximately 220 miles of unpaved roads.

In general, unpaved roads, particularly in steeper areas are susceptible to rapid erosion if not maintained properly. Legacy roads designed for logging or ranching access were not typically designed to be sustainable. In many cases, unpaved roads on Midpen lands have inadequate or damaged drainage structures that need to be replaced. Many portions of existing roads in Midpen lands (e.g., La Honda Creek OSP) were built by "in-sloping" which involves collecting surface water along the inside edge of the road prior to releasing it through a ditch relief culvert that is placed perpendicular to the road. Currently, some unpaved roads experience gullying and erosion due to water concentrating on the road surface caused by improper construction,

infrequent maintenance, or compaction of the roadway surface from use over time. Thus, ensuring appropriate roadway design and routinely maintaining unpaved roads is necessary to reduce road-related sedimentation impacts. In addition, unpaved roads are maintained to provide seasonal access for inspections, ranching operations, research, and emergency response purposes. Unpaved roads may be designated for seasonal use only, primarily to avoid impacts during the wet rainy season. However, in some instances during the wet season, roads may only be accessible by all-terrain vehicle (ATV) or similar off-highway vehicle (OHV). In addition, approximately 7 miles of remnant ranch, logging, and other former roads that are no longer necessary for access have been decommissioned and restored as these abandoned roads can act as a source of sedimentation. Please refer to Chapter 9, *Restoration and Enhancement Projects* for more information on road decommissioning.

Depending on roadway conditions, unpaved road surface maintenance activities include re-grading the road to its existing grade or original cut, installing additional drainage structures (i.e., culverts, inside ditches, rolling dips), repairing/cleaning rolling dips and roadside ditches, filling ruts, relocating road surface materials that have moved due to erosion, and removing debris from landslides. Repairing roadway slides and slip-outs is discussed in Section 7.4, below. In addition, minor relocations of roads (i.e., within 400 feet upstream or downstream of original location) are conducted as long as it improves drainage, removes roads from environmentally sensitive areas, or increases stability. As described in Chapter 5, drainage features (e.g., culverts, rolling dips, etc.) are monitored and repaired or cleaned as needed to minimize both damage to road surface and potential sedimentation effects on nearby water bodies.

Heavy equipment utilized for road repairs includes dozers, loaders, excavators, rollers, dump trucks, cables and winches, etc. Earthwork adjacent to a creek crossing or having the potential to direct drainage into a creek that provides habitat for salmonids is limited to June 15 to October 31. Earthwork within and around creeks that do not provide habitat for salmonids is limited to April 15 to October 31. Earthwork on all other roads may occur year-round during dry periods, scheduled around blooming periods for special-status plant species, provisions for special status species (e.g., noise restrictions for murrelet, bats etc.), and according to local grading ordinances. Midpen prepares Road and Trail Inventories and Maintenance Plans for its Preserves that identify sites in need of work; these plans are updated after significant work to document completed repair. Each year, work is conducted based on road assessment and project prioritization. Work is performed during the dry season by Midpen staff or contractors. Roads that are solely used in support of ranching and agricultural activities may be maintained by the conservation grazing tenants.

7.3 Trail Maintenance and Repair

Trail maintenance and grading in Russian Ridge OSP

Midpen is responsible for maintaining numerous trails throughout its lands and other agency lands to ensure public safety of recreationists (i.e., bicyclists, equestrians, and pedestrians). Midpen's standard trail size is approximately 2 to 6 feet wide, may be accessible by ATV for maintenance work, and consists of natural or base rock surfaces. Midpen maintains over 240 miles of public trails throughout its 26 open space preserves, which includes 115 miles of single-track trails and 125 miles of roads. Approximately 7 miles of these trails are easy access/Americans with Disabilities Act (ADA) trails that were built to accommodate those with limited mobility. Many of these easy access/ADA trails are at least 4 feet wide, have a grade generally not exceeding 5%, and have a fairly uniform and compacted surface consisting of natural surfaces, decomposed granite, or pavement. Midpen currently has approximately 1 mile of trails that are ADA-compliant. Midpen is working to upgrade additional easy access trails to be ADA-compliant.

Trail surfaces commonly wear down in areas where a particular trail is heavily used making trail surface repair or re-grading work necessary. Trail surface repair involves adding the proper soil type to the problem area and re-compacting the soil. Re-grading a trail may be necessary to address problematic sections of a trail and involves grading the trail back to the original cut and filling in ruts as needed. Natural and existing drainage patterns are retained where possible. Increased flow velocities, caused by change in trail slope or surface material, may require a change in storm water drainage. In Midpen's experience, a hard-packed trail with a native surface, if compacted, can function similarly as a paved trail; not all resurfacing or hardening projects will necessarily change the storm water function of the trail. Earthen materials moved by erosion or landslides and washed into drainage ditches may require returning the earthen materials to the restructured trail. In some instances, due to severe erosion or the presence of landslides, short segments of a trail may require re-routing.

Trail maintenance and grading in Russian Ridge OSP

Trails may be relocated within 400 feet upstream or downstream of the original location as long as the new trail improves drainage, removes a path from environmentally sensitive area, increases trail stability, or increases long-term operation and maintenance sustainability of the trail. Similar to unpaved road maintenance work described above, rolling dips and drainage ditches may require cleaning to improve drainage and prevent or reduce erosion and downstream sedimentation issues in nearby channels and creeks. Other trail maintenance work includes repairing and installing new signage, removing graffiti, and repairing other trail structures.

Trail maintenance adjacent to a creek crossing or having the potential to direct drainage into a creek that provides habitat for salmonids is limited to June 15 to October 31. Trail work within and around creeks that do not provide habitat for salmonids is limited to April15 to October 31. Earthwork on all other trails may occur year-round during dry periods, scheduled around blooming periods for special-status plant species. As mentioned above, trails in need of repair are scheduled to occur prior to the next rainy season and are identified in each Preserves' Road and Trail Inventories and Maintenance Plan. Typically, hand tools such as shovels, McLeod tools, and pick-mattocks are used by Midpen staff or volunteers for trail maintenance activities. Mechanical equipment may include power carriers, mini-excavators, and Sweco separators. A majority of trails are open year-round for equestrian, bicycle, and pedestrian use; however, a small number of trails, typically for equestrian and bicycle use, may be closed to the public during wet periods. During wet periods, trails may also be closed to hiking due to landslides.

7.4 Roadway or Trail Slip-outs and Slide Repairs

Slope failures on the cut slope side of a roadway or trail are typically referred to as "slides," whereas slope failures on the fill side are typically referred to as "slip-outs." Such repairs are performed on an as-needed basis to prevent additional failure of supporting soils or structures, and to reduce the potential risk of falling debris. In some instances, the base of the roadway or trail slide occurs along a stream course whose streambank has eroded. The streambank failure may be a consequence (non-cause) of the upslope larger slide surface; or the streambank failure may be the driving cause of the slide that affects the hillslope and roadway above.

During (and after) the rainy season, when soils are saturated, the possibility of roadway or trail slip-outs and landslides increases. Thus, the number of slip-out and slide repairs in any given year will vary depending on weather conditions. In the late winter and spring months following a particularly wet season, roadway or trail slip-outs and slides are more numerous and require more repair maintenance.

Slip-out/slide repairs are common in areas where soils underlying roadways or trails are unstable and erosive, such as along Mt. Umunhum Road, Purisma Creek Road, and La Honda Road, as well as within Fremont Older, Bear Creek Redwoods, El Sereno, and El Corte de Madera OSPs. The cause for slope failure depends on site-specific conditions such as soil type,

historic road construction methods on uncompacted fill, topography, hydrologic and drainage conditions that contribute to slope instability, and a prior history of mass movement along the hillslope. Before initiating repair work, Midpen may retain a qualified civil engineer to assess the slope conditions supporting a particular road or trail. To address slip-outs and slides, Midpen will evaluate the cause of the instability and first aim to use earthen and biotechnical solutions to minimize adverse environmental effects. However, depending on the severity of the road slip-out/slide, construction of retaining wall systems or placement of riprap are sometimes necessary. Small slides can typically be stabilized with riprap or short (i.e., less than 3-foot) retaining walls; however, larger slides or slip-outs that require engineering may require County permits. If the road surface is still intact underneath a slide, Midpen clears the slides and places the soil on nearby road surfaces with appropriate drainage structures. The site is stabilized with large rock or compacted and sloped soil to fill in the road prism.

Equipment used for slip-out/slide repair activities may include excavators, bulldozers, front-end loaders, and dump trucks. Material removed from slides is typically deposited nearby, graded, and appropriate drainage features are installed. Erosion control measures, such as strawing or local vegetation, are then installed on top of the graded soil to prevent erosion.

Occasionally in areas with large scale landslides, such as along the Schilling Lake Trail in the Thornewood OSP or Harrington Creek Trail in La Honda OSP, the entire slide moves. In cases where no reroutes are available to avoid the slide (such as in these locations), Midpen grades through the slide to reconnect the ends of trail and installs drainage features to pass water across the trail. A recent example of slip-out repair that Midpen conducted in summer 2019 was on Middle Road at Windy Hill OSP. The slip-out was between two levels of the roadway switchback. Midpen widened the road and placed rock at the toe of the slide for stability and then shaped the slope and added drainage features to divert road surface runoff way from the slip-out.

Chapter 8. New Small-Scale Facilities Improvements

New small-scale facilities improvements included in the Open Space Maintenance and Restoration Program (Program) are projects that reduce the threat to, or correct degradation of, natural environments and reduce adverse impacts to sensitive species that result from current conditions.

8.1 Existing Buildings and Structure Repairs and Utility Improvements

A vault toilet was replaced to be Americans with disabilities Act (ADA) accessible in Purisima Creek Redwoods Open Space Preserve (OSP or Preserve)

Existing building and structure improvements and repairs include stabilizing historic residences (e.g., Thornewood Estate house and Hawthorns house), barns, stables and other structures in working ranches/farms; removing dilapidated structures; designing and constructing structures for sensitive species (e.g. turtle basking platforms, bird boxes, bat boxes); remodeling field staff offices and accessory structures, and tenant and workforce housing within the existing footprint; replacing and potentially relocating restrooms to more suitable areas; and conducting driveway improvements, described in more detail in Chapter 7, *Roads and Trail Maintenance*. Typically, this work occurs in uplands but may occur along the edges of riparian areas. In some instances, new construction of utilities or temporary staging is necessary for operational reasons. Any new

construction would be located in a disturbed area ancillary to an existing building/structure. Typically, approximately five projects would be conducted each year.

Midpeninsula Regional Open Space District (Midpen) is responsible for maintaining septic, water supply, telephone, telecommunications, and other utilities within the Program area. Utility work would be confined to areas surrounding existing residences, offices, restrooms, maintenance yards, and existing utility lines, typically located in areas that are already disturbed. Although infrequent, some utility-related work may occur adjacent to riparian areas or near sensitive habitats, which may require a biological monitor to be present and implementation of avoidance and minimization measures to minimize impacts to sensitive habitats. Midpen anticipates working on two to four utility projects per year. The installation of new utilities located outside of existing developed areas would require applicable project-specific permits and would be permitted outside of this Program.

8.2 Recreational Facility Improvements

8.2.1 New Trails/Roads and Re-Routes

To facilitate improved access to Midpen's lands, the Program includes the construction of new trail connections (including at grade road crossings) and loop routes and, in some locations, rerouting of existing trails and roads within 400 feet of the existing road/trail. Re-routes of existing trails/roads would only be conducted if the new route would reduce habitat degradation associated with existing access; provide necessary access for other OSPs habitat management or enhancement activities supporting sensitive species (e.g., pond maintenance); or if the original facility was sited improperly (e.g. located on unstable soils). Former routes are regraded to minimize erosion and to meet the natural grade and are replanted with appropriate native plants to restore the area, unless the previous route is needed for ongoing operations.

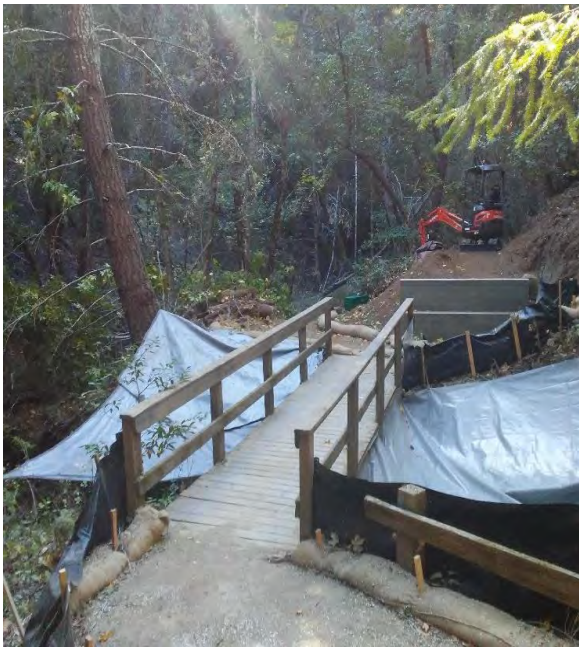
New trails would typically be 4 feet in width for single track or 6 feet in width to accommodate all-terrain vehicles (ATVs). ADA-compliant trails would be at least 4 feet wide, have a grade generally not exceeding 5%, and have a fairly uniform and compacted surface consisting of natural surfaces, decomposed granite, or pavement. Midpen currently has approximately 1 mile of trails that are ADA-compliant and is working to upgrade additional easy access trails to be ADA-compliant. Some new trails are constructed in whole or in part by re-use and conversation of an existing abandoned road (typically from logging or other prior land use). Re-use of old roads for trails consists of removing of fill from outboard edge to narrower width and replacing stream crossings. New trails and roads would provide access for conducting invasive plant management activities, evaluating potential sediment reduction work on old logging roads, monitoring plant and animal populations, and facilitating wildland fire actions.

This work may include installing puncheons and armored fords at small and ephemeral crossings or swales, ditch relief culverts, trail bridges and other features associated with new or

rerouted trails. Refer to Chapter 5 for a discussion on road and trail drainage features and Section 8.2.2. for a discussion on trail bridges. Midpen anticipates constructing one to four new trails and roads and/or reroutes per year with an average of one per year. These projects are infrequently located in jurisdictional areas, but when proposed will be included in the annual notification.

8.2.2 New Bridges, Replacements, and Relocations

Midpen seeks to replace degraded bridges, culverts or ford crossings with improved crossings that have a smaller footprint in the creek and are less impacting to the natural landscape. Bridges, culverts, and fords previously built without hydraulic calculations and flow modeling are poorly situated relative to the 100-year floodplain and require replacement. Midpen's preferred approach is to replace crossings in-kind at a higher elevation along the stream; however, sometimes relocation of the bridge crossing upstream or downstream of the original site is the only feasible means of correcting the issue. Trail and vehicle bridges are discussed in more detail below.



Trail bridge replacement at Monte Bello OSP- new abutment at top right, debris catch pre-demolition at center, and erosion control measures

New Trail Bridges and Replacements

New 6-foot-wide trail bridges are a part of many new trail projects, whether the project involves grading a new 4 to 6-foot trail or converting an existing legacy roadbed into a trail. New trail bridges involve the installation of concrete abutments 4-feet below grade located outside of the 100-year floodplain; steel or glulam spanning beams; and wood decking and railings (or fiberglass in more remote settings). New trail bridges are sited in suitable geological and geotechnically stable areas to minimize crossing length, disturbance to riparian trees, and grading on the trail and the approach to the riparian area. No chemical treatments, such as pressure-treated, or paints are used, except for minimal applications of epoxy on attachment details, as required by an engineer.

Trail bridge replacements typically consist of replacing degraded (i.e., rotted) wooden trail bridges originally built in the 1980s-1990s. In most cases, a site-specific analysis may suggest relocation of the trail bridge to span the 100-year floodplain or to setback the abutments from

the top of bank. Proper hydraulic design often results in longer trail bridges than previously constructed (up 1.5 times to 2 times in length). Midpen anticipates working on two to four new trail bridges and replacements per year.

Vehicle Bridge Replacements

Vehicle bridge replacements may be necessary when a bridge is sited improperly and is redirecting flows, and thus increasing erosion and the risk of flooding. Replacing vehicle-width bridges often requires widening the existing bridge area to provide fire-vehicle response and installing modern abutments that are seismically stable, including spread footings, piers, and wingwalls. The footprint for installing these seismically stable abutments is a much larger in footprint than crib-log abutments typical of previously built bridges. Older bridge widths are typically 10-12 feet, whereas 15-20 feet in width is a more common current day standard. Midpen has replaced a few vehicles bridges in the last 5 years, with an average length of 55 feet. Although bridge replacements would disturb riparian areas, temporary vegetation impacts would be restored and stream morphology would be improved by relocating the bridge at a higher location on the stream bank. Falsework or other temporary support within the bed and bank is necessary for the demolition of old bridges and culverts, including debris nets, catchment structures, other containment measures. A typical vehicle bridge replacement project consists of installation of erosion control measures (i.e., wattles, silt fencing, straw bales, gravel bags, and falsework or debris nets beneath the bridge); removal of the existing bridge with a crane or excavator; installation of a temporary culvert stream crossing, where necessary; installation of a dewatering bypass, if necessary; excavation of bridge abutments or drilling of piers; concrete pouring for the abutments; craning/hoisting in steel beams or a steel prefabricated bridge; installation of railings; and lastly, pouring of a concrete bridge deck. Midpen anticipates working on one to two new vehicles bridges per year to replace outdated crossings.

8.2.3 New Interpretative Facilities and Signage

Preserve and interpretive signs at Purisima Creek Redwoods OSP in a riparian setting

New interpretative facilities and signage would be installed at existing OSPs typically at parking lots, trail heads, or near natural aesthetic features such as rock formations, ponds, overlooks, old-growth trees, etc. to educate recreational users about sensitive natural resources. Interpretative facilities and signage would be located in already disturbed areas outside of sensitive habitats. These facilities benefit sensitive habitats and species by providing information on the need for protection of sensitive resources and the regulations on protection of lands where sensitive resources occur. Impacts from installation of these facilities are anticipated to be minimal and take of sensitive species would not occur. Midpen anticipates working on two to four interpretative facilities and signage projects per year. Typical signboard widths are 4.5 feet, made of redwood posts buried 3 feet below grade. Preserve entrance signs are either 4 feet or 9 feet wide with 2-foot-deep concrete footings. Custom interpretive panels are typically 2 to 3 feet wide and 2 feet tall with a single post buried 2 feet below grade.

8.2.4 Wildlife Crossings

A large culvert installed by Caltrans as a California tiger salamander wildlife crossing on Highway 246 near Santa Barbara, CA (Caltrans 2017)

Safe wildlife passages would be provided underneath or over existing roads and highways, most of which are within the right-of-way of local, County, or state agencies. These wildlife crossings, when feasible, may also be used by the public to access trails and other areas of the preserves, thus improving public access. Wildlife crossings generally consist of pipes or tunnels that do not convey flow and which accommodate the size of the wildlife intended to use the structure, ranging from small, 8-inch culverts for very small wildlife to large, greater than 48 inches, arched, bottomless culverts with wingwalls for larger mammals. The lengths of these crossings depend on the roadway and the surrounding habitat, but they have a minimum length of 10 feet and a maximum length of 50 feet for a wider road. Target species range from mountain lions to small newts. Species whose populations are restricted by habitat connectivity, such as badgers, are also a target species. Midpen would typically conduct one to two wildlife passage projects per year, but may conduct up to eight wildlife passage projects per year.

8.3 Conservation Grazing Infrastructure Improvements

As described in Chapter 6, Midpen conducts conservation grazing to manage coastal grasslands while enhancing the diversity of native plants and animals and reducing wildland fire fuels. Since 2008, Midpen has leased land to small-scale, local ranchers on portions of five Preserves (i.e., Russian Ridge OSP, Skyline Ridge OSP, Purisima Creek Redwoods OSP, Tunitas Creek OSP, and La Honda Creek OSP) and ensures that the grazing practices are compatible with or contribute to resource protection. Typical infrastructure associated with conservation grazing includes barns, corrals, wildlife friendly fences, and stock water facilities. Midpen routinely conducts in-kind replacements or repairs of conservation grazing infrastructure to protect species and waters, as well as to control livestock.

Wildlife friendly fence line at Skyline Ridge OSP

Historic grazing operations prior to Midpen's ownership often did not design grazing improvements with the protection of species and habitats in mind. Thus, current grazing operations often require new small-scale construction to achieve conservation grazing objectives consistent with Midpen approved grazing management plans. New small-scale improvements include installation of new fencing and gates around riparian areas and stock ponds/wetlands to keep livestock out of these sensitive areas and relocation of water lines/water troughs that extend from water sources/storage to a location that allows for the better distribution of cattle to achieve desirable habitat objectives for soil health and erosion. Cattle are drawn to water sources and high concentration of cattle in one area could result in negative impacts to waters and soils. New diversion structures within stock ponds may include pumps, siphons, or emergency fire standpipes or other mechanisms to provide cattle water without allowing the cattle direct access. The goal of these projects is to provide water to cattle away from sensitive aquatic environments. Additional water infrastructure improvements are described below in Section 8.3.1.

All new conservation grazing infrastructure improvements or small-scale construction would achieve a conservation grazing resource or restoration objective included in Midpen's Grazing Management Policy (Midpen 2008). Most of this work is limited to existing or previously disturbed grazing lands and would be similar in nature to the maintenance of fences, roads, and water supply facilities. Although infrequent, maintenance of conservation grazing infrastructure may occur in or adjacent to sensitive habitats potentially requiring a biological monitor to be present and implementation of avoidance and minimizations measures to minimize impacts to

sensitive habitats. A majority of Midpen's new small-scale facilities improvements are associated with the conservation grazing program.

8.3.1 New Water Infrastructure

Typical water infrastructure projects include rebuilding historic spring boxes or repairing a water system that is in disrepair. Most water improvements are associated with springs and include a spring box, water lines, and/or storage tanks. Spring diversion structures include a 4 ft by 4 ft by 4 ft wooden or concrete box and 6-inch diameter or less horizontal pipes or an 18-inch diameter or less vertical standpipe. Springs typically produce 0.10 gallons per minute or up to 2.5 gallons per minute. Some springs are located in riparian areas, while others are isolated in \ upland areas.

Wildlife-friendly measures include providing wildlife escape ramps in legacy infrastructure and excluding wildlife from primary water storage to prevent entrapment during repair or upgrade of these facilities. In addition, during repair and upgrade, an overflow and/or bypass water supply accessible to wildlife would be provided to prevent the risk of entrapment. This approach ensures ongoing water supply for wildlife while excluding them from the developed water supply system. Midpen typically works on up to four to six water infrastructure projects per year.

Livestock trough with a wildlife escape ramp

Direct consumption of pond water by cattle (and associated grazing in wetland plants) is the most common form of water use on conservation grazing lands. Some soils and plant communities benefit from restricting cattle access in the form of fencing. To utilize the pond water appropriately, a pump or siphon is installed to relocate water to trough, water tank, and water line for distribution further away. Pumps can be automatically activated by float valves in tanks or troughs and are most commonly powered by solar panels. Pump intakes are screened with a ¼ inch steel mesh to avoid entrainment of aquatic inverts. Pump intakes are set within a 12 inch by 12 inch screened box (similar to a milk crate) that slows intake velocities to a minimal amount. Pumps are either temporarily set in the pond or set floating in the interior away from emergent vegetation. Where a spring is passively diverted into a holding tank, pumps within the tank are used to pressurize water to distribute it to more distant pastures.

Table 8-1. Midpen Projected New Small-Scale Facility Improvements

	Estimated Typical Jurisdictional Disturbance Per Project (square feet)	Max Number of Projects Per Year	Reasoning for Improvement
Buildings and Structures Repairs and Utility Improvements			
Septic System Repair or Replacement	400	2	Facilitates land management
Electrical, Plumbing, or other Utility Line	100	2	Facilitates land management
Existing Building and Structure Repair (e.g., stabilizing historic barns, removing dilapidated structures, remodeling offices and tenant and workforce housing, replacing restrooms, etc.)	50	10	Facilitates land management
Recreational Facility Improvements			
Trail Reroutes	1,500	2	Reduces trail maintenance
Road Reroutes	850	2	Reduces road maintenance
New Trail and Trail Bridge	1,500	4	Facilitates restoration and monitoring
Trail Bridge Replacements	500	4	Improves channel geomorphology
Vehicle Bridge Replacements	3,000	2	Improves channel geomorphology
Interpretive Panels	50	2	Improves public engagement with restoration
Wildlife Crossings	1200	9	Provides safe passage for wildlife

	Estimated Typical Jurisdictional Disturbance Per Project (square feet)	Max Number of Projects Per Year	Reasoning for Improvement
New Conservation Grazing Infrastructure			
Water Lines	20	4	Distribute conservation grazing to achieve grassland health
Spring boxes	30	4	Minimizes cattle use of riparian areas
Tanks, Troughs	10	4	Distribute conservation grazing to achieve grassland health
Pond Diversions/Pumps	50	2	Minimizes cattle disturbance to aquatic habitats

Chapter 9. Restoration and Enhancement Projects

Ecological restoration consists of intentional activities conducted by Midpeninsula Regional Open Space District (Midpen) to accelerate the recovery of an ecosystem with respect to its health, integrity and sustainability. Enhancement is the process of altering habitat to provide specific ecosystem functions. The purpose of restoration and enhancement projects are to improve and/or create habitat for plant and animal species and to restore ecosystem function within Midpen Open Space Preserves (OSPs or Preserves). These projects may be utilized to offset impacts associated with other Program activities. A description of Midpen's restoration and enhancement activities, including aquatic habitat restoration, native vegetation plantings, invasive species removal, road decommissioning, and other restoration activities, are described below.

9.1 Aquatic Habitat Restoration

Midpen conducts aquatic habitat restoration activities within ponds, wetlands, seeps, and springs as well as along and adjacent to creeks and rivers within the Open Space Maintenance and Restoration Program (Program) area.

9.1.1 Pond and Wetland Restoration

Pond restoration work conducted with heavy construction equipment

Midpen enhances pond and wetland habitat through reinforcing or repairing failing earthen berms; improving inlet or outlet features; removing sediment from aquatic features whose hydroperiod no longer supports suitable conditions for sensitive species; recontouring ponds to increase aquatic habitat; removing excessive aquatic vegetation and invasive species; installing wildlife habitat structures and escape features; placing large woody materials to restore and enhance aquatic habitat; and enlarging aquatic features to optimize geometry to support vegetative benches and open water areas for use by sensitive species, including California red legged frog. Pond maintenance activities are described in more detail in Section 5.6, *Ponds.*

Some ponds on Midpen lands were created illegally and/or have no water rights and do not provide useful habitat for sensitive species. Ponds or wetland features that are detrimental to sensitive species (e.g., insufficient ponding period, perennial waters that support invasive species, etc.) may be modified or decommissioned and restored to a native condition (i.e., riparian channel, swale, or upland habitat), which returns water to the surrounding ecosystem and often benefits downstream species and/or habitat. Midpen's preferred approach is to modify an existing pond/wetland feature prior to decommissioning. A loss of wetlands would be offset by improvements to other aquatic features that support sensitive species and implemented consistent with the United States Fish and Wildlife Service (USFWS) 10(a)1(a) permit.

Pond restoration work conducted with hand tools

In addition to modifying existing habitat (i.e., typically historic ponds), Midpen may create new features by restoring previously filled in wetlands or constructing off-channel pools to expand aquatic habitat for sensitive species.

Modifying existing aquatic habitat may also include the reintroduction of native plants and wildlife species.

To prohibit cattle from accessing and trampling sensitive areas such as California red-legged frog egg depositories, Midpen installs, realigns, and maintains exclusion fencing within and around water features to enhance aquatic and riparian habitat. Fencing may also be installed around populations of rare plants that may be adversely affected by conservation grazing or other activities.

Stream restoration work involving removal of an old crossing (left) and installation of a new bridge outside of the channel (right)

Heavy equipment such as dozers, loaders, excavators, rollers, compactors etc. as well as some hand work will be used for aquatic habitat restoration, enhancement and creation. These activities will occur once seasonal ponds or wetlands are dry (if prior to August 15) or if draining of features is required and California red-legged frog are present, work will occur between August 15 and November 1, prior to the beginning of California red-legged frog breeding season. Surveys and monitoring may occur year-round. A qualified biologist will be required to sample the aquatic feature two days before the start of work to ensure that all California red-legged frogs are in the post metamorphic stage.

9.1.2 Creek and River Restoration

Restoration activities within creeks and rivers may include removal of in-stream infrastructure and barriers to fish passage; removal of old crossings, including culverts on no longer used roads or collapsed crossing structure; installation of habitat features, such as large woody material; removal of in-channel debris (i.e., tires, trash, other non-sedimentary materials); riparian vegetation treatment and planting in accordance with the Midpen's Integrated Pest Management (IPM) Program, and gravel augmentation. Riparian vegetation treatment and planting is described in Section 9.2, *Native Vegetation Plantings*, below.

Removal of in-stream infrastructure, including diversion impoundments and collapsed structures, such as bridges and culverts that may block fish passage, would create and improve aquatic habitat and improve connectivity for fish and other species, including steelhead. In addition, as a steward of the environment, Midpen routinely removes debris/trash that may impair hydraulic conditions and reduce flow conveyance capacity. In-channel work would be limited to the dry season or during low flows. Prior to work, humanmade materials or other debris to be removed below the ordinary high water mark would be reviewed by a qualified geomorphologist, engineer, or hydrologist. Removal of humanmade materials or refuse would be done by hand wherever possible. Cables, winches, and heavy equipment used to pull out large material would be staged above the top of bank. Where these materials are within the bank, streambank slopes would be stabilized to prevent erosion with bioengineering techniques (i.e., willow stakes, slash packing, etc.), weed-free straw, or jute-netting.

Large woody materials (i.e., downed trees) can provide habitat, and geomorphic or other channel stability benefits. However, fallen large woody materials may also have the potential to increase flooding or erosion threats by significantly obstructing flows or deflecting flows towards banks or other facilities. If it is unlikely for large woody materials to pose a threat to the environment or infrastructure and there is adequate flow capacity, Midpen seeks to retain the materials in place as a habitat feature. In some cases, Midpen may trim or limb some branches that could collect debris or re-orient the large woody material in the channel. Cables, winches, and heavy equipment would be used to pull or tie large woody material into place. In some areas, hand tools and hand laborers would be utilized. Down tree management is discussed in more detail in Section 6.3.1, *Downed Tree Management*. Installation of new large woody materials can be used to restore natural stream grade, store sediment, promote groundwater recharge, reduce water temperature, promote scour pools and high flow refugia, and prevent headcutting. Techniques for large wood installation follow best practices developed by California Department of Fish and Wildlife (CDFW), National Oceanic Atmospheric Administration (NOAA), and the Salmon Restoration Federation, even in streams without salmonids. Large wood installation is focused on watersheds that are impaired for sediment and/or support salmonids with a focus on less developed areas and natural stream channels.

Instream gravel and course sediment along a streambed can be a fundamental habitat element to a healthy functioning stream directly supporting life-cycle needs of fish, amphibians and other aquatic wildlife. Gravel augmentation provides direct benefits for improving fish spawning and rearing habitat by enhancing sedimentary materials within the channel bed. Midpen may use watershed specific gravels collected through sediment removal activities behind in-stream structures (i.e., dams) as the source for gravel augmentation projects. Midpen would collect, sort, separate, and reuse clean and appropriately sized gravel. When designing a gravel augmentation project, several factors will be considered, including: the existing channel conditions; the grain size distribution of the sediment to be added; the volume of gravel to deposit; the frequency of gravel addition that will be required in light of sediment transport;

how the added gravel will interact with the existing flow regime and/or channel geometry; and the extent of augmentation effects within the channel reach. In the future, Midpen may assess opportunities to augment gravel in salmonid streams (e.g., streams in San Gregorio, Pescadero-Butano, or Pilarcitos watersheds).

Restoration activities adjacent to creeks and rivers may include floodplain reconnection, including the lowering of artificial berms, streamside decommissioning of roads, and other measures to restore the lateral connectivity of streams. Decommissioning of roads is discussed in more detail in Section 9.4, *Road Decommissioning*.

Work within and around creeks and streams that provide habitat for salmonids would be limited to June 15 to October 31. Work within and around creeks that do not provide habitat for salmonids and do not discharge directly into such drainages would be limited to April15 to October 31.

9.2 Native Vegetation Plantings

Staff and volunteers planting native trees/ vegetation

The objective of native vegetation plantings is to enhance the complexity and diversity of upland and wetland habitats and restore areas disturbed during Program activities (i.e., trail construction in riparian areas, replacement of bridges, or reconstruction of ponds for California red-legged frog). Native vegetation plantings will also enhance habitat for birds, amphibians, and other wildlife using upland, wetland, and riparian areas. Planting source materials vary by setting and the desired restoration condition. Live wood cuttings and seed are generally preferred, especially in riparian habitats, because they avoid the import of soils that may contain harmful soil pathogens that can be found in nursery stock. Where nursery plants are necessary, Midpen sources nursery plants from vendors that have a soil sterilization process and can certify pathogen free soils. Species types are determined by Midpen vegetation staff, who consider plant survivability, ecosystem benefits, climate change, and other factors. The appropriate species to plant will vary based on several factors including soil conditions, water availability, slope angle, aspect, shade tolerance, and propagule sources. Native vegetation established in undisturbed adjacent areas is often a good indicator of species suitable for native vegetation planting sites. Native vegetation plantings involve planting and seeding locally collected native species; installing temporary irrigation, as necessary; controlling

weeds and invasive plants through manual, mechanical, or biological methods such as herbicide application, prescribed fire or use of grazing animals; installing herbivory protection structures (such as cages or plastic hoops); and using bioengineering techniques for planting, where appropriate, such as willow plantings in rip-rap or incorporating wood into a slope stabilization site. Erosion control best management practices (BMPs) such as straw wattles, coir rolls, certified weed-free straw, and erosion mats would be implemented to minimize impacts to streambanks and to prevent erosion and soil loss. Wildlife friendly netting such as "Nature Zone ™" or equivalent would be utilized. At Mt. Umunhum in Sierra Azul OSP, which was heavily disturbed by the previous air force base, the rocky substrate and high altitude have made for unusual planting conditions. A number of endemic species as well as California Native Plant Society listed species are present. This 'rock island' and some of the surrounding chaparral communities benefited from the planting of 25 species and approximately 1,200 individual plants on the site. Midpen has also acquired former orchards (fruit or Christmas tree sites) that benefit from the removal of the overstory trees and planting with trees that reflect the surrounding vegetation communities, such as oaks. In jurisdictional areas, willows and other fast-growing species are typically favored in order to stabilize slopes and restore the vegetative functions as soon as practical.

9.3 Invasive Species Removal

All invasive species removal is conducted under Midpen's IPM, which emphasizes an ecological approach to managing pests. Invasive species removal restores native ecosystems and increases biodiversity. Midpen's goal in removing invasive species is to maintain the long-term stability and resiliency of its natural areas. A summary of invasive plant and animal removal activities conducted under the IPM is included below.

Invasive plant removal activities conducted under the IPM Program

Invasive Plant Removal

Controlling invasive plants enhances native riparian and aquatic vegetation and increase biodiversity. Removal of invasive and non-native vegetation also protects valuable habitat assets such as ponds and grasslands. Midpen actively treats 105 plant species on their lands using various methods including manual, mechanical, chemical (e.g., herbicide and fungicide), and biological control (e.g., bio-control agent). Refer to Midpen's *Integrated*

Pest Management Program Guidance Manual (Midpen 2014) for a complete list of plant species. Note that not all of the plant species are worked on every year. The following nine (9) species are the most common: English ivy, French broom, goatgrass, hanging sedge, purple star thistle, slender false brome, distaff thistle, stinkwort, and yellow starthistle. Manual removal may include the use of hand picks, planting knifes, weed wrenches and other hand tools. Mechanical removal methods may include the use of brushcutters, hedgers, chainsaws, chippers, and mowers. Chemical methods involve the use of herbicides, including Roundup Custom (Glyphosate), Roundup ProMax (Glyphosate), Milestone (Aminopyralid), Transline (Clopyralid), Polaris (Imazapyr), Stalker (Imazapyr), Envoy Plus (Clethodim), Capstone, and Garlon 4 Ultra. Agi-Fos is a fungicide used to prevent Sudden Oak Death (SOD). Biological methods may include using other organisms to control pests. Flaming of seedlings, burn piles, and prescribed fires may also be used. Invasive plant removal and the controls methods are described in more detail in Chapter 6, *Vegetation Management*. Depending on the target species, surveys, treatments, and monitoring may occur year-round. Prior to invasive species removal, a biologist will evaluate the area for special-status species. If special status species are present, they would be avoided and/or effects would be minimized through the implementation of BMPs. Invasive and non-native plants would be disposed of appropriately by the contractor to reduce and/or avoid their proliferation and spread. Midpen anticipates working on up to 100 invasive plant removal projects per year.

Invasive Animal Removal

Invasive animals threaten Midpen's natural areas by competing for resources with native species and disturbing natural food webs. The most common invasive animal species in Midpen's OSPs include non-native fish, American bullfrogs (*Rana [Lithobates] catesbeiana*), wild (feral) pigs, and non-native turtles. Known species non-native fish include black bass (*Micropterus* sp.), sunfish (*Lepomis* sp.), catfish (*Ameiurus*/*Ictalurus* sp.) and mosquitofish (*Gambusia* sp.). These species are generally found in humanmade stock ponds and reservoirs but may occur in natural sag ponds. Midpen does not actively manage non-native fish in humanmade water features unless the water body also supports protected native sensitive species, such as the California red-legged frog. Bullfrogs are quite common in ponds and are the most problematic invasive species in Midpen lands because they directly affect the California red-legged frog. In habitats where they exist together, bullfrogs outcompete California red-legged frogs or consume them directly in all forms (i.e., as tadpoles, metamorphs, or as adult frogs). In addition to competition and predation, bullfrogs spread chytrid fungus, which is a lethal skin disease known as chytridmycosis that impacts many of California's native amphibians. Feral pigs are widespread in the central coast of California and impact Midpen lands by digging up meadows and wetlands and by carrying diseases that can affect people and livestock. Since 2000, Midpen has been trapping feral pigs and has substantially reduced their population. Non-native turtles including red-eared slider (*Trachemys scripta elegans*) and eastern snapping turtle (*Chelydra serpentina serpentina*) have been documented to occur on Midpen lands. Midpen selectively manages non-native turtles especially in waterbodies that also support native sensitive species,

such as California red-legged frog. Both bullfrogs and wild pigs are examples of introduced invasive animals found in Midpen lands that displace or consume native plants and wildlife that inhabit natural areas as well as alter natural processes.

Midpen employs several methods to control invasive animal species, including through temporary seasonal draining of ponds to control bullfrogs and/or non-native fish; shooting or trapping to eradicate bullfrogs and feral pigs, and trapping non-native turtles. Because it is challenging to completely eradicate a species (i.e., the removal of all of the pest species, which is typically only achievable for new invasive species and small populations of pests), Midpen typically controls pest numbers, removes individuals that have the greatest impact on critical resources, or excludes a pest species from a defined sensitive area. Programs to control invasive plant and animal species often require a long-term commitment. Midpen anticipates working on up to three invasive animal species removal projects per year. Midpen also responds to abandoned pets (i.e., cats, dogs, rabbits, etc.) on its lands that are then returned to a local animal shelter.

9.4 Road Decommissioning

A former road that is no longer used for access prior to road decommissioning work

Road decommissioning is used to reduce chronic sediment delivery, restore watershed hydrology, and reduce impacts to aquatic, riparian, and terrestrial ecosystems of roads crossings. Remnant ranch, logging, and other former roads are located through Midpen lands that are no longer necessary for access. Midpen has decommissioned and restored approximately 7 miles of old roads. The typical process involves pulling fill from the outboard edge of a road with an excavator and placing the material on the original cut face of the road. Decommissioning starts from the end and works backwards towards the access road. The general goal is to provide a suitable substrate for natural revegetation to stabilize slopes in the longer term and to keep a drainage pattern that is similar to the inferred natural contour. Subtle dips may be installed where prior erosion and soil loss makes reestablishing natural drainage difficult.

A former road after road decommissioning work

Alternatively, where landslides and other features make access to the end of a road impractical, partial decommissioning may occur by installing large rolling dips that are not passable to vehicles and then covering the road with "slash" (i.e., lopped branches and other plant material) from the surrounding area. For Midpen, covering the road with slash also deters trespass or public access and it suppresses invasive species that may occur. Decommissioning roads from within jurisdictional drainage features requires more specific engineering designs based on site conditions and stream morphology. The typical approach is to remove any remnant, artificial crossing part (e.g., rusted culvert, bridge, crib wall, etc.) and to lay back the slopes at stable 2:1 repose. If the crossing itself is not where the stream should naturally occur, further engineering is warranted to determine what geomorphic grade controls are necessary and prudent on the site. Less-active forms of decommissioning may occur as out-of-use roads become naturally revegetated. Midpen Natural Resources staff evaluate these former roads for decommissioning based on the level of disturbance necessary to achieve a beneficial effect on watershed conditions. For example, removing 1,000 linear feet of vegetation to remove an old culvert that has already lost its fill and is relatively stable may be a net negative on the environment. The effectiveness and priority of sediment reduction activities are contextualized within Midpen's "Road and Trail Inventories" that serve as sediment-source inventories and, where applicable, fulfill the requirements of RWQCB regulations on sediment management plans (e.g. Pescadero sediment total maximum daily load [TMDL]). Decommissioning is usually best combined with Midpen's activities that require large heavy equipment.

9.5 Other Restoration Activities

Midpen often acquires rural residential or grazing properties with abandoned/inactive water wells that are required to be decommissioned by State law to protect groundwater per the Public Health and Safety Code, Part 9.5, Section 115700. The standard decommissioning procedure is to pull the pump, remove the well head, and fill the well with concrete or grout to seal it to a certain depth. Capping the water well after decommissioning varies; however, Midpen typically seals the well below grade and returns native soil on top with a t-post to indicate a no-dig zone. Water well decommissioning activities are undertaken to protect surface water and groundwater quality. In addition, these water wells are often entrapment hazards for wildlife, particularly creatures that are attracted to water sources. Water wells are rarely located in jurisdictional areas (they mostly occur in upland areas); however, they may occur near riparian corridors. Decommissioning water wells and capping them prevents impacts to species. Midpen has approximately 50 abandoned/inactive wells that require decommissioning. Once Midpen has decommissioned these existing water wells, Midpen anticipates working on 1 to 3 sites per year as new properties are acquired.

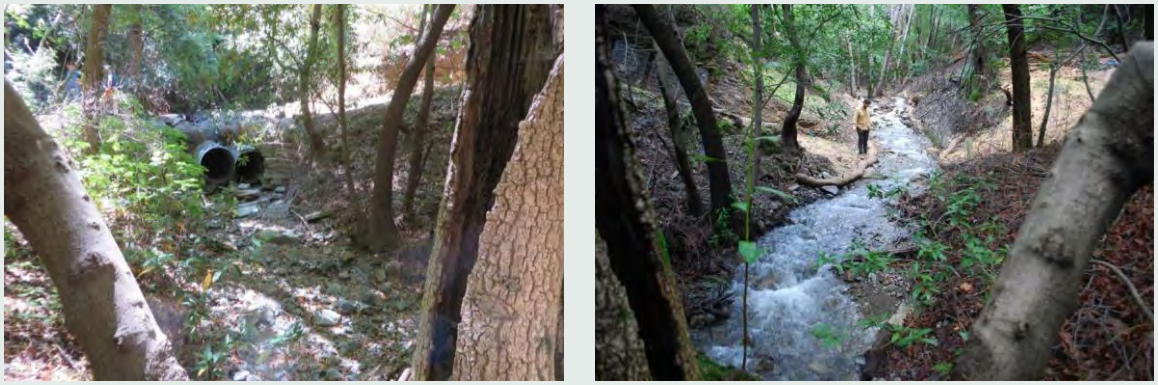
Other restoration activities include installing wildlife friendly spring boxes, troughs, and fences and other structures associated with conservation grazing described in Chapters 6 and 8 and prescribed burns described in Chapter 6.

Table 9-1 summaries that estimated jurisdictional disturbance, projected average number and maximum number of projects, and reasoning for activity per restoration and enhancement activity.

Case Study – Hendry's Creek Restoration Project

Hendry's Creek Restoration Project located adjacent to Lexington Reservoir in the town of Los Gatos involved enhancing habitat at a formal rural residential compound along approximately 4,000 linear feet of Hendry's Creek. Restoration activities included removing old stream crossings, restoring the channel, removing invasive species, and planting native plants. Impacts associated with the project included the removal of trees and understory. Although this project restored the natural habitat in the area, resulting in an overall beneficial effect, mitigation was still required, including high tree replacement ratios.

In this Program, Midpen is proposing to pair restoration projects like Hendry's Creek Restoration Project with the temporary and permanent impacts caused to riparian areas by roads and trail projects, resulting in an overall beneficial effect to Midpen lands.



Before photo looking upstream of Hendry's Creek from site H1-1 (left) and an after restoration photo looking upstream of Hendry's Creek from site H1-1 (right).

Before photo looking from left to right bank of Hendry's Creek from site T4 (left) and an after restoration photo from left to right bank of Hendry's Creek from site T4 (right).

Before photo looking from left to right bank of Hendry's Creek from site H1-2 (left) and an after restoration photo from left to right bank of Hendry's Creek from site H1-2 (right).

Before photo looking from left to right bank of Hendry's Creek from site T5 (left) and an after restoration photo from left to right bank of Hendry's Creek from site T5 (right).

Before photo looking upstream of Hendry's Creek from site H4-1 (left), during removal of the stream crossing (center), and after restoration from site H4-1 (right).

Table 9-1. Restoration and Enhancement Activities

Restoration and Enhancement Activity	Estimated Typical Jurisdictional Disturbance Per Project (square feet)	Projected Average Number of Projects Per Year	Max Number of Projects Per Year	Reasoning for Activity
Pond and Wetland Restoration		8	13	
Reconstruction	12,000	1	2	Unsuitable hydroperiod
Berm/Inlet/Outlet Modification	2,000	1	1	Risk of failure, unsuitable hydroperiod, climate adaptation
De-sedimentation/ Vegetation Removal	1 acre 1,000	6 (2 de-sedimentation and 4 vegetation removal projects)	10 (4 de-sedimentation and 6 vegetation removal projects)	Lack of open water or escape habitat, and habitat enhancement for native species and/or California red-legged frog (CRLF) and San Francisco garter snake (SFGS) recovery
Creek and River Restoration		11	28	
Structure Demolitions in Riparian Areas	1,500	4	8	Attractive nuisances and wildlife entrapment
In-Channel Debris Removal	100	2	6	Stream restoration
Stream Crossing Removal	2,000	4	12	Unnecessary access

Restoration and Enhancement Activity	Estimated Typical Jurisdictional Disturbance Per Project (square feet)	Projected Average Number of Projects Per Year	Max Number of Projects Per Year	Reasoning for Activity
Large Woody Material	2,000	1	2	Salmonid pool habitat, sediment storage, and lateral connectivity
Invasive Species Removal		51	103	
Invasive Animal Removal (trapping of species or draining ponds)	1,000	1	3	Habitat enhancement for native species and/or CRLF and SFGS recovery
Invasive Plant Removal	50	50	100	Resilient native plants populations
Road Decommissioning		1	4	
Road Decommissioning	2,000	1	4	Unsuitable access, restore natural hydrology and watershed, reduce sedimentation

Chapter 10. Impact Avoidance and Minimization, BMPs, and Mitigation

10.1 Introduction

The Chapter begins by describing Midpeninsula Regional Open Space District's (Midpen's) general approach to conducting maintenance, small-scale facility improvements, and restoration activities in accordance with the tiered approach described in Chapter 2 followed by a summary of conditions that would trigger maintenance activities. The Chapter then describes impact minimization measures and work limits and best management practices (BMPs) that would be implemented prior to and/or during Open Space Maintenance and Restoration Program (Program) activities to further avoid or reduce potential impacts. The Chapter concludes by describing how residual impacts of the Program would be mitigated.

10.2 Using Impact Tier Categories to Classify Potential Effects

The Program uses a tiered approach to address potential effects on sensitive species and habitats, primarily for the purpose of determining which avoidance and minimization measures are necessary to minimize potential take of species. The tiered approach considers past occurrences or observations of species at or near the site, the general or regional suitability for species and habitats around the site, and the specific resource conditions at the maintenance site to support potential species and habitats, and the specific conditions (e.g., time of day, season) when the maintenance activity will occur to determine the potential for take of individuals. This approach is intended to help both Midpen and regulatory agency staff identify resource and site sensitivity and thereby prioritize impact avoidance and minimization measures and/or BMPs and mitigation needs. The tiering classification may vary from species to species at each location depending upon site specific conditions. To evaluate resource sensitivity at proposed Program work sites, Midpen undertakes the following process:

1. Identify the type of Program activity that is needed and confirm the specific location where work is planned to occur.

2. Conduct a desktop audit to evaluate whether suitable habitat for special-status species is present. A qualified biologist will conduct a desktop audit to evaluate whether suitable habitat for special-status species is present. Additional resources reviewed may include, but are not limited to, aerial photographs of the vicinity, U.S. Geological Survey (USGS) topographic maps, California Natural Diversity Database (CNDDB) records, critical habitat layers, U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory Maps, in-house species data compiled by Midpen from previous activities within Open Space Preserves (OSPs or Preserves), and species data compiled by the California Native Plant Society, the National Audubon Society, or other public interest groups. If determined to be necessary, the qualified biologist or a biological monitor will visit the site and confirm presence or lack of sensitive habitat or special-status species occurrence. During this step, the biologist or biological monitor will determine whether any small aquatic features (such as seeps, springs, or spring boxes) that are not evident on coarser-scale habitat mapping are present within 100 feet of a Program activity area.

3. Based on the desktop audit and site visit (if conducted), classify the Program activity at the site according to one of the following tiers:

    - Tier 1 (No Effect) – There is no potential for a special-status species to be present in the maintenance area at any time. Tier 1 is appropriate if the biologist determines that Program activities would occur in creek reaches inaccessible to special-status fish or, for terrestrial special-status species other than birds, in areas where no suitable breeding habitat is present and there is no connectivity between the site and known or potential breeding habitat (so that non-breeding individuals can also be presumed to be absent). Because foraging or roosting birds could easily fly away before being impacted by Program activities, the implementation of Program activities in non-breeding habitat for special-status bird species would also be considered a Tier 1 because such activities would not result in impacts on individuals that rise to the level of "take". No qualified biologist or biological monitor would need to conduct pre-activity surveys or be present during the performance of Tier 1 activities. Tier 1 activities would not result in take of individuals or habitat, even if permanent impacts to habitat conditions occur.

    - Tier 2 – A special-status species could occur, at least at times, at a site, but take will not occur. Tier 2 is applicable if the biologist determines that one or more special-status species are known to occur or could possibly occur on-site either because (1) suitable breeding habitat is present, or (2) for terrestrial species and fish, suitable non-breeding habitat is present and there is connectivity between the work site and suitable breeding habitat.

        - Tier 2A (Not Likely to Adversely Affect) – The activity will not result in take of special-status species based on the location and timing of work; although

a special-status species could occur at the location at times, none would be present when the work will occur. For example, California red-legged frogs (CRLFs) could potentially occur in numerous work areas during nighttime, wet-season dispersal but are not expected to occur far (e.g., more than 100 feet) from aquatic and wetland habitats during daytime, dry-season activities. During numerous pre-activity surveys and performance of Program activities (including associated biological monitoring), Midpen has not observed any CRLFs under such conditions. Pre-activity surveys and monitoring by a qualified biologist or biological monitor are not required for this tier, though either may be conducted (e.g., they may pre-check a work location and/or monitor as a precautionary measure). Examples are dry-season, daytime brushing, minor facility improvements, mowing, pesticide application consisting of spot-application, or fencing installation or repair that takes place more than 100 feet from wetland or aquatic habitat. During all work, Midpen's personnel (who are well-trained on the biology of special-status species, appropriate avoidance measures, and procedures to follow when they are encountered) will keep an eye out for special-status species and contact the Midpen biologist immediately if any animal that could potentially be a special-status species is observed. If any such individual is encountered, maintenance activities that could potentially affect the species will cease until the species is confirmed to have left the work area on its own, or until a qualified biologist or biological monitor visits the site to determine whether it is a special-status species and whether it is in harm's way from the activity. If so, avoidance and minimization measures will then be implemented as described below for Tier 2B activities.

- Tier 2B (Not Likely to Adversely Affect for individuals, but may be considered Likely to Adversely Affect if permanent habitat impacts occur) – This activity will not result in take of special-status species with implementation of BMPs, such as pre-activity surveys, exclusion of individuals from the site, and/or implementation of non-disturbance buffers around active nests of special-status birds. Such BMPs would be implemented or overseen as necessary by a qualified biologist or biological monitor. Depending on the sensitivity of the work area and the likelihood that individuals may move into the work area after the pre-activity surveys are conducted, some of these activities may require a biological monitor. Though a qualified biologist would not necessarily be on-site, they would be assigned to each project and would determine when pre-activity surveys and monitoring are necessary, and would oversee any avoidance and minimization measures implemented by biological monitors. In addition, as discussed for Tier 2A, trained Midpen maintenance personnel will keep an eye out for special-status species and contact the Midpen

biologist immediately if any animal that could potentially be a special-status species is observed.

Some Tier 2B activities may result in a permanent loss of habitat. If permanent habitat loss occurs in holdings where special-status species occur in higher densities and/or with a higher frequency of occurrence, the USFWS would likely consider this loss of habitat to constitute take under Federal Endangered Species Act (FESA), in which case the FESA determination for that activity would be "Likely to Adversely Affect". Permanent habitat loss in holdings where special-status species occur in lower densities and/or with a lower frequency of occurrence and temporary habitat loss in any holding would be considered "Not Likely to Adversely Affect" the species.

- Tier 3 (Likely to Adversely Affect) – The activity may result in take of special-status species, even with implementation of BMPs. Tier 3 is applicable if the biologist determines that (1) a special-status species are known to occur or may occur on site either because suitable breeding habitat is present or suitable non-breeding habitat with connectivity between the site and suitable breeding habitat is present; (2) the special-status species may be present at the time of day/season in which the Program activity occurs; and (3) special-status species cannot be effectively excluded from the work area, pre-activity surveys cannot definitively determine the absence of the species, and/or "take" in the form of permanent loss of habitat cannot be avoided. An example Tier 3 project might include culvert replacement activities on streams known for salmonid habitat or pond maintenance activities in CRLF habitat. For these types of activities, Midpen anticipates that BMPs, avoidance and minimization measures, and possibly an on-site qualified biologist would be needed to minimize and/or avoid adverse effects. Compensatory mitigation may be needed to offset permanent effects on sensitive species and/or habitat. However, for CRLF and San Francisco garter snake (SFGS), because the Program will have a net beneficial effect on these species' populations, compensatory mitigation for permanent impacts from one activity (or set of activities) may simply consist of the identification and implementation of enhancement and management activities that offset those permanent impacts. In short, the Program as a whole will be self-mitigating with respect to the CRLF and SFGS.

Knowing which tier is applicable to Program activity sites helps guide the planning and impact avoidance approach. It is also noteworthy that Midpen has been conducting biological resources assessments for many years within its OSPs as part of its ongoing land management; therefore, desktop reviews for Program activities can draw on a lot of existing and specific well documented knowledge regarding habitat suitability for special-status species, as well as the

conditions (including habitat, time of day, and season) in which special-status species have been observed.

The level of qualifications for the monitor is dependent upon the tiering level for a project. Table 10-1 summarizes the level of qualifications and the sites or situations of when that level of monitor would be required. For Tier 1 projects, no monitor would be required to conduct pre-activity surveys or to be present during the performance of Tier 1 activities. Tier 2A projects do not require pre-activity surveys or monitoring, though either may be conducted by a biological monitor trainee, biological monitor or wildlife handler. Tier 2B projects do not require a qualified/professional biologist to be on-site, but a qualified/professional biologist would be assigned to each project and would oversee pre-activity surveys and monitoring implemented by a qualified biological monitor. Tier 3 projects would require a qualified/professional biologist to be on-site during activities.

Table 10-1. Summary of Midpen's Qualified Monitoring Requirements

Level of Qualification of Monitor	Qualified Sites/Situations	Additional Requirements
None	Tier 1: No Effect	No pre-activity surveys are required
Biological Monitor Trainee Biological Monitor Wildlife Handler	Tier 2A: Not Likely to Adversely Affect ▪ Upland areas ▪ Areas with low potential for special-status species either due to habitat and/or nature of activity ▪ May work in increasingly complex sites/situations (Tiers 2 and 3) under direct supervision of Qualified Monitor/Biologist/Botanists May conduct nesting bird surveys (if trained)	▪ Address general non-special status species ▪ Required to call Natural Resource staff for assistance with special-status species, active bird nests, unusual, or more complex situations ▪ Reports all special-status species observations and project monitoring results to the project lead biologist and/or Natural Resource staff
Qualified Biological Monitor Qualified Biologist/Botanist	Tier 2B: Not Likely to Adversely Affect ▪ Upland areas ▪ Areas with potential for special-status species (for which they have qualification(s))	▪ May direct, lead or supervise biological monitor trainees/biological monitors

Level of Qualification of Monitor	Qualified Sites/Situations	Additional Requirements
	▪ Project sites for which they are regulatory agency approved ▪ Surveys for and may handle of special-status species for which they are qualified to survey and/or handle ▪ Conducts nesting bird surveys	▪ Responsible to report all special-status species observations, survey results, and project monitoring efforts/results to Natural Resource staff
Qualified or Professional Biologist/Botanist	Tier 3: Likely to Adversely Affect ▪ Completes or leads protocol level survey efforts for plant or animal species ▪ Complex situations where a regulatory agency permitted biologist is required ▪ All areas known to have special-status species, where handling or interaction are expected to occur ▪ May lead marking of wildlife or plant collection efforts	▪ Oversees all biological monitoring, species surveys, collection and/or recovery efforts undertaken on Midpen lands ▪ Reviews and approves qualifications of biological monitors and project biologist/botanists ▪ Point of contact with regulatory agencies

10.3 Program Triggering Criteria

Maintenance activities are conducted only when determined to be necessary or in conjunction with other nearby essential work to provide cost saving efficiencies or to minimize equipment entries into an area. On an annual basis, Midpen will conduct site inspections throughout their Preserves to evaluate maintenance needs. The triggers described below will be used by Midpen staff during annual inspections and site evaluations to identify which sites have exceeded the thresholds identified by the triggers, thus requiring maintenance. Midpen will then prioritize maintenance activities according to the degree in which the identified site exceeds the maintenance triggers. Sites that exceed the triggers in a greater or more intense manner will be identified as higher priorities.

This Section describes observed conditions that would trigger the need for maintenance work. The discussion below is organized by facility type.

10.3.1 Maintenance Triggers for Culverts, Channels, Bridges, and Other Facilities

1. Repair or Replacement of Existing Culverts: This work is conducted when an existing culvert has been crushed or otherwise damaged and cannot operate properly; is at risk of future failure or deterioration (e.g., bottom of a corrugated metal pipe (CMP) culvert is beginning to rust); is clogged with debris, sediment and/or vegetation; is notably undersized and cannot provide adequate conveyance capacity; or has been dislodged, moved, or positioned in such a way that the culvert cannot function properly. A culvert repair or replacement project may be prioritized based on factors such as whether the damaged culvert is causing other adverse effects like roadway flooding (due to a clogged culvert), increased erosion downstream of a culvert, or contributing large amounts of sediment to nearby creeks.

2. Bridge Repair/Maintenance: Bridge maintenance activities are necessary when the bridge structure and/or abutments are deteriorating and protective paint coating have chipped off or cracks on the exterior have noticeably worsened. Erosion protection improvements at the base of a bridge are necessary when scour damage begins to undermine the structural stability of bridge wingwalls and/or abutments. Maintenance along bridge decks is necessary when damage or cracks on the surface have magnified to the degree that the damaged bridge could represent a public safety risk. Debris clearing is necessary when the capacity beneath the bridge has been reduced by 30% or more due to debris build-up.

3. Road and Trail Drainage Feature Maintenance. This work is necessary when debris, sediment, or woody debris have reduced the conveyance capacity by 10% to 30%, or if rock or other materials that are part of the drainage feature have washed away. This work is necessary to prevent the washout and flooding of roads and trails, and to prevent excess sediment loading and erosion.

4. Streambank Stabilization: This work is necessary when bank failure has occurred and must be repaired to re-establish the banks of a creek, protect the channel's flood conveyance capacity, and prevent additional sediment input to the channel. This work is also necessary when bank erosion or failure poses a threat to existing infrastructure (e.g., utilities, roads, trails). This work is necessary if persistent bank erosion is occurring, leading to excess sediment loading and/or damage to riparian vegetation.

5. Pond and Lake Berm Stabilization. This work is necessary when berm erosion or sinking poses a threat to existing infrastructure (e.g., ponds, lakes, roads). This work is also necessary to prevent excess sediment loading and erosion into the pond or lake.

6. Water Supply Structure Maintenance. Vegetation removal is necessary when overhanging shrubs and trees pose a safety risk to these structures, prevent proper intake, or impede access for maintenance. Defensible space around water supply facilities is also required per the Board of Forestry Fire Safe Regulations (2021). In addition, mowing is necessary when overgrown weeds and grasses are encroaching on the structures.

7. Sediment Removal from Creeks, Bridges, and Ponds: This work is necessary when sediment or debris has reduced channel or pond capacity to the extent that the likelihood of overbank is significantly increased and flooding could damage property or substantially threaten public safety. This work is also necessary when sediment or debris deposits are evidently causing scour erosion of streambanks supporting bridges or other public facilities, like roads and trails. Sediment removal within ponds occurs when needed to maintain habitat for CRLF or storage capacity for cattle.

8. Sediment Removal/Clearing Culverts, Crossings, and Other Drainage Features. This work is necessary when culvert inlets, outlets, ditches, rocked fords, rolling dips, and beneath bridges at road, trail, and stream crossings are blocked with debris or sediment so that the conveyance capacity is reduced by at least 10% to 30%. Culverts that are more than 1/3 blocked can be cleaned at any time, even when the channel is wet.

9. Downed Tree Management: Downed or standing dead trees will be evaluated for their potential to cause or increase erosion, flooding, bank failure, or negatively impact a public infrastructure facility in a high use area (e.g., bridge, culvert, trail), or threaten public safety. If it is determined that the downed or standing dead tree would increase any of the risks listed above, Midpen will trim and/or reposition the downed or standing dead tree immediately with hand tools or consider removing or reusing the tree elsewhere. If such risks are unlikely, Midpen will explore options for preserving and/or repositioning the tree along the channel to provide habitat functions.

10.3.2 Maintenance Triggers for Roads and Trails

The following maintenance triggers are applied to evaluate and determine when work is required at roads and trails:

1. Paved Road Surface Maintenance Activities: Most paved road repairs that entail patching cracks, resurfacing, repaving, and repairing the roadway base are prioritized based on severity of traffic safety risks and are typically conducted outside of the rainy season (between April and October). These activities are conducted to ensure a safe roadway surface for motorists and to prevent further roadway deterioration or failure.

Other paved road maintenance activities, including pothole repairs, occur shortly after they occurred to prevent accidents, vehicle damage, and other traffic safety risks.

2. Unpaved Road Surface Maintenance Activities: This work is necessary when a road surface has deteriorated or failed due to erosion or stormwater flows, is contributing sediment and subsequent adverse water quality and/or hydrology impacts, or is leading to erosion downslope.

3. Trail Maintenance and Repair: This work is necessary when trail tread has worn down and ruts are evident, thus requiring addition of the proper type of soil or surface material and/or re-compaction. The need for trail tread repair work is determined during periodic inventories. Repair of trail signs and other structures is conducted as needed to address damage.

4. Roadway/Trail Slip-out/Slide Repairs: Slide repair is necessary when slope failures have occurred on the cut slope side of a roadway or trail; a slip-out repair is necessary when slope failure has occurred on the fill side. This work is necessary when the roadway/trail slip-out/slide poses a threat to existing roads or other facilities like utilities, or public safety. This work is also necessary when the roadway/trail slip-out/slide has contributed sediment to a nearby drainage, channel, or other waterbodies.

5. Vegetation and Fuel Management Along Roads: Mowing, trimming and pruning of vegetation along roads is necessary to maintain appropriate line of sight clearance (usually 6 feet at an intersection), to maintain a 14-foot height clearance for vehicles or equestrians, and to maintain a 7-foot height clearance for pedestrians. Longer line of sight clearance is appropriate for mountain biking intersections. This work is necessary when overhanging limbs or trees pose a public safety risk. This work may also include removal of ladder fuels to reduce the impacts of wildland fires or for the removal of invasive species for ecological reasons. Midpen staff formally inspect trails and roads on a 3-5-year rotation (and almost all are visited for other reasons, providing an opportunity to identify problem issues). Midpen aims to brush approximately 66% of all roads and trails each year. Certain fast-growing vegetation communities require annual management to maintain the access width.

6. Vegetation and Fuel Management and Maintenance of Fire Breaks Along Roads, Trails, and other Open Space Features (i.e., picnic or rest areas, natural areas, rangeland, staging areas, parking lots, structures): Midpen will inspect trails, picnic or rest areas, and other recreational amenities on a 3-5-year cycle. Vegetation thinning or pruning along trails is typically necessary when shrubs or trees are overhanging or encroaching on the trail or picnic or rest area. Mowing is needed when overgrown vegetation encroaches the trail or recreational facility. Tree removal is necessary if a particular tree has a higher likelihood of failure along or near facilities and

the situation cannot be fixed by limbing or pruning. The locations of fuel breaks have largely been determined through stakeholder and expert input and are reflected in the 'Tier 1 and Tier 2' maps in the Wildland Fire Resiliency Program. Once established, the fuel breaks will be maintained once every five to ten years. Facilities maintenance ("defensible space") is triggered by general adherence to California Department of Forestry and Fire Protection (CALFIRE) and local fire agency recommendations and is dependent on the growth of the surrounding vegetation community and topography.

10.4 Work Limits

The focus of Midpen's Program activities is to protect, maintain, and enhance the natural environment within its Preserves and managed lands. In support of this, Midpen has developed self-imposing work limits to limit the extent of impacts associated with Program activities. Established site, annual, and 5-year Program work limits per activity type are included in Table 10-2 below. Table 10-2 also provides an estimate of the typical jurisdictional disturbance per project and quantifies the number of projects of jurisdictional projects per year per activity type. Please note that these values are estimates and may be revised as Midpen acquires new lands and builds new facilities.

10.5 Best Management Practices (BMPs)

The BMPs in Table 10-3, presented at the end of this chapter, include general avoidance and minimization practices as well as measures focused on biological resources and habitat protection, cultural resources protection, erosion control, sediment and water quality control, and dewatering. These BMPs reflect current recommended practices. The BMPs in Table 10-3, and this manual as a whole, are intended to be a living document that will be periodically updated to reflect new BMP technologies and maintenance techniques.

Table 10-2. Program Activity Work Limits Per Activity Type

Type of Activity	Limits per site (linear feet [LF]; square feet [SF]; cubic yards [CY])	Average Number of sites per year	Maximum Number of Sites Per Year	Annual limits	5-Year Program limits	Estimated Typical Jurisdictional Disturbance Per Project	Estimated Typical Jurisdictional Sites Per Year
Culvert, Bridge, Channel, Pond and Other Maintenance							
Culvert repair/replacement	150 LF, 3,000 SF	25	50	20,000 SF	60,000 SF	360 SF	25
	100 CY culvert replacement			5,000 CY	25,000 CY	50 CY	
	10 CY culvert repair			7,500 LF	15,000 LF	90 LF	
Bridge repair/maintenance (railing, decking, minor abutment or armoring)	100 LF; work area is limited to 25 LF upstream/downstream of site	5	10	400 LF	2,500 LF	50 LF; 1,500 SF	5
	5 CY (grading primarily on approach)			20 CY	100 CY	2 CY	
Road and trail ditch clearing and installation	30 CY of sediment and debris removal for every 300 LF; 500 LF	15	50	9,000 LF	45,000 LF	150 LF; 5 CY; 600 SF	5
Fords/ swales replacement, repair, and maintenance	200 LF	2	6	2,000 LF; 5,000 SF	10,000 LF	100 LF; 600 SF	2
	20 CY			120 CY	600 CY	10 CY	
Annual pre-rainstorm preparation and clearing (i.e., hand shovel clearing of fords, rolling dips, ditches, culverts, etc.)	5 CY	100	200	100 CY	500 CY	1 CY	50
Sediment removal from channels (e.g., from landslides, road failures, or slip-outs)	160 LF	10	20	1,000 LF for all sediment removal sites	1,000 LF	40 LF	10
	4,000 SF			Dewatering limit of 1,000 LF for all sites.	20,000 SF	200 SF	
	10 CY			100 CY	1,000 CY	4 CY	
Sediment removal from culverts, crossings, and other drainage features	150 LF Dewatering limit 300 LF	3 sites in an average hydrologic year (based on average seasonal precipitation)	8	23,000 LF; 12,000 SF	15,000 LF; 48,000 SF	100 LF	3

Type of Activity	Limits per site (linear feet [LF]; square feet [SF]; cubic yards [CY])	Average Number of sites per year	Maximum Number of Sites Per Year	Annual limits	5-Year Program limits	Estimated Typical Jurisdictional Disturbance Per Project	Estimated Typical Jurisdictional Sites Per Year
	10 CY	8 sites in a wet hydrologic year		200 CY	1,000 CY	8 CY	
Streambank Stabilization	100 LF; 1,000 SF	2 projects in an average hydrologic year	4	200 LF	1,000 LF	60 LF; 600 SF	2
		4 projects in wet hydrologic year		400 LF	2,000 LF		
Water supply structure maintenance (instream)	Vegetation removal is limited to 30 to 100 ft buffer; 4 CY removed per site	2	4	500 SF	2,500 SF	100 SF	2
Minor maintenance activities (i.e., repair of fences, gates, signage, and trash rack clearing)	200 SF	3	6	1,000 SF	5,000 SF	80 SF	1
	4 CY			20 CY	100 CY	1 CY	
Vegetation Management Activities							
Riparian or pond adjacent tree removal (inclusive of all Program activities)	Trees between 6" dbh and 24" dbh. No trees greater than 24"dbh would be removed (unless for public safety reasons).	12 trees	36 trees	30 trees	150 trees	750 SF (assumes 30-inch diameter canopy)	12
Tree trimming/pruning (inclusive of all Program activities)	No more than 25% of individual tree canopy would be trimmed/pruned	300 trees	750 trees	750 trees	3,750 trees	500 SF	75
Non-native vegetation removal	4 acres of treatment per site Typical site involves 15% cover over 8 acres	300 acres	450 acres	450 acres	2,250 acres	2,000 SF	35
Vegetation management along roads/trails	Typically, 10 feet on either side of a road or 3 feet along a trail. Steeper side slopes in chaparral and hardwood forest may call for a 10-foot buffer along a road.	230 miles of road/trail	350 miles of road and trail; 665 acres	774 acres	3,870 acres	720 SF (assumed 60-feet along riparian areas with 12-foot treatment area)	50

Type of Activity	Limits per site (linear feet [LF]; square feet [SF]; cubic yards [CY])	Average Number of sites per year	Maximum Number of Sites Per Year	Annual limits	5-Year Program limits	Estimated Typical Jurisdictional Disturbance Per Project	Estimated Typical Jurisdictional Sites Per Year
Fuels management along roads and trails	Typically 100-foot shaded fuel break and 100-foot lighter fuels treatment beyond in each area every 5 years.	8 sites	12 sites, approximately 1 mile per project	80 acres 12 miles of roads	400 acres 60 miles of roads	*See ecosystem resiliency; all Fuels treatments in jurisdictional areas will follow Resiliency treatments.	2 to 4
Vegetation management around open space facilities (i.e., for defensible space)	100-foot buffer around each building, 15,000 SF	100 sites, 35 acres[1]	150 buildings	50 acres	250 acres	50 SF	10
Ecosystem Resiliency Fuel Treatments	TBD	10	20	500 acres	2,500 acres	720 SF	2 to 4 fuel sites and 2 to 4 ecosystem resiliency sites
Road and Trail Maintenance							
Paved road surface maintenance (major work)	10,000 LF	2	4	20,000 LF	60,000 LF	500 LF (adjacent to ditches)	1
Minor paved road repair (potholes, tack oil, small subgrade failures)	300 SF 200 LF	5	10	3,000 SF 2,000 LF	15,000 SF 10,000 LF	10 LF (adjacent to ditches)	1
Unpaved road surface maintenance (major sites more than 1,000 LF)	20,000 LF 100 CY	15	30	75,000 LF	375,000 LF	150 LF	12
Trail maintenance repair (major sites more than 1,000 LF)	20,000 LF 100 CY	10	15	25,000 LF	125,000 LF	600 LF	8
Road relocation	500 LF	1	2	1,000 LF	5,000 LF	60 LF	1
	10,000 SF			20,000 SF	100,000 SF	850 SF	
	1,500 CY			2,500 CY	12,500 CY	-	
Trail reroutes	500 LF	0	2	1,000 LF	5,000 LF	80 LF	0

[1] These numbers may increase as Midpen acquires new lands and constructs new trails and other facilities.

Type of Activity	Limits per site (linear feet [LF]; square feet [SF]; cubic yards [CY])	Average Number of sites per year	Maximum Number of Sites Per Year	Annual limits	5-Year Program limits	Estimated Typical Jurisdictional Disturbance Per Project	Estimated Typical Jurisdictional Sites Per Year
	3,000 SF			4,000 SF	20,000 SF	1,500 SF	
	200 CY			200 CY	1,000 CY	40 CY	
Roadway/trail slip-outs and slide repairs	250 LF	5	10 (or 20 sites in a wet hydrologic year)	2,500 LF	12,500 LF	100 LF	3
	4,000 SF			40,000 SF	200,000 SF	2,000 SF	
	100 CY			1,000 CY	5,000 CY	20 CY	
New Small-Scale Facilities Improvements							
New trails and roads construction							
Trail bridge replacements	100 LF	2	4	200 LF	10,000 LF	50 LF	2
	2,000 SF			4,000 SF	20,000 SF	500 SF	
	20 CY			40 CY	200 CY	15 CY	
New trail and trail bridges	100 LF	2	4	400 LF	2,000 LF	100 LF	2
	2,000 SF			8,000 SF	40,000 SF	1,500 SF	
	50 CY			200 CY	1,000 CY	25 CY	
New trail (uplands)	5,800 LF	2	4	10,000 LF	50,000 LF	100 LF	2
	45,000 SF			90,000 SF	450,000 SF	1,500 SF	
	800 CY			16,000 CY	80,000 CY	25 CY	
Vehicle bridge replacement	200 LF	1	2	200 LF	1,000 LF	3,000 SF	1
	4,000 SF			4,000 SF	20,000 SF		
	200 CY			200 CY	1,000 CY		
New Conservation Grazing Infrastructure							
Water lines	6,000 LF	2	4	18,000 LF	90,000 LF	20 SF	1
	60,000 SF			180,000 SF	900,000 SF		
	330 CY			1,000 CY	5,000 CY		
Spring box	200 LF	2	4	400 LF	2,000 LF	30 SF	2
	100 SF			200 SF	1,000 SF		

Type of Activity	Limits per site (linear feet [LF]; square feet [SF]; cubic yards [CY])	Average Number of sites per year	Maximum Number of Sites Per Year	Annual limits	5-Year Program limits	Estimated Typical Jurisdictional Disturbance Per Project	Estimated Typical Jurisdictional Sites Per Year
	10 CY			20 CY	1000 CY		
Tanks, troughs	200 LF	2	4	8,000 LF		10 SF	1
	300 SF			1,200 SF			
	10 CY			40 CY			
Pond diversion	200 LF	0	2	200 LF		50 SF	0
	100 SF			100 SF			
	10 CY			10 CY			
Building Repairs, Utilities, and Other Misc.							
Electrical, plumbing, or other utility lines	1,000 LF	2	2	1,000 LF	5,000 LF	100 SF	0
	6,000 SF			6,000 SF	30,000 SF		
	55 CY			55 CY	275 CY		
Septic line repair	1,000 LF	2	2	2,000 LF,	10,000 LF	400 SF	0
	6,000 SF			6,000 SF	30,000 SF		
	10 CY			10 CY	50 CY		
New Interpretive Facilities/ Signage	50 LF	2	2	100 LF	500 LF	50 SF	1
	100 SF			200 SF	1,000 SF		
	5 CY			10 CY	50 CY		
Existing building and structure repairs	200 LF	5	10	1,000LF	5,000 LF	50 SF	0
	100 SF			500 SF	25,000 SF		
	10 CY			50 CY	250 CY		
Safe wildlife passages	200 LF	1 large and 2 small	1 large and 8 small	400 LF	20,000 LF	200 LF	1
	1,200 SF			2,500 SF	12,500 SF	1,200 SF	
	100 CY			200 CY	1,000 CY	100 CY	
Restoration and Enhancement Projects							
Pond reconstruction	20,000 SF	1	2	20,000 SF	100,000 SF	12,000 SF	1

Type of Activity	Limits per site (linear feet [LF]; square feet [SF]; cubic yards [CY])	Average Number of sites per year	Maximum Number of Sites Per Year	Annual limits	5-Year Program limits	Estimated Typical Jurisdictional Disturbance Per Project	Estimated Typical Jurisdictional Sites Per Year
	1,200 CY			1,200 CY	6,000 CY		
Pond Inlet/Outlet pipe or spillway overflow modification[2]	300LF	1	1	300 LF	1,500 LF	300 LF	1
	2,000 SF			2,000 SF	10,000 SF	2000 SF	
	200 CY			200 CY	1,000 CY	-	
Sediment removal from ponds	600 CY	2	4	1,800 CY 1 acre	9,000 CY 5 acres	900CY, 0.40acres.	2
Pond vegetation removal	2,500 SF	4	6	10,000 SF	50,000 SF	1,000 SF	4
	150 CY			600 CY	3,000 CY		
Pond berm stabilization	200 LF/berm	1	3	600 LF	3,000 LF	200LF/400CY	1
Structure demolitions/ removal in riparian areas	400 CY/berm	4	8	1,200 CY	6,000 CY	1,500 SF	4
In channel debris removal (i.e., removal of tires)	100 LF	2	6	400 LF	2,000 LF	100 SF	2
	3,000 SF			12,000 SF	60,000 SF		
	150 CY			600 CY	3,000 CY		
Road decommissioning	10,000 LF	1	4	20,000 LF	100,000 LF	2,000 SF	1
	160,000 SF			300,000 SF	1,500,000		
	10,000 CY			20,000 CY	100,000 CY		
Stream crossing removal and restoration of natural channel	150 LF	4	12	1,000 LF	5,000 LF	2,000 SF	4
	4,000 SF			24,000 SF	120,000 SF		
	300 CY			1,800 CY	9,000 CY		
Traditional ecological knowledge practices (indigenous stewardship)	24,000 SF	6	12	300,000 SF	1,500,000 SF	100 SF	0

[2] Note that many of these activities are typically aboveground maintenance. Midpen conducts these activities for maintenance or for restoration purposes. These activities may be duplicative to other pond activities listed above and below.

10.6 Mitigation Opportunities

This Section outlines and describes mitigation options available for offsetting the Program's residual impacts on wetlands, waters, riparian resources, and federally- and state-listed species. Once the Program is operating under regulatory approvals and permits, annual mitigation will be identified and implemented as necessary to address any potential impacts, including the need for any compensatory action. Program activities will be notified annually with mitigation needs also identified.

The overall goal of this Program is to avoid or reduce all potential impacts associated with routine maintenance, vegetation management, and small-scale facility improvements with Midpen's restoration and enhancement projects that increase aquatic habitat, enhance native vegetation, and restore natural watershed processes.

The following discussion is intended to provide a context and basis for a variety of mitigation approaches that may be utilized by Midpen.

Ponds and Wetland Restoration

Midpen's pond activities are largely self-mitigating work in support of habitat maintenance. Activities that may require compensatory mitigation, such as decommissioning of ponds that do not support special-status species and raise safety concerns due to poor construction, may be offset by the restoration and maintenance of high-quality habitats. Midpen actively maintains some of the highest quality wetland habitat in the region as parts of its mission. To that end, Midpen is considering evaluating a CRLF mitigation bank to bolster future restoration and ensure effective mitigation for impacts at a regional landscape scale.

Native Vegetation Restoration

Midpen's vegetation treatment activities, though large in scale, have a minimal impact on jurisdictional areas and have been analyzed through the IPM Program EIR and the Wildland Fire Resiliency Program EIR, both of which balance operational needs with ecosystem function. Further, impacts to native vegetation (e.g., from roads and trail brushing or fuels work) are offset by restoration of native plant communities through invasive plant work and seeding and/or planting of Santa Cruz Mountain native species.

Reduction in Sedimentation

Midpen's roads and trails maintenance is the most frequent jurisdictional activity covered by the Program. All temporary impacts to waters are minimized through design (i.e., complying with the design specifications included in *National Marine Fisheries Service (NMFS) Guidelines for Salmonid Passage at Stream Crossings* [NMFS 2019]). Any permanent impacts to waters are only necessary to support geomorphic stability and flow conveyance, correcting a lack of design

from a prior condition and resulting in a net benefit for wildlife, water quality, and natural resource protection. The proactive prevention of failure and reduction of episodic release of road fill reduces in-stream sedimentation over time, improving water quality for the benefit of fish and other wildlife that rely on the creek for survival. For example, over 16 years Midpen treated 25 miles of roads and trails at El Corte de Madero OSP and reduced sediment volume in stream pools by approximately 17% and reduced turbidity leaving the OSP by approximately 1.5 times-2 times (Midpen data collected 2020). Midpen also decommissions old roads and culverts regularly to restore stream habitats, and removes debris and other unnatural features within the creek corridor.

As described in Chapter 9, although the purpose of the Hendry's Creek Restoration Project was to restore a riparian corridor that had been heavily disturbed by a formal rural residential compound, this habitat enhancement project required its own mitigation. In essence, an act to restore the natural values of open space lands can itself require mitigation measures even when the project itself is being conducted to restore native habitat. In this Program, Midpen is proposing to implement future native habitat enhancement projects like the Hendry's Creek Restoration Project to mitigate for potential impacts caused to riparian areas by road and trail projects that create broader and more significant net environmental benefits across the region.

In-Stream Habitat Restoration

In-stream work, such as water diversion maintenance, wood relocation, and hardening to prevent streambank failures, is done infrequently and is designed to minimize impacts. Flood control is not part of Midpen's mission and thus, only minimal instream infrastructure requires maintenance. Restoration of instream habitats, through retention of large wood where possible, conveyance of 100-year flow events under bridges and arched culverts, and removal of other barriers, is an important part of Midpen's mission and is likely to exceed the scale and cost of the in-stream infrastructure maintenance work.

Road Decommissioning

New trails and trail bridges provide an opportunity for Midpen to access areas with equipment and tools that can benefit from active restoration work. New trails are limited to a 6-foot path and supporting features such as retaining walls. The location of trails and bridge or crossings are selected to minimize effects on the environment and species as well as reduce ongoing maintenance. A few approaches that Midpen is exploring to offset impacts associated with new trails and new bridges is through road decommissioning, the preservation or restoration of other habitat in the area, or the designation of "Conservation Management Units" (the CMUs). CMUs are defined in Midpen policies as areas managed for the preservation of natural resources and which generally do not allow public access. The designation is currently found in important CRLF and SFGS habitat, as well as historic logging lands requiring stream restoration.

10.6.1 Summary of Impacts to Wetlands, Waters, and Riparian Resources and the Federally or State Listed Species They Support

Program activities such as culvert repair/replacement, bridge maintenance/replacement, sediment removal, bank stabilization along creeks and ponds, pond maintenance, slip-outs along roads and trails, road and trail maintenance, conservation grazing infrastructure, recreational facility improvements, aquatic habitat restoration, invasive species removal, and road decommissioning may result in temporary and/or permanent impacts on wetlands and waters of the United States (U.S.)/state, as well as the federally- and state-listed species they support. Impacts from culvert repair/replacement projects, streambank stabilization, pond maintenance, road and trail maintenance, conservation grazing infrastructure, and recreational facility improvements could result in the permanent loss of vegetation and reduction in open water areas. Use of rock rip-rap to support culvert outfalls or bank/berm repairs may result in fill of waters of the U.S./state and therefore, require mitigation for resulting impacts, including loss of habitat for federally- or state-listed species.

10.6.2 Timing of Mitigation

Under the Program, at the beginning of each year, Midpen would prepare an annual notification report summarizing proposed Program activities for a given year. The tiering approach described earlier and in Chapter 2 would be applied to classify the types of impacts to federally or state listed species anticipated to occur at each Program activity site.

As discussed in Chapter 11, the notification report will summarize anticipated impacts on wetlands and waters of the U.S./state, riparian resources, and federally and state listed species. The annual notification report will describe avoidance and minimization measures, BMPs, and restoration/enhancement projects (or mitigation) that would be implemented to avoid or reduce the Program's potential impacts to wetlands/waters, riparian resources, and special-status species. The preferred mitigation approach would be to implement mitigation prior to impacts to avoid temporal loss. Compensatory mitigation for impacts to waters of the U.S. would be provided in accordance with the "Mitigation Rule," which was established by the U.S. Environmental Protection Agency (USEPA) and U.S. Army Corps of Engineers (USACE) in 2008. Since then, the USACE published *Guidelines for Preparing a Compensatory Mitigation*

Plan[3], Attachment 12501.6 – SPD Mitigation Ratio Checklist[4], and *2501-SPD Regulatory Program Standard Operating Procedure for Determination of Mitigation Ratios*[5] (2017). Midpen will provide compensatory mitigation for impacts on waters of the U.S. in accordance with the Mitigation Rule and the USACE's guidelines for preparing compensatory mitigation plans and determining mitigation ratios and Attachment 12501.6 – SPD Mitigation Ratio Checklist.

10.6.3 Mitigation Approaches

To compensate for impacts associated with Program activities, Midpen may conduct on-site or off-site mitigation approaches. In general, Midpen prioritizes on-site mitigation in locations that provide suitable habitat to restore the type of habitat that was impacted by the activity in the same vicinity or stream reach of where the disturbance occurred. However in some locations, off-site mitigation is a more suitable option due to the lack of suitable habitat in the surrounding area, re-planting in an already overstocked area (e.g., replacing riparian vegetation in an overstocked forest), or the availability of higher priority areas that would provide better habitat quality for species. Both on-site and off-site mitigation approaches play important roles in the context of Midpen as a whole. These various approaches are described in more detail below.

10.6.4 On-Site Mitigation Approach

For Program activities that take place outside of wetland/other waters habitat within the USACE and/or Regional Water Quality Control Board's (RWQCB's) jurisdiction, one mitigation approach is on-site mitigation. Midpen will evaluate on-site mitigation opportunities to address impacts in the immediate vicinity of the Program activity area.

The general on-site mitigation approach is to restore the type of habitat that is impacted by Program activities in the same project vicinity or stream reach where the disturbance has

[3] U.S. Army Corps of Engineers (USACE). 2010. Guidelines for Preparing a Compensatory Mitigation Plan. Last Revised October 7. Available: www.sac.usace.army.mil/Portals/43/docs/regulatory/Guidelines_for_Preparing_a_Compensatory_Mitigation_Planf.pdf.

[4] USACE. 2013. Attachment 12501.6 – SPD Mitigation Ratio Checklist. Available: www.spd.usace.army.mil/Missions/Regulatory/Public-Notices-and-References/Article/487060/12501-spd/.

[5] USACE. 2017. *2501-SPD Regulatory Program Standard Operating Procedure for Determination of Mitigation Ratios*. Available: www.spd.usace.army.mil/Portals/13/docs/regulatory/qmsref/ratio/12501-SPD.pdf

Onsite mitigation example at Old Harkins Bridge, Purisima Creek, Purisima Creek OSP

occurred. This approach not only compensates for the specific jurisdictional habitat that is potentially impacted, but also results in restoration or enhancement of habitat for any special-status species that may be affected by the Program activity.

If riparian habitats are affected, this mitigation strategy is to re-establish riparian habitat on-site. This could involve planting riparian vegetation, removing non-native plants, or enhancing this type of habitat along or near the impacted site.

Past On-Site Mitigation Examples

An example of when an on-site mitigation approach was appropriate was for the Harkins Bridge Project. This project involved the removal and replacement of a 50-foot-long vehicle bridge over Purisima Creek in the Purisima Creek OSP, outside of Half Moon Bay. A large redwood tree fell immediately downstream of the existing deteriorated bridge, resulting in minimal freeboard under the existing bridge. Rather than move the downed redwood tree, Midpen relocated the bridge 100 feet upstream from the current bridge site and elevated the bridge above the 100-year flood elevation. The old bridge location was then restored with native cuttings, locally collected seeds, and other measures.

10.6.5 Off-Site Mitigation Approach

Off-site mitigation for multiple projects at Bear Creek Redwoods OSP, former Christmas tree farm

Off-site mitigation can provide opportunities for in-kind mitigation that aligns with the functions and values of natural resources that are potentially impacted by the Program but is done at a different location than where the Program activity occurs. The general approach is to conduct off-site mitigation within the same watershed or general region as where the Program activities occur. This type of mitigation is similar to the on-site option in that the focus is to provide in-kind habitat enhancement or restoration, stream functional improvement, water quality benefits, or overall watershed health improvements that

offset Program impacts or, for instance, reduce the need for maintenance. This could involve planting riparian vegetation, removing non-native plants, or enhancing habitat in offsite locations which share similar qualities or conditions to the Program activity site.

Off-Site Mitigation Example

An example of when an off-site mitigation approach is more appropriate was for multiple projects at Bear Creek Redwoods OSP, located near the town of Los Gatos. At the Bear Creek Redwoods OSP, public access projects and pond maintenance activities required upland and riparian off-site mitigation due to the lack of available riparian planting locations c in the densely stocked forest (due to fire exclusion). A former Christmas tree farm in the same watershed was selected for restoration and mitigation plantings. Midpen has many lands that have been historically degraded and require restoration that can benefit from off-site mitigation opportunities.

Potential Off-Site Mitigation Options

Midpen has historically mitigated the vast majority of its projects at the original site. Increased public access projects through bond funding measures and larger scale restoration work has increased mitigation requirements. Critical habitat, impaired watersheds, priority salmonid watersheds, and other regional conservation analysis can be used to identify locations in need of mitigation funds and work. In general, Midpen has focused more of its restoration work in the San Mateo County coastal area due to its relative abundance of important and more intact ecology compared to the more urbanized bay-side areas. Midpen has worked with USFWS in the past to promote restoration projects in support of recovery of listed species, particularly at La Honda OSP and Mindego Ranch within Russian Ridge OSP. The rich habitats found on Midpen's land provide ample restoration opportunities.

Preservation of Habitats

Compensatory plantings and maintenance are very expensive and require significant staff, contractor, and regulatory oversight to ensure a mitigation plan is effective and successful. Further, certain environmental settings (e.g., hardwood forests) typically have an overabundance of woody vegetation that not only pose a fire risk to the ecosystem but also may require compensatory mitigation when affected. This can result in a perverse situation where low quality habitats and mitigation projects receive funding and high quality habitats needing restoration do not receive the needed support. The sum of temporary and permanent impacts Midpen's activities have on the land through the Program would be minimal. Where Program impacts occur in locations that are not suitable for onsite mitigation, Midpen may mitigate these impacts by protecting other offsite habitats that could benefit from this protection. Midpen acquires approximately 500 to 1,000 acres of land each year (i.e., 65,000 acres in 48 years) and dozens of acres of jurisdictional areas. Midpen proposes to offset all permanent removal of

vegetation from jurisdictional areas (the largest cost category to Midpen) through acquisition and permanent protection of new riparian habitats.

10.6.6 Partner with Local Watershed Organizations

Midpen regularly partners with like-minded organizations to facilitate restoration and stewardship. The San Mateo Resource Conservation District (RCD) is a frequent collaborator on fisheries, agricultural best practices, and invasive plant control. The Peninsula Open Space Trust (POST) is a not-for-profit primary partner for the acquisition and preservation of habitats. Where cross-property cooperation and stewardship is required, Midpen engages with these partners for the benefit of the ecosystem. Midpen is also a member of the Santa Cruz Mountain Stewardship Network, which is a blend of public and private organizations representing the largest land managing entities in the region.

Midpen has almost never mitigated for impacts off of Midpen lands as no shortage of opportunities exists within Midpen lands. There may be an instance where a species potential habitat occurs in very limited range within Midpen lands and mitigation is required off of Midpen lands. For example, Midpen purchased mitigation bank credits for work at Ravenswood OSP for a trail project; it is one of only two Midpen OSPs with tidal influenced Bay front habitat and onsite mitigation opportunities were limited. The reverse is more likely to be true; Midpen has facilitated mitigation from impacts caused by other parties on other properties.

10.6.7 Mitigation Monitoring

For any mitigation efforts that Midpen will undertake in support of the Program, Midpen will ensure adequate monitoring to document that the mitigation is operational and successfully providing the functions and valued needed to offset potential Program impacts. Midpen will be responsible to monitor such projects for a period of 3-5 years depending upon the type of mitigation project, as the majority of projects maintain and improve existing conditions. Performance criteria will be used to inform an adaptive management approach. The annual notification and reporting actions are described in Chapter 11 in more detail. Specific details describing the monitoring responsibilities of Midpen will be included in each year's annual notification and summary report of Program activities implemented.

The page intentionally left blank

Table 10-3. Program Best Management Practices

BMP Number	BMP Title	BMP Description
General Avoidance and Minimization Measures		
GEN-1	Staging and Access	▪ Staging, access, and parking areas will be located outside of sensitive habitats to the extent feasible. Where feasible, staging areas will be located 30 feet from the top of bank or on the outboard side of pond levees. Vegetation removal shall be limited to the minimum amount necessary to provide access. ▪ All staging shall occur on adjacent access roads or previously disturbed areas. Soil and riprap shall be staged in areas that have been previously disturbed (i.e., service road, turn-outs, etc.).
GEN-2	Minimize Area of Disturbance and Site Maintenance	▪ Areas of disturbance will be limited to the smallest footprint necessary and a single access pathway, where feasible. For maintenance activities near waterways or other sensitive habitat, the designated work area shall be clearly identified in the field using highly visible material, and work will not be conducted outside this area. ▪ Keep excavated soil and materials on the site where they will not collect into the street or get transported to storm drains or nearby water bodies by rainfall or runoff in order to avoid deleterious effects to fish, wildlife, and beneficial uses. ▪ Transfer excavated materials to dump trucks on the site.
GEN-3	Construction Entrances and Perimeter	▪ Establish and maintain effective perimeter controls and stabilize all construction entrances and exits to sufficiently control erosion and sediment discharges from site and tracking off site. ▪ Sweep or vacuum any street tracking immediately and secure sediment source to prevent further tracking. Never hose down streets to clean up tracking. ▪ When in-channel work is required, where available use existing ingress or egress points or perform work from the top of the stream banks.
GEN-4	Salvage/Reuse of Plant and Woody Material	▪ Large wood or weed-free topsoil displaced by Program activities may be stockpiled for use during site restoration. Native vegetation displaced by Program activities will be stockpiled if it would be useful during site restoration.

BMP Number	BMP Title	BMP Description
		▪ Stockpiled material shall not be placed over riparian or wetland vegetation. Stockpiled material shall not be placed in areas where it could enter the stream, riparian or wetland areas. ▪ To the extent feasible, all other woody material that is not re-usable should be disposed at a composting facility or left at a suitable location to decompose naturally.
GEN-5	Hazardous Materials Storage/ Disposal	▪ Any hazardous or toxic materials that could be deleterious to aquatic life that could be washed into State waters or its tributaries will be contained in watertight containers or removed from the project site. ▪ Use biodegradable chainsaw bar oil. ▪ Label all hazardous materials and hazardous wastes (such as pesticides, paints, thinners, solvents, fuel, oil, and antifreeze) in accordance with city, county, state, and federal regulations. ▪ Store hazardous materials and wastes in watertight containers, store in appropriate secondary containment, and cover them at the end of every workday or during wet weather or when rain is forecast. ▪ Follow manufacturer's application instructions for hazardous materials and be careful not to use more than necessary. Do not apply chemicals outdoors when rain is forecast within 24 hours. ▪ Arrange for appropriate disposal of all hazardous wastes. ▪ Cleanup of all pesticide and adjuvant containers will be triple rinsed with clean water at an approved site, and the rinse water will be disposed of by placing it in the batch tank for application. Used containers will be punctured on the top and bottom to render them unusable, unless said containers are part of a manufacturer's container recycling program, in which case the manufacturer's instructions will be followed, and disposed of at an appropriate facility. Disposal of all pesticides will follow label requirements and local waste disposal regulations.
GEN-6	Spill Prevention and Control	▪ Keep spill cleanup materials (rags, absorbents, etc.) available at the construction site at all times. ▪ Inspect vehicles and equipment frequently for and repair leaks. Vehicle and equipment operators should inspect beneath all vehicles that have been parked more than 15 minutes before they leave the work area. Use drip pans to catch leaks until repairs are made. ▪ Clean up spills or leaks and any contaminated soil immediately, and dispose of cleanup materials properly.

BMP Number	BMP Title	BMP Description
		▪ Do not hose down surfaces where fluids have spilled. Use dry cleanup methods (absorbent materials, cat litter, and/or rags). ▪ Sweep up spilled dry materials immediately. Do not try to wash them away with water or bury them. If water must be used, Midpen or its contractor shall collect the water and spilled fluids and dispose of it as hazardous waste. ▪ Clean up spills on dirt areas by digging up and properly disposing of contaminated soil. ▪ If a pesticide is spilled, immediately contact one of Midpen's qualified first responders with Hazardous Waste Operations and Emergency Response (HAZWOPER) training. ▪ Small spills (less than 18 inches in diameter) including small quantities of oil, gasoline, paint or other materials should be controlled by a qualified first responder (Midpen staff has several) and do not necessarily require an emergency response team. Medium spills (greater than 18 inches but less than 6 feet in diameter) are typically controlled by the first responder (Midpen staff) but police or fire department Hazardous Materials (HAZMAT) teams may be called based on conditions. Report significant spills (larger than 6 feet in diameter and any "running" spill) immediately. You are required by law to report all significant releases of hazardous materials, including oil. To report a spill, contact the San Mateo County Environmental Health Services Division, or other emergency office (e.g., local fire or police department) as warranted, immediately and document the spill using the spill documentation form. Alternatively, 1) dial 911, the local emergency response number, 2) the National Response Center at (800) 424-8802; or 2) call the Governor's Office of Emergency Services Warning Center, (800) 852-7550 (24 hours). As appropriate, contact other agencies including California Occupational Safety and Health Administration or the Regional Water Quality Control Board. All chemical spills shall be reported as soon as possible to the emergency site contact.
GEN-7	Waste Management	▪ Cover waste disposal containers securely at the end of every workday and during wet weather. ▪ Check waste disposal containers frequently for leaks and to make sure they are not overfilled. Never hose down a dumpster on a project site. ▪ Ensure that portable toilets have a secondary containment plan (e.g., a containment pan). ▪ Clean or replace portable toilets and inspect them frequently for leaks and spills.

BMP Number	BMP Title	BMP Description
		▪ Dispose of all wastes and debris properly. Inorganic waste removed and dewatered waste material will be compiled at a material staging yard and taken to a permitted landfill, approved upland sediment disposal site, or at an approved reuse site in accordance with applicable State and federal regulations. Organic debris removed will be distributed in upland areas similar to the surroundings of where the material was removed from. Recycle materials and wastes that can be recycled (such as asphalt, concrete, aggregate base materials, wood, pipe, etc.). ▪ All raw construction materials and wastes will be removed from project sites following the completion of maintenance activities. Food-contaminated wastes generated during work shall be removed on a daily basis to avoid attracting predators to project sites. All temporary fences, barriers, and/or flagging shall be completely removed from project sites and properly disposed of upon completion of maintenance activities. ▪ Midpen or its contractor will not dump any litter or construction debris within the project area. All such debris and waste shall be picked up daily and properly disposed of at an appropriate site. ▪ Dispose of liquid residues from paints, thinners, solvents, glues, and cleaning fluids as hazardous waste.
GEN-8	Vehicle Maintenance and Parking	▪ All vehicles must stay on designated roads paved and unpaved, and if it is necessary for a vehicle to travel off the designated road (paved or 2-track unpaved), a monitor will precede the vehicle to clear wildlife from the pathway of the vehicle. ▪ Designate an area, fitted with appropriate BMPs, for vehicle and equipment parking and storage. ▪ Perform major maintenance, repair jobs, and vehicle and equipment washing off site. ▪ Conduct vehicle and equipment cleaning at appropriate maintenance yards and ensure that rinse water does not run into gutters, streets, storm drains, or surface waters. ▪ Keep an ample supply of spill clean-up materials near fueling sites and vehicle maintenance and hazardous materials/hazardous waste storage areas. Inventory clean-up materials monthly and restock as needed. ▪ Post proper fueling and spill clean-up instructions at fueling areas. Never leave the area while equipment is being filled. ▪ Recycle or dispose of fluids as hazardous waste.

BMP Number	BMP Title	BMP Description
		▪ Do not clean vehicle or equipment on-site using soaps, solvents, degreasers, steam cleaning equipment, etc. ▪ Perform vehicle and mobile equipment steam cleaning, pressure washing or degreasing only over a containment designed to collect any generated wash water. Collect wash water and properly dispose of wastewater.
GEN-9	Equipment Maintenance & Fueling	▪ Staging and storage areas for equipment, materials, fuels, lubricants and solvents shall be located away from the wetted areas. Stationary equipment such as motors, pumps, generators, compressors and welders, located within or adjacent to the creek shall be positioned over drip-pans. ▪ Any equipment or vehicles driven and/or operated adjacent to a Water of the State and/or U.S. will be checked and maintained daily to prevent leaks of materials that if introduced to water could be deleterious to aquatic life, wildlife or riparian habitat. Vehicles must be moved away from the watercourse prior to refueling and lubrication. ▪ Refueling of equipment will be conducted at least 150 feet away from streams and other waterbodies using heavy-gauge tarps made of chemically resistant polypropylene or other impervious material with vertical sides for spill containment. These containment tarps will be set up under the equipment prior to servicing or refueling. Once the work is completed, the tarp and its contents must be immediately removed from the property and all contaminants properly disposed of off-site. Standard operating procedures will be implemented immediately in case of fuel spillage. ▪ All vehicles entering the site will carry a functional fire extinguisher. ▪ Equipment should not be stored in areas that will potentially drain to watercourses or drainage facilities. If equipment must be stored in areas with the potential to generate runoff, drip pans, berms, gravel bags, or absorbent booms should be employed to contain any leaks or spills. ▪ In the event of a spill, follow procedures outlined in BMP GEN-6.
GEN-10	Paving and Asphalt Work	▪ Avoid paving and seal coating in wet weather or when rain is in the forecast, to prevent materials that have not cured from contacting stormwater runoff. ▪ Cover adjacent storm drain inlets and manholes when applying seal coat, tack coat, slurry seal or fog seal; and when saw cutting asphalt or concrete.

BMP Number	BMP Title	BMP Description
		▪ Collect and recycle or appropriate dispose of excess abrasive gravel or sand. Do not sweep this material into gutters. ▪ Do not use water to wash down fresh asphalt concrete pavement. ▪ Use filter fabric, catch basin inlet filters, or gravel bags to keep slurry out of the storm drain system. ▪ Shovel, absorb or vacuum saw-cut slurry and dispose of all waste as soon as work is complete in one location or at the end of the workday. ▪ If sawcut slurry enters a catch basin, clean it up immediately.
GEN-11	Concrete, Grout and Mortar Application	▪ Store concrete, grout, and mortar away from storm drains or waterways, and on pallets under cover to protect them from rain, runoff and wind. ▪ Wash out concrete equipment/trucks offsite or in a designated washout area, where the water will flow into a temporary waste pit, and in a manner that will prevent leaching into the underlying soil or onto surrounding areas. Let concrete harden and dispose of as garbage. ▪ When washing exposed aggregate, prevent wash water from entering storm drains. Block any inlets and vacuum gutters, hose wash water onto dirt areas, or drain onto a bermed surface to be pumped and disposed of properly.
GEN-12	Exclude Concrete from Channel	▪ For Program activities that involve concrete pouring, Midpen shall ensure that poured concrete be excluded from the wetted channel for a period of 30 days after it is poured. During that time, the poured concrete shall be kept moist, and runoff from the concrete shall not be allowed to enter a stream. Containment structures should be installed to control the placement of wet concrete and to prevent it from entering the channel outside of those structures. ▪ Commercial sealants may be applied to the poured concrete surface where difficulty in excluding water flow for a long period may occur. If sealant is used, water shall be excluded from the site until the sealant is dry. ▪ No dry concrete shall be placed on the banks or in a location where it could be carried into the channel by wind or runoff.

BMP Number	BMP Title	BMP Description
GEN-13	Concrete Washout Facilities	▪ Concrete washout facilities should be established for Program activities that require on-site preparation and use of Portland cement concrete, asphalt concrete or cement mortar, establish concrete washout facilities. These facilities capture wash water, concrete and aggregate flushed from concrete mixers, chutes, etc. Concrete washouts may be contained settling basins dug into the ground, raised and contained structures, trailers, etc. They are also applicable for projects that require equipment washouts. ▪ An appropriate area for the washout must be identified at least 50 feet away from watercourses and storm drains in case of accidental breaching. The storage capacity of the basin must be sized correctly for the job. <u>Construction Guidelines:</u> ▪ The location of the concrete washout should be clearly labeled and all employees should be educated about proper concrete disposal. ▪ Avoid mixing excess amounts of fresh concrete or cement mortar on-site. ▪ Wash out concrete mixers only in designated washout areas where the water will flow into temporary sealed basins or onto stockpiles of aggregate base or sand. Use as little water as possible to reduce hardening and evaporation time of waste products. ▪ Construct a basin large enough to contain all liquid and waste concrete materials generated during washout procedures. A minimum basin size is 9 feet x 9 feet and 2 feet deep. Plastic liner materials shall be a minimum of 60-mil polyethylene sheeting free of holes and defects. ▪ Recycle washout by pumping back into mixers for reuse when possible. <u>BMP Maintenance:</u> ▪ The concrete washout should be checked frequently to ensure proper use and effectiveness. ▪ At 75% capacity, the washout must be cleaned or new facilities must be constructed and ready for use. <u>BMP Removal:</u> ▪ The hardened concrete and materials related to the washout must be broken up, removed, and disposed of in accordance with local regulations. ▪ Area disturbed by the concrete washout must be repaired.

BMP Number	BMP Title	BMP Description
GEN-14	Painting and Paint Removal	▪ Never clean brushes or rinse paint containers into a street, gutter, storm drain, or stream. ▪ For water-based paints, paint out brushes to the extent possible, and rinse into a drain that goes to the sanitary sewer. Never pour paint down a storm drain. ▪ For oil-based paints, paint out brushes to the extent possible and clean with thinner or solvent in a proper container. Filter and reuse thinners and solvents. Dispose of excess liquids as hazardous waste. ▪ Paint chips and dust from non-hazardous dry stripping and sand blasting may be swept up or collected in plastic drop cloths and disposed of as trash. ▪ Chemical paint stripping residue and chips and dust from marine type paints or paints containing lead, mercury, or tributyltin must be disposed of as hazardous waste. Lead based paint removal requires a state-certified contractor.
GEN-15	Dust Management Controls	Midpen will implement the Bay Area Air Quality Management District (BAAQMD) Basic Dust Control Measures. Current measures stipulated by the BAAQMD Guidelines include the following: 1. All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day. 2. All haul trucks transporting soil, sand, or other loose material off-site shall be covered. 3. All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited. 4. All vehicle speeds on unpaved roads shall be limited to 15 mph. 5. All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used. 6. Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]). Clear signage shall be provided for construction workers at all access points. 7. All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified visible emissions evaluator.

BMP Number	BMP Title	BMP Description
GEN-16	Site Stabilization	Earthwork will be completed as quickly as possible, and where practical, site restoration will occur immediately following Program activities. If site restoration involves planting, such activities may commence in late fall or early winter during the onset of rainy season. ▪ Bare soil surfaces resulting from maintenance and/or construction activities shall be covered with suitable erosion controls (seed or plant vegetation, fabrics, hydroseeding, mulch, etc.): ▪ Within 12 hours of any break in work unless Program activities will resume within 7 days. ▪ No later than 3 days following the disturbance during the rainy season (approximately October through April). ▪ No later than 7 days following the disturbance during the dry season (approximately May through September). ▪ Every effort shall be made to immediately cover bare soil surfaces resulting from maintenance and/or construction activities prior to storms.
GEN-17	Fire Prevention	▪ All earthmoving and portable equipment with internal combustion engines will be equipped with spark arrestors. ▪ During the high fire danger period (May 1–November 30), work crews will: 1. Have appropriate fire suppression equipment available at the work site. 2. Keep flammable materials, including flammable vegetation slash, at least 10 feet away from any equipment that could produce a spark, fire, or flame. 3. Not use portable tools powered by gasoline-fueled internal combustion engines within 25 feet of any flammable materials unless a round-point shovel or fire extinguisher is within immediate reach of the work crew (no more 25 feet away from the work area). In high risk fire areas, operations involving mechanical equipment including flailing, masticating, disking, grading in heavy brush, operating a mower or brush cutter equipped with metal blades, welding, grinding, etc. or any other operation that could start a fire within or adjacent to any wildland areas will be conducted using the following protocols:

BMP Number	BMP Title	BMP Description
		▪ Whenever possible, high risk activities in wildland areas will be conducted outside of the high fire danger period (May 1 through November 30). The high fire risk areas will be mowed early in the day when the fire risk is lower. ▪ No high-risk activities will occur within a red flag area during a red flag event or within 24 hours of a predicted red flag event as determined by the National Weather Service (*National Weather Service Monterey Office Website: http://www.wrh.noaa.gov/mtr/)* ▪ Before beginning high-risk activities, weather conditions will be monitored. Weather samples will be taken every 2 hours if the ambient temperature is below 80 degrees Fahrenheit. Weather samples will be taken hourly if ambient temperature is at or over 80 degrees Fahrenheit. If one of the following conditions occurs and the ambient temperature is at or over 80 degrees Fahrenheit, operations will be delayed or if one of these conditions occur while running equipment, all operations will cease immediately. – RH (relative humidity) is at 30 percent or lower. – Sustained wind speeds reach 10 mph or higher. ▪ If ambient temperature is at or over 95 degrees Fahrenheit, all high-risk activities will cease. ▪ Maintenance staff will also assess the surrounding wildland fire risk conditions and make a judgment regarding what would be threatened if a fire was started. Maintenance staff may choose to stop activity at a lower threshold than described above if it is determined to be a risk to life or property. ▪ If a fire district within Midpen boundaries recommends a moratorium on mowing due to conditions, Midpen will not mow within their jurisdiction unless Midpen has coordinated with the fire district and staff are operating within Midpen guidelines. <u>C. Operation</u> 1. Be aware of risks related to driving and parking in tall, dry grass—particularly with catalytic converters. 2. Have an "Action Plan" in mind if a fire starts and have an "Escape Plan" if it gets beyond your ability to control with suppression equipment on-hand. Plan how to communicate with nearby coworkers or others threatened by fire. 3. If possible, plan mowing operations so that prevailing wind will blow over areas that have already been mowed. If a fire starts, it will initially burn in mowed grass with a better chance of stopping the fire early.

BMP Number	BMP Title	BMP Description
		4. Before starting *high-risk* operations using tractor mowers on District roads, a non-divertible pumper-equipped pickup will be assigned to the operation. An observer that is familiar with pumper operations; vehicle radio; must staff the truck. The employee acting as spotter will be in close proximity to *high-risk* operation. 5. Any deviation from having a pumper truck and spotter on site must be approved by Area Manager. 6. When operating a hand mower or small riding mower, staff must have one round point shovel with an overall length of at least forty-six (46) inches backpack pump water-type fire extinguisher available in the immediate area. 7. When on or near a wildland and operating stationary power equipment such as a generator, motor, welder, cutting torch, grinder or similar device from which a spark, fire, or flame may originate, all of the following are required (re: Public Resource Code (PRC) 4427): a. Clear away all flammable material around the area for a distance of 10 feet. b. Have one round point shovel with an overall length of at least forty-six (46) inches backpack pump water-type fire extinguisher available in the immediate area. 8. When operating chainsaws and other portable gas-powered tools in a wildland, one of the following is required for use within 25 feet of the area (re: PRC 4431): a. One round point shovel with an overall length of at least forty-six (46) inches or a fire extinguisher appropriate to provide fire control for the area and conditions. <u>D. Fueling</u> 1. When fueling equipment, allow it to cool where there is no flammable vegetation that can be ignited by the hot exhaust, preferably in a dirt area. 2. See Safety Manual Chapter 1.7.00 regarding fire prevention requirements and Sections 1.6.5.4 to 1.6.5.7 regarding safe fueling of equipment.

BMP Number	BMP Title	BMP Description
GEN-18	Project Completion by End of Work Period	No project shall be initiated unless there is high confidence it can be completed, including installation of any erosion and drainage control features, before the appropriate end of the work windows designated in BMP BIO-21, Salmonid Protection Measures. After September 15 of each year, projects that have not been started, or are still underway, or meet the conditions in BMP BIO-21 shall be evaluated to ensure they can be completed before the end of the applicable seasonal work window. Program activities in streams that support anadromy will occur beginning June 15. Program activities will be at least 50% complete by October 15 of any year, and will be completed by October 31 or before the first significant rainfall occurs. Those projects unlikely to be completed before the end of the seasonal work windows will not be started or will be winterized to be completed in the following year.
GEN-19	Avoid Inclement Weather	▪ The Midpen Project Manager will monitor the seventy-two-hour forecast from the National Weather Service (http://www.nws.noaa.gov and https://www.accuweather.com). When there is a forecast of more than 40% chance of rain, or at the onset of unanticipated precipitation, the Project Manager shall remove all equipment from the creek zone, shall implement erosion and sediment control measures, and all Program activities shall cease. ▪ No earth work shall occur during a dry out period of 24 hours after there has been ¼ inch or more of precipitation. ▪ If, in the opinion of Midpen, conditions arise or change, in such a manner as to be considered deleterious to the stream or wildlife, project activities shall cease until corrective measures are taken.
GEN-20	Aquatic Resource Protection Measures	▪ No equipment shall be operated within the active creek (i.e., wetted channel) except in perennial streams or during wet weather years in which the channel does not dry. In these instances, work will be scheduled during periods of low flow and must adhere to the dewatering BMPs (DW-1, DW-2, and DW-3).

BMP Number	BMP Title	BMP Description
		▪ Surveys for special-status species and monitors will normally not be required for small scale pond maintenance activities using hand tools and fewer than five persons per one half acre. Activities including mechanical dredging, excavating, and bulldozing for shoring up earthen berms or leveling spillways will require pre-activity visual surveys as well as monitoring during the activities. All pond repair and maintenance activity proposals involving mechanized equipment and associated monitoring proposals must be approved by the USFWS prior to implementation. Surveys and monitors during the pond repair and maintenance activities will only be conducted by federal and state permitted biologists in accordance with their permits, or by monitors approved to work under the direction of permitted biologists.
GEN-21	Staged Materials Management and Excavation Ramps	▪ Midpen or their contractor will visually check all construction materials (bridges, pipes, culverts) for the presence of wildlife sheltering within them prior to the materials being moved and placed in their proper locations. ▪ Building materials or equipment will not be stored where they could be washed into the water or where they will cover aquatic or riparian vegetation. ▪ Open trenches or pits, at the end of each workday, will incorporate an escape ramp at each end of the open trench to allow any animals that may have become entrapped in the trench to climb out overnight. The ramp may be constructed of either dirt fill or wood planking or other suitable material that is placed at an angle no greater than 30 degrees. ▪ Building materials and/or construction equipment shall not be stockpiled or stored where they could be washed into the water or where they will cover aquatic or riparian vegetation.
GEN-22	Spoils Management	Spoils will not be placed where it could enter the stream, riparian or wetland areas. Spoil shall not be placed over riparian or wetland vegetation, unless approved by the Midpen Natural Resources Department.
GEN-23	Vegetation and Tree Removal and Retention	▪ Native soils, rock, gravel, vegetation, and vegetation will be retained to the extent feasible. Avoid removing/thinning the canopy layer in mature, established forests and woodlands to maximize shading (thereby promoting shade and related increased moisture under the canopy level) and increase resistance to non-native plant invasion. ▪ Vegetation will not be removed or intentionally damaged beyond the construction corridor or intended vegetation management area.

BMP Number	BMP Title	BMP Description
		▪ Hand tools (e.g., trimmer, chain saw, etc.) will be used to trim vegetation to the extent necessary to gain access to the work sites. No bulldozers, backhoes, or other heavy equipment will be used to remove vegetation along streambanks or within the stream unless submitted to CDFW during annual project notifications. ▪ The disturbance or removal of vegetation will be restricted to the minimum necessary to complete maintenance activities. Precautions shall be taken to avoid other damage to vegetation by people or equipment. Branches and/or limbs overhanging the trails and channel and impacting trail access and water flows shall be properly pruned. Trees may be removed from natural channels if and only if they are below ordinary high water mark (OHWM) and they are restricting the capacity of the channel and they are causing erosion or flooding. Any trees which will be cut are to be cut at ground level and the root mass left in place to maintain bank stability. ▪ Woody and herbaceous plants, fallen trees, or trunks or limbs lodged in the bed or bank of stream channels causing flow restriction will be cut off at the bed or bank invert with small tools and removed with winch and cable or other equipment operated from top of bank. Root structures will not to be disturbed. ▪ Embedded pieces of large woody material or stumps that potentially serve as basking sites or that encourage pool formation shall be left in place if it does not obstruct the flow of water and there is adequate flood flow capacity. Objects embedded/anchored in the bank, such as tree stumps, shall not be removed during periods of heavy flow if removal would result in release of sediment into the channel. However, protruding objects that could capture additional debris and result in obstruction of the channel (e.g., the branches and trunk of a downed tree) may be trimmed. If an embedded object must be removed to prevent a debris jam, BMPs EC-1 and SWQ-3 will be used to prevent the release of sediment into the channel, and the bank shall be reseeded, revegetated, mulched and/or covered with erosion-control fabric following removal. ▪ The following measures would be implemented for tree removal in riparian areas: – Prior to removal, Midpen will conduct all necessary biological surveys in compliance with regulatory permits.

BMP Number	BMP Title	BMP Description
		– No living trees, shrubs, vegetation, or woody material greater than 6 inches dbh will be removed from within a stream. – All trees that provide canopy cover along the stream will be replanted with native species, unless they are removed for fuels treatment within an overstocked forest, as determined by a qualified ecologist, identified by CALFIRE, or identified as an Ecosystem Resiliency treatment area in the Wildland Fire Resiliency Program. Any trees not providing canopy cover of the stream do not need to be replanted. Native trees less than 6 inches dbh will not be replaced unless native regeneration is not occurring. – 75% of the existing canopy will be maintained over a stream at all times. – Non-native tree removal will not require replanting if the site is regenerating native vegetation.
GEN-24	Vegetation Management with Prescribed Burns	1. All burning will be conducted according to prescriptions in the vegetation management plan, and burn developed specifically for the project by the California Department of Forestry and Fire Protection (CALFIRE), or as otherwise described in the forthcoming Wildland Fire Resiliency Program. The fire will be ignited only if the conditions are within the parameters specified in the burn plan. Smoke dispersal, emergency response, safety, and contingency planning are addressed in the burn plan. Other habitat management activities (i.e., invasive plant removal and cattle grazing) may occur year-round if prescriptions are not likely to adversely affect San Francisco garter snake (SFGS) or California red-legged frog (CRLF). 2. All participants in the burn will be briefed on the endangered species potentially present, where they would likely be found, and who to contact if one is sighted. This briefing will be performed by the Resource Advisor, who is a biologist or cultural resource specialist with fire training. Resource Advisor will work with the ignition teams, and be a part of any ignition sequence planning. Resource Advisors will be in radio contact with either the Ignition Specialist or the Incident Commander directly to ensure quick communication and decision-making regarding the safety of sensitive wildlife.

BMP Number	BMP Title	BMP Description
		3. No more than 350 acres (141.6 hectares) of habitat will be manipulated by prescribed fire per treatment period. An average 20-foot (6.1-meter) buffer will be established around all ponds prior to conducting prescribed burns, depending on the vegetative cover. Those shorelines with vegetation that provide cover for the snake will provide the greatest buffer, while those shore-lines without adequate vegetative cover will be given less buffer. These buffer areas may be managed using other habitat management techniques following each burn (e.g., cattle grazing), but are to remain completely undisturbed during prescribed fire events. Every reasonable attempt will be made to maintain 1/4 to 1/2 acre (0.1 to 0.2 hectare) of unburned area for every 10 acres (4 hectares) of burned habitat (i.e., 4 to 8 acres of refugia habitat are needed for a 160-acre burn, and 9 to 18 acres are needed for a 350-acre burn). When feasible, refugia areas will be conserved randomly throughout the treatment area, especially in areas with known populations of SFGS and CRLF. These refugia areas may be naturally occurring areas such as rock formations, ponds and other wetland/riparian areas, areas with a high density of burrows, and other areas not prone to burn, or these areas may be created and maintained using hand tools or water to create fire-breaks or wet-lines. 4. No more than 24 hours prior to conducting prescribed fires, visual surveys will be conducted by walking transects throughout the proposed burn area in an attempt to locate individual SFGS and CRLF. A trained biologist or biological monitor will capture, transfer, and release in a safe area any SFGS and CRLF deemed to be in danger of being harmed by the prescribed fire activities. If SFGS or CRLF are located during the pre-treatment surveys but escape capture, an area approximately 50 feet (15 meters) in diameter around the individual will be protected from the burn. If necessary, individual SFGS may be held in captivity in a pillowcase for less than 24 hours and may later be released near the point of capture after the burn has been completed. The number of SFGS and CRLF encountered and transferred to safe areas or held in captivity during treatment will be reported to USFWS, and each individual SFGS will be photographed for use in identification. 5. All vehicles involved with the site-specific burn will be retained in a prearranged, marked parking area in a clearing as close to the main road as possible. At least one monitor will ensure wildlife is clear from the parking area while vehicles are arriving and leaving. All vehicles must stay on designated roads, and if it is necessary for a vehicle to travel off the designated main road, a monitor will precede the vehicle to clear wildlife from the pathway of the vehicle. Only biological monitors specifically authorized by the USFWS and CDFW to handle SFGS or CRLF (normally these will be individuals holding a federal recovery permit for the species) will be allowed to handle, transport, and relocate individuals of these species.

BMP Number	BMP Title	BMP Description
		6. Below ground temperature monitoring will be conducted during the burn to monitor air temperatures in San Francisco garter snake refugia. One or more biologists or biological monitors will place "hobo thermocouples" (ground temperature monitoring devices) in rodent burrows throughout the burn area to monitor changes in temperature in the burrows as fire moves across the landscape. The knowledge gained will be useful in determining how to conduct future prescribed fires in San Francisco garter snake habitat in a manner that will minimize potential effects to the species. 7. Immediately following each prescribed fire, the permittee will search the affected post-treatment area to identify dead or injured individuals of all vertebrate taxa. Dead SFGS and CRLF will be salvaged and deposited at an approved repository. Injured individuals will be handled only by a permittee authorized to capture and handle SFGS and CRLF. Medical assistance will be provided to injured animals by a certified wildlife veterinarian familiar with amphibian and reptile care. 8. Ignition will be completed in less than three hours. The fine fuels should be consumed quickly and most coyote brush and grass thatch are expected to bum down within one hour after ignition. Some minor smokes may be evident for one day following the burn. Spot checks of the plot will be conducted until all smokes are out. 9. A pond located to the northeast of the former Wool Ranch has been designated for fire use. Emergency response plans that identify designated water sources for fire use are being developed for all Midpen Preserves. Existing hydrants or fire storage tanks will be targeted first, and ponds that are known to support California red-legged frogs and other protected species will be utilized as a last resort in emergency situations. Midpen currently provides a patrol map book to fire agencies that has all water sources including water storage tanks mapped. In addition, Midpen Natural Resources staff maintains fire training in order to function as resource advisors to the Incident Commander in the event of a large wildland fire. If an emergency situation necessitates the use of water from a CRLF-occupied pond, a striker pump and intake hose may be used to draw water from one of the small wetland ponds in the burn area to fill engines or back pumps. The intake hose will be screened with 1/4-inch mesh to prevent intake of California red-legged frogs. The burn plan details the use of lake and ocean water to fill helicopter buckets to aid suppression efforts. If a helicopter bucket is used, it will draft from the center of the pond, to prevent uptake of California red-legged frogs that may potentially be present.

BMP Number	BMP Title	BMP Description
		10. Within San Francisco garter snake habitat, post-burn monitoring will be conducted as part of the project and will include (1) vegetative response to the burn, (2) wildlife response to the burn, and (3) fire behavior and burn conditions. Because the burn is intended to enhance San Francisco garter snake habitat, the monitoring emphasis for vegetation and wildlife will be on the wildlife and habitat features that are considered to be necessary to support San Francisco garter snakes. The variables measured for San Francisco garter snake response to habitat are pre- and post-burn data on the (1) pre- and post-burn vegetation community in the burn area in order to determine vegetative response to the burn and (2) the frequency of valley pocket gopher (*Thomomys bottae*) burrows and other burrows. As part of its standard post-fire evaluation CALFIRE will provide an analysis of the burn, including how the fire responded to weather and other burn conditions, and percent coverage of the burn within the boundaries of the burn area. Beginning immediately after the burn the frequency (number) of rodent burrows will be measured during the vegetation transect monitoring. Vegetation monitoring will include the establishment of four transects within and three transects outside of the burn area for comparative analysis. Transects will be randomly established in burned and unburned areas and each transect will measure 50 meters in length. A meter-square plot will be established at five-meter intervals along the transects. Vegetative composition and percent cover for all plant species will be recorded for each plot. Transects sampling will take place prior to the burn and at least once per year after the burn for three years. Response of native and non-native grasses and coyote brush to the burn will be of particular interest. Data collected before, during, and after the burn, and the observations made during the evaluation of the burn will be compiled into a report within one year following the burn. Upon completion, the report will be submitted to USFWS.
GEN-25	Vegetation Management with Livestock	▪ Livestock will be used for vegetation management to avoid the use of chemical herbicides, to control invasive vegetation, and promote the growth of native vegetation. Where livestock is used in association with a specific routine maintenance project, vegetation removal will not exceed 2,000 square feet (0.05 acres) in size, 150 adjacent linear feet, or the minimum necessary to complete the operation, whichever is less, and livestock will be managed and prohibited from creating or worsening existing erosion and sedimentation to flowing stream channels.

BMP Number	BMP Title	BMP Description
		▪ Monitor and protect ponds that provide habitat for special-status species, depending on the vegetative cover. Those shorelines with vegetation that provide cover for special-status species will provide the greatest buffer, while those shore-lines without adequate vegetative cover will be given less buffer. ▪ Monitor forage utilization and distribution by grazing animals to assure appropriate amounts of residual dry matter (RDM) remain on the ground to achieve desired resource management objectives. In the course of RDM monitoring, evaluate and report on wildland fire fuel levels that may result in an increased risk of wildland fire. ▪ Manage access to existing water features and where needed supply supplemental drinking water through stock ponds and water troughs to preserve clean water for livestock, protect water quality, and enhance habitat for wildlife.
GEN-26	Non-native Plant Removal and Herbicide Management	▪ Focus vegetation biomass reduction on non-native vegetation and avoid damaging native grasses, and mature shrublands and forests wherever possible. Where active treatment is needed, seek to break the vertical fuel ladder connection between the ground and the canopy layer, and create some horizontal physical separation between plants where possible. Prioritize projects where invasive plant removal alone can result in fire-safe landscapes. ▪ Implement fuel management projects with low impact tools and methods such as hand cutting and pruning rather than vegetation removal or soil disturbance with hand methods or machines. ▪ Prioritize leaving forest duff and organic soil layers undisturbed in all fuel management actions. ▪ For invasive pest management and hazardous fuel reduction activities: 1. Prior to conducting non-native (e.g., pampas grass) and native (e.g., cattail, cocklebur) plant removal or treatments (e.g., spraying with herbicide or fungicide, cutting, pulling, digging out), the permittee will make every reasonable attempt to ensure that SFGS and CRLF are not hidden within the plant or the residual plant matter to be treated. 2. All invasive plant and animal work will be done in accordance with the Midpen's other and Best Management Practices identified in the Midpen Integrated Pest Management Program.

BMP Number	BMP Title	BMP Description
		3. No burrow fumigants will be used. Only pesticides that are part of the Midpen Integrated Pest Management Program will be used, and only if they are used in accordance with the guidelines on the label and if they comply with the restrictions listed in the critical habitat designation. ▪ Midpen will choose site-specific strategies and times of treatment that provide the best combination of protecting preserve resources, human health, and non-target organisms and that are efficient and cost-effective in controlling the target invasive species. Direct the control method narrowly at the target organism to avoid broad impacts on the ecosystem. Modify control methods over time as site conditions and treatment techniques change. Use pesticides only where alternative methods are known to be ineffective. Apply pesticides in an environmentally safe manner. Take all reasonable precautions to protect the environment, the health and safety of employees, adjacent lands and preserve visitors. ▪ Midpen will comply with BMPs and other mandatory measures to protect sensitive resources and employee and public health during pesticide application. All appropriate laws and regulations pertaining to the use of pesticides and safety standards for employees and the public, as governed by the U.S. Environmental Protection Agency, the California Department of Pesticide Regulation, and local jurisdictions will be followed. All applications will adhere to label directions for application rates and methods, storage, transportation, mixing, and container disposal. Midpen staff will coordinate with the County Agricultural Commissioners, and all required licenses and permits will be obtained prior to pesticide application. ▪ All pesticides will be implemented consistent with Pest Control Recommendations prepared annually by a licensed Pest Control Advisor. ▪ Midpen will maintain a minimum 30-foot buffer around special-status species habitats and a 15-foot buffer around all other aquatic and riparian habitats when applying pesticides, unless specially requested to work closer. ▪ All vegetation management activities that could result in the runoff of pesticides that are not registered for aquatic use into waters of the State and/or U.S. will be avoided. Only pesticides and adjuvants registered for aquatic use will be applied to aquatic areas or within the banks of channels. ▪ Only pesticides and adjuvants registered for aquatic use will be applied to aquatic areas or within the banks of channels. All conditions of the herbicide label will be followed.

BMP Number	BMP Title	BMP Description
		▪ Surfactants and other adjuvants will be used and applied consistent with the District's Pest Control Recommendations. ▪ Avoid pesticide drift by not applying pesticides under windy conditions in close proximity to special-status species or their habitat, and by using plastic shields around target weeds and pests, ground-based applicators, low tank pressures and spray nozzles adjusted for larger droplet sizes and to limit the spray area. ▪ Pesticide application will cease when weather parameters exceed label specifications, when wind at site of application exceeds 7 miles per hour, or when precipitation (rain) occurs or is forecasted with greater than a 40 percent probability in the next 24-hour period to prevent sediment and pesticides from entering the water via surface runoff. ▪ None of the following activities will be undertaken in aquatic or riparian areas: mixing, loading and storage of pesticides; rinsing of equipment and pesticide containers. All activities will take place at least 300 feet from aquatic or riparian areas. ▪ Refilling of pesticides will be required to occur at least 300 feet way from any body of water in a contained area and include a secondary containment plan. Any transfer or mixing on the ground shall be within containment pans or over tarps. ▪ A 30-foot buffer will also be maintained when applying pesticides unless previously approved by the regulatory agencies. ▪ Midpen staff, contractors, and tenants will undergo annual pesticide safety training. Pesticide applicators will have or work under the direction of a person with a Qualified Applicator License (QAL) or Qualified Applicator Certificate (QAC). Contractors and grazing and agricultural tenants may apply approved herbicides after review and approval by Midpen and under the direction of QAL/QAC field supervisors. ▪ Appropriate non-toxic colorants or dyes will be added to the pesticide mixture to determine treated areas and prevent over-spraying. ▪ The following general application parameters will be employed during pesticide application: – Spray nozzles will be configured to produce a relatively large droplet size; – Low nozzle pressures (30-70 pounds per square inch) will be observed;

BMP Number	BMP Title	BMP Description
		– Spray nozzles will be kept within 24 inches of vegetation during spraying; ▪ Signs will be posted notifying the public, employees, and contractors of the use of pesticides. The signs will consist of the following information: signal word, product name, and manufacturer; active ingredient; USEPA registration number; target pest; preserve name; treatment location in preserve; date and time of application; date which notification sign may be removed; and contact person with telephone number. Signs will generally be posted 24 hours before the start of treatment and notification will remain in place for 72 hours after treatment ceases, in compliance Midpen's Integrated Pest Management Program.
GEN-27	Snags	To the maximum amount practicable, individual dead or dying trees shall be retained, with modification if appropriate, as snags. This measure should not be considered to apply in areas where removal is warranted to control spread of a disease or for human safety purposes.
GEN-28	Culvert Replacement	▪ The following alternatives and structure types should be considered in order of preference: 1. Streambed simulation strategies - bottomless arch, embedded culvert design, or ford 2. Non-embedded culvert - this is often referred to as a hydraulic design, associated with more traditional culvert design approaches limited to low slopes for fish passage 3. Baffled culvert, or structure designed with a fishway - for steeper slopes. If a segment of stream channel where a crossing is proposed is in an active salmonid spawning area then only full span bridges or streambed simulations are acceptable. ▪ Replacement of any existing concrete, wood, plastic (ABS, HDPE etc.) or metal pipe culvert up to 48 inches inner diameter (unless authorized to be a larger diameter by California Department of Fish and Wildlife [CDFW]) with the following restrictions: 1. Work will be done only when the channel is dry, except in perennial streams or during wet weather years in which the channel does not dry. In these instances, work will be scheduled during periods of low flow and must adhere to the dewatering BMPs (DW-1, DW-2, and DW-3).

BMP Number	BMP Title	BMP Description
		2. The new culvert will typically be as large as or larger than the existing culvert unless the original culvert was oversized or a natural obstruction such as bedrock is encountered. For anything other than an ephemeral drainage, the culvert will be sized where feasible to convey a 100-year flow or cover the entire channel width. 3. Total earthwork will be limited to the extent necessary at each project to complete the work, and will not exceed 80 cubic yards per culvert. 4. The new culvert will be installed at or below grade.
GEN-29	Culvert Maintenance	▪ Culverts with recurring blockages are cleaned annually, regardless of the amount of blockage. Sediment, vegetation or debris will be removed using hand tools in creeks supporting salmonids, unless other methodology is submitted to CDFW in writing during annual project notifications. Sediment, vegetation or debris will be removed with mechanized equipment in creeks that do not provide habitat for salmonids where hand removal is infeasible. ▪ Culverts that are more than 1/3 blocked may be cleaned at any time, even during periods when the channel is wet, with the following restrictions: 1. Up to 32 cubic yards of material may be removed, using hand tools only, under any conditions. 2. Removal of amounts greater than 32 cubic yards requires that the channel be dewatered first and heavy equipment may be used with written approval from CDFW. 3. The total cumulative area of disturbance will not exceed 150 feet of channel or 2,000 square feet of area, whichever is less. 4. After completion of the work, the disturbed area will immediately be treated with erosion control materials BMPs sufficient to control turbidity and sediment loss. 5. Nearby perched or otherwise unstable fill may be removed as well, up to 10 cubic yards. 6. No Coho salmon are present.

BMP Number	BMP Title	BMP Description
GEN-30	Culvert Removal and/or Replacement with Rolling Dips or Fords	▪ If the channel was created by the original emplacement of the culvert, any number may be removed. ▪ Culvert replacements will be installed at or below stream grade. Align the slope and gradient of replacement culverts that will discharge to a ditch, creek, or channel consistent with the direction of the receiving water course.
GEN-31	New Culvert Installation (non-stream crossings)	▪ The following alternatives and structure types should be considered in order of preference: 1. Streambed simulation strategies - bottomless arch, embedded culvert design, or ford 2. Non-embedded culvert - this is often referred to as a hydraulic design, associated with more traditional culvert design approaches limited to low slopes for fish passage 3. Baffled culvert, or structure designed with a fishway - for steeper slopes. If a segment of stream channel where a crossing is proposed is in an active salmonid spawning area then only full span bridges or streambed simulations are acceptable. ▪ Design new culverts to blend in with the surrounding environment and to not interfere with the movement of fish. ▪ Design and install new culverts in fish bearing streams to provide sufficient depth and velocity of water for passage of native fish and other native aquatic species during high and low flow conditions. ▪ Outside of stream crossings, new culverts may be installed to maintain existing roads and trails with the following restrictions: 1. New culverts will not be installed in streams but will be limited to engineered drainage ditches associated with roads and trails. 2. If an existing road or trail has an inadequately drained inboard ditch (excessive length between existing ditch relief culverts or dips), new ditch relief culverts (where rolling dips would be insufficient) may be placed as directed by the project engineer to adequately convey stormwater and reduce sediment to downstream watercourses.

BMP Number	BMP Title	BMP Description
GEN-32	Bridge and Puncheon Replacement	▪ Removal, or replacement of any size bridge (including puncheons) in the same location, on any trail or road, where no channel entry is necessary, no work is proposed to in-channel abutments or supports and vegetation removal is limited to no more than a six (6) foot buffer around the existing bridge structure and to trimming of no more than 20% of any individual tree canopy within that six-foot buffer. ▪ Bridge replacement (not in the same location, such as higher on the bank or upstream/downstream) will be allowable if it reduces overall habitat impacts and/or removes the bridge completely from the stream bed, bank or channel (for example, a bridge for which the current bridge or footings are located below the OHWM) made longer to be placed above the OHWM. ▪ Removal, or replacement of any size bridge in the same location, with limited channel entry to place fabric or other devices to catch debris or place falsework, with the following restrictions: 1. Work may only occur when the channel is dry, except in perennial streams or during wet weather years in which the channel does not dry. In these instances, work will be scheduled during periods of low flow and must adhere to the dewatering BMPs (DW-1, DW-2, and DW-3). 2. Only very limited modifications to the channel surfaces are proposed. 'Very limited' means movement of rocks less than 8 inches in size, less than two hand shovels of earth, footprints and indentations caused by equipment and structures. Any modifications to correctly place falsework will occur to the falsework rather than the channel. 3. Vegetation removal is limited to no more than a six (6) foot buffer around the existing bridge structure and to trimming of no more than 20% of any individual tree canopy within that buffer. ▪ Removal, or replacement of smaller bridges (up to six [6] feet width) on trails, as long as work is completed when the channel is dry or during periods of low flow (for perennial streams) and must adhere to the dewatering BMPs (DW-1, DW-2, and DW-3). The bridge will be supported on mudsills or abutments placed outside of the channel.
GEN-33	Bridge and Puncheon Repair and Maintenance	Repair and maintenance of bridge (including puncheon) parts and grading for drainage correction on the approaches will implement the following conditions: 1. All work shall be done from the bridge or by workers standing in the channel or on a ladder in the channel.

BMP Number	BMP Title	BMP Description
		2. A net or other device (e.g., diaper, underlayment) shall be attached to the underside of the bridge to catch any debris falling from bridge. 3. Pressure treated lumber shall be sealed and coated off-site. Sealants shall be approved by Midpen Natural Resources Department prior to their incorporation into the bridge. Tread material shall not be pressure treated to prevent leaching and breakdown of pressure treated materials into the waterway. 4. Only minor saw work and drilling shall occur; the primary work shall occur off site. 5. Grading on the approaches is limited to a maximum of five (5) cubic yards per bridge. This amount is not cumulative with the culvert replacement standard of five (5) cubic yards.
GEN-34	Ford and Swale (including Drain Lenses and Causeways) Replacement	Full replacement of existing fords or repair/maintenance by replacing rock and removing sediment and woody debris with the following restrictions: 1. No use of chemicals, concrete, mortar or other sealants or adhesives. 2. This category applies only to narrow width trails and emergency vehicle/multi-use trails where the drainage does not support salmonids. 3. The ford is not on an intermittent or perennial drainage or, if it is, the ford has been confirmed by CDFW to not be considered a barrier to the movement of aquatic organisms. 4. Vegetation removal is limited to no more than a five-foot buffer around the existing ford and to trimming of no more than 20% of any individual tree canopy within the five-foot buffer only. 5. All work shall be done when the channel is dry, except in perennial streams or during wet weather years in which the channel does not dry. In these instances, work will be scheduled during periods of low flow and must adhere to the dewatering BMPs (DW-1, DW-2, and DW-3).

BMP Number	BMP Title	BMP Description
Biological Resource Measures		
BIO-1	Environmental Awareness Training	Prior to commencing maintenance activities in a given year, all participating maintenance personnel will attend a worker environmental awareness training program. The training will include a brief review of special-status species, sensitive habitats, and other sensitive resources that may exist in the project area, including species identification, habitat requirements, procedures to follow when encountering any species in the work area, and the legal status and protection of each relevant species, penalties for take, work restrictions, as well as locations of sensitive biological resources. The training will include materials concerning the following topics: sensitive resources, resource avoidance, permit conditions, and possible consequences for violations of State or federal environmental laws. The training will cover the maintenance activity's conservation measures, environmental permits, and regulatory compliance requirements, as well as the roles and authority of the monitors and biologist(s). It will include printed material (with photos of San Francisco garter snake and California red-legged frog) and an oral training session by a qualified biologist or biological monitor.
BIO-2	Biological Monitor	▪ A qualified biologist is an individual who has a minimum of five (5) years of academic training and professional experience in biological sciences and related resource management activities, with a minimum of two survey seasons years (e.g., two seasons during the blooming season of sensitive plants) conducting surveys for each species that may be present within the Project area. ▪ A biological monitor is an individual who has academic and professional experience in biological sciences and related resource management activities, experience with construction-level biological monitoring, be able to recognize species that may be present within the Project area, and be familiar with the habits and behavior of those species. ▪ The biological monitor(s) or qualified biologist(s) shall have the responsibility and authority of stopping the proposed project if any crews or personnel are not complying with regulatory permit conditions. The biological monitor or qualified biologist will possess necessary agency approvals and/or regulatory permits required for project work, dependent on the location and potential to encounter special-status species, prior to the initiation of Program activities. The biological monitor or qualified biologist will have stop-work authority over Program activities to avoid take or impacts to special-status species or protected biological resources.

BMP Number	BMP Title	BMP Description
		▪ To maintain safety and limit any chance of take or habitat disturbance, a simple system of hand signals will be established for the monitors, truck drivers, equipment operators, and field personnel to use during habitat enhancement and related activities.
BIO-3	Work Area Designation	Prior to Program activities in suitable habitat for special-status species, a biological monitor or qualified biologist shall clearly mark/flag or erect temporary construction fencing to designate the work area and to delineate the areas that shall be avoided. The boundaries shall be inspected on a regular basis to ensure that work has remained within the marked boundaries. If one or more boundary(ies) has/have been violated, work shall cease until the Midpen Project Manager has taken action to ensure there is no recurrence of the trespass. Flagging and/or temporary construction fencing shall be removed immediately after the completion of construction work.
BIO-4	Special-Status Plant Species Avoidance Measures	This measure includes, but is not limited to, Mt. Hamilton fountain thistle (MHFT), western leatherwood (WL), Loma Prieta hoita (LPH), San Francisco popcorn flower, Santa Clara Valley dudleya, and Congdon's tarplant (CT). The following rare plant avoidance measures will be implemented within riparian habitat or Waters of the State and/or U.S. and within one-quarter (1/4) mile of a known rare plant occurrence, or within suitable rare plant habitat but where rare plants are not known to occur: ▪ Prior to the start of Program activities, a qualified biologist will conduct protocol level surveys for sensitive plant species. For information on special status plant survey methodology visit: – https://cnps.org/wp-content/uploads/2018/03/cnps_survey_guidelines.pdf – https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=18959&inline – https://www.fws.gov/ventura/docs/species/protocols/botanicalinventories.pdf ▪ If at any time MHFT, LW, LPH, popcorn flowers, CT or other rare plant species is found, it will be flagged for avoidance and site-specific avoidance buffers, developed through coordination with CDFW, will be implemented. Rare plants and associated buffer zones shall be avoided during Program activities. ▪ If at any time, MHFT, LW, LPH, CT, or popcorn flower cannot be avoided, Program activities will not be conducted until Midpen coordinates with CDFW and mitigation plan is agreed upon.

BMP Number	BMP Title	BMP Description
BIO-5	Sensitive Natural Communities	Sensitive Natural Communities of plants occur throughout Midpen's lands, but are not well mapped as distinct areas from other vegetation types, and some are too small of scale to accurately map. Many of Midpen's activities will have no effect on the communities (such as grading an existing road). The following measure will take place before vegetation projects covered by the program occur: ▪ During treatment of vegetation within a CDFW designated sensitive natural community, treatments will be implemented to maintain the membership rules of the natural community. Characteristic species will be preferentially retained over other species to maintain the structure and composition consistent with current membership rules for the subject community based on the Manual of California Vegetation Online."
BIO-6	Invasive Plant Material Management and Disposal	▪ All staff, contractors, and volunteer crew leaders will be properly trained to prevent spreading weeds and pests to other sites. Midpen staff will appropriately maintain facilities where tools, equipment, and vehicles are stored free from invasive plants. Midpen staff will inspect rental equipment and project materials (especially soil, rock, erosion control material, and seed) to confirm as much possible that they are free of invasive plant material before their use at a worksite. ▪ All personnel working in infested areas will take appropriate precautions to not carry or spread weed seed outside of the infested area. Such precautions will consist of, as necessary based on site conditions, cleaning of soil and plant materials from tools, equipment, shoes, clothing, or vehicles before entering or leaving the site. ▪ Develop and implement an employee and contractor training program; include aquatic invasive plant identification and cleaning protocols for clothing, tools, vehicles, and boats. Prevent the spread of plant fragments (roots, stems) of certain species that can produce new plants in ditches, canals, and streams. ▪ Construction equipment will arrive at project sites clean and free of soil, seed, and plant parts to reduce the likelihood of introducing new weed species. Invasive weed species occurring within locations of construction clearing and grubbing shall be flagged for removal by the biological monitor or qualified biologist. These species, along with associated duff and topsoil, as appropriate, shall be disposed of by the contractor. These materials shall not be allowed to be integrated with other onsite topsoil materials intended for salvage and replacement. ▪ Target control of invasive species that rank high in the IPM prioritization matrix

BMP Number	BMP Title	BMP Description
		▪ When transporting invasive plant material offsite for disposal, the plant material will be contained in enclosed bins, heavy-duty bags, or a securely covered truck bed. All vehicles used to transport invasive plant material will be cleaned after each use. ▪ Suitable onsite disposal areas shall be identified to prevent the spread of weed seeds. Invasive plant material shall be rendered nonviable when being retained onsite. Midpen staff shall desiccate or decompose plant material until it is nonviable (partially decomposed, very slimy, or brittle). Depending on the type of plant, disposed plant material can be left out in the open as long as roots are not in contact with moist soil, or can be covered with a tarp to prevent material from blowing or washing away. Midpen staff will monitor all sites where invasive plant material is disposed onsite and treat any newly emerged invasive plants. ▪ Inspect recreational facilities (e.g., parking lots, trails, visitor centers) that experience high visitor use often during target invasive plant flowering and seed production times.
BIO-7	Sudden Oak Death and Plant Pathogen Control	▪ All personnel working in infested areas will take appropriate precautions to not carry or sudden oak death (SOD)-associated spores or other plant pathogens outside of the infested area. Such precautions will consist of, as necessary based on site conditions, cleaning of soil and plant materials from tools, equipment, shoes, clothing, or vehicles before entering or leaving the site. ▪ Track the effects of sudden oak death (Phytophthora sp.) (SOD) disease (mapping dead oaks as staffing and budgeting permit), and share this information with the California Oak Mortality Task Force (www.suddenoakdeath.org) as staffing and funding allow. ▪ Removal of California bay trees or their branches within 15 feet of the trunks of high value oaks. Ongoing research at Midpen and other locations in the state are evaluating whether bay removal is effective for managing larger stands or forests infested with SOD or to prevent or slow down the spread of SOD. This option is costly and requires regular maintenance and monitoring and, therefore, is implemented in limited areas. ▪ For individual high value oaks such as very large mature oaks near picnic facilities, consider spot treatment of individual oaks with pest control sprays (e.g., Agri-FosTM) intended to reduce potential for SOD infection.

BMP Number	BMP Title	BMP Description
BIO-8	Non-Native Animal Control	▪ Midpen will attempt to trap non-native turtles and remove them in compliance with CDFW when they share habitat with protected, native species. Midpen will attempt to trap restricted turtles and remove them in compliance with CDFW regulation. ▪ Midpen will continue to capture feral pigs using baited traps and employ humane euthanasia in compliance with CDFW regulations and the Animal Welfare Act. ▪ Midpen will employ public education signage and/or brochures to prevent the intentional release of non-native or feral animals on Midpen lands and feeding of wildlife. Education can be an important tool for Midpen in preventing pets from being intentionally released onto Midpen lands. Public outreach and judiciously placed educational materials such as signs and brochures in Midpen preserves may be a useful strategy to curb intentional releases of animals. ▪ Midpen will continue eradication efforts of non-native fish and bullfrogs compliant with CDFW regulations and the Animal Welfare Act. Eradication of invasive animals (e.g., non-native fish, bullfrogs) by shooting, trapping, or gigging for the purpose of reducing predation on or competition with CRLF, must be authorized in writing by the Sacramento USFWS Office prior to conducting removal activities. Shooting, trapping, and gigging of aquatic species will be conducted only by a qualified biologist with experience in the identification of frog and turtle species. Inadvertently trapped California red-legged frogs will be released immediately upon discovery. ▪ Prohibit contractors, consultants, staff and tenants from feeding feral domestic pets on Midpen property. Develop education programs to encourage the public not to feed wildlife or feral animals on Midpen property. ▪ Ensure outside garbage cans and dumpsters have tight-fitting lids to prevent foraging on human food waste. This is especially important in public gathering areas in parks and open spaces. Cans with domed lids and self-closing, hinged lids are preferred in these outside areas. ▪ Store native seeds, hay, and other vegetation-based materials that can attract animals in properly sealed containers or designated sealed storage facilities. ▪ Store all food properly, in containers with tight fitting lids, or in the refrigerator or freezer. ▪ Do not leave pet food in open bowls overnight. Wash pet food bowls immediately after feeding

BMP Number	BMP Title	BMP Description
BIO-9	General Wildlife Protection Measures	▪ Biological monitors will check for any reptiles, amphibians, or other animals under vehicles and equipment parked for more than 30 minutes. ▪ Vehicles traveling to and from the project sites off of established ranch roads must travel slowly (5 mph) and be preceded by a monitor to ensure that wildlife will not be run over by the passing vehicle. Vehicle monitors need not be trained biologists. ▪ Midpen generally limits the use of exclusion fencing for special-status species to limit habitat disruption and entrapment potential. Midpen more commonly uses exclusion fencing around stockpiled materials or directional fencing to move wildlife away from the worksite. Midpen rarely fences a full work site. ▪ Biological monitors/biological handlers will monitor sites for special-status species and if handling is permitted/authorized, they may relocate the special-status species or halt/modify work to avoid the special-status species as it passed through the active work site. ▪ If a fence is used and if special-status species are found in routine maintenance activity sites using large equipment to remove sediment, they will be excluded from the project site. USFWS and/or CDFW-approved exclusion fencing shall be installed around the sediment removal sites, staging areas and any areas where fill may be dumped. After installation of the fence barrier, a biological monitor or qualified biologist shall inspect the project work area daily, staging and stockpiling areas prior to the commencement of activities. Exclusion fencing will be placed, at a minimum, around the immediate work area where machinery will be operating. During activities involving mechanized equipment, biological monitors will maintain exclusion fencing and evaluate work performed during pond activities. Monitors are required to temporarily stop any work that they believe may harm the San Francisco garter snake or California red-legged frog. Work will not resume until a satisfactory method is agreed upon to minimize take of the snake or frog. ▪ If the biological monitor or qualified biologist determines that sensitive species are not within the work area, equipment or materials may be moved onto the work site and Program activities may commence under the observation of the biological monitor.
BIO-10	Special-status Species Reporting	▪ Information on new localities for special-status species (e.g., SFGS, CRLF, Loma Prieta hoita) will be reported to the Sacramento USFWS Office and the California Natural Diversity Database (CNDDB) annually.

BMP Number	BMP Title	BMP Description
		▪ Any incidental capture, injury or mortality of a federally or state listed species, with the exception of "fully protected" species which are not to be harassed, pursuant to the conditions of federal and State permit conditions shall be recorded and reported in the annual report submitted to the applicable agencies.
BIO-11	San Francisco Garter Snake Protection Measures	▪ Within riparian habitat or Waters of the State and/or U.S. and one (1) mile of a known San Francisco garter snake (SFGS) occurrence: 1. Program activities will be conducted consistent with permit terms and conditions of the current versions of the USFWS Recovery Permit Number: TE225974-2 and CDFW Memorandum of Understanding "Research and Recovery of San Francisco Garter Snake and California Tiger Salamander". ▪ In suitable habitat where SFGS has not been documented: 1. A biological awareness training will be provided by a qualified biologist or biological monitor to all persons prior to beginning work. A biological monitor shall remain onsite in sensitive areas identified during the pre-survey. If at any time a SFGS is observed, work shall stop immediately until a biological monitor is contacted. Biological monitor(s) and/or qualified biologist(s) shall remain on the project site while initial ground disturbing activities are being conducted, after which biological monitor(s) and/or qualified biologists shall be on-call while Program activities are being conducted at these sites. 2. Vegetation Removal by Mechanized Equipment. For vegetation removal on berms around ponds or other areas within or adjacent to wetted/perennial aquatic sites, if vegetation is too tall or dense to allow adequate detection of SFGS, one of two approaches will be used to minimize the potential for impacts to individuals: – Vegetation will be mown with the blade set at least 6 inches above the ground. A qualified biologist or biological monitor will walk ahead of the mower to look for SFGS and will ensure that no impacts to individuals occur. – Vegetation will initially be cut down to three (3) inches by hand tools (weedwhacker, etc.). Once the ground is visible, a visual survey for SFGS will be conducted by a qualified biologist or biological monitor. If no sensitive species are found in the area, removal of vegetation may continue by mowing or mechanized equipment very slowly with a biological monitor walking in front of the equipment present to observe.

BMP Number	BMP Title	BMP Description
		3. If vegetation is short or sparse enough that any SFGS present can be detected by the qualified biologist biological monitor without the need for removal of vegetation by hand tools, mowing can proceed after the biologist/monitor has thoroughly surveyed the areas to be mown. If a SFGS is observed, all activities shall cease and Midpen will coordinate with CDFW immediately. Prior to the start of work, areas will be identified by the biological monitor-in-charge and approved by the USFWS and CDFW as acceptable locations to which SFGS may be relocated if these species are encountered within a work area. Relocation areas will be a minimum of 500 feet from the boundary of any work area and will not include staging areas or roads. No SFGS will be removed from the site or maintained in captivity overnight without prior notification and written approval by the USFWS and CDFW unless the animal is in need of emergency medical assistance. Medical assistance will be provided to injured animals by a certified wildlife veterinarian familiar with amphibian and reptile care. When transporting individual SFGS, precautions will be taken to ensure that the animals are not over-stressed and are maintained in safety. Such measures include: keeping animals in a cool, dark, and safe location (snake bag for SFGS), providing adequate hydration, maintaining a stable cool temperature to avoid over-heating, keeping animals isolated to prevent them from harming one another, and ensuring holding tanks or bags are kept clean to prevent the spread of any diseases. 4. If feasible, mowing will not be conducted during the most active periods for SFGS (mid-March to mid-June and September-October) in areas where SFGS are known to occur. 5. No Stockpiling of Vegetation. Vegetation removed shall be placed directly into a disposal vehicle and removed from the site. Vegetation shall not be piled on the ground unless it is later transferred, piece by piece, under the direct supervision of the biological monitor or qualified biologist or is going to remain on site for erosion control or slash and not be moved or disturbed. ▪ All practicable measures will be taken to avoid killing or injuring SFGS during habitat enhancement activities. Any project-related, human caused injuries to SFGS will be reported to CDFW and USFWS.

BMP Number	BMP Title	BMP Description
		▪ No more than 24 hours prior to conducting pond enhancement activities, visual surveys will be conducted by walking at least a 50-foot buffer area around the pond in an attempt to locate individual SFGS. A trained and permitted biologist will capture, transfer, and release in a safe area any SFGS deemed to be in danger of being harmed by the prescribed enhancement activities. If a SFGS is located during the pre-treatment surveys but escapes capture, the area where the snake was lost will be marked by flag and a 50-foot (15 meter) radius will be actively patrolled during the work. If necessary, individual SFGS may be held in captivity in a pillowcase for less than 24 hours and may later be released near the point of capture after the work has been completed. After the pre-treatment survey, an avoidance strategy will be devised and presented to all individuals involved in the pond enhancement prior to starting any activities. The number of SFGS encountered and transferred to safe areas or held in captivity during treatment will be reported to USFWS, and each individual snake will be photographed for use in identification. ▪ The minimum number of qualified biological monitors required at each pond site will be determined in advance by a qualified biologist based on pond size, the amount and complexity of work to be performed, and the equipment to be used. This number of monitors will be approved by USFWS prior to the start of any work. ▪ Corridors for travel of vehicles and heavy machinery to the pond site will be established at least 24 hours in advance of the proposed work. Corridors that are not established marked improved roads (paved or unpaved) require special consideration for use by any vehicle. During the use of these off-road corridors by vehicles and machinery, a monitor will proceed directly before the vehicle or machinery to ensure all SFGS and observable wildlife is cleared from the pathway of the oncoming vehicle. Monitors will signal vehicles to stop if a SFGS is on the pathway, and will allow the animal to clear the pathway by its own direction. Any handling of the garter snake must only be done by a qualified permitted individual. Measures will be taken to minimize the number of vehicles allowed on the property. All vehicles involved with the site-specific work that are not transported to the work site will be retained in a prearranged, marked parking area in a clearing as close to the main road as possible. At least one monitor will ensure wildlife is clear from the parking area while vehicles are arriving and leaving. All vehicles must stay on designated roads.

BMP Number	BMP Title	BMP Description
BIO-12	California Red-Legged Frog Protection Measures	General Measures ▪ Handling of CRLF will be done by permitted and qualified biologists or biological monitors in an expedient manner with minimal harm to the individuals being handled. Handling of CRLF will be done with wet hands. The hands and arms of all workers handling CRLF will be free of lotions, creams, sunscreen, oils, ointment, insect repellent, or any other material that may harm CRLF. Larval CRLF will not be handled out of the water for longer than 30 seconds unless rewetted, and will not be retained for longer than 5 minutes for processing. If captured CRLF exhibit signs of distress (e.g., lack of response to stimuli or erratic behavior), they will be immediately released at the point of capture. All captured CRLF will be released at the point of capture unless that location puts them in imminent danger, in which case they will be placed in a nearby refugium sufficient to protect them. The number of CRLF to be captured is no more than 30 adults per habitat location per year. No egg masses may be disturbed or injured in any manner for any activity authorized in the USFWS take permit. Amplexing pairs of CRLF will not be captured, handled, or disturbed. The permittee will disinfect sampling and field gear to minimize the spread of pathogens as follows: 1. Sampling and field gear will be disinfected after exiting one aquatic habitat and before entering the next aquatic habitat, unless the waters are hydrologically connected to one another. 2. All organic matter will be removed from nets, traps, boots, vehicle tires and all other surfaces that have come into contact with water or potentially contaminated sediments. These items will then be rinsed with clean water before leaving each study site. 3. Boots, nets, traps, hands, etc., will be scrubbed with a bleach solution (0.5 to 1.0 cup per 1.0 gallon of water), Quat-128™ (1:60), or a 3 to 6 percent sodium hypochlorite solution and thoroughly rinsed clean with water between study sites. Equipment will be rinsed clean with water between study sites. Cleaning equipment in the immediate vicinity of aquatic habitats will be avoided (e.g., clean in an area at least 100 feet from aquatic features). Care will be taken so that all traces of the disinfectant are removed before entering the next aquatic habitat. 4. Used cleaning materials (liquids, etc.) will be disposed of safely, and if necessary, taken back to the lab for proper disposal. Used disposable gloves will be retained for safe disposal in sealed bags.

BMP Number	BMP Title	BMP Description
		5. CRLF will not be removed from the wild and held in captivity for any reason unless prior written approval is acquired by the appropriate USFWS Office or unless the severity of an injury to the CRLF obviates immediate care. Animals will be transported according to accepted methods, in moist cloth bags or in terrarium with moisture gel or non-cellulose sponge to minimize desiccation. Holdings where California Red-Legged Frogs have a Lower Density/Lower Frequency of Occurrence (Tier 2A) For maintenance activities that occur within preserves, easements, and management areas with a lower density/lower frequency of occurrence of California red-legged frogs, Midpen will implement the Tier 2A BMPs described below to avoid and minimize impacts on individual California red-legged frogs. Tier 2A BMPs ▪ Biological awareness training shall be provided to all maintenance personnel prior to beginning work. ▪ During all work, Midpen maintenance personnel (who are well-trained on the biology of California red-legged frogs, appropriate avoidance measures, and procedures to follow when they are encountered) will keep an eye out for California red-legged frogs and contact the Midpen biologist immediately if a California red-legged frog, or an individual that could potentially be a California red-legged frog, is observed. ▪ If an animal believed to be a California red-legged frog is detected during maintenance activities, those activities that could potentially affect the animal will cease until the frog is confirmed to have left the work area on its own, or until a qualified biologist or biological monitor visits the site to determine whether it is a California red-legged frog and whether it is in harm's way from the activity. If so, avoidance and minimization measures will then be implemented as described below for Tier 2B activities below, and Midpen will re-evaluate the likelihood of occurrence of California red-legged frogs in the work area vicinity for future Program activities. Any project-related, human-caused injuries to California red-legged frogs will be reported to USFWS and CDFW.

		Holdings where California Red-Legged Frogs have a Higher Density/Higher Frequency of Occurrence (Tier 2A, Tier 2B, or Tier 3) ▪ For preserves, easements, and management areas with a higher density/higher frequency of occurrence of California red-legged frogs, as shown on Figure 1 or based on updated mapping by Midpen, Midpen will identify streams, waterbodies, riparian habitats, and other features that support perennial water (e.g., wetlands, seeps, and spring boxes) within the maintenance activity work area and a surrounding buffer of 100 feet during the desktop audit and field review described under Impact Tiers above. Areas within 100 feet of perennial water will be identified as areas where California red-legged frogs are most likely to occur during the dry season. ▪ Midpen will then determine if the proposed maintenance activity is likely to result in take of California red-legged frogs, if frogs are present within the work area. For instance, if the activity consists of hand work or is located entirely within developed areas (e.g., roads and buildings) where no cover for California red-legged frogs is present, the likelihood of take of California red-legged frogs would be very low, even within 100 feet of perennial water. ▪ If (1) the proposed maintenance activity is not located within 100 feet of perennial water, or (2) the activity is located within 100 feet of perennial water but is not likely to result in take of California red-legged frogs, Midpen will implement the Tier 2A BMPs described above. ▪ If (1) the proposed maintenance activity is located in upland areas within 100 feet of perennial water, wet areas, or riparian vegetation; (2) no wet areas, riparian vegetation, or refugia for California red-legged frogs (e.g., woody debris and burrows) are present within the work area; and (3) no take of individuals is anticipated due to the proposed activities, Midpen will implement the Tier 2B BMPs described below. ▪ If (1) the proposed maintenance activity is located in wet areas or riparian areas, or in upland areas within 100 feet of these areas; (2) refugia for California red-legged frogs are present in the work area; and/or (3) take of California red-legged frog individuals may occur due to the proposed activities, Midpen will implement the Tier 3 BMPs described below. Tier 2B BMPs ▪ Prior to and within 48 hours of the planned start of Program activities, a focused survey for California red-legged frogs using an agency-approved protocol will be conducted by a qualified biologist or biological monitor to determine if they are in the area. ▪ A biological awareness training shall be provided to all persons prior to beginning work. This training will

BMP Number	BMP Title	BMP Description
		include a discussion of all practicable measures to be taken to avoid killing or injuring any life stage of California red-legged frogs during Program activities. ▪ Based on the results of the desktop audit and field visit, Midpen's biologist will determine if a qualified biologist or biological monitor is needed to monitor some (e.g., initial ground disturbance) or all activities. Regardless of whether a biologist is present, during all work, Midpen maintenance personnel (who are well-trained on the biology of California red-legged frogs, appropriate avoidance measures, and procedures to follow when they are encountered) will keep an eye out for California red-legged frogs and contact the Midpen biologist immediately if a California red-legged frog, or an individual that could potentially be a California red-legged frog, is observed. ▪ Midpen generally limits the use of exclusion fencing for special-status species to limit habitat impacts. However, if Midpen's biologist determines that the benefits of installing wildlife exclusion fencing around the work area (i.e., in terms of reducing the potential for take of individuals and/or reducing the need for a full-time biological monitor) outweigh any impacts on habitat, exclusion fencing will be installed around the work area prior to the initiation of maintenance. ▪ Any vehicle parked on-site for more than 15 minutes will be inspected by the biological monitor, qualified biologist, or a trained member of the work crew before it is moved to ensure that a California red-legged frog has not moved under the vehicle. Any parking areas must also be checked in advance by the biological monitor, qualified biologist, or trained crew member. ▪ For vegetation removal on berms around ponds or other areas within or adjacent to wetted/perennial aquatic sites, if vegetation is too tall or dense to allow adequate detection of frogs, one of two approaches will be used to minimize the potential for impacts to individuals: – Vegetation will be mown with the blade set at least 6 inches above the ground. A qualified biologist or biological monitor will walk ahead of the mower to look for red-legged frogs and will move any detected frogs out of harm's way. – Vegetation will be initially cut down to three (3) inches by hand tools (weedwhacker, etc.). Once the ground is visible, a visual survey for California red-legged frogs will be conducted by a qualified biologist or biological monitor. If no sensitive species are found in the area, removal of vegetation may continue by mowing or mechanized equipment with a biological monitor present to observe.

BMP Number	BMP Title	BMP Description
		▪ If vegetation is short or sparse enough that any frogs present can be detected by the qualified biologist or biological monitor without the need for removal of vegetation by hand tools, mowing can proceed after the biologist/monitor has thoroughly surveyed the areas to be mown. ▪ Vegetation removed shall be placed directly into a disposal vehicle and removed from the site. Vegetation shall not be piled on the ground unless it is later transferred, piece by piece, under the direct supervision of the biological monitor or qualified biologist or is going to remain on site for erosion control or slash and not be moved or disturbed. ▪ Soil shall not be stockpiled on the ground unless it is on a paved surface or staging area where there aren't burrows. ▪ General Avoidance if a California Red-legged Frog Enters the Project Area: – All work that may harm the frog shall stop until the animal is confirmed to have left on its own, or until personnel approved by USFWS under Midpen's 10(a)(1)(A) or any other project-specific approval (e.g., if a qualified consultant is assisting Midpen and is approved by USFWS to relocate California red-legged frogs for Program activities) has captured the individual. Midpen will coordinate with USFWS and CDFW prior to the start of work to identify acceptable relocation sites if California red-legged frogs are encountered within a work area. No California red-legged frogs will be held in captivity overnight without prior notification and written approval by the USFWS and CDFW unless the animal is in need of emergency medical assistance. Medical assistance will be provided to injured animals by a certified wildlife veterinarian familiar with amphibian and reptile care. When transporting individual California red-legged frogs, precautions will be taken to ensure that the animals are not over-stressed and are maintained in safety. Such measures include: keeping animals in a cool, dark, and safe location (e.g., a terrarium), providing adequate hydration, maintaining a stable cool temperature to avoid over-heating, keeping animals isolated to prevent them from harming one another, and ensuring holding tanks or bags are kept clean to prevent the spread of any diseases. – All practicable measures will be taken to avoid killing or injuring any life stage of California red-legged frogs during work activities.

BMP Number	BMP Title	BMP Description
		– The biological monitor and/or qualified biologist shall have the authority to halt work activities that may affect California red-legged frog adults, tadpoles or egg masses until they can be moved out of harm's way. – Any project-related, human-caused injuries to California red-legged frogs will be reported to USFWS and CDFW. <u>Tier 3 BMPs</u> ▪ Prior to and within 48 hours of the planned start of Program activities, a focused survey for California red-legged frogs using an agency-approved protocol will be conducted by a qualified biologist or biological monitor to determine if they are in the area. ▪ A biological awareness training shall be provided to all persons prior to beginning work. This training will include a discussion of all practicable measures to be taken to avoid killing or injuring any life stage of California red-legged frogs during Program activities. ▪ A biological monitor or qualified biologist will be on the project site while Program activities are being conducted. ▪ Midpen generally limits the use of exclusion fencing for special-status species in order to limit habitat impacts. However, if Midpen's biologist determines that the benefits of installing wildlife exclusion fencing around the work area (i.e., in terms of reducing the potential for take of individuals and) outweigh any impacts on habitat, exclusion fencing will be installed around the work area prior to the initiation of maintenance. For example, California red-legged frogs will typically be excluded from the project site prior to Program activities at sites involving the use of large equipment for sediment removal. USFWS and CDFW-approved exclusion fencing will be installed around the sediment removal site, staging areas, and any areas where fill may be dumped. After installation of the fence barrier, a biological monitor or qualified biologist will inspect the project work area, staging and stockpiling areas daily prior to the commencement of activities. If the biological monitor or qualified biologist determines that California red-legged frogs are not within the work area, equipment or materials may be moved into the project site and Program activities may commence under the observation of the biological monitor.

BMP Number	BMP Title	BMP Description
		▪ Any vehicle parked on site for more than 15 minutes will be inspected by the biological monitor or qualified biologist before it is moved to ensure that a California red-legged frog has not moved under the vehicle. Any parking areas must be checked in advance by the biological monitor or qualified biologist. ▪ For vegetation removal on berms or other sites, vegetation will be cut down to three (3) inches by hand tools (weedwhacker, etc.). Once the ground is visible, a visual survey for California red-legged frogs will be conducted. If no sensitive species are found in the area, removal of vegetation may continue by mowing or mechanized equipment very slowly with a biological monitor walking in front of the equipment to observe. California red-legged frogs can be relocated only if a person is permitted by the USFWS to handle the species. ▪ Vegetation removed shall be placed directly into a disposal vehicle and removed from the site. Vegetation shall not be piled on the ground unless it is later transferred, piece by piece, under the direct supervision of the biological monitor or qualified biologist or is going to remain on site for erosion control or slash and not be moved or disturbed. ▪ Soil shall not be stockpiled on the ground unless it is on a paved surface or staging area where there aren't burrows. ▪ California Red-Legged Frog Measures for Work in Ponds – During the focused pre-activity survey within 48 hours of the planned start of Program activities, the pond will be sampled by a qualified biologist to ensure that all California red-legged frogs from that pond are in the post metamorphic stage and will be minimally affected by draining the pond. If a California red-legged frog is located during the pre-treatment surveys but escapes capture, the area where the frog was lost will be marked by flag and a 50-foot (15 meter) radius will be actively patrolled during the work. After the pre-project survey, an avoidance strategy will be devised and presented to all individuals involved in the pond enhancement prior to starting any activities. The number of California red-legged frogs encountered and transferred to safe areas or held in captivity by a permitted and qualified biologist during treatment will be reported to the Sacramento USFWS Office and CDFW.

BMP Number	BMP Title	BMP Description
		– The minimum number of qualified biological monitors required at each pond site will be determined in advance by a qualified biologist based on pond size, the amount and complexity of work to be performed, and the equipment to be used. – Corridors for travel of vehicles and heavy machinery to the pond site will be established at least 24 hours in advance of the proposed work. Corridors that are not established marked improved roads (paved or unpaved) require special consideration for use by any vehicle. During the use of these off-road corridors by vehicles and machinery, a monitor will proceed directly before the vehicle or machinery to ensure all California red-legged frogs and observable wildlife are cleared from the pathway of the oncoming vehicle. Monitors will signal vehicles to stop if a California red-legged frog is on the pathway, and will allow the animal to clear the pathway by its own direction. Any handling of the red-legged frog must only be done by a qualified permitted individual. Measures will be taken to minimize the number of vehicles allowed on the property. All vehicles involved with the site-specific work that are not transported to the work site will be retained in a prearranged, marked parking area in a clearing as close to the main road as possible. At least one monitor will ensure wildlife is clear from the parking area while vehicles are arriving and leaving. All vehicles must stay on designated roads. – Seasonal Work Period in Ponds. If California red-legged frogs are found in the pond and water is present in the pond, sediment removal and berm or outfall repair activities will be performed from August 15 to November 1. Midpen will coordinate with USFWS and CDFW prior to dredging or de-watering activities. Sediment will be removed from ponds by hand to the extent feasible. Sediment removal from ponds will occur as soon as the ponds are dry (if prior to August 15). – Vegetation Removal at Ponds. If California red-legged frogs are found, tule and emergent vegetation will be removed by hand when feasible. If mechanized equipment is used, one or more biological monitors or qualified biologists will be onsite monitoring the scoop bucket while scooping and watching each load unload. Midpen will coordinate with USFWS and CDFW during the annual project notification process regarding anticipated mechanized equipment use for vegetation removal at ponds. In areas where egg masses are known, Midpen and contractor personnel will not enter the channel/pond to avoid dislodging egg masses (except as noted in the following bullet to salvage egg masses for purposes unrelated to Program activities). Trimming activities shall be performed from the banks, if possible.

BMP Number	BMP Title	BMP Description
		– Inspection for Egg Masses. In work areas containing emergent vegetation (e.g., tules, cattails), vegetation will be inspected for California red-legged frog egg masses prior to Program activities. If work cannot be postponed, a buffer of vegetation at least ten (10) feet in diameter shall be left around any egg masses found. Midpen will keep a record of sites where egg masses are found and conduct vegetation removal at these sites prior to November 1 in subsequent years. In the course of monitoring associated with the activities, if egg masses are observed in ponds or wetted areas that are going to dry naturally before tadpoles develop (as determined by a qualified biologist), emergency salvage of egg masses by the qualified biologist is permitted to relocate egg masses into deeper waters that will not be affected by the proposed activities. USFWS shall be notified of the emergency salvage per the terms of the recovery permit. ▪ General Avoidance if a California Red-legged Frog Enters the Project Area: – All work that may harm the frog shall stop until the animal is confirmed to have left on its own, or until personnel approved by USFWS under Midpen's 10(a)(1)(A) or any other project-specific approval (e.g., if a qualified consultant is assisting Midpen and is approved by USFWS to relocate California red-legged frogs for Program activities) has captured the individual. Midpen will coordinate with USFWS and CDFW prior to the start of work to identify acceptable relocation sites if California red-legged frogs are encountered within a work area. No California red-legged frogs will be held in captivity overnight without prior notification and written approval by the USFWS and CDFW unless the animal is in need of emergency medical assistance. Medical assistance will be provided to injured animals by a certified wildlife veterinarian familiar with amphibian and reptile care. When transporting individual California red-legged frogs, precautions will be taken to ensure that the animals are not over-stressed and are maintained in safety. Such measures include: keeping animals in a cool, dark, and safe location (e.g., a terrarium), providing adequate hydration, maintaining a stable cool temperature to avoid over-heating, keeping animals isolated to prevent them from harming one another, and ensuring holding tanks or bags are kept clean to prevent the spread of any diseases. – All practicable measures will be taken to avoid killing or injuring any life stage of California red-legged frogs during work activities.

BMP Number	BMP Title	BMP Description
		– The biological monitor and/or qualified biologist shall have the authority to halt work activities that may affect California red-legged frog adults, tadpoles or egg masses until they can be moved out of harm's way. – Any project-related, human-caused injuries to California red-legged frogs will be reported to USFWS and CDFW.
BIO-13	Foothill Yellow-Legged Frog Protection Measures	If foothill yellow-legged frog (FYLF) enters the project area, all work shall stop in that area until the animal leaves on its own. Midpen will coordinate with CDFW to develop site appropriate avoidance measures that will be implemented prior to resumption of Program activities at that location.
BIO-14	Western Pond Turtle Protection Measures	Within riparian habitat or Waters of the State and/or U.S. and one (1) mile of a known western pond turtle (WPT) occurrence: 1. Prior to and within 48 hours of the planned start of Program activities, a focused survey for WPT and WPT nests will be conducted by a qualified biologist or biological monitor to determine if they are in the area. In the event WPT are found in the project area, Midpen will exercise measures to avoid direct injury to WPT as well as avoid areas where they are observed to occur. If a WPT is observed, it shall be left alone to move out of the area on its own. If it does not move on its own, it can be relocated to a safe location at least 100 meters (m) distant from the project location. Relocation areas will be of suitable habitat, on shallow banks with slow moving water and will be far enough away so as not to be affected by Program activities. If a WPT nest is found, all activities will cease and Midpen will coordinate with CDFW to develop site appropriate avoidance and minimization measures.
BIO-15	California Giant Salamander, Santa Cruz Black Salamander Protection Measures	▪ In suitable habitat where Santa Cruz black salamander (SCBS) and/or California giant salamander (CGS) are known to occur: 1. A biological awareness training provided by a qualified biologist or biological monitor will be provided prior to starting work. 2. A qualified biologist and biological monitor will be available and on-call for the duration of the project. 3. A biological monitor will be present onsite when working within or immediately adjacent to wetted areas including stream channels, seeps, and springs.

BMP Number	BMP Title	BMP Description
		4. For SCBS only, a biological monitor is also required in areas of talus slopes or areas having human stacked rocks and other suitable materials acting as talus. 5. The biologist and/or biological monitor has the authority to stop work at any time. 6. Dismantling of talus and human-stacked rocks and other suitable materials acting as artificial talus will be avoided and minimized whenever possible. If removal is required to meet project objectives, these materials will be dismantled by hand whenever possible. 7. Whenever possible individual SCBS and CGS shall be allowed to leave the area on their own. 8. Individual SCBS or CGS (not with eggs) that are in harm's way or do not leave the work site on their own may be relocated by a qualified biologist or biological monitor to predetermined sites located outside of the work area but within the same subwatershed. 9. Work in wetted areas, talus slopes, or human stacked rocks or other suitable materials acting as artificial talus should be completed prior to July to avoid displacement of SCBS females laying eggs and attending to clutches. 10. If heavy equipment is required to remove talus, human stacked rocks or other suitable materials acting as artificial talus, this will be done in the presence of a qualified biological monitor. 11. If at any time, SCBS or CGS eggs are found, the area shall be flagged for avoidance. If the area cannot be avoided to meet project objectives, Midpen will coordinate with CDFW to determine the best course of action. ▪ In all other areas of suitable habitat for SCBS and CGS: 1. A pre-survey of the project site is required prior to starting work. If no SCBS or CGS are observed, work may proceed. 2. If an individual SCBS or CGS are observed at any time, all project work shall stop and the biologist and/or biological monitor will be notified and the above measures will be implemented.

BMP Number	BMP Title	BMP Description
BIO-16	San Francisco Dusky-footed Woodrat and Nest Protection Measures	▪ Projects occurring in suitable San Francisco dusky-footed woodrat (SFDFW) habitat, prior to project implementation, a qualified biologist or biological monitor shall survey the site for evidence of nesting SFDFW (i.e., large stick nests). ▪ Any SFDFW and/or nest that are found within project boundaries, will implement the measures listed below: 1. In natural areas: – All SFDFW nests will be flagged in the field and delineated on project site maps. In all instances, every effort should be made to avoid impacts to SFDFW nests. Avoidance, even with a small buffer area is considered preferable to relocation. Avoidance buffers of a minimum of 3-10 feet shall be implemented, flagged where appropriate, and avoided during project implementation. As evaluated by the project biologist, where appropriate to minimize impacts from Program activities, fencing will be installed around the nest and include the buffer area. Whenever possible, materials associated with an individual SFDFW nest will be left in place. – All SFDFW nests that cannot be avoided by Program activities (i.e., will require relocation), a qualified biologist shall live trap to determine if the nest is in use. Trapping activities should occur prior to April and after mid-July each year to prevent impacts to SFDFW rearing young or young SFDFW s. If a nest is found to be unoccupied or not in use for 3 full days (2 nights of trapping), then it may be removed. The nest shall be relocated or a pile of replacement sticks shall be placed outside of the project footprint for future colonization or re-use. If a lactating female is trapped, Program activities shall be postponed until young have become independent. Trapped SFDFW may be kept in captivity by a qualified biologist for the minimal time necessary until their nests are relocated to suitable habitat outside of the project footprint. The qualified biologist will complete and submit a CNDDB form to CDFW for any SFDFW trapped. Once trapped, nests shall be torn down and rebuilt surrounding a log-based structure, an inverted wooden planter, or similar structure that is slightly buried into the ground and has at least one entrance and exit hole. Cached food and nest material encountered shall be placed within the new structure during nest rebuilding. Whenever possible, the structure shall be "over-built" by adding larger branches for predator protection to create an area for the individual to safely emerge outside of the nest. One or more persons shall remain outside the release structure for up to 10 minutes to

BMP Number	BMP Title	BMP Description
		mimic a predator. Trapped woodrats should be released into the reconstructed nest by plugging the individual into the shelter using loose dirt over the entrance. Relocated SFDFW nests will be monitored (visual and/or wildlife camera) for one year following relocation, and the biologist will submit a monitoring report to CDFW. 2. In non-natural areas (e.g., structures, abandoned vehicles, human debris piles): – If individuals cannot be live-trapped consistently (especially if there is a risk to human health) and/or there is a lack of woody materials for nest reconstruction, live trapping is not required. Work at these locations must occur prior to April and after mid-July to prevent impacts to SFDFW rearing young. If SFDFW is observed, work at the location shall cease until the individual leaves the area on its own. If the SFDFW does not leave the area, work shall continue to cease at the location and the qualified biologist will be notified. If nests are present that cannot be trapped or removed, woody debris piles that look like woodrat houses can be constructed to provide opportunities for sheltering and colonization by displaced SFDFW under the direction of the qualified biologist or onsite biological monitor. Nest replacement ratios will be determined based on the number of SFDFW and/or nests observed, as well as the size and number of undisturbed nests in the surrounding area.
BIO-17	Migratory Bird Nest Protection Measures (excludes Marbled Murrelet)	▪ To avoid potential impacts to tree or shrub-nesting birds, any trimming or pruning of trees or shrubs will be conducted during the time period of September 1 to February 14 unless a preconstruction nesting bird survey has been conducted by a qualified biologist or biological monitor. Work will be done during the non-breeding season whenever possible. The bird nesting seasons are defined as follows: 1. March 15 to August 30 for smaller bird species such as passerines; and 2. February 15 to August 30 for raptors. 3. Earlier surveys may be needed for specific species such as owls, hummingbirds, herons and egrets and/or other species if nesting activity shifts due to climate change.

BMP Number	BMP Title	BMP Description
		▪ If Program activities are scheduled during the nesting season of raptors and/or migratory birds, a focused survey for active nests of such birds will be conducted by the qualified biologist or biological monitor within 15 days prior to the beginning of project-related activities. Surveys will be conducted in all suitable habitat located at project sites and in staging and storage areas. The minimum survey radii surrounding the work area shall be the following: 1. 250 feet for passerines; 2. 500 feet for other small raptors such as accipiters; 3. 1,000 feet for larger raptors such as buteos and eagles. The bird survey methodology and the results of the survey shall be submitted to the CDFW prior to commencement of Program activities. ▪ If an active nest (i.e., a nest having eggs or chicks present, or a nest that adult birds have staked a territory and are displaying, constructing a nest, or are repairing an old nest) is found and work cannot be postponed, Midpen will designate active nest sites as "Ecologically Sensitive Areas" and protected (while occupied) during Program activities with the establishment of flagging or a fence barrier surrounding the nest site. No trees or shrubs that contain active bird nests will be disturbed until all eggs have hatched, and young have fully fledged (are no longer being fed by the adults, and have completely left the nest site). No habitat removal or modification shall occur within the Ecologically Sensitive Area fenced nest zone even if the nest continues to be active beyond the typical nesting season for the species, until the young have fully fledged and will no longer be adversely affected by the project. The minimum distances of the protective buffers surrounding each identified nest site will be the following, with some considerations depending on nest location and substrate: 1. 500 feet for large raptors such as buteos; 2. 250 feet for small raptors such as accipiters; 3. 250 feet for passerines; and 4. 1,000 feet for eagles. A biological monitor or qualified biologist will monitor the behavior of the birds (adults and young, when present) at the nest site to ensure that they are not disturbed by project-related activities. Nest monitoring

<table>
<tr><th>BMP Number</th><th>BMP Title</th><th>BMP Description</th></tr>
<tr><td></td><td></td><td>will continue during project-related construction work until the young have fully fledged, are no longer being fed by the parents and have left the nest site and surrounding area, as determined by a biological monitor. If a protective buffer must be modified, Midpen will coordinate with the CDFW and/or the USFWS as appropriate prior to resumption of Program activities.
▪ If a lapse in project-related work of 15 days or longer occurs, another focused survey will be conducted before project work is reinitiated.</td></tr>
<tr><td>BIO-18</td><td>Marbled Murrelet Nest Protection Measures</td><td>In areas within the range of marbled murrelet (MAMU) habitat as identified in the Midpen 2007 maps, Midpen will conduct a survey of habitats within ¼-mile of the project area for trees that meet the Pacific Seabird Group definition of potential MAMU nesting trees. If such trees are present within 300 feet of the project area or if a MAMU nest is detected, Midpen will coordinate with CDFW and USFWS before proceeding. If habitat trees are present within ¼-mile of the project site but are greater than 300 feet from the work area, Midpen will implement the following conditions:
▪ Work within the project area shall be confined to the period of September 16 to March 23. If maintenance activities cannot be conducted during this seasonal work period, Midpen will coordinate with CDFW and USFWS during the February 1 notification and implement the following conditions:
1. If construction activities occur during the marbled murrelet breeding season (March 24 to September 15), seasonal disturbance minimization buffers as listed in the table below and in the October 28, 2020 document, Revised Transmittal of Guidance: Estimation of the Effects of Auditory and Visual Disturbance to Northern Spotted Owls and Marbled Murrelets in Northwestern California (table below), shall be followed:
<table>
<tr><th></th><th colspan="4">Anticipated Action Generated Sound Level (decibels [dB])2</th></tr>
<tr><th>Existing Pre-Project (Ambient) Sound Level1</th><th>Moderate (71-80 dB)</th><th>High (81-90 dB)</th><th>Very High (91-100 dB)</th><th>Extreme (101-110 dB)</th></tr>
<tr><td>Natural Ambient (<=50 dB)[3]</td><td>165</td><td>500</td><td>1,320</td><td>1,320</td></tr>
<tr><td>Very Low (51-60 dB)</td><td>0</td><td>330</td><td>825</td><td>1,320</td></tr>
</table>
</td></tr>
</table>

BMP Number	BMP Title	BMP Description

Low (61-70 dB)	0	165	825	1,320
Moderate (71-80 dB)	0	165	330	1,320
High (81-90 dB)	0	165	165	500

1. Existing (ambient) sound level includes all natural and human-induced sounds occurring at the project site prior to the proposed action, and are not causally related to the proposed action.
2. Action-generated sound levels are given in decibels (dB) experienced by a receiver, when measured at 15.2 m from the sound source.
3. "Natural Ambient" refers to sound levels generally experienced in habitats not substantially influenced by human activities.

Midpen will conduct a sound level monitoring study to determine level of ambient and construction activity noise anticipated during construction activities to calculate seasonal disturbance minimization buffer widths. Disturbance distances listed in the table above apply to noise generating activities that are not within 2 hours of sunrise or sunset; project generated noise impacts will be calculated accordingly. Midpen will provide a description of methods and results of the study to USFWS and CDFW to coordinate site-specific avoidance measures 30 days prior to commencement of Program activities at the applicable location(s). In order to alert work crews to their presence, marbled murrelet seasonal disturbance buffers, as determined by the sound study and table above, shall be flagged in the field where they enter the project area. If Midpen chooses not to conduct the sound study, no maintenance activities shall occur within 0.25-mile of potential nest trees during the marbled murrelet breeding season (March 24 to September 15).

2. If noise generating construction activity takes place during the breeding season (March 24 to September 15) within suitable Redwood and Redwood/Douglas-fir forests, construction activities will be restricted to 2 hours after sunrise to 2 hours before sunset to minimize disturbance of potential nesting MAMU using forest habitat as a travel corridor between inland nesting and coastal habitat.

BMP Number	BMP Title	BMP Description
		3. Midpen or its contractor will not conduct Program activities within a visual line-of-sight distance of 40 m or less from a suitable nest tree as designated by a qualified biologist or biological monitor. Additionally, Midpen or its contractors will not conduct Program activities within a visual line-of-site distance of 100 meters or less from a known or active nest tree confirmed by a qualified biologist. If MAMU protocol level surveys are conducted and do not indicate that the habitat is occupied by MAMU, the seasonal and distance work restrictions may be lifted with approval from CDFW and USFWS. Protocol level survey procedures and information can be found at: http://www.pacificseabirdgroup.org/publications/PSG_TechPub2_MAMU_ISP.pdf. If Midpen chooses to conduct marbled murrelet protocol level surveys, Midpen will coordinate with CDFW and USFWS regarding the survey stations to ensure all contiguous suitable habitat is covered and good visuals of the sky and nearby flyways, if present, are provided. If marbled murrelet protocol level surveys are conducted, Midpen will submit the report consistent with *Methods for Surveying Marbled Murrelets in Forests: A Revised Protocol for Land Management and Research*.
BIO-19	Bay Checkerspot Butterfly and Santa Clara Valley Dudleya Protection Measures	▪ For all ponds and wetland, creeks and rivers, prescribed fire and property clean up and building removal, sites will be pre-surveyed by a qualified botanist for Santa Clara Valley dudleya and Bay checkerspot butterfly host plants prior to implementing recovery actions. In certain cases, prescribed fire may be used to enhance a native species or to control nonnative species, but site-specific recommendations will be made based on the species composition and the objectives for the site. ▪ All prescribed grazing areas within Midpen have been mapped for sensitive status plant species and there are not currently any federally or State-listed plants within grazed properties. To ensure no newly listed species or previously undiscovered species are present, Midpen rangeland ecologist will perform annual monitoring and reporting to agencies. ▪ For all roads and trail maintenance activities, grassland areas will be surveyed by a qualified botanist for sensitive status plant species every 3 years. Woodland, hardwood, shrub and scrub, and forested areas will be mapped by a qualified botanist every 5 years.

BMP Number	BMP Title	BMP Description
		▪ All areas having known occurrences of Santa Clara Valley dudleya or Bay checkerspot butterfly host plants for which recovery actions are proposed will be surveyed prior to treatment. Listed and host plants will be avoided either through timed activities (for example mowing after annuals set seed) or flagging individual plants for avoidance. In any areas in which host plants cannot be avoided, seed will be collected and the area reseeded under approvals from the USFWS and CDFW. ▪ Prior to conducting any manual, mechanical, or chemical IPM treatment in serpentine habitats, surveys will be conducted for dwarf plantain (*Plantago erecta*), purple owl's clover (*Castilleja densiflora*), and exserted paintbrush (*Castilleja exserta*) during the appropriate blooming period, and host plants containing eggs, larva, or pupa of Bay checkerspot butterfly will not be treated.
BIO-20	Bat Colony Protection Measures	▪ In areas of suitable habitat, preconstruction surveys are required for the following bat species: – Pallid Bat (*Antrozous pallidus*) – Townsend's Big-eared Bat (*Corynorhinus townsendii*) – Bat surveys should take place during the April 15 through August 31 maternity roost season whenever possible. Surveys may also take place between February 16 and April 14, or between September 1 and November 15. Findings during spring and fall surveys may indicate that a second summer survey is necessary ▪ Bats generally breed April through Aug, no building or tree work (over 16" dbh) is allowable during this time if surveys determine that special status bats or maternity roosts are present ▪ Bats may go into a deep torpor period November 16 through February 15, no building or tree work (over 16" dbh) is allowable during this time if surveys determine that special status bats or hibernaculum roosts are present ▪ If individual nonbreeding and non-special status bats are present, a qualified biologist may be retained to remove the bats and work may proceed year round ▪ If maternity roosting or special status bat species are present at any time, no work is allowed without first excluding and providing alternate roost site(s), or identifying suitable nearby existing roosting sites, outside of the breeding season

BMP Number	BMP Title	BMP Description
		▪ Alternate roost site(s) must be determined by District Natural Resources staff or a consulting biologist and submitted to California Department of Fish and Wildlife before installation ▪ Whenever possible alternative roost site(s) will be provided 6 months to 1 year prior to the removal of maternity roosting habitat to allow bats adequate time to discover the new locations ▪ Alternative roost site(s) shall be monitored for occupancy by a qualified biologist within one year of installation ▪ Contractors, Midpen staff, and others working in areas known to support maternity roost site(s) and/or special status bat species will be provided biological awareness training by a qualified biologist prior to the commencement of work *Mitigation for impacts to maternity roost(s) and special status bat species:* Buildings and Other Human Structures: ▪ To mitigate for demolition activities, fumigation, or other activities that involve the removal or disturbance of roosting bats in buildings, bridges, outbuildings, dilapidated structures, old vehicles (buses, trailers etc.), or other human created structures (including debris piles): ▪ If signs of bats are evident and removal or disturbance of bats is necessary, a qualified biologist will conduct surveys for roosting bats prior to beginning work. Surveys will consist of daytime pedestrian surveys to look for visual signs of bats (e.g., guano), and if determined necessary, evening emergence surveys to note the presence or absence of bats. If evidence of bat roosting is found, the number and species of roosting bats will be determined. If congregations of more than five bats are found within a single human-made structure during the maternity roosting season it may be assumed that the colony constitutes a maternity roost and the location will be recorded in the District's wildlife database. If no evidence of bat roosts is found, then no further study will be required. Bat detectors and/or infrared detectors may be used to supplement survey efforts, but are not required. ▪ When bat roosting sites are located in buildings, exclusion of bats from the building will occur outside of the April through August nursery season.

BMP Number	BMP Title	BMP Description
		▪ If roosts of special-status bats are determined to be present and must be removed, a bat exclusion plan will be prepared and submitted to CDFW. The exclusion plan will describe the method of exclusion, which may include the use of one-way doors at roost entrances (bats may leave but not re-enter), or sealing roost entrances when the site can be confirmed by a bat expert to contain no bats. No bats will be excluded until the plan is approved by CDFW and alternative roosting habitat is approved. The bats will be excluded from the roosting site before the site is disturbed or modified in any way. <u>Tree Removal:</u> ▪ Avoid removal of trees greater than sixteen inches dbh during the April through August nursery season whenever possible. ▪ If removal of trees greater than sixteen inches dbh during the nursery season cannot be avoided, a qualified biologist will conduct surveys for roosting bats where suitable large trees are to be removed. Surveys will consist of daytime pedestrian surveys to look for visual signs of bats (e.g., guano), and if determined necessary, evening emergence surveys to note the presence or absence of bats. If evidence of roosting bats is found, the number and species of roosting bats will be determined. If no evidence of bat roosts is found, then no further study will be required. Bat detectors and/or infrared detectors may be used to supplement survey efforts, but are not required. ▪ If roosts of special-status bats are determined to be present and must be removed during the April through August nursery season, a bat exclusion plan shall be prepared and submitted to CDFW. The exclusion plan will describe the method of exclusion, which may include the use of one-way doors at roost entrances (bats may leave but not re-enter), or sealing roost entrances when the site can be confirmed by a bat expert to contain no bats. The use of sonic bat deterrents may also be allowed when called for by a qualified biologist. No bats will be excluded until the plan is approved by CDFW and alternative roosting habitat is approved. Exclusion efforts may be restricted during periods of sensitive activity (e.g., during hibernation or while females in maternity colonies are nursing young). The bats will be excluded from the roosting site before the site is disturbed, closed or modified in any way. When possible, alternative roosting sites will be provided 6 months to a year prior to the removal of existing roosts. Once the replacement roosts are constructed and it is confirmed that bats are not present in the original roost site, the structures may be removed or sealed.

BMP Number	BMP Title	BMP Description
		Work in or adjacent to areas known to support special status bats and/or maternity roosts: ▪ Whenever possible work shall take place outside of the April through August nursing season. ▪ Natural Resources staff shall provide and/or consult with qualified biologists having knowledge specific to the bat species present at the site. Species specific noise tolerance levels (including high frequency noise) shall be established for work taking place within a determined buffer around the maternity roost. All equipment working within the site during the nursing season must be tested for high frequency noise outputs prior to use on the site. If equipment is determined to produce any noise that is expected to cause bats to abandon a maternity roost it will not be used on the site within the biologist established buffer during the nursing season. Relocation of bat boxes: ▪ Relocation requires the approval of the Natural Resources department and may be performed by a qualified biologist. ▪ Bat boxes may be relocated between mid-September to mid-October, or from mid-February to mid-March (during warm periods outside of the nursing season). Bat boxes may be relocated outside of these recommended time periods with sign off from a qualified biologist. ▪ Relocation of boxes that support special status bat species requires notification to CDFW before implementation. ▪ If a bat box is determined to be unoccupied by a qualified biologist, it may be relocated at any time without modification. If occupied, a one-way door shall be installed on the entrance/exit of the bat box, preferably during a warm period when bats are likely to be active. The one-way door shall remain in place for a period of 3-7 days. After this period a qualified biologist shall arrive on site and check the box for occupancy. If the box is still occupied then the one-way door shall remain in place for an additional 3-7 days. Once the box is determined to be unoccupied then it may be relocated with direction from Natural Resources or a qualified biologist to a nearby suitable habitat. The new location will be recorded and added to the Districts' GIS database. The one-way door shall then be removed to allow bats to access the box. Relocated bat boxes shall be monitored for occupancy by a qualified biologist within one year of installation.

BMP Number	BMP Title	BMP Description
BIO-21	Salmonid (Coho and Steelhead) Protection Measures	▪ Dewatering will not occur in stream reaches where known occurrences of Coho salmon exist. Midpen will coordinate with USFWS and CDFW in the event that dewatering such a stream reach becomes necessary. ▪ Seasonal Work Period for Salmonids: Work within and around NOAA designated critical habitat for steelhead and Coho salmon streams that provide habitat for salmonids shall be limited to June 15 to October 31. Revegetation activities are not confined to this period. ▪ Alternative Seasonal Work Period. Work within and around creeks that do not provide habitat for salmonids and reaches that are 1,000 feet or more upstream of discharge points which do not discharge directly into such drainages will be limited to April 15 to October 31, or is permissible from November 1 to April 14 under the following conditions: 1. Work will not occur until the site has received no rainfall for a period of 10 days and there is no rain in the forecast for a period of 7 or more days, and work requires no greater than 5 days to complete. 2. Work started during this period must be at least 50% complete within 2.5 days of beginning work. 3. Winterization materials must be on hand and installed if unanticipated rainfall begins (defined as 0.5 inches of rain in a 24-hour period). 4. Corrective actions are allowable year-round for the following situations: – To correct improperly installed and/or unauthorized work on Midpen lands that occurred during the same calendar year that result in sediment delivery. – To correct damage from winter storms that threatens access to homes, ponds, water systems, and other critical infrastructure.
BIO-22	Biological Monitoring for Stranded Aquatic Life	▪ For all projects within watercourses that are known to support or have the potential to support threatened and/or endangered species, a qualified biologist or biological monitor shall conduct a pre-construction survey.

BMP Number	BMP Title	BMP Description
		▪ A biological monitor or qualified biologist will check daily for stranded aquatic life as the water level in the dewatering area drops. All reasonable efforts will be made to capture and move all stranded aquatic life observed in the dewatered areas. Capture methods may include fish landing nets, dip nets, buckets and by hand. Captured aquatic life will be released immediately in the closest body of water adjacent to the work site. This measure does not allow for the take or disturbance of any state or federally listed species. ▪ Any aquatic nonnative invasive species found will be disposed of properly and will not be placed back into the creek where work is being conducted or any other drainages, creeks or streams. The Midpen Project Manager will send a list to CDFW of species found and the location they were found after completion of Program activities.
BIO-23	Large Woody Material Management	Large Woody Material management and removal will be undertaken only as a last resort to mitigate ongoing or imminent damage. Large wood is defined as logs with a diameter of 6 inches or greater and a length of 10 feet or longer, rootwads and stumps. Locations will be assessed for sensitive species prior to beginning any work at the site. Smaller pieces of large woody material shall be removed to above the OHWM of the channel, and will be stacked or spread for terrestrial habitat
BIO-24	Riparian Avoidance	Riparian trees shall be protected from damage to the greatest extent possible during repair and replacement. Vegetation management activities will not adversely impact the riparian zone, shade, canopy coverage, or habitat.
BIO-25	Riparian Restoration	▪ Restoration Area. Where feasible, restoration will take place in the same Preserve and preferably on the same waterway or watershed and adhere to the conditions below. Planting or seeding of riparian vegetation may be done at any time provided there is no erosion and sedimentation that may cause an adverse impact to water quality. ▪ Tree Replacement. In suitable areas, trees shall be replaced at the following ratios (replacement trees to removed trees) to mitigate for permanent net loss of habitat and canopy cover: 1. For non-native trees that provide canopy cover to the creek: 1:1 (compensation to impact) ratio 2. For native trees: 2:1 ratio unless approved otherwise by CDFW. In certain areas where regeneration will occur or overcrowding is an issue, a 1:1 ratio is acceptable.

BMP Number	BMP Title	BMP Description
		▪ Re-vegetation Ratio. In suitable areas, other vegetation shall be replaced with the following ratios: wetlands, 1:1; general riparian vegetation, 3:1; sycamore alluvial woodland or other rare habitat types: 5:1; other general habitat types, 1:1. ▪ Native Species for Re-vegetation. Replacement trees and vegetation will be local native species adapted to the lighting, soil and hydrological conditions at the replanting site, except in cases where non-native trees are considered culturally significant. In these areas, non-native trees may be replaced with the same species of non-native tree to preserve the cultural landscape in ongoing maintenance to prevent the spread of the non-native is provided. If replanting within the work area is infeasible due to lack of space, slope steepness or other physical constraints, replacement trees and vegetation may be planted at an alternate location along the stream corridor. Vegetation will be replaced by December 31 of the year impacts occur in a location that is not subject to future maintenance or construction work. ▪ Re-vegetation Plan. Where active restoration is warranted, Midpen will submit a re-vegetation plan to CDFW with the annual February notification. The plan will describe the project site and vegetative community, including the conditions warranting active re-vegetation. Proposed restoration measures will be described, including location, number, size and type of replacement plantings, installation specifications and irrigation specifications if warranted. ▪ Re-vegetation Survivorship. Any re-vegetation plan will include success criteria specific to the circumstance. The re-vegetation effort will replace or improve on the habitat value of the impacted area in a reasonable amount of time. The term 'Reasonable amount of time' means a return to the pre-project baseline in approximately the same period of time that the pre-existing habitat took to establish naturally. For habitats where this is not feasible (such as oak woodland), success criteria should focus on attributes that will provide a reasonable assurance that the re-vegetation will eventually result in the required replacement value. These attributes could include plant vigor, establishment of minimal species diversity, cover, lack of limiting factors and others.

BMP Number	BMP Title	BMP Description
		▪ Re-vegetation Success Criteria. For every project where habitat is removed, whether active re-vegetation is removed or not, the annual February notification should provide an estimate of the time necessary to re-establish the baseline habitat value lost. Midpen will monitor the site for that period (as modified by CDFW where warranted). If the site reaches the pre-project habitat baseline prior to the end of the projected monitoring period and keeps that habitat value for two consecutive years, Midpen can request CDFW to waive further monitoring. For sites requiring longer terms to reasonably reach a pre-project baseline and which are clearly doing well and therefore can reasonably be considered likely to reach the site habitat goals (such as oak woodland or redwood forest), Midpen can request CDFW to reduce or end the monitoring after five years. ▪ Re-vegetation Remediation. If re-vegetation success criteria requirements do not meet established goals, Midpen is responsible for replacement planting, additional watering, weeding, invasive exotic eradication, or any other practice, to achieve these requirements. All plants that die within the monitoring period will be replaced during the fall the year the plant was determined to have failed, or as soon as replacement nursery stock can be grown, on site seed collected, or whichever propagation method is most effective, as necessary to satisfy success criteria. Replacement plants will be monitored with the same goal as initial planting until habitat goals are met. If the problem(s) is/are larger in scope, are likely to recur and cannot be corrected, Midpen will coordinate with CDFW to develop a modified plan for the site. ▪ Sedimentation. Primary sedimentation control will be provided by implementation of the best management practices under *Sediment/Water Quality Control* and *Erosion Control*. For any project where erosion and sedimentation cannot be completely controlled by these measures (such as clearing a plugged culvert in a live channel), additional measures will be implemented as necessary. Midpen will identify any projects where this condition occurred during the preceding calendar year and estimate the amount of sediment that bypassed protective measures, if any. To compensate, as part of the annual February notification, Midpen will propose sufficient erosion control projects to halt chronic sedimentation from other sources of a similar or greater amount. This annual quantity of erosion control projects will be determined through coordinate between Midpen and CDFW.

BMP Number	BMP Title	BMP Description
Cultural Resources Measures		
CUL-1	Review Sensitivity Maps	During the early phases of Annual Work Plan development, for all locations where ground-disturbing activities are proposed where excavation would be required beyond the facility's as-built design or otherwise reach previously undisturbed soils beyond existing engineered depths or extent, Midpen will review the Cultural Sensitivity Maps (Appendix C of the Manual). If the foregoing conditions are not applicable to the maintenance activity being performed, only BMP CUL-5 and CUL-6 will be required. Based on the location of projects, and whether or not excavation or ground disturbance will occur beyond existing engineered depths or extent, BMPs CUL-2 through CUL-4 shall be implemented as follows: ▪ High Sensitivity: BMPs CUL-2, CUL-3, and CUL-4 ▪ Moderate Sensitivity: BMP CUL-2 and CUL-3 ▪ Low Sensitivity: BMPs CUL-2 through CUL- 4 not required ▪ Unknown Sensitivity: BMP CUL-2 and CUL-3 ▪ BMPs CUL-6 is applicable to all ground-disturbing activities in natural channels or native soils, regardless of the sensitivity level of the work area.
CUL-2	Record Search and Field Inventory for Highly or Moderately Sensitive Areas, and Areas of Unknown Sensitivity	▪ Midpen will retain a qualified cultural resources specialist to conduct a review and evaluation of locations that involve soil disturbance/excavation in natural channels or native soils identified as Highly to Moderately Sensitive to determine the potential for these activities to affect significant cultural resources. ▪ The initial evaluation will be based on a review of archival information maintained by Midpen. If there is no information in Midpen's archives that indicates Midpen ever received comprehensive cultural resources data on the project area, or that the project area has previously ever been subject to pedestrian archaeological survey, the qualified cultural resources specialist will request a record search by the Northwest Information Center (NWIC) of the California Historical Resources Information System to cover the project area and on a 0.25-mile search radius. This initial archival review will be completed by the professional archaeologist who will be able to view confidential site location data and literature to arrive at a preliminary sensitivity determination.

BMP Number	BMP Title	BMP Description
		▪ It is recommended that Midpen conduct a review of the Sacred Lands Inventory of the Native American Heritage Commission (NAHC) and due diligence outreach with individuals identified by the NAHC and/or local historical societies or groups. This outreach would involve sending a letter with a request for pertinent information about cultural resources within the project area and to identify any concerns. This outreach is in addition to notification under PRC 21080.3.1 (i.e., CUL-3), and may be appropriate for projects that would not otherwise require Assembly Bill 52 notification. Such outreach is also encouraged under Section 106 implementing regulations at 36 CFR 800.4(a)(3) for identification of historic properties. ▪ The qualified archaeologist will conduct field inventory of the project area to determine the presence/absence of surface cultural materials. The results, along with any mitigation and/or management recommendations, will be presented to Midpen in an appropriate report format that includes any necessary maps, figures, and correspondence with interested parties. The report will also include a summary of the records search and archival research data, and pertinent geoarchaeological overviews and studies, and regional research designs, as appropriate. ▪ A summary table indicating appropriate management actions (e.g., monitoring during construction, presence/absence testing for subsurface resources, and data recovery) will be developed for each project work area reviewed. ▪ The maintenance activities will be implemented to avoid significant impacts to cultural resources, if possible. ▪ EXCEPTIONS: After the Midpen archival search, NWIC record search, and NAHC sacred lands search have been conducted, the qualified archaeologist may determine that a field review is not necessary under the following circumstances: ▪ Locales that have previously been subject to cultural resource studies where no previously identified cultural resources or historical resources were documented. ▪ Locales that have previously been subject to cultural resources studies, but identified cultural resources have been determined by a qualified archaeologist/resource specialist as not eligible for listing in the California Register of Historical Resources (CRHR) or the National Register of Historic Places (NRHP). ▪ A short report would be required to document the decision not to conduct a field study.

BMP Number	BMP Title	BMP Description
CUL-3	Consult with Native American Tribes	Midpen, as the lead CEQA agency, has notified Native American tribes about the Program according to PRC 21080.3.1 (also referred to as Assembly Bill 52); *only Native American tribes that have previously requested notification from Midpen pursuant to PRC 21080.3.1(b) require notification*. For tribes that request consultation under PRC 21080.3.1(b)(2), Midpen will consult with those tribes pursuant to PRC 21080.3.2 for projects in areas of high, moderate, and unknown sensitivity.
CUL-4	Construction Monitoring	▪ Midpen will retain a qualified archaeologist to be present on-site during ground-disturbing activities within areas identified as highly sensitive for cultural areas, unless the qualified archaeologist determines otherwise after the field inventory conducted under CUL-2. Similarly, after conducting the field study under CUL-2, the qualified archaeologist may determine that areas originally identified as moderately sensitive for cultural resources warrant monitoring during construction. The reasons for conducting monitoring in areas initially considered of moderate sensitivity would be discussed in the inventory report. ▪ The qualified archaeologist will have the authority to stop work if cultural resources are discovered. ▪ If any cultural resources are discovered during construction monitoring, BMP CUL-7 would be implemented as appropriate.
CUL-5	Conduct Pre-Maintenance Educational Training	At the beginning of each maintenance season, and in concert with implementing BMP BIO-1, as well as before conducting activities subject to BMP CUL-2 through BMP CUL-5, all maintenance personnel will participate in an educational training session conducted by a qualified cultural resources specialist. This training will include instruction on how to identify historic and prehistoric resources that may be encountered, and will describe the appropriate protocol to be followed if resources are discovered during maintenance work.
CUL-6	Address Discovery of Cultural Remains	Unanticipated discoveries of cultural and paleontological resources may occur during maintenance construction activities. Examples of prehistoric Native American cultural remains are obsidian and chert flaked-stone tools (e.g., projectile points, knives, scrapers) or significant areas of tool-making debris; culturally darkened soil ("midden") containing heat-affected rocks, artifacts, or shellfish remains; stone milling equipment (e.g., mortars, pestles, handstones, or milling slabs); and battered stone tools, such as hammerstones and pitted stones. Historic-period artifacts may include stone, concrete, or adobe footings, foundations, and walls; filled wells or privies; and deposits of metal, glass, and/or ceramic refuse. Paleontological resources are fossilized remains of plants and animals.

BMP Number	BMP Title	BMP Description
		Work will be restricted or stopped in areas where remains or artifacts are found until proper protocols are met, as described below. Protocol for treatment of prehistoric or historic cultural resources, or human remains: 1. Work at the location of the find will halt immediately within 50 feet of the find. A "no work" zone will be established utilizing appropriate flagging to delineate the boundary of this zone, which will measure at least 50 feet in all directions from the find. 2. Midpen will retain the services of a consulting archaeologist, who will visit the discovery site as soon as practicable and perform minor hand excavation to describe the archaeological resources present and assess the amount of disturbance. 3. The consulting archaeologist will provide to Midpen and USACE, at a minimum, written and digital-photographic documentation of all observed materials, utilizing the CRHR and NRHP guidelines for evaluating archaeological resources. Based on the assessment, Midpen and USACE will identify the CEQA and Section 106 cultural resources compliance procedures to be implemented. 4. If the consulting archaeologist determines that the find appears not to meet the CRHR or NRHP criteria of significance, and a USACE archaeologist concurs with the consulting archaeologist's conclusions, construction may continue while monitored by the consulting archaeologist. The authorized Program work will resume at the discovery site only after Midpen has retained a consulting archaeologist to monitor and the Program Manager has received notification from USACE allowing work to continue. 5. If the find appears significant, avoidance of additional impacts is the preferred alternative. The consulting archaeologist will determine if adverse impacts to the resources can be avoided. 6. Where avoidance is not practical (e.g., maintenance activities cannot be deferred or must be completed to satisfy the Program objective), Midpen will develop an action plan (also known as a data recovery plan) and submit it to USACE within 48 hours of determining that maintenance activities cannot be deferred. The action plan will be submitted by email to the appropriate archeological/cultural resources contact at the USACE. The action plan is equivalent to a data recovery plan. It will be prepared in accordance with the current professional standards and state guidelines for reporting the results of the work, and will describe the services of a Native American consultant, if appropriate, and a proposal for curation of cultural materials recovered from a non-grave context.

BMP Number	BMP Title	BMP Description
		7. The recovery effort will be documented in a report prepared by the consulting archaeologist in accordance with current archaeological standards. Any non-grave artifacts will be placed with an appropriate repository. 8. In the event of discovery of human remains (or if a find consists of bones suspected to be human), the field crew supervisor will take immediate steps to secure and protect such remains from vandalism during periods when work crews are absent.) 9. The maintenance crew supervisor will immediately notify the San Mateo County Coroner and provide any information that identifies the remains as Native American. If the remains are determined to be those of a prehistoric Native American or a Native American from the ethnographic period, the Coroner will contact NAHC within 24 hours of being notified about the remains. NAHC will designate and notify a most likely descendant (MLD) within 24 hours. The MLD will have 48 hours to consult and provide recommendations for the treatment or disposition, with proper dignity, of the human remains and grave goods. 10. Preservation in situ is the preferred option for human remains. Human remains will be preserved in situ if continuation of the maintenance work, as determined by the consulting archaeologist and MLD, will not cause further damage to the remains. The remains and artifacts will be documented, the find location carefully backfilled (with protective geo-fabric if desirable), and the information recorded in Midpen Program files. 11. If human remains or cultural items are exposed during maintenance that cannot be protected from further damage, they will be exhumed by the consulting archaeologist at the discretion of the MLD and reburied, with the concurrence of the MLD, in a place mutually agreed upon by all parties.
Geology/Paleontological Resources Measures		
GEO-1	Address Discovery of Paleontological Resources	Protocol for treatment of paleontological resources: 1. Work at the location of the find will halt immediately within 50 feet of the find. A "no work" zone will be established utilizing appropriate flagging to delineate the boundary of this zone, which will measure at least 50 feet in all directions from the find.

BMP Number	BMP Title	BMP Description
		2. Midpen will retain the services of a consulting paleontologist who meets the Society for Vertebrate Paleontology's criteria for a "qualified professional paleontologist" (Society of Vertebrate Paleontology 1995). The consulting paleontologist will follow the Society for Vertebrate Paleontology's guidelines for treatment of the find. Treatment may include preparation and recovery of fossil materials for donation to an appropriate museum or university collection, and may include preparation of a report describing the find. Midpen will be responsible for ensuring that the paleontologist's recommendations are implemented.
Erosion Control Measures		
EC-1	General Erosion Control Measures	▪ All exposed soils within a project site will be stabilized immediately following the completion of earthmoving activities to prevent erosion into the stream channel. Erosion control BMPs, such as silt fences, certified weed-free straw hay bales, gravel or rock lined ditches, water check bars, certified weed-free wattles, forest duff or mulches, and broadcasted certified weed-free straw will be used as necessary (Refer to Appendix D and E for detailed descriptions of erosion control BMPs). Erosion control fabrics will be constructed of biodegradable materials, such as coir or jute. Erosion control products will not contain monofilament material. The effectiveness of erosion control BMPs will be monitored during and after each storm event. Modifications, repairs and improvements to erosion control BMPs shall be made as needed to protect water quality. At no time shall silt laden runoff be allowed to enter the stream or directed to where it may enter the stream. ▪ Soil accumulated behind erosion control features will be removed promptly to an erosionally safe location and controlled for erosion. Erosion control measures will be monitored following significant storm events and modifications, repairs, and improvements to erosion controls measures will be made whenever they are needed. ▪ Erosion control measures will be utilized throughout all phases of operation where sediment runoff from exposed slopes threatens to enter Waters of the State and/or U.S. This may require the construction at the toe of the slope below the construction site, of silt catch basins, silt fencing, certified weed free straw bale dikes, or other siltation barriers. At no time shall silt laden runoff be allowed to enter the stream or directed to where it may enter a stream.

BMP Number	BMP Title	BMP Description
EC-2	Slope or Bank Stabilization	▪ Implement bio-compatible bank stabilization methods such as brush layering (live cut branches interspersed between layers of soil wrapped in natural geotextile materials with branches in alternative crisscrossing or overlapping pattern), brush mattresses, and live siltation to stabilize slopes and banks where feasible. The finished slopes should be seeded with native seed and mulched with a biodegradable tackifier. ▪ Riprap of proper size and weight to withstand high water flows, where necessary, will be set below grade and keyed into the bank such that it is above the OHWM to the extent feasible. Work will be confined to the damaged or failed sections and immediate adjacent bank area affected by the damage failure. No more than 40% of bank repairs in a given year will use "hard" or impervious structure design. Incorporate rootwad revetments, live stakes, and pole planting at suitable locations to encourage vegetation growth over rip-rap where feasible. The following measures will be implemented during Program activities. 1. Streambank areas receiving rock slope protection will be back-filled with appropriate native or clean imported topsoil. The topsoil will fill some portions of the voids in the rock slope protection above the normal high water mark and provide a substrate for revegetation efforts. This work will be done manually using hand tools and power tools such as a toter or mule for single-track trail environments or an excavator or dump truck when needed for multiuse trails or roads. 2. Other bank stabilization measures that may be employed include broadcast and hydro-seeding, riparian vegetation planting, slopes armored with rocks or sandbags staked with live willow and other bioengineering techniques such as willow staking, live willow pole drains, vegetated crib walls, log or rock weirs. 3. Riparian trees will be protected from damage to the greatest extent possible during repair and replacement.
EC-3	Road and Trail Drainage Maintenance	▪ Minimize fine sediment contributions from roads, cutbanks, and ditches through seasonal closures and installing a variety of surface drainage techniques including berm removal, road surface shaping (outsloping, insloping, or crowning), rolling dips, ditch relief culverts, water bars, and other measures to disperse road surface runoff and reduce or eliminate sediment delivery to streams. ▪ Implement "live pole drains" where feasible to prevent landslides, unstable slopes, and slumping.

BMP Number	BMP Title	BMP Description
		▪ Cleaning roadside/trailside ditches will be limited to no more than 10 cubic yards of soil per 100-yard length of road/trail and allows associated vegetation removal. ▪ Sloughs and berms may be occasionally removed (every 3-5 years) from trails and roads, but material removed will not exceed 5 cubic yards per 100-yard length of trail and 10 cubic yards per 100-yard length of road. ▪ Up to two (2) cubic yards of accumulated sediment will be removed from rolling dips per 100-yard length of road/trail that is located within a drainage subject to CDFW jurisdiction. ▪ In the event of a landslide, up to five (5) cubic yards per event or up to two (2) cubic yards under any conditions will be removed per the following conditions: 1. Up to 2 cubic yards of material may be removed, using hand tools only, under any conditions. 2. Removal of amounts greater than 2 cubic yards requires that the channel be dewatered first and heavy equipment may be used if submitted to CDFW in writing through annual notification process with written approval from CDFW and where no Coho salmon are present. 3. The total area of disturbance shall not exceed 150 feet of channel or 2,000 square feet of area, whichever is less. 4. The disturbed area shall immediately be treated with erosion control materials sufficient to control turbidity. 5. Nearby perched or otherwise unstable fill shall be removed as well, up to 5 cubic yards.
EC-4	Road and Trail Minor Relocation	<u>Narrow-width Trails:</u> ▪ The new location will be no more than 400' upslope or downslope of the existing location. ▪ New crossings shall be free span bridges in creeks providing salmonid habitat or free span bridges or mortar or concrete free fords in creek without salmonid habitat. ▪ Vegetation removal is limited to no more than a six (6) foot buffer around the new crossing and to trimming of no more than 20% of any individual tree canopy in that six-foot buffer. Vegetation removal shall be limited to the minimum amount necessary to provide access. ▪ All work will be done when the work area is dry and the work period is outside the rainy season.

BMP Number	BMP Title	BMP Description
		▪ Work must be completed during the appropriate fish and aquatic habitat avoidance times (BMP DW-2). <u>Other Trails and Roads:</u> ▪ The new location must be no more than 400' upslope or downslope of the existing location ▪ The total amount of earthwork will not exceed 75 cubic yards per year. ▪ New crossings shall be free span bridges in creeks providing salmonid habitat or free span bridges or mortar or concrete free fords in creeks without salmonid habitat. ▪ All work is to be done when the work area is dry, during the appropriate fish and aquatic habitat avoidance times (BMP DW-2). When work will be done within or around perennial streams or during wet weather years in which the channel does not dry, work will be scheduled during periods of low flow and will adhere to the dewatering BMPs (DW-1, DW-2, and DW-3). ▪ Vegetation removal is limited to no more than a five-foot buffer around the new crossing and to trimming of no more than 20% of any individual tree canopy with the five-foot buffer.
EC-5	Revegetation of Disturbed Areas	Disturbed areas shall be re-vegetated according to Midpen's BMPs for Revegetation (Refer to Appendix D and E for detailed descriptions) and will use native plants whenever possible. If locally collected native plants are not available, sterile revegetation plants shall be used (e.g., cereal barley, Regreen, Trios). Disturbed areas shall be protected with correctly installed erosion control measures (e.g., jute, certified weed free straw, coconut fiber, or coir logs). Materials containing monofilament or plastic shall not be used.
Sediment/Water Quality Control Measures		
SWQ-1	Water Body Protection Measures	▪ Midpen will divert any flow at the project around the active maintenance site in a nonerosive manner. ▪ Limit work activities outside of a stream channel to the extent feasible to minimize stream disturbance and turbidity. ▪ If work within an inundated water body is necessary, conduct applicable dewater procedures to minimize water body disturbance and turbidity. ▪ During Program activities, silt control measures will be used during all phases of the project to prevent silt or earthen fill from entering the aquatic environment. In addition, exposed or disturbed areas within the project site will be stabilized to the greatest extent possible.

BMP Number	BMP Title	BMP Description
		▪ BMPs will be used on temporarily stockpiled excavated sediment prior to disposal or reuse to protect water quality and beneficial uses. The excavated sediment may be stockpiled onsite so that it can be loaded into trucks for off-site disposal within three (3) working days. The excavated sediment may also be temporarily stockpiled at an off-site location so that runoff, sediment, or decant water from the excavated materials will not contact waters of the State and/or U.S. ▪ Implement a debris catchment system (e.g., nets, tarping) during bridge work to avoid the introduction of materials into a water way.
SWQ-2	Turbidity Monitoring	▪ When working within wet channels there will be a designated water quality monitor to monitor and document turbidity entering and exiting the work site. ▪ During Program activities in wetted stream channels or other aquatic habitat, Midpen or their contractor will monitor turbidity levels up and downstream of the project area before and during Program activities, and shall keep a log of turbidity data. Maintenance activities will not result in increases in turbidity of the stream of more than 20 percent of upstream sampling locations, as measured visually or by Nephelometric turbidity units (NTU) as approved by the RWQCB Waste Discharge Requirements and Water Quality Certification covering the project. ▪ Upon Midpen's determination that turbidity/siltation levels resulting from project-related activities constitute a threat to aquatic life, activities associated with the turbidity/siltation will be halted until effective approved control devices are installed or abatement procedures are initiated.
SWQ-3	Sediment Filtering Measures	Midpen or their contractor will deploy silt curtains or other appropriate silt filtering devices, such as straw bales, around the excavation site to prevent heavily silted water from impacting areas around the project area. The silt curtain or silt filtering devices shall be maintained throughout all phases of the excavation and construction activities.

BMP Number	BMP Title	BMP Description
Dewatering Measure		
DW-1	Stream/Aquatic Habitat Isolation	▪ If repair activities affect the active channel, the work area shall be isolated from flowing stream segments using silt fences, wattles, and/or cofferdams and restored to pre-project conditions after maintenance is complete. All stream diversions shall be closely maintained and monitored. Pumped diversions shall be continuously monitored (24-hours). Upon completion of work in diverted channels, the stream diversion shall be removed and flow shall be re-directed through the new culvert or back into the original stream channel. ▪ Stream or aquatic habitat diversion systems will maintain as much instream or aquatic habitat connectivity as possible to allow for movement of aquatic organisms. Diversion will be conducted such that water at the downstream end does not scour the channel bed or banks. Coffer dams, if used, will be constructed upstream and downstream of the work area as close as practicable to the work site. Coffer dams shall be constructed of a non-erodible material which does not contain soil or fine sediment and shall be constructed with clean gravel and bags, and may be sealed with sheet plastic. All materials shall be removed from the stream or aquatic habitat upon project completion. Normal flows shall be restored to the affected stream immediately upon completion of work at that location. Coffer dams and the stream diversion system will remain in place and functional throughout the construction period. If, the coffer dams or stream diversion fail, they shall be repaired immediately. ▪ During dewatering of the channel, the decrease in water surface elevation (WSE) shall be controlled such that WSE does not change at a rate that increases turbidity to the creek that could be deleterious to aquatic life and the likelihood of stranding aquatic life up- and downstream of the creek. Flows shall be provided to downstream reaches during all times the natural flow would have supported aquatic life. Said flows shall be sufficient quality and quantity, and of appropriate temperature to support fish and other aquatic life both above and below the diversion.
DW-2	Pond Dewatering	When pond draining is required, work will occur between August 15 and November 1, prior to the beginning of California red-legged frog breeding season.
DW-3	Pumps	All pump intakes will be fitted with ¼ inch mesh screens to prevent aquatic species injury, mortality, or impingement.

BMPs above include components of the source documents below.

Sources: Midpen , 2012, 2014, 2021; CDFG 2002; Best 2006-2012; Salix Applied Earthcare 2004; USFWS 2016a, 2016b; San Francisco Bay RWQCB 2010, 2018; CDFW 2017a, 2017b, 2018; NMFS 2019.

Chapter 11. Program Administration and Reporting

11.1 Introduction

This chapter describes how the Open Space Maintenance and Restoration Program (OSMRP or Program) will be implemented and administered by Midpeninsula Regional Open Space District (Midpen). Routine maintenance activities, including removal of sediment and vegetation in channels and ponds/lakes; clearing debris, woody debris, and sediment from culverts and ditches; culvert replacement; bank stabilization and slip-out repairs; water supply maintenance; vegetation management (including fire and fuel management) along roads, trails, channels, and other facilities; road grading; trail relocation; bridge maintenance and replacement; and existing structure maintenance represent the majority of Midpen's routine maintenance work. Less frequent activities also described and covered under this Program include the installation of new facilities and conducting improvements as new land is acquired and managed as an Open Space Preserve (OSP). Typically, when Midpen acquires new land, the land is in a degraded condition and these activities are necessary in order to protect and enhance the natural environment and improve public access throughout Midpen lands. All activities under the Program incorporate impact minimization measures, work limits, and best management practices (BMPs) to further avoid or reduce potential impacts per the approach described in Chapter 10 of this Manual.

11.2 Annual Maintenance and Facilities Improvements Cycle

Activities in the Program originate in response to winter storms, facilities inspections, scheduled re-occurring maintenance (e.g., trail brushing), and annual work plan development. Road related activities are prioritized by the condition of the facility, the volume of chronic and episodic sediment to be mitigated, or an operational problem. In some cases, an otherwise lower priority activity next to a high-priority may be undertaken to save costs and increase work efficiency. Maintenance, grazing management, and Natural Resources staff all identify maintenance activities to be undertaken.

Facilities improvements largely originate from the Conservation Grazing Program and from the public access programs' within Midpen. The priority and development of facilities improvement projects are based on site-specific plans. Grazing facility activities address an operational need for the grazing operations, but also serve to improve an ecological goal (e.g., replacing a spring box, water line, and trough to facilitate even grazing). New trails are developed as part of a site-specific plan and are constructed with the least impacting methods, are located to avoid sensitive resources, and are designed to minimize disturbance to riparian areas at stream crossings. New trail projects are typically conducted in conjunction with larger capital projects.

Restoration projects are identified by Natural Resources, grazing management, and maintenance staff. Wetland and species-specific recovery projects (e.g., for California red-legged frog [CRLF] or San Francisco garter snake [SFGS]) are undertaken as part of the current Recovery Permit; where applicable (e.g., on grazing lands), these projects are completed in consultation with the grazing staff to ensure that the modifications meet the operational needs of grazing. Approximately 100 ponds are located throughout Midpen lands. Thus, Midpen routinely conducts annual pond maintenance and pond improvement projects to maintain the ecological function and support recovery work. A subset of ponds is inspected annually from January through September as part of Midpen's CRLF population studies. The priority of a pond project is dependent upon either the physical condition or ecological data.

11.3 Project Site Definitions

For the purposes of this program, project sites can be defined in several ways. Project sites are defined as work within an area that is hydrologically connected to or within the area of potential effect of a defined, jurisdictional feature. For example, replacing a culvert entails adjacent work such as staging, installing critical dips, and shaping the road around the drainage, all of which would be considered one project site in the annual notification. If a linear project is within a different sub-watershed or drainage, it would be noticed as a separate, discrete project site. Projects without a nexus to waters of the United States (U.S.)/state (i.e., uplands) would be noticed as one individual project, unless there are discrete sub-areas that are disconnected, within different habitats, and different watersheds, in which case two or more sites would be noticed (e.g., fuels treatment project with three separated treatment areas would be noticed as three sites unless they are within the same watershed in the same habitat).

Some Program activities, such as annual mowing, are part of the baseline condition of the Program and are not noticed individually. Any new disturbance that is part of an annual process/project (such as opening a new property acquisition) would be noticed and analyzed.

11.4 Annual Work Plan Notification

At the beginning of each year, Midpen will prepare an annual notification report summarizing proposed activities for that upcoming given year. The notification report will describe the locations, natural resource conditions, and other key resource issues as well as summarize anticipated impacts on wetlands and waters of the U.S. and state, riparian resources, and federally and state listed species. The annual notification will also describe avoidance and minimization measures, BMPs, and proposed mitigation that will be implemented. If requested, Midpen is available to host a tour of the identified Program sites.

The annual notification report will also distinguish activities for which take of federally listed species will be covered via Midpen's U.S. Fish and Wildlife Service (USFWS) 10(a)(1)(A) Recovery Permit from those for which take will be covered via the USFWS Biological Opinion (BO) that will be issued pursuant to Section 7 consultation between the U.S. Army Corps of Engineers (USACE) and USFWS. This distinction will be made based on whether the proposed activity has a direct recovery benefit for federally listed species, in which case take would be covered by the Recovery Permit. If there is no direct recovery benefit for federally listed species but the activity is covered in the USFWS BO, take will be covered via the BO. Some activities do not have a direct recovery benefit and will not be included in the USFWS BO because they are not regulated by the USACE (or interdependent/interrelated with USACE-regulated activities); for these activities, implementation of avoidance and minimization measures will avoid take of federally listed species, as described below.

Midpen's biologist will determine the tiering category for each project according to the definitions described in Section 2.3 to classify the type of impacts to federally or state listed species anticipated to occur at each Program activity site. These tiering categories will help guide Midpen in determining appropriate impact avoidance measures and activity-specific BMPs (listed in Chapter 10, Table 10-3). Note that all projects (both Tier 1 projects and Tier 2A, 2B and 3 projects) will utilize appropriate program-wide BMPs for impact avoidance and minimization as identified in Chapter 10; however, the precise BMPs considered appropriate or necessary may vary by tier. For example, the tiering categories will assist Midpen in determining which Program activities will require pre-activity surveys or monitoring by a qualified/professional biologist or biological monitor (e.g., Tier 1 and Tier 2A activities would not require these tasks, whereas Tier 2B and Tier 3 activities may) and which will require compensatory mitigation. The tiering approach will guide development of the mitigation plan described below in Section 11.8. In general, Program activities take place on an annual cycle, as shown in Table 11-1, depending on whether they are located away from wetlands and waters of the U.S. and state, riparian resources, and/or federally or state listed species (Tier 1 projects); or activities near such resources (Tier 2 and 3 projects) (Table 11-2).

Table 11-1. Timeline for Tier 1 Program Activities

January to December	January to December	March to November	December
Assess Midpen facilities and conditions	Prioritize Program activities and develop work plan	▪ Notify regulatory agencies for certain activities ▪ Conduct necessary pre-activity resource surveys ▪ Conduct Program activities ▪ Vegetation: generally March-August ▪ Culvert and water feature maintenance: typically late spring or early summer ▪ Grazing: late spring or early summer	Prepare annual summary report

Note: Tier 1 – No Effect

Table 11-2. Timeline for Tier 2A, Tier 2B, and Tier 3 Program Activities

January to February	February	March and April	May to October	November to December
Assess facility maintenance, improvement, or restoration needs and site conditions	Prioritize Program activities and develop work plan (including resource/site-specific BMPs)	Notify regulatory agencies Regulatory agency coordination	Conduct maintenance, facility improvement, or restoration activities	Prepare annual summary report Update database & BMP list

Notes: Tier 2A – Not Likely to Adversely Affect; Tier 2B – Not Likely to Adversely Affect for individuals, but may be considered Likely to Adversely Affect if permanent habitat impacts occur; Tier 3 – Likely to Adversely Affect

11.5 Tier 1 Program Activities

Tier 1 Program activities would be located in creek reaches inaccessible to special-status fish or, for terrestrial special-status species other than birds, in areas where no suitable breeding habitat is present and there is no connectivity between the site and known or potential breeding habitat (so that non-breeding individuals can also be presumed to be absent). The implementation of Program activities at Tier 1 sites is not expected to result in impacts on individuals that rise to the level of "take" and; therefore, no compensatory mitigation is necessary for such activities. No qualified biologist or biological monitor would be needed to conduct pre-activity surveys or to be present during the performance of Tier 1 activities. Tier 1 activities would not result in take of individuals or habitat, even if permanent impacts to habitat conditions occur.

Tier 1 Program activities generally include mowing, controlled burning, grazing, vegetation trimming, and invasive vegetation management in uplands or along Midpen roads, trails, and facilities. These activities will generally follow the timeline shown in Table 11-1 and will typically be conducted between March and December with summary reporting in the winter. Depending on the targeted invasive plant species, limited herbicide application (above ordinary high water mark [OHWM]) occurs at various times of the year to control the target species. For example, oxalis is treated in November through February, whereas most other non-native plants are targeted between the spring and early fall season. Other minor maintenance activities such as removing trash and debris from culverts, minor maintenance work occurring at bridges (above OHWM), non-bridge structure maintenance, trail maintenance, or any other non-ground-disturbing activities may occur year-round, although the bulk of such activities would take place in the spring and summer season (Table 11-1). For vegetation management and fuel reduction activities, a reconnaissance evaluation precedes such activities and is typically conducted every three to five years in the winter months. Vegetation thinning, mowing, and removal of dead branches or understory, where determined necessary, are typically conducted in the spring and summer, once the primary wet months are over and before the drier conditions in the fall, when the maintenance activities themselves can be a source of fire ignition. Tree trimming is conducted in the fall and winter to protect tree vigor and health.

Activities that will be exempt from regulatory agency notification include the following:

- Fence, gate, and signage repair;
- Trash rack clearing;
- Minor repair/maintenance of scientific instrumentation (i.e., gages, sensors, etc.) and wildlife habitat structures (i.e., turtle platforms, exclusion screens, and spring box features);
- Routine vegetation management activities conducted in the same place each year to maintain the status quo (e.g., maintenance of established shaded fuel breaks on existing Midpen lands);
- Debris and trash removal (unless above 0.01 acre or 436 sq ft);
- Water supply structure maintenance where activities will not impact waters of the U.S./state;
- Maintenance of roads and trails located above the top of bank where there will be no impact on waters of the U.S./state or without the potential to impacts waters of the U.S./state;

- Maintenance of drainage ditches along existing roads where all work is above the level of top of bank of adjacent stream, and there will be no impact to waters of the U.S./state.
- Pre-storm checks conducted with hand shovels to prevent clogging and reduce sedimentation

This list may be modified and revised throughout implementation of the Program.

11.6 Tier 2A, 2B and 3 Program Activities

Tier 2A, 2B, and 3 Program activities would occur in areas where special-status species are known to occur or could possibly occur, either because suitable breeding habitat is present or, for terrestrial species and fish, suitable non-breeding habitat is present and there is connectivity between the project site and suitable breeding habitat. Activities may involve ground disturbance near wetlands or waters of the U.S. and state, riparian resources, and/or near federally or state listed species, such as sediment removal from channels and ponds/lakes, culvert replacement, bridge replacement, trail stream crossings, and bank stabilization or slip-out repairs. Tier 2A activities are those that would not result in "take" of special-status species based on the location and timing of work (i.e., although a special-status species could occur at the site at times, none would be present when the work will occur). Tier 2B activities are those that would not result in "take" of special-status species with the implementation of BMPs, such as pre-activity surveys, exclusion of individuals from the site, and/or implementation of non-disturbance buffers around active nests of special-status birds. However, some Tier 2B activities may result in permanent loss of habitat. If permanent habitat loss occurs in holdings where special-status species occur in higher densities and/or with a higher frequency of occurrence, the USFWS would likely consider this loss of habitat to constitute take under Federal Endangered Species Act (FESA), in which case the FESA determination for that activity would be "Likely to Adversely Affect". Permanent habitat loss in holdings where special-status species occur in lower densities and/or with a lower frequency of occurrence and temporary habitat loss in any holding would be considered "Not Likely to Adversely Affect" the species. Tier 3 activities are those where "take", either in the form of handling, injury, or mortality of individuals or permanent loss of habitat, cannot be avoided. Tier 2A and 2B activities would not require compensatory mitigation, while Tier 3 activities may require some form of compensatory mitigation to offset impacts.

Midpen conducts routine facility assessments periodically throughout the year to ensure functional integrity, public access, and environmental resource protection. If not previously done, Midpen will conduct an evaluation at each site during January and February (as shown in Table 11-2). The majority of road sites have been evaluated by an engineering geologist or civil engineer as part of sediment source inventory. Those evaluations specify the size of a facility to

accommodate flow events. Maintenance staff revisits these sites regularly and may prioritize work based on an observed deterioration (such as a rusting culvert).

During February to March, an annual work plan will be developed for activities that are occurring in wetlands and waters of the U.S. and state, riparian resources, near federally/state-listed species, or other facilities that involve Tier 2A, 2B, and 3 project activities based on the assessment and prioritization process. The number of activities prioritized for the annual work plan will be dependent on factors such as the climatic and hydrologic conditions in the preceding years. The history of past maintenance activities and specific resource conditions at individual facilities will be reviewed as upcoming tasks are identified and prioritized. Projects marked as low priority and not included in the current year's work plan will be noted for inspection and reassessment during the next annual work cycle. As appropriate, regulatory agencies would be notified of the planned Tier 2A, 2B, and 3 maintenance activities in March/April. The work window for this maintenance work that takes place in sensitive habitat and/or in regulated jurisdiction (e.g., wetlands and waters of the U.S. and state, riparian resources) would be implemented between May 15 and October 31 with at least 50% of project activities completed by October 15, as dictated by local site conditions and resource avoidance measures.

The annual work plan for Tier 2A, 2B, and 3 project activities will identify specific treatment approaches, conceptual plans, and/or design plans for each treatment that will be implemented. A summary description of design treatments selected, construction equipment to be used, access and staging, and discussion of why the treatment was selected will be implemented. Details including the linear feet of channel to be disturbed, linear feet of the replacement culvert/bridge/crossing, length of the bank repair, and volume of sediment to be removed will be provided. In addition, the area (in acres) of wetlands, waters of the U.S., and waters of the state will be described.

Midpen will oversee the Program throughout all steps of the above-described work cycle. Continuity in oversight and attention will enable the Program to run effectively. A designated staff person from Midpen will serve as the Midpen Project Manager. The Midpen Project Manager's primary responsibility will be to supervise and guide Program activities, including implementation of mitigation necessary. A key responsibility for the Midpen Project Manager will be to provide communication and coordination between Midpen departments and the relevant regulatory agencies throughout all steps of the work cycle. The Program will be administered to be consistent with the objectives and activities described in this Manual.

11.7 Special Review Process

Unanticipated project needs may arise during the course of the permit term. An activity that meets the 'spirit' of the Program, and has the appropriate mitigations developed, may require

consultation with agency staff to discuss whether it can and should be permitted through this Program. Every effort has been made to describe the Program's needs and activities, but some activities may require consultation because they are not expressly described or because certain quantitative limits may be exceeded. Should the need arise, Midpen proposes to include these as a separate submittal in the Tier 2/3 annual notification and will note the consistency issues with each activity. Midpen will track these exceptions, whether approved or not for inclusion, and seek to amend the permits as necessary upon the future renewal process.

11.8 Projects on Properties Not Under Fee Ownership of Midpen

Midpen owns easements, works with neighbors, and conservation partners on a variety of projects that occur adjacent to or off Midpen's Preserves (i.e., lands owned in fee title by Midpen). Certain projects on Midpen lands may partially extend onto private lands. Work done as a part of a private road association, defensible space projects, other wildland fire fuel resiliency work, species recovery, or on lands Midpen is about to acquire in fee are the most likely uses. Midpen also works in the right-of-way of local, County, and state agencies (e.g., installing a wildlife crossing). As a government agency, Midpen is required to make a finding of public benefit in any activity that is undertaken, including these types of projects. These projects are expected to be limited to a few projects each year at most.

11.9 New Lands

The Program analyzes the whole of Midpen's boundary (i.e., Sphere of Influence) (with the exception of Bay-front lands). Midpen acquires new lands annually, which are often acquired in a degraded condition, and manages and restores those lands to protect and enhance the natural environment. As part of the annual work plan submission, Midpen will include an updated map of Midpen's boundary and highlight all newly acquired parcels/lands. Projects occurring on these new lands would be included in the annual notification report, reviewed for consistency with the Program, and would then be added to the Manual as part of the baseline condition.

11.10 Develop Mitigation Plan

In parallel with developing the annual Program work plan, Midpen will develop the annual mitigation plan for Program activities considered as "Tier 2A", "Tier 2B", and "Tier 3", as well as any "Tier 1" projects that result in unavoidable impacts to wetlands, waters of the U.S. and state, or riparian resources. The mitigation plan will describe the on-site and/or off-site (elsewhere within the Midpen Preserve System) planned mitigation activities led by Midpen. The mitigation plan will include the following types of information:

- A description of on-site and off-site habitat restoration or enhancement activities planned for the coming year including the locations, lengths, areas, and other project details;
- A description of how restoration and enhancement projects will address watershed processes and functions that will provide suitable mitigation for the year's Program activities;
- Schedule for implementing mitigation project activities;
- A statement describing the status of permit approvals necessary to perform project (if applicable); and
- A mitigation and reporting plan.

Permitting agencies will have the opportunity to review and comment on the proposed annual mitigation plan. The annual mitigation plans will be consistent with the mitigation approaches outlined above and in Chapter 10.

11.11 Project Implementation

Once Midpen receives a notice to proceed from the relevant regulatory agencies, regulated Program activities may be initiated. Ground disturbing work in or adjacent to wetlands, waters of the U.S. and state, riparian resources, or sensitive habitats for federally and state listed species would take place after May 15. Ground-disturbing work outside of channels and creeks and sensitive habitat would take place after March 1. All Program activities will be conducted in accordance with the project description, program-wide and resource/activity-specific BMPs, and terms of the Program permits. This includes conducting any necessary pre-activity surveys for federally or state listed fish, wildlife, plants, and other resources, if Tier 2 and 3 project activities may affect these resources. An on-site biologist or biological monitor trained in using the Program Manual will oversee and guide all Program activities and ensure that the proper Program principals and avoidance and minimization measures and/or BMPs and mitigation, as described in Chapter 10, are employed.

As described previously, some vegetation management activities must take place early in the work season (e.g., riparian planting, invasive plant control, mowing, tree thinning, and removal of dead branches), before the fuel load is too dry and the fire ignition risk increases. Most fuel and vegetation management activities (including mowing, and weed and brush control) that are not subject to regulatory approvals may be conducted as early as March. As previously described, herbicide application occurs at various times of the year depending on plant phenology and is timed to be most effective. For some plants above OHWM and outside of riparian resources, herbicide application occurs during the spring and for others, it occurs

during the fall or early winter. As previously described, other minor maintenance activities that occur above OHWM may occur during both spring and fall. Culverts more than 30% clogged could significantly reduce channel capacity may be cleaned at any time, even when the channel is wet, as such situations could threaten Midpen facilities, infrastructure, environmental functions and values, and may present safety issues to Midpen staff or the public.

During implementation of Program activities, if an issue arises that requires a different treatment or approach than that described in the notification package and that change would result in a greater impact (e.g., conversion from Tier 1 to Tier 2 or Tier 3, or greater magnitude of take of individuals, or extent of impacts to listed species or habitat increased by more than 10%), then the agencies will be notified immediately by the Midpen Project Manager. If the change in treatment or approach would not result in greater impacts or an increase in tiering, then the Midpen Project Manager will notify the relevant agencies in a quarterly update or in the annual summary report. If Program activities near waters of the U.S. and state are unable to be completed by October 31, Midpen will winterize the project site until work can resume during the following year consistent with relevant BMPs and permit conditions.

When projects are implemented, data will be collected at the project site before, during, and immediately after project implementation or as required by regulatory permits or the protocols described in this Manual. Data collected may include before, during, and after photographs; quantification of material removed (for sediment removal projects) or placed (for bank/berm stabilization projects); the length and area of vegetation maintenance activities (e.g., herbicide application, tree trimming); and the location or occurrence of any federally or state listed species or other resources encountered at the site during pre-activity survey(s) or project implementation. Monitoring data will be collected shortly after the completion of Program activities at each site.

11.12 Annual Maintenance Summary Report

At the conclusion of the Program implementation season (generally after October 31 and before December 31), Midpen will prepare and submit to the relevant regulatory agencies an annual summary report describing the work plan status and confirm which projects were completed. The report will comply with permitting requirements issued by the relevant regulatory agencies and may include the following information:

- Description of the extent to which the work plan was completed during the prior season (i.e., projects that were and were not implemented) and, for any projects that were not implemented, a brief explanation of why, and whether the project will be incorporated into the next year's work plan or placed on a watch list;
- Statement of whether activities were conducted according to the project description and, if not, how the actual project varied from the project description;

- Site photographs taken before and after project completion;
- A record, if applicable, of how much sediment and vegetation was removed and the number of acres affected;
- A record, if applicable, of how much material was disposed of off-site, the disposal locations, and the approximate footprint area affected;
- Description of whether any federally or state listed species or other sensitive resources were encountered during construction and, if so, what impact avoidance steps were taken in response;
- Description of any take of federally or state listed species that occurred;
- A brief description of site monitoring activities;
- Any lessons learned from that year's activities, including treatments that were not effective, administrative difficulties, and proposed steps to facilitate the process; and
- Recommended updates (if any) to the Program BMPs.

The annual report will also include status reporting on the Program's mitigation activities, including the submittal of follow-up monitoring reports. Topics to be addressed in the monitoring reports are addressed in Chapter 10, Section 10.7.6.

At the end of the annual work cycle, Midpen will update its Program tracking database and the BMP list (Table 10-3), as appropriate, to include any updates or changes made over the recent work cycle. By doing so, development of the next year's work plan will be built on updated information across Midpen lands under the Program Manual.

This page intentionally left blank

Chapter 12. Acronyms and Abbreviations

A		**Chapter**
ACHP	Advisory Council on Historic Preservation	2
ATV	all-terrain vehicle	7
B		
BA	Biological Assessment	2
BAAQMD	Bay Area Air Quality Management District	10
Basin Plan	water quality control plan	2, 3
Bd	*Batrachochytrium dendrobatidis* is a species of chytrid fungus only found in amphibians.	4
BGEPA	Bald and Golden Eagle Protection Act	2
BMP	best management practice	1, 2, 6, 9, 10, 11
BO	Biological Opinion	2, 11
C		
CALFIRE	California Department of Forestry and Fire Protection	6, 10
Cal-IPC	California Invasive Plant Council	4
CALVEG	Classification and Assessment with Landsat of Visible Ecological Groupings	4
CCC	California Coastal Commission	2
CCH1	Consortium of California Herbaria	4
CCR	California Code of Regulations	10
CDFA	California Department of Food and Agriculture	4
CDFW	California Department of Fish and Wildlife (since 2012)	1, 2, 4, 9, 10
CEQA	California Environmental Quality Act	1, 2

CESA	California Endangered Species Act	2, 4
CFR	Code of Federal Regulations	2
CGS	California giant salamander	10
CIP	Capital Improvement Project	2
CMP	corrugated metal pipe	5, 10
CNDDB	California Natural Diversity Database	4, 10
CNPS	California Native Plant Society	4, 6
CRLF	California red-legged frog	1, 2, 10, 11
CRPR	California Rare Plant Rank	4
CT	Congdon's tarplant	10
CTS	California tiger salamander	2
CWA	Clean Water Act	2, 3
CWHR	California Wildlife Habitat Relationship System	4
cy	cubic yards	10
D		
dB	Decibels	10
dbh	diameter at breast height	6, 10
DDT	Dichlorodiphenyltrichloroethane	3
DOC	California Department of Conservation	3
DWR	California Department of Water Resources	3
E		
EA	Environmental Assessment	2
EFH	essential fish habitat	
EIR	Environmental Impact Report	6, 10
F		
F&G Code	California Fish and Game Code	2
FEMA	Federal Emergency Management Agency	10
FESA	Federal Endangered Species Act	2, 4, 10
FMP	Federal Fishery Management Plan	2
FONSI	finding of no significant impact	2
FRA	Fuel Reduction Area	6
FWCA	Fish and Wildlife Coordination Act	2
FYLF	foothill yellow-legged frog	10
G		
GAMA	Groundwater Ambient Monitoring and Assessment	3
GGNPC	Golden Gate National Parks Conservancy	4

GIS	Geographic Information System	4
H		
HAZMAT	hazardous materials	10
HAZWOPER	Hazardous Waste Operations and Emergency Response	10
HDPE	high-density polyethylene	5
HUC	Hydrologic Unit Code	3
I		
IPM	Integrated Pest Management	1, 2, 4, 6, 8, 9, 10
ITP	Incidental Take Permit	2
L		
LCP	Local Coastal Program	2
LF	linear feet	10
LPH	Loma Prieta hoita	10
M		
MAMU	marbled murrelet	10
Manual	Open Space Maintenance and Restoration Program Manual	1
MBTA	Migratory Bird Treaty Act	2
MHFT	Mt. Hamilton fountain thistle	10
MidPen	Midpeninsula Regional Open Space District	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
MOU	Memorandum of Understanding	2
MS4	municipal separate storm sewer systems	2, 3
MSA	Magnuson-Stevens Fishery Conservation and Management Act	2
N		
NCCP	Natural Community Conservation Plan	2
NEPA	National Environmental Policy Act	2
NHPA	National Historic Preservation Act	2
NMFS	National Marine Fisheries Service	2, 4, 10
NOAA	National Oceanic Atmospheric Administration	2, 9
NPDES	National Pollutant Discharge Elimination System	2
NRCS	Natural Resource Conservation Service	3
NRHP	National Register of Historic Places	2
O		
OHV	off-highway vehicle	7

OHWM	ordinary high water mark	1, 2, 10, 11
OSMRP	Open Space Maintenance and Restoration Program	1, 6, 10, 11
OSP	Open Space Preserve	1, 2, 4, 5, 6, 7, 8, 9, 10, 11
P		
PCB	Polychlorinated Biphenyls	3
PCR	Public Resource Code	10
Porter-Cologne Act	Porter-Cologne Water Quality Control Act	2
POST	Peninsula Open Space Trust	1
Preserves	Open Space Preserves	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
Program	Open Space Maintenance and Restoration Program	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
Q		
QAC	Qualified Applicator Certificate	10
QAL	Qualified Applicator's License	10
R		
RCD	resource conservation district	1
RDM	residual dry matter	6, 10
RGP	Regional General Permit	2
RH	relative humidity	10
RMA	Routine Maintenance Agreement	1, 2
RWQCB	California Regional Water Quality Control Board	1, 2, 3, 10
S		
SAA	Streambed Alteration Agreement	2
SCBS	Santa Cruz black salamander	10
SCP	Scientific Collecting Permit	2
SFDFW	San Francisco dusky-footed woodrat	10
SFGS	San Francisco garter snake	2, 10, 11
SFPUC	San Francisco Public Utilities Commission	3
SHPO	State Historic Preservation Officer	2
SOD	sudden oak death	4, 6, 9, 10
SWRCB	State Water Resources Control Board	2, 3

T		
TEK	traditional ecological knowledge	6
TMDL	total maximum daily load	2, 3, 6
U		
U.S.	United States	2, 6, 10, 11
USACE	U.S. Army Corps of Engineers	1, 2, 10
USC	U.S. Code	2
USDA	U.S. Department of Agriculture	4
USEPA	U.S. Environmental Protection Agency	2, 3, 10
USFS	U.S. Forest Service	4
USFWS	U.S. Fish and Wildlife Service	1, 2, 4, 7, 9, 10
USGS	U.S. Geological Survey	10
V		
Valley Water	Santa Clara Valley Water District	3
VMP	Vegetation Management Plan	6
VOC	volatile organic compound	3
W		
WDR	Waste Discharge Requirement	1, 2
WL	western leatherwood	10
WPT	known western pond turtle	10
WQC	Water Quality Certification	2
WSE	water surface elevation	10
WUI	wildland urban interface	6

Page intentionally left blank

Chapter 13. Reference

Chapter 1 Introduction

Midpen. *See* Midpeninsula Regional Open Space District.

Midpeninsula Regional Open Space District. 1993. Ordinance for Use of Midpeninsula Regional Open Space District Lands. July 1993. Available at: https://www.openspace.org/sites/default/files/District_Regulations.pdf.

Midpeninsula Regional Open Space District. 2012 (August). La Honda Creek Open Space Preserve Master Plan. Available at: https://www.openspace.org/sites/default/files/2012.08.21.LHCMP_.pdf.

Midpeninsula Regional Open Space District. 2014a. Vision Plan Summary. Available at: https://www.openspace.org/our-work/projects/vision-plan.

Midpeninsula Regional Open Space District. 2014b. Top 25 Open Space Projects. Available at: http://www.top25.openspace.org/#.

Midpeninsula Regional Open Space District. 2014c (September). *Integrated Pest Management Program Guidance Manual.* Prepared by May & Associates., Shelterbelt Builders., and Ascent Environmental., Available at: https://www.openspace.org/sites/default/files/IPM_Guidance_Manual.pdf.

Midpeninsula Regional Open Space District. 2017 (January). Bear Creek Redwoods Open Space Preserve Plan. Available at: https://www.openspace.org/sites/default/files/BCRPreservePlan.pdf.

Midpeninsula Regional Open Space District. 2021 (February). Resource Management Policies. Available at: https://www.openspace.org/sites/default/files/Resource_Management_Policies.pdf.

Midpeninsula Regional Open Space District. 2021. Draft Wildland Fire Resiliency Program. January 2021. Available at: https://www.openspace.org/our-work/projects/wfrp#DraftWFRP.

Midpeninsula Regional Open Space District. 2003. Service Plan for the San Mateo Coastal Annexation Area. June 2003. Available at: https://www.openspace.org/sites/default/files/Coastal_Service_Plan.pdf.

Chapter 2 Regulatory Framework

No references cited.

Chapter 3 Physical Setting

California Department of Conservation. 2019. *Data Viewer.* Available at: https://maps.conservation.ca.gov/geologichazards/DataViewer/index.html. Accessed December 30, 2019.

California Department of Water Resources. 2020. Groundwater Basin Boundary Assessment Tool. Available at: https://gis.water.ca.gov/app/bbat/. Accessed January 16, 2020.

Central Coast Regional Water Quality Control Board. 2019. Water Quality Control Plan for the Central Coast Basin. June 2019 Edition. Available at: https://www.waterboards.ca.gov/centralcoast/publications_forms/publications/basin_plan/docs/2019_basin_plan_r3_complete.pdf. Accessed January 14, 2020.

Central Coast RWQCB. *See* Central Coast Regional Water Quality Control Board

DOC. *See* California Department of Conservation.

DWR. *See* California Department of Water Resources.

Midpen. *See* Midpeninsula Regional Open Space District.

Midpeninsula Regional Open Space District. 2002 (June). *San Mateo Costal Annexation Draft EIR*.

Midpeninsula Regional Open Space District. 2014 (September). *Draft Environmental Impact Report for the Midpeninsula Regional Open Space District Integrated Pest Management Program.* SCH# 2013092033. Prepared by Ascent Environmental. Available at: https://www.openspace.org/sites/default/files/IPM_EIR.pdf.

Midpeninsula Regional Open Space District. 2019. *Winter 2019—Open Space Views.* Available at: https://www.openspace.org/newsletter/winter-2019. Accessed December 30, 2019.

Natural Resources Conservation Service. 2019. Web Soil Survey. Available at: websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. Accessed December 30, 2019.

Natural Resources Conservation Science. 2020. Official Soil Series Description. Available at: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2_053587. Accessed March 10, 2020.

NRCS. *See* Natural Resources Conservation Service.

San Francisco Bay Regional Water Quality Control Board. 2017. San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan). May 2017. Available at: https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/planningtmdls/basinplan/web/docs/BP_all_chapters.pdf. Accessed January 14, 2020.

San Francisco RWQCB. San Francisco Bay Regional Water Quality Control Board.

State Water Resources Control Board. 2020. Diazinon and Pesticide-Related Toxicity in Urban Creeks TMDL. Available at: https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/urbancrksdiazinontmdl.html. Accessed January 15, 2020.

State Water Resources Control Board. 2019a. 2014 and 2016 California Integrated Report Clean Water Act Sections 303(d) and 305(b). Final Staff Report. October. Available at: www.waterboards.ca.gov/water_issues/programs/tmdl/docs/final_staff_report.pdf. Accessed January 15, 2020.

State Water Resources Control Board 2019b. Stevens Creek Toxicity TMDL. Available at: https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/stevenscktoxicity.html. Accessed January 15, 2020.

State Water Resources Control Board. 2019c. Guadalupe River Watershed Mercury TMDL. Available at: https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/guadaluperivermercurytmdl.html. Accessed January 16, 2020.

State Water Resources Control Board. 2018. Permanente Creek Selenium TMDL. Available at: https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/permanenteselenium.html. Accessed January 16, 2020.

SWRCB. *See* State Water Resources Control Board.

Timothy C. Best, CEG. 2011. Mercury Mine Waste Erosion Inventory: Rancho de Guadalupe Area, Sierra Azul Open Space Preserve. April 13. Available at: https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/guadalupe_river_mercury/MidPen_2_AmendFinalReport%20_April_2012.pdf. Accessed January 16, 2020.

Chapter 4 Biological Resources

Altman and Sallabanks 2000. Olive-sided Flycatcher (*Contopus cooperi*). *In*The birds of North America, No. 502 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

AmphibianArk. 2019. Available at: www.amphibianark.org/the-crisis/chytrid-fungus/#WhatIsBd. Accessed November 7, 2019.

AmphibiaWeb. 2008. Introduced species. Available at: amphibiaweb.org/declines/IntroSp.html. Accessed October 31, 2019.

Barrios-Garcia and Ballari. 2012. Impact of wild boar (Sus scrofa) in its introduced and native range: a review. Biological Invasions 14: 2283–2300.

Barry, S. J. 1994. The distribution, habitat, and evolution of the San Francisco garter snake, *Thamnophis sirtalis tetrataenia*. Unpublished M.A. Thesis. University of California, Davis.

Baskin, L., and K. Danell. 2003. Ecology of ungulates: a handbook of species in Eastern Europe and Northern and Central Asia. Springer Science & Business Media.

Black, S. H., and D. M. Vaughan. 2005a. Species Profile: *Icaricia icarioides missionensis*. In Shepherd, M. D., D. M. Vaughan, and S. H. Black (Eds). Red List of Pollinator Insects of North America. CD-ROM Version 1 (May 2005). Portland, OR: The Xerces Society for Invertebrate Conservation.

Black, S.H. and D.M. Vaughan. 2005b. Species profile: *Speyeria callippe callippe* in M.D. Shepard, D.M. Vaughan, and S.H. Black, editors. Red list of pollinator insects of North America. Xerces Society for Invertebrate Conservation, Portland, Oregon.

Black, S.H. and D.M. Vaughan. 2005c. Species profile: *Speyeria zerene myrtleae* In Shepard, M. D., D. M. Vaughn, and S. H. Black (eds.). Red List of Pollinator Insects of North America. CD-ROM version 1 (May 2005). Portland, OR: Xerces Society for Invertebrate Conservation.

Black, S.H. and D.M. Vaughan. 2005d. Species profile: *Euphydryas editha bayensis* in M.D. Shepard, D.M. Vaughan, and S.H. Black, editors. Red list of pollinator insects of North America. Xerces Society for Invertebrate Conservation, Portland, Oregon.

Bossard, C.C., J. M. Randall, and M.C. Hoshovsky, editors. 2000. Invasive Plants of California's Wildlands. Wiley, Hoboken, New Jersey.

Bourret, T. B. 2018. Efforts to detect exotic Phytophthora species reveal unexpected diversity. Ph.D. Dissertation. Davis: University of California. 181p.

Bousman, W.G. 2007. Yellow warbler *Dendroica petechia*. Pages 376-377 in W.G. Bousman, editor. Breeding bird atlas of Santa Clara County. Santa Clara Valley Audubon Society, Cupertino, California.

California Department of Food and Agriculture. 2019. Encycloweedia. Available at: www.cdfa.ca.gov/plant/ipc/encycloweedia/weedinfo/winfo_table-sciname.html. Accessed October 2019.

California Department of Fish and Game. 2008. CWHR version 8.2 personal computer program in California Department of Fish and Game, California Interagency Wildlife Task Group.

California Department of Fish and Wildlife. 2015. Recovery Strategy for California Coho Salmon Progress Report 2004–2012.

California Department of Fish and Wildlife. 2019a. Rarefind 5.0. California Natural Diversity Database. Available at: www.dfg.ca.gov/biogeodata/cnddb/mapsanddata.asp. Accessed September 2019.

California Department of Fish and Wildlife. 2019b. Fishing for black bass. https://wildlife.ca.gov/Fishing/Inland/Black-Bass. Accessed September 2019.

California Department of Fish and Wildlife. 2019c. California Department of Fish and Wildlife Invasive Species Program Information. Available at: www.wildlife.ca.gov/Conservation/Invasives/About. Accessed September 2019.

California Department of Fish and Wildlife. 2020. California Department of Fish and Wildlife Invasive Species Program Information. Available at: wildlife.ca.gov/Conservation/Plants/Endangered/Lessingia-germanorum. Accessed February 2020.

CDFW. *See* California Department of Fish and Wildlife.

California Fish Website. 2019. Available at: calfish.ucdavis.edu/. Accessed through October 31, 2019.

California Invasive Plant Council. 2019. California Invasive Plant Inventory Database. Available at: www.cal-ipc.org/paf/. Accessed September 2019.

Cal-IPC. *See* California Invasive Plant Council.

California Native Plant Society. 2019a. Inventory of Rare and Endangered Plants (online edition, v8-03 0.39). Available at: www.cnps.org/inventory. Accessed September 2019.

California Native Plant Society [Calflora web application]. 2019b. The Calflora Database: Information on California plants for education, research and conservation, with data contributed by public and private institutions and individuals, including the Consortium of California Herbaria. Berkeley, California. Available at: www.calflora.org/. Accessed September 2019.

CNPS. *See* California Native Plant Society.

California Native Plant Society. 2019c. Calscape [online database]. Available at: calscape.org/. Accessed through October 31.

CaliforniaHerps. 2019. Available at: www.californiaherps.com/. Accessed through October 31, 2019.

CEMAR. 2008. Steelhead/Rainbow Trout Resources of San Mateo County. Prepared for the California Coastal Conservancy.

Center for Biological Diversity 2019. Smith's blue butterfly. Available at: www.biologicaldiversity.org/species/invertebrates/Smiths_blue_butterfly/index.html. Accessed through October 31, 2019.

Chan, Y. and H. Spautz. 2008. Alameda Song Sparrow (Melospiza melodia pusillula). In: Shuford, W.D. and T. Gardali (eds.). California Bird Species of Special Concern: A Ranked Assessment of Species, Subspecies, and Distinct Populations of Birds of Immediate Conservation Concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California; and California Department of Fish and Game, Sacramento.

Consortium of California Herbaria. 2019. Data provided by the participants of the Consortium of California Herbaria. Regents of the University of California, Berkeley. Website. Available at: ucjeps.berkeley.edu/consortium/. Accessed in September 2019.

CCH. *See* Consortium of California Herbaria. 2019.

Cornell Lab of Ornithology. 2019. eBird database. https://ebird.org/home. Accessed in September 2019.

County of San Mateo. 1982. San Bruno Mountain Area Habitat Conservation Plan: Final. Distributed by the San Bruno Mountain Habitat Conservation Plan Steering Committee. November 1982.

Cushman, J. H., T. A. Tierney, and J. M. Hinds. 2004. Variable effects of feral pig disturbances on native and exotic plants in a California grassland. Ecological Applications 14:1746–1756.

DeSante et al. 2007. The distribution and relative abundance of Burrowing Owls in California during 1991-1993: evidence for a declining population and thoughts on its conservation. Pages 1-41 in: Proceedings of The California Burrowing Owl Symposium. Bird Populations Monograph No. 1.

Frederick, J. M. 1998. Overview of wild pig damage in California. Proceedings of the Eighteenth Vertebrate Pest Conference 18:82–86.

Friends of Edgewood [website]. 2015. Friends of Edgewood. Available at: friendsofedgewood.org/learn-about-edgewood-park/bay-checkerspot-butterfly. Accessed October 31, 2019.

Gamradt, S. C., and L.B. Kats 1996. Effect of Introduced Crayfish and Mosquitofish on California Newts. Conservation Biology 10:1155-1162.

Graber, D.M. 1996. Status of terrestrial vertebrates. In Sierra Nevada Ecosystem Project: Final report to Congress. Chapter 25. Davis, California: Centers for Water and Wildland Resources.

Gregory, S. V., F. J. Swanson, W. A. McKee, and K. W. Cummins. 1991. An ecosystem perspective of riparian zones. Bioscience, 540-551.

Hatfield, Rich, Sarina Jepsen, Sarah Foltz, Jordan, Michele Blackburn, and Aimée Code. 2019. The Xerces Society petition to list four bumblebees as endangered under the CESA. A petition to the State of California Fish And Game Commission. For action pursuant to Section 670.1, Title 14, California Code of Regulations (CCR) and Sections 2072 and 2073 of the Fish and Game Code relating to listing and delisting endangered and threatened species of plants and animals.

Holland, R. 1986. Preliminary descriptions of the terrestrial natural communities of California. Unpublished document, California Department of Fish and Game, Natural Heritage Division. Sacramento, CA.

iNaturalist [website]. 2019. Available at: www.inaturalist.org/. Accessed October 31, 2019.

Jolley, D. B., S. S. Ditchkoff, B. D. Sparklin, L. B. Hanson, M. S. Mitchell, and J. B. Grand. 2010. Estimate of herpetofauna depredation by a population of wild pigs. Journal of Mammalogy 91:519–524.

Kreith, M. 2007. Wild Pigs in California: The Issues. Agricultural Issues Center Issues Brief: 1–6.

Lawler, S. P., Dritz, D., Strange, T., and M. Holyoak. 1999. Effects of Introduced Mosquitofish and Bullfrogs on the Threatened California red-legged frog. Conservation Biology 13:613-622.

Leidy, R. A., G. S. Becker, B. N. Harvey. 2005. Historical distribution and current status of steelhead/rainbow trout (Oncorhynchus mykiss) in streams of the San Francisco Estuary, California. Center for Ecosystem Management and Restoration, Oakland, CA.

Leidy, R.A. 2007. Ecology, Assemblage Structure, Distribution, and Status of Fishes in Streams Tributary to the San Francisco Estuary, California. San Francisco Estuary Institute.

Lips, K.R., F. Brem, R. Brenes, J.D. Reeve, R.A. Alford, J. Voyles, C. Carey, L. Livo, A.P. Pessier, and J.P. Collins. 2006. Emerging infectious disease and the loss of biodiversity in a Neotropical amphibian community. Proceedings of the National Academy of Sciences of the United States of America 103:3165-3170.

Mayer, J. J., and I. L. Brisbin. 1991. Wild pigs of the United States: Their history, comparative morphology and current status. University of Georgia, Athens, Georgia, USA..

Meyer, K. E., and W. F. Laudenslayer. 1988. A guide to wildlife habitats of California. 1988. Sacramento. California Dept. of Fish and Game.

Midpen. *See* Midpeninsula Regional Open Space District.

Midpeninsula Regional Open Space District. 2014 (September). *Integrated Pest Management Program Guidance Manual.* Prepared by Ascent Environmental., May & Associates., and Shelterbelt Builders. Available at: https://www.openspace.org/sites/default/files/IPM_Guidance_Manual.pdf.

Midpeninsula Regional Open Space District. 2017. Sensitive species list.

Midpeninsula Regional Open Space District. 2019. Sensitive species occurrence data provided to H.T. Harvey & Associates.

Moyle, P. B. 2002. Inland Fishes of California. University of California Press, Davis, California.

National Marine Fisheries Service. 1999. Designated Critical Habitat; Central California Coast and Southern Oregon/Northern California Coasts Coho Salmon. Federal Register 64(86):24049–24062.

National Marine Fisheries Service. 2000. Designated Critical Habitat: Critical Habitat for 19 Evolutionarily Significant Units of Salmon and Steelhead in Washington, Oregon, Idaho, and California. Final rule. Federal Register 65(22): 7764-7787.

National Marine Fisheries Service. 2005. Endangered and threatened species: Designation of critical habitat for seven evolutionarily significant units of Pacific steelhead and salmon in California. Final rule. Federal Register 70:52488-52626.National Marine Fisheries Service. 2016. 2016 5-Year Review: Summary & Evaluation of Central California Coast Steelhead. April 2016.

NMFS. *See* National Marine Fisheries Service.

Peninsula Open Space Trust. 2019. Coho Salmon Return to Pescadero Creek. Available at: openspacetrust.org/coho-salmon-pescadero/. Accessed October 28, 2019.

POST. *See* Peninsula Open Space Trust.

Phytosphere Research. 2018. Evaluating threats posed by exotic Phytophthora species to endangered Coyote ceanothus and selected natural communities in the Santa Clara NCCP area. Prepared for the Santa Clara Valley Habitat Agency.

Rana Creek Habitat Restoration. 2002. San Mateo County Parks Vegetation Resources. Prepared for County of San Mateo Environmental Services Agency Parks & Recreation Division. March 2002.

Reilly, Sean B., Daniel M. Portik, Michelle S. Koo, and David B. Wake. 2014. Journal of Herpetology, Vol. 48, No. 3, 371–379.

Robertson, B.A., and R.L. Hutto. 2007. Is selectively harvested forest an ecological trap for olive-sided flycatchers? Condor 109:109-121.

Rooney-Latham, S., Blomquist, C.L., Guo, Y.Y., Soriano, M.C., Kosta, K.L., Swiecki, T.J., Bernhardt, E.A., Frankel, S.J. 2015. An update on Phytophthora species in native plant nurseries and outplanted material in restoration areas. Presentation. Annual meeting of the California Forest Pest Council, November 5, 2015. Available at: caforestpestcouncil.org/wp-content/uploads/2015/11/2015-CFPC-11.5.15-AM-Latham.pdf.

Rottenborn, S. 2007a. Vaux's swift. pp. 244–245 in Breeding Bird Atlas of Santa Clara County, California. Santa Clara Valley Audubon Society, Cupertino, California. 547 p.

Rottenborn, S. 2007b. Alameda song sparrow. pp. 412–413 in Breeding Bird Atlas of Santa Clara County, California. Santa Clara Valley Audubon Society, Cupertino, California. 547 p.

Sawyer, J. O., T. Keeler-Wolf, and J. M. Evens. 2009. A Manual of California Vegetation Second Edition. California Native Plant Society Press, Sacramento, CA.

Sequoia Audubon Society. 2001. San Mateo County Breeding Bird Atlas. 224 p.

SAS. *See* Sequoia Audubon Society.

Smith, K.G., K.R. Lips, and J.M. Chase. 2009 Selecting for extinction: nonrandom disease-associated extinction homogenizes amphibian biotas. Ecology Letters 12:1069-1078

Spence B.C., Bjorkstedt E.P., Garza J.C., Smith J.J., Hankin D.G., Fuller D, Jones W.E., Macedo R, Williams T.H., Mora E. 2008. A framework for assessing the viability of threatened and endangered salmon and steelhead in the North-Central California Coast recovery domain. NOAA Tech Memo NMFS NOAA-TM-NM

Spinks, P.Q., G.B. Pauly, J. J. Crayon, and H. B. Shaffer. 2003. Survival of the western pond turtle (Emys marmorata) in an urban environment. Biological Conservation 113:257-267.

Steiner, J., R. A. Arnold, S. Mattoon, D. V. McCorkle and K. H. Osborne. 1994. Pages 436-437. In Thelander, C. G., and M. Crabtree, editors. Life on the Edge: A Guide to California's Endangered Natural Resources: Wildlife. BioSystems Books, Santa Cruz, CA. 550 p.

Swiecki, T., and E. Bernhardt. 2014. Phytophthora species move from native plant nurseries into restoration plantings [presentation]. Available at: caforestpestcouncil.org/wp-content/uploads/2014/12 /Swiecki.pdf.

Thomson, R.C., P.Q. Spinks, and H.B. Shaffer. 2010. Distribution and abundance of invasive red-eared sliders (*Trachemys scripta elegans*) in California's Sacramento River Basin and possible impacts on native western pond turtles (*Emys marmorata*). Chelonian Conservation and Biology 9:297-302.

Unitt, P. 2008. Grasshopper sparrow (*Ammodramus savannarum*) in W.D. Shuford and T. Gardali, editors. California bird species of special concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Western Field Ornithologists and California Department of Fish and Game, Camarillo, California.

U.S. Department of Agriculture, U.S. Forest Service. 2004. Existing Vegetation - CALVEG, [ESRI personal geodatabase]. USDA, Forest Service, Pacific Southwest Region, Remote Sensing Lab, McClellan, CA. EvegTile03B_99_04_v2.

USDA USFS. *See* U.S. Department of Agriculture, U.S. Forest Service.

U.S. Fish and Wildlife Service. 1992. Endangered and Threatened Wildlife and Plants; Six Plants and Myrtle's Silverspot Butterfly from Coastal Dunes in Northern and Central California Determined to Be Endangered Status; Final Rule. Federal Register 57(120): 27848-27859.

U.S. Fish and Wildlife Service. 1998a. Seven Coastal Plants and the Myrtle's Silverspot Butterfly Recovery Plan. Portland, Oregon. 141 pp.

U.S. Fish and Wildlife Service. 1998b. Recovery plan for serpentine soil species of the San Francisco Bay Area.

U.S. Fish and Wildlife Service. 1998c. Recovery Plan for Insect and Plant Taxa from the Santa Cruz Mountains in California. Portland, Oregon. 83 pp.

U.S. Fish and Wildlife Service. 2005. Recovery Plan for the Tidewater Goby (*Eucyclogobius newberryi*). Portland, Oregon.

U.S. Fish and Wildlife Service. 2007. Species account: Callippe silverspot butterfly (*Speyeria callippe callippe*). Available at: www.fws.gov/sacramento/es/animal_spp_acct/callippe_silverspot_butterfly.pdf. Accessed October 31, 2019.

U.S. Fish and Wildlife Service. 2016. Intra-Service Biological Opinion on the issuance of a 10(a)(1)(A) permit to Midpeninsula Regional Open Space District for the San Francisco Garter Snake and California Red-legged Frog Habitat Enhancement Projects at their Open Space Preserves in San Mateo and Santa Clara Counties, California. December 9, 2016.

USFWS. *See* U.S. Fish and Wildlife Service

Voyles, J., S. Young, L. Berger, C. Campbell, W.F. Voyles, A. Dinudom, D. Cook, R. Webb, R.A. Alford, L.F. Skerratt, and R. Speare. 2009. Pathogenesis of chytridiomycosis, a cause of catastrophic amphibian declines. Science 326:582-585.

Chapter 5 Culvert, Channel, and Bridge, and Other Facility Maintenance

No references cited.

Chapter 6 Vegetation Management

Marin County. 2015 (April). Administrative Draft Vegetation and Biodiversity Management Plan. Prepared by May & Associates. Available at: https://www.marincounty.org/-/media/files/maringov/board-actions/2013/2013jul/20130716mcp_vmbp_admindraft.pdf.

Midpeninsula Regional Open Space District. 2008. Grazing Management Policy.

Midpeninsula Regional Open Space District. 2011 (November). Defensible Space Clearing Guidelines.

Midpeninsula Regional Open Space District. 2014a (September). *Integrated Pest Management Program Guidance Manual.* Prepared by Ascent Environmental, May & Associates, and Shelterbelt Builders. Available at: https://www.openspace.org/sites/default/files/IPM_Guidance_Manual.pdf.

Midpeninsula Regional Open Space District. 2014b (September). *Draft Environmental Impact Report for the Midpeninsula Regional Open Space District Integrated Pest Management Program.* SCH# 2013092033. Prepared by Ascent Environmental. Available at: https://www.openspace.org/sites/default/files/IPM_EIR.pdf.

Midpeninsula Regional Open Space District. 2019 (January). *Addendum to the Environmental Impact Report for the Midpeninsula Regional Open Space District Integrated Pest Management Program*. SCH #2013092033. Prepared by Blankinship & Associates, Inc. Available at: https://www.openspace.org/sites/default/files/IPM_EIR_Addendum.pdf.

Midpeninsula Regional Open Space District. 2021a (February). Resource Management Policies. Available at: https://www.openspace.org/sites/default/files/Resource_Management_Policies.pdf.

Midpeninsula Regional Open Space District. 2021b (January). Wildland Fire Resiliency Program Environmental Impact Report. SCH # 2020049059. Prepared by Panorama Environmental.

Midpen. *See* Midpeninsula Regional Open Space District.

Chapter 7 Road and Trail Maintenance

No references cited.

Chapter 8 New Small Scale Facilities and Improvements

California Department of Transportation. 2017. Tiger salamander Undercrossing nearing completion on Hwy 246 west of Buellton. Available at: https://lompocrecord.com/news/local/tiger-salamander-undercrossings-nearing-completion-on-hwy-west-of-buellton/article_54d962a6-c40b-5adb-b323-0cb3e4e8b461.html. Accessed December 8, 2020.

Caltrans. *See* California Department of Transportation.

Midpeninsula Regional Open Space District. 2008. Grazing Management Policy.

Midpen. *See* Midpeninsula Regional Open Space District.

Chapter 9 Restoration and Enhancement Projects

Midpeninsula Regional Open Space District. 2014 (September). *Integrated Pest Management Program Guidance Manual.* Prepared by Ascent Environmental., May & Associates., and Shelterbelt Builders. Available at: https://www.openspace.org/sites/default/files/IPM_Guidance_Manual.pdf.

Midpen. *See* Midpeninsula Regional Open Space District.

Chapter 10 Impact Avoidance and Minimization, BMPs, and Mitigation

Best, Timothy C. Certified Engineering Geologist (CEG), 2006-2012. Engineering Geology and Hydrology, Santa Cruz, California.

California Department of Fish and Game. 2002. California Salmonid Stream Habitat Restoration Manual. Fourth Edition. Available at: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=22610&inline.

CDFG. See California Department of Fish and Game.

California Department of Fish and Wildlife. 2017a. Memorandum of Understanding for San Francisco Garter Snake and California Tiger Salamander.

California Department of Fish and Wildlife. 2017b. Scientific Collecting Permit No. SC-10927.

California Department of Fish and Wildlife. 2018 (May 16). Wildland Fire Resiliency Program Draft Environmental Impact Report, Appendix 4.4d Streambed Alteration Agreement (includes amendments 1 through 5). System-wide Routine Maintenance Agreement. Notification No. 1600-2012-0444-R3. Available at: https://www.openspace.org/sites/default/files/WFRP_DEIRAppendices_January2021_digital.pdf.CDFW. *See* California Department of Fish and Wildlife.

Midpeninsula Regional Open Space District. 2012. Best Management Practices for Routine Maintenance Activities in Water Courses.

Midpeninsula Regional Open Space District. 2014 (September). *Integrated Pest Management Program Guidance Manual.* Prepared May & Associates, Shelterbelt Builders, and by Ascent Environmental. Available at: https://www.openspace.org/sites/default/files/IPM_Guidance_Manual.pdf.

Midpeninsula Regional Open Space District. 2021 (February). Resource Management Policies. Available at: https://www.openspace.org/sites/default/files/Resource_Management_Policies.pdf.

Midpen. *See* Midpeninsula Regional Open Space District.

National Marine Fisheries Service. 2019 (September). *Guidelines for Salmonid Passage at Stream Crossings*. September 2019.

NMFS. *See* National Marine Fisheries Service.

Salix Applied Earthcare. 2004. Erosion Draw 5.0, Bio Draw 3.0, and Environmentally-Sensitive Streambank Stabilization Manual (E-SenSS) [interactive CDs], John McCullah, Redding California. Available at: http://salixaec.com/streambanks.html.

San Francisco Bay Regional Water Quality Control Board. 2010. Waste Discharge Requirements and Water Quality Certifications for Routine Maintenance Activities for Mid-Peninsula Open Space District, Order No. R2-2010-0083. Available at: https://www.waterboards.ca.gov/sanfranciscobay/board_decisions/adopted_orders/2010/R2-2010-0083.pdf.

San Francisco Bay Regional Water Quality Control Board. 2018. Work Extension for Routine Maintenance Activities for Mid-Peninsula Open Space District, Order No. R2-2010-0083.

San Francisco Bay RWQCB. *See* San Francisco Bay Regional Water Quality Control Board.

Society of Vertebrate Paleontology. 1995 (January). Assessment and Mitigation of Adverse Impacts to Nonrenewable Palaeontologic Resources: Standard Guidelines. Conformable Impact Mitigation Guidelines Committee. *Society of Vertebrate Paleontology News Bulletin*. Number 163: 26. Available at: https://www.contracosta.ca.gov/DocumentCenter/View/34167/SVP-1995-StandardsAndGuidelines-PDF.

U.S. Fish and Wildlife Service. 2016a. Native Endangered and Threatened Species Recovery Permit No. TE225974-2.

U.S. Fish and Wildlife Service, 2016b. Intra-Service Biological Opinion on the issuance of a 10(a)1(A) permit to the Midpeninsula Regional Open Space District for the San Francisco Garter Snake and California Red-Legged Frog Habitat Enhancement Projects at their Open Space Preserves in San Mateo and Santa Clara counties, California.

USFWS. *See* U.S. Fish and Wildlife Service.

Chapter 11 Program Administration and Reporting

No references cited.

Page intentionally left blank

Appendix A Biological Resources Information

Table A-1. **Federal Endangered Species Act Coverage Mechanism for California Red-legged Frog and San Francisco Garter Snake.**

Facility or Feature	Description of Activities	Section 7	Section 10a[1,2]
Routine Maintenance Activities			
Ponds and lakes	▪ Berm repair/maintenance ▪ Vegetation removal ▪ Sediment removal (may include some recontouring) ▪ Planting vegetation	N/A	All these activities are explicitly covered by the existing 10(a)(1)(A) Recovery Permit.
	▪ Non-native plant treatment	N/A – In recent years, the USFWS has generally declined to cover herbicide use in Section 7 consultations.	This activity is explicitly covered by the existing Recovery Permit, but only herbicides that are part of a formal integrated pest management plan may be used, and only if they are used in accordance with the guidelines on the label and if they comply with the restrictions listed in the critical habitat designation.
	▪ Outlet, inlet, and pipe repair ▪ Trash and woody debris removal ▪ Wildlife structure installation (basking platforms/logs)	N/A	Although the Recovery Permit does not explicitly mention these activities, the USFWS may allow them under the existing permit because they contribute to habitat management and enhancement, and species recovery. If deemed necessary (for Recovery Permit coverage) by the USFWS, these activities should be explicitly added to the Recovery Permit.

Facility or Feature	Description of Activities	Section 7	Section 10a[1,2]
Water supply structures	▪ Vegetation removal	If maintenance of the water supply structure in question does not serve a residence or other tenant/staff structure, habitat, or fire management purpose (e.g., if the water supply is solely for public drinking water or restrooms), then the activity would need to be covered under Section 7 consultation or omitted from the Program. However, all anticipated maintenance of water supply structures would serve a direct or indirect habitat management purpose and therefore should be covered by the Recovery Permit.	Non-native plant management is explicitly covered by the existing Recovery Permit, but only herbicides that are part of a formal integrated pest management plan may be used, and only if they are used in accordance with the guidelines on the label and if they comply with the restrictions listed in the critical habitat designation. Native vegetation removal necessary for maintenance of water supply structures is not explicitly covered by the existing Recovery Permit. The USFWS may allow this activity under the existing permit if the water supply structure maintenance activity is necessary for fire management or habitat management (e.g., water supplies for ponds, for livestock troughs that facilitate grazing management of habitat, or for maintenance of tenant, rancher, or staff residences and other structures necessary to facilitate habitat management). Otherwise, vegetation removal that is necessary for water supply structure maintenance for all these fire/habitat management purposes should be explicitly added to the Recovery Permit.

Facility or Feature	Description of Activities	Section 7	Section 10a[1,2]
	▪ Spring box and/or water tank maintenance or replacement ▪ Water line replacement, extensions, or realignments ▪ Instream diversion intake clearing	If maintenance of the water supply structure in question does not serve a residence or other tenant/staff structure, habitat, or fire management purpose (e.g., if the water supply is solely for public drinking water or restrooms), then the activity would need to be covered under Section 7 consultation or omitted from the Program. However, all anticipated maintenance of these water supply structures serves a direct or indirect habitat management purpose and therefore should be covered by the Recovery Permit.	Although the Recovery Permit does not explicitly mention these activities, the USFWS may allow them under the existing permit if the water supply structure in question clearly contributes to fire management or habitat management (e.g., water supplies for ponds, for livestock troughs that facilitate grazing management of habitat, or for maintenance of tenant, rancher, or staff residences and other structures necessary to facilitate habitat management). If deemed necessary (for Recovery Permit coverage) by the USFWS, these activities should be explicitly added to the Recovery Permit, when pertaining to water supply structures that contribute to habitat management.

DRAFT

Facility or Feature	Description of Activities	Section 7	Section 10a[1,2]
Roads	▪ Grading and shaping (may include rocking) ▪ Culvert repair and replacement ▪ Removal of asbestos from culverts and other structures ▪ Sediment and debris removal at inboard ditches and stream crossings (including culvert inlets, outlets, and rocked fords) ▪ Fords and swales repair and replacement (including new culverts in place of fords) ▪ Bank stabilization ▪ Repair of gabion rock or riprap ▪ Road brushing/mowing ▪ Vegetation management ▪ Installation of new roadside and trailside ditch relief culverts at non-stream crossings Repair and replacement of driveways Minor relocation of roads (unpaved)	If any of these activities do not serve a direct or indirect habitat or fire management purpose, then the activity would need to be covered under Section 7 consultation or omitted from the Program. However, all anticipated road maintenance serves a direct habitat management purpose (e.g., by avoiding erosion or sedimentation) or indirect habitat management purpose (e.g., by providing staff and tenants access to habitat management and enhancement areas, or to residences/facilities for these staff/tenants) and therefore should be covered by the Recovery Permit.	The Recovery Permit generally mentions "road and trail maintenance" as being covered, but without any details regarding specific activities that are covered under the permit. Per Midpen's prior coordination with the USFWS, the USFWS is expected to consider any of these road maintenance activities to be covered under the existing permit because they facilitate access for covered species habitat management (e.g., by allowing land managers and cattle to access certain areas for habitat management purposes) or avoid or reduce an adverse condition (e.g., erosion or sedimentation). If any such activities are not covered by the permit, then they should be explicitly added to the Recovery Permit.

Facility or Feature	Description of Activities	Section 7	Section 10a[1,2]
Bridges	▪ Replace decking and handrails ▪ Minor structural repairs ▪ Repair and fortify bridge abutments ▪ Sediment and debris removal ▪ Addition of surface material to puncheons ▪ Vegetation management/removal ▪ Bridge removal or replacement (e.g., increasing span to outside OHWM) ▪ Removal of lead paint	If any of these activities do not serve a habitat or fire management purpose, then the activity would need to be covered under Section 7 consultation or omitted from the Program. However, all anticipated bridge maintenance serves a direct habitat management purpose (e.g., by avoiding erosion or sedimentation) or indirect habitat management purpose (e.g., by providing staff and tenants access to habitat management and enhancement areas, or to residences/facilities for these staff/tenants) and therefore should be covered by the Recovery Permit.	The Recovery Permit generally mentions "road and trail maintenance" as being covered, but without any details regarding specific activities that are covered under the permit. Per Midpen's prior coordination with the USFWS, the USFWS is expected to consider any of these bridge maintenance activities to be covered under the existing permit because they facilitate access for covered species habitat management (e.g., by allowing land managers and cattle to access certain areas for habitat management purposes) or avoid or reduce an adverse condition (e.g., erosion or sedimentation). If any such activities are not covered by the permit, then they should be explicitly added to the Recovery Permit.
Roadside/trailside ditches	▪ Replace culverts and ditches ▪ Replace and repair fords ▪ Sediment and debris removal ▪ Vegetation management ▪ Cleaning ditches	If any of these activities do not serve a habitat or fire management purpose, then the activity would need to be covered under Section 7 consultation or omitted from the Program.	See "Roads" above. Per Midpen's prior coordination with the USFWS, the USFWS is expected to consider any of these roadside/trailside maintenance activities to be covered under the existing permit because they facilitate access for covered species habitat management (e.g., by allowing land managers and cattle to access certain areas for habitat management purposes) or avoid or reduce an adverse condition (e.g., erosion or sedimentation).

Facility or Feature	Description of Activities	Section 7	Section 10a[1,2]
		However, as discussed for "Roads" above, all anticipated road maintenance serves a direct habitat management purpose (e.g., by avoiding erosion or sedimentation) or indirect habitat management purpose (e.g., by providing staff and tenants access to habitat management and enhancement areas, or to residences/facilities for these staff/tenants) and therefore should be covered by the Recovery Permit.	Also, the USFWS may be amenable to amending the Recovery Permit to include activities related to trails that are used only for recreation but that facilitate listed species conservation by directing the public away from more sensitive habitat areas.
Trails	▪ Grading and shaping ▪ Culvert repair and replacement ▪ Repair and replace fords and swales (including with new culverts) ▪ Bank stabilization ▪ Repair of gabion rock or riprap ▪ Trail brushing/mowing ▪ Vegetation management ▪ Minor relocation ▪ Sediment and debris removal at channel/trail crossings	If any of these activities do not serve a habitat or fire management purpose, then the activity would need to be covered under Section 7 consultation or omitted from the Program.	See "Roads" above. Per Midpen's prior coordination with the USFWS, the USFWS is expected to consider any of these trail maintenance activities to be covered under the existing permit because they facilitate access for covered species habitat management (e.g., by allowing land managers and cattle to access certain areas for habitat management purposes) or avoid or reduce an adverse condition (e.g., erosion or sedimentation). Also, the USFWS may be amenable to amending the Recovery Permit to include activities related to trails that are used only for recreation but that facilitate listed species conservation by directing the public away from more sensitive habitat areas.

Facility or Feature	Description of Activities	Section 7	Section 10a[1,2]
		However, as discussed for "Roads" above, all anticipated trail maintenance serves a direct habitat management purpose (e.g., by avoiding erosion or sedimentation) or indirect habitat management purpose (e.g., by providing staff and tenants access to habitat management and enhancement areas, or to residences/facilities for these staff/tenants) and therefore should be covered by the Recovery Permit.	
Creeks	▪ Vegetation management	N/A	Non-native plant management is explicitly covered by the existing Recovery Permit, but only herbicides that are part of a formal integrated pest management plan may be used, and only if they are used in accordance with the guidelines on the label and if they comply with the restrictions listed in the critical habitat designation.

Facility or Feature	Description of Activities	Section 7	Section 10a[1,2]
			Native vegetation removal necessary for creek maintenance is not explicitly covered by the existing Recovery Permit. The USFWS may allow this activity under the existing permit if it clearly contributes to habitat management by improving instream habitat or avoiding/reducing an adverse condition such as erosion and sedimentation. Otherwise, vegetation removal that is necessary for creek maintenance, and that has a clear nexus to habitat management and enhancement, and species recovery, should be explicitly added to the Recovery Permit.
	▪ Sediment and debris removal ▪ Downed tree management and large woody material removal ▪ Bank stabilization	If creek maintenance does not serve a habitat or fire management purpose, then the activity would need to be covered under Section 7 consultation or omitted from the Program.	The Recovery Permit does not explicitly mention creek maintenance activities. However, the USFWS may allow them under the existing permit because they clearly contribute to habitat management by improving instream habitat or avoiding/reducing an adverse condition such as erosion and sedimentation, or because they help avoid damage to infrastructure used by staff and tenants to access habitat management and enhancement areas, or residences/facilities for these staff/tenants. If deemed necessary (for Recovery Permit coverage) by the USFWS, these activities should be explicitly added to the Recovery Permit.

Facility or Feature	Description of Activities	Section 7	Section 10a[1,2]
		However, anticipated creek maintenance serves a direct habitat management purpose (e.g., by reducing erosion or excessive sedimentation) or indirect habitat management purpose (e.g., by avoiding damage to infrastructure used by staff and tenants to access habitat management and enhancement areas, or residences/facilities for these staff/tenants) and therefore should be covered by the Recovery Permit.	
Other Midpen Parks and Open Space features (picnic or rest areas, natural areas, rangeland, staging areas, parking lots, tenant structures, remote offices, etc.)	▪ Non-native vegetation removal (e.g. manual, mechanical, chemical, and biological) in natural lands	N/A – In recent years, the USFWS has generally declined to cover herbicide use in Section 7 consultations.	This activity is explicitly covered by the existing Recovery Permit, but only herbicides that are part of a formal integrated pest management plan may be used, and only if they are used in accordance with the guidelines on the label and if they comply with the restrictions listed in the critical habitat designation.

Facility or Feature	Description of Activities	Section 7	Section 10a[1,2]
	▪ Fire fuel management (e.g. manual, mechanical, and chemical) for disc lines and fuel breaks ▪ Maintenance/clearing of defensible space buffers around buildings, staging areas, roads, trails, and use areas	If any of these activities do not serve a habitat management purpose, then the activity would need to be covered under Section 7 consultation or omitted from the Program. However, all anticipated fire management activities serve a direct habitat management purpose (e.g., by avoiding habitat loss and degradation due to wildfire) or indirect habitat management purpose (e.g., by protecting infrastructure for staff and tenants who perform habitat management/enhancement activities) and therefore should be covered by the Recovery Permit.	The Recovery Permit mentions "hazardous fuel reduction activities" only once, without any detail regarding which activities are and are not covered. The USFWS may allow fire fuel management and maintenance/clearing of defensible space under the existing permit because all anticipated fire management activities serve a direct habitat management purpose (e.g., by avoiding habitat loss and degradation due to wildfire) or indirect habitat management purpose (e.g., by protecting infrastructure for staff and tenants who perform habitat management/enhancement activities). If deemed necessary (for Recovery Permit coverage) by the USFWS, these activities should be explicitly added to the Recovery Permit.
	▪ Mechanical and chemical treatment of vegetation at helicopter landing zones	See previous row - all anticipated fire management activities serve a direct or indirect habitat management purpose and should be covered by the Recovery Permit.	Clearing of non-native vegetation for habitat management purposes is covered by the existing Recovery Permit, but only herbicides that are part of a formal integrated pest management plan may be used, and only if they are used in accordance with the guidelines on the label and if they comply with the restrictions listed in the critical habitat designation.

Facility or Feature	Description of Activities	Section 7	Section 10a[1,2]
			See previous row – the USFWS may allow clearing of native vegetation to maintain helicopter landing zones under the existing permit because helicopters are engaged in habitat management activities (such as fire protection). If deemed necessary (for Recovery Permit coverage) by the USFWS, these activities should be explicitly added to the Recovery Permit if they are related to habitat management.
New Facilities and Improvements			
Bridges	▪ Bridge relocation or new installation	See the bridge maintenance section above. Bridges serve a direct habitat management purpose (e.g., by avoiding erosion or sedimentation) or indirect habitat and fire management purpose (e.g., by providing staff and tenants access to habitat management and enhancement areas, or to residences/facilities for these staff/tenants) and therefore should be covered by the Recovery Permit.	Per Midpen's prior coordination with the USFWS, the USFWS is expected to consider bridge relocation or installation to be covered under the existing permit because this activity facilitates access for covered species habitat management (e.g., by allowing land managers and cattle to access certain areas for habitat management purposes) or avoid or reduce an adverse condition (e.g., erosion or sedimentation). If any such activities are not covered by the permit, then they could be explicitly added to the Recovery Permit when necessary for habitat management purposes, if the USFWS is amenable.

Facility or Feature	Description of Activities	Section 7	Section 10a[1,2]
Interpretive facilities and signage	▪ Installation of new interpretative facilities and infrastructure at existing parks	Implementation of minimization measures can likely avoid take of listed species during these activities. Otherwise, interpretive facilities and signage serve a habitat and fire management purpose by reducing the potential for adverse effects and therefore should be covered by the Recovery Permit.	It is possible that the USFWS could consider the installation of interpretive facilities or signage to be covered under the existing permit, particularly if it reduces the potential for adverse effects (e.g., by instructing the public to avoid listed species habitat or to report invasive species or other adverse conditions). If any such activities are not covered by the permit, and take of listed species during these activities cannot be avoided with minimization measures, then they could be explicitly added to the Recovery Permit, if the USFWS is amenable.
Ranching infrastructure	▪ Improve existing or install new ranching infrastructure, including fences, corrals, stock water	Implementation of minimization measures can likely avoid take of listed species during most of these activities. Otherwise, ranching infrastructure serves a direct habitat management purpose (e.g., by preventing unwanted livestock access to sensitive habitats) or indirect habitat management purpose (e.g., by enabling habitat management through managed grazing) and therefore should be covered by the Recovery Permit.	The Recovery Permit covers grazing management activities, and the USFWS's BO for the Recovery Permit discusses installation and maintenance of grazing infrastructure. Because managed grazing is an important habitat management tool, all these activities are expected to be covered by the Recovery Permit.

Facility or Feature	Description of Activities	Section 7	Section 10a[1,2]
Utilities	▪ Maintenance of septic, telephone, telecommunications, and other utilities etc.	Implementation of minimization measures can likely avoid take of listed species during most of these activities. Otherwise, these activities serve an indirect fire and habitat management purpose by maintaining infrastructure and communications for tenants and staff who perform habitat management and enhancement activities; these activities should therefore by covered by the Recovery Permit.	It is possible that the USFWS could consider the maintenance of utilities to be covered under the existing Recovery Permit given the indirect habitat and fire management benefits (e.g., by maintaining infrastructure and communications for tenants and staff who perform habitat management and enhancement activities). If any such activities are not covered by the permit, and take of listed species during these activities cannot be avoided with minimization measures, then they could be explicitly added to the Recovery Permit, if the USFWS is amenable.
Trails	▪ Reroute existing trails and provide new trail connections and public access	See the trail maintenance section above. Trail construction can serve a habitat management purpose by providing staff and tenants access to habitat management and enhancement areas, or to residences/facilities for these staff/tenants) and by directing the public away from sensitive habitat areas, and therefore should be covered by the Recovery Permit.	Rerouting of existing trails or providing new trails and public access is not explicitly covered by the USFWS under the existing Recovery Permit. However, the USFWS may be amenable to covering these activities under the existing permit given the habitat management benefits they provide (e.g., by providing staff and tenants access to habitat management and enhancement areas, or to residences/facilities for these staff/tenants and by directing the public away from more sensitive habitat areas. If any such activities are not covered by the permit, they could be explicitly added to the Recovery Permit, if the USFWS is amenable.

Facility or Feature	Description of Activities	Section 7	Section 10a[1,2]
Wildlife crossings	▪ Construct wildlife crossings, some of which may also provide public access	If the USFWS does not want to cover these activities under the Recovery Permit (e.g., because they involve new facilities or may also provide public access), then they would need to be covered under Section 7 consultation or omitted from the Program. However, any wildlife crossing could facilitate movement of listed species across roads, and therefore should be covered by the Recovery Permit.	This activity is not explicitly covered by the existing Recovery Permit. However, the USFWS may be amenable to covering construction of wildlife crossings under the existing permit given the conservation benefits they provide. If not, the Recovery Permit could be amended to include construction of these crossings.
Existing buildings and structures	▪ Repair existing structures to provide habitat or to exclude wildlife species when there is a human safety issue (e.g., related to bats or rats)	Implementation of minimization measures may be able to avoid take of listed species during these activities. Otherwise, these activities serve an indirect fire and habitat management purpose by maintaining infrastructure for tenants and staff who perform habitat management and enhancement activities; these activities should therefore by covered by the Recovery Permit.	The existing Recovery Permit includes removal of dilapidated structures but does not explicitly mention repair of buildings. The USFWS may be amenable to covering these activities under the existing permit given the indirect habitat management benefits they provide (e.g., for tenants and staff who perform habitat management and enhancement activities). If not, the Recovery Permit could be amended to include these activities.

Facility or Feature	Description of Activities	Section 7	Section 10a[1,2]
Water infrastructure	▪ Install or replace or remove degraded water infrastructure facilities	If maintenance of water infrastructure in question does not serve a residence or other tenant/staff structure, habitat, or fire management purpose (e.g., if the water supply is solely for public drinking water or restrooms), then the activity would need to be covered under Section 7 consultation or omitted from the Program. However, all anticipated removal, installation, or replacement of water supply structures would serve a direct or indirect habitat management purpose and therefore should be covered by the Recovery Permit.	The existing Recovery Permit includes removal of dilapidated structures, so the USFWS is likely to allow maintenance of degraded water infrastructure facilities under the existing permit. In addition, the USFWS may allow installation or replacement of water infrastructure under the existing permit if the water supply structure in question clearly contributes to fire management or habitat management (e.g., water supplies for ponds, for livestock troughs that facilitate grazing management of habitat, or for maintenance of tenant, rancher, or staff residences and other structures necessary to facilitate habitat management). If deemed necessary (for Recovery Permit coverage) by the USFWS, these activities should be explicitly added to the Recovery Permit, when pertaining to water infrastructure that contributes to habitat management.

Facility or Feature	Description of Activities	Section 7	Section 10a[1,2]
Restoration and Enhancement Activities			
Removal of in-stream infrastructure (i.e., impoundments), collapsed structures (i.e., bridges or culverts), and anthropogenic debris or fish passage barriers, or upsizing of culverts	▪ Improvement of fisheries habitat and fish passage, flows, sediment transport	N/A	These activities have a clear nexus to habitat management and enhancement for listed species, and although the Recovery Permit does not explicitly mention all these activities, the USFWS should allow these activities under the existing permit. If deemed necessary (for Recovery Permit coverage) by the USFWS, these activities should be explicitly added to the Recovery Permit.
Native vegetation plantings and seeding	▪ Habitat enhancement	N/A	The existing Recovery Permit includes planting of vegetation in association with pond enhancement activities. These activities have a clear nexus to habitat management and enhancement for listed species, and even if they are not related specifically to pond enhancement, the USFWS should allow these activities under the existing permit. If deemed necessary (for Recovery Permit coverage) by the USFWS, these activities should be explicitly added to the Recovery Permit.

Facility or Feature	Description of Activities	Section 7	Section 10a[1,2]
Wildlife friendly spring box/troughs	▪ Habitat enhancement and prevents wildlife entrapment	N/A	Although the Recovery Permit does not explicitly mention these activities, the USFWS should allow these activities under the existing permit due to their obvious benefits to listed species. If deemed necessary (for Recovery Permit coverage) by the USFWS, these activities should be explicitly added to the Recovery Permit.
Pond and stream restoration	▪ Improve ponds and streams to restore aquatic habitat	N/A	These activities are covered by the existing Recovery Permit.
Treatment of invasive and pest species	▪ Habitat enhancement (including coyote brush management)	N/A – In recent years, the USFWS has generally declined to cover herbicide use in Section 7 consultations.	This activity is explicitly covered by the existing Recovery Permit, but only herbicides that are part of a formal integrated pest management plan may be used, and only if they are used in accordance with the guidelines on the label and if they comply with the restrictions listed in the critical habitat designation.
Exclusion fencing	▪ Habitat enhancement to exclude cattle and protect species	N/A	The Recovery Permit covers grazing management activities, and the USFWS's BO for the Recovery Permit discusses installation and maintenance of grazing infrastructure such as fencing. Because managed grazing is an important habitat management tool, yet sensitive habitats need to be protected from unwanted livestock access, these activities are expected to be covered by the Recovery Permit.

Facility or Feature	Description of Activities	Section 7	Section 10a[1,2]
Prescribed burns	▪ Habitat enhancement and fuels management (including coyote brush management)	N/A	These activities are covered by the existing Recovery Permit.
Conservation grazing	▪ Fuels and species management (including coyote brush management)	N/A	These activities are covered by the existing Recovery Permit.
Road decommissioning	▪ Restored hydrology and watershed processes	N/A	The existing Recovery Permit includes removal of dilapidated structures. Although the Recovery Permit does not explicitly mention road decommissioning, the USFWS should allow this activity under the existing permit because it has a clear benefit to listed species. If deemed necessary (for Recovery Permit coverage) by the USFWS, this activity should be explicitly added to the Recovery Permit.
Structural demolitions in riparian areas	▪ Habitat enhancement	N/A	The existing Recovery Permit includes removal of dilapidated structures.

1. Eligibility for coverage of activities under the 10(a)(1)(A) Recovery Permit assumes that all administrative/notification requirements of the permit, such as inclusion of an activity in the annual workplan, are satisfied.

2. The 10(a)(1)(A) Recovery Permit currently covers activities on Midpen lands only in San Mateo and Santa Clara Counties. No activities on Midpen lands in Santa Cruz County could currently be covered under the Recovery Permit, but the permit should be amended to include activities in that county.

Appendix B Meeting Notes and Guidance from Regulatory Agencies

Inter-Agency Meeting
for the
Midpeninsula Regional Open Space District
Routine Maintenance and Facilities Improvements Program
4/11/19
Meeting Notes

Attendees:

Frances Malamud-Roam, USACE
Walt Deppe, BCDC
Randi Adair, CDFW
Kim Sanders, Central Coast RWQCB
Brian Meux, NOAA Fisheries
Kirk Lenington, Midpen
Aaron Hébert, Midpen
Julie Andersen, Midpen
Coty Sifuentes-Winter, Midpen
Jeff Thomas, Horizon Water and Environment
Bridget Lillis, Horizon Water and Environment
Steve Rottenborn, H. T. Harvey & Associates

Date and Time: Thursday, April 11, 2019 from 1:40 p.m. to 3:10 p.m.

I. Program Presentation (provided separately)

II. Agency Discussion and Comments

A. NOAA Fisheries

- Does it make sense to pursue a programmatic Biological Opinion (BO) and Incidental Take Authorization with NOAA Fisheries?
    - Consultation has not been required for Midpen projects conducted within the past five years.
    - Most projects will occur within the upper watersheds, generally beyond barriers to anadromous species, though Midpen is looking to acquire some lower-elevation properties.
    - Suggestion of submitting specific actions/projects with potential for fisheries impacts one year ahead for concurrence under the Regional General Permit (RGP), similar to East Bay Regional Parks District (EBRPD).
    - Might also be able to utilize the 2018 NLAA programmatic BO issued to the USACE.
- Midpen/Horizon will quantify how many projects may require NMFS consultation to determine if programmatic BO makes sense or not.

B. BCDC

- Currently, there are only two preserves within BCDC jurisdiction. When conducting routine maintenance work along the Bayside, Midpen should be aware of areas within BCDC jurisdiction.

- It makes the most sense to handle each project individually for BCDC unless Midpen acquires more land within BCDC jurisdiction. BCDC and EBRPD have a larger agreement that could be used as a model if Midpen acquires more land within BCDC jurisdiction.

C. USACE
- USACE will confirm acceptability of developing an RGP that provides flexibility to include future land acquisitions in the Midpen operational boundary or participation by adjacent landowners or partners.
- USACE would prefer a single annual notification and requested that enough time after winter weather has passed be included for Midpen to assess and ensure the projects for the year are within the categories included in the Program.
- USACE does not see any issues with the proposed mitigation approach and does not require compensation for restoration.
- A cultural records search for sites will be required, including cultural resource sensitivity maps. Be aware that structures over 50-years old will need to be evaluated if they will be impacted.
    - EBRPD may have a programmatic agreement with the State Historic Preservation Officer (SHPO). USACE will follow up with information regarding EBRPD's SHPO and Section 106 compliance process.
- Wetland delineations will be conducted on an annual basis.
    - There are two types of wetland delineations: (1) preliminary and (2) approved. Preliminary wetland delineations do not expire and approved wetland delineations are valid for five years.
    - USACE will forward the regulatory guidance letter on wetland delineations.
    - Ponds constructed in uplands may not be jurisdictional to the USACE. Might want approved jurisdictional delineation for illegal-created ponds that Midpen wants to convert back to uplands.

D. Central Coast RWQCB
- Relatively little of Midpen's land is within the jurisdiction of the Central Coast RWQCB. A majority of Midpen land is within the jurisdiction of the San Francisco Bay RWQCB.
- The Central Coast RWQCB will confirm permitting approach with the San Francisco Bay RWQCB, and may defer SFB RWQCB to lead permitting of the Program.

E. CDFW
- No comments.

III. Action Items
- Midpen and consultant team will quantify how many projects they anticipate will require NMFS consultation.
- Frankie Malamud-Roam (USACE) will check on strategies on writing up an RGP that gives flexibility for the potential to acquire more land and/or include Midpen project partners.
- Kim Sanders (Central Coast RWQCB) will contact Tahsa Sturgis (San Francisco Bay RWQCB) to confirm RWQCB permitting approach.

- Frankie Malamud-Roam (USACE) will follow up on EBRPD's SHPO process and provide feedback.
- Frankie Malamud-Roam (USACE) will send regulatory guidance letter on wetland delineations.
- Midpen and consultant team will contact Leif Goude of the U.S. Fish and Wildlife Service to discuss the Program and the approach to Federal Endangered Species Act consultation.
- Midpen and consultant team will develop a draft Program manual over the next 4-5 months for agency review. Anticipate submittal of permit applications by the end of this year.

Midpeninsula Regional Open Space District

Routine Maintenance and Facilities Improvements Program

U.S. Fish and Wildlife Service Pre-Consultation Meeting

Location: Midpen Headquarters, 0330 Distel Circle, Los Altos, Conference Room Ravenswood
Date: June 3, 2019
Time: 12:30-2:15pm

Attendees:

Leif Goude (USFWS)
Julie Andersen (MidPen)
Aaron Hébert (Midpen)
Jeff Thomas (Horizon)
Bridget Lillis (Horizon)
Steve Rottenborn (HT Harvey)
Ginger Bolen (HT Harvey)

Meeting Notes/Action Items

I. Endangered Species Act (ESA) Section 7 Biological Opinion (BO) Approach

- Action Area
  - Should be larger than Midpen current land holdings to account for future acquisitions.
  - Midpen's "sphere of influence" will be the action area.
  - Include "pre-managed" lands – those that are likely to be purchased.
  - Could describe land additions as part of the annual reporting.
- Leif intends for the BO to cover all Program activities that are not covered under Midpen's 10(a)(1)(A) (see below), even if the U.S. Army Corps of Engineers (USACE) wants to limit the scope of the ESA Section 7 consultation.
- Leif suggested that BO should include "other stuff" and "emergency" categories so all effects (e.g., types of take) have been captured even if certain activities aren't specifically described in the Program Manual.
- Leif will prepare a 5-year BO (to match the anticipated USACE Section 404 Regional General Permit term) that includes a description of procedures to renew/reauthorize the BO for additional periods.
- Leif could use the ESA Section 10 recovery permit as basis for preparing the Section 7 BO; however, it doesn't need to be as protective as the recovery permit BO.
- Leif will discuss internally which activities may make be better suited for Section 7 vs Section 10 (See Section IV below).

II. Peninsula Open Space Trust (POST) and San Mateo Resource Conservation District (RCD)

- Include POST lands as 3rd party beneficiary lands in the Program?
  - POST acquires land but does not have much management capacity

    - One option is to include all POST lands in the consultations so that Midpen or POST could do activities on such lands.
- Midpen could partner with San Mateo RCD. For example, Midpen would be able to eradicate bull frog in ponds on RCD managed properties that are close to Midpen land (or vice versa?).
- San Mateo RCD has a running list of unfunded projects that could be supported by 3rd party sources as mitigation. Midpen could consider a similar approach to provide mitigation for outside 3rd parties.

III. Other Mitigation Considerations

- Species-Specific Mitigation Banking Option: Midpen lands support meaningful populations of California red-legged frogs (CRLF) and could create a CRLF mitigation bank, which Leif believes is highly needed in the area. A mitigation bank would solidify the CRLF population in coastal areas on the peninsula.
    - Random projects could purchase credits from the mitigation bank
    - Midpen, as the mitigation bank holder, could turn away projects if found to be in conflict with Midpen's mission or policies.
    - Leif can provide more information to Midpen on the process. The Nature Conservancy has land holdings that are used for mitigation.
    - Aaron indicated that Midpen management can discuss this with their Board; however, Midpen would not likely be able to make a CRLF mitigation bank happen within this next year.
    - The parties agreed this a related but separate discussion from current programmatic permitting efforts that can continue on a different timeline
- Regarding desire for Program to be self-mitigating, Leif in agreement with general approach.
    - A more qualitative assessment can be provided annually that addresses impacts versus restoration benefits. For example, annual reports can indicate how many acres of potential habitat for a species were impacted (and by what projects) and indicate that those impacts were offset by restoration activities (listing those activities) without needing to quantify the acreage of restored habitat or achieve a certain acre-for-acre mitigation ratio.

IV. ESA Section 7 and Section 10 (i.e., Midpen's 10(a)(1)(A) permit)

- Midpen conducts approximately 24 projects in a given year.
- Leif suggests covering a majority of the activities under ESA Section 7 unless they are truly recovery and/or beneficial activities. Section 7 take limits could potentially be higher than those under Midpen's 10(a)(1)(A). There also may be activities that USFWS Recovery would like added to the Section 7 BO.
    - Midpen will review and assess which activities would best fall under ESA Section 7 compared to Section 10.
    - Leif will follow-up with Sarah Markegard in the USFWS Recovery Unit.
- USFWS preference is to have the Program description include all activities but indicate that take coverage for many will be provided via the 10(a)(1)(A). The Program description would indicate which types of activities would be covered under Section 7.
- The avoidance and minimization measures in Section 7 and Section 10 should be similar to avoid confusion with the crews.

  - Minimize the use of exclusion fencing.
- The Program BO will describe the conservation benefits from Section 10 activities as potentially offsetting any adverse effects of both Section 7 and Section 10-covered activities.
  - Need to incorporate this in the Program manual description.
- Section 10 reporting can be provided as an appendix to the Section 7 annual report.
- USFWS preference to have BO without having to append projects to the BO on an annual basis.
  - Leif suggests preparing mini biological assessments (BAs) (3-5 pages) for Section 7 that include a project/activity description, location, species potential and effects, CNDDB, and maps. Leif will provide examples to Midpen staff for review.
  - Interrelated and interdependent projects, or groups of similar projects, can be lumped together in the same mini BA (e.g., prepare one mini BA for planned culvert replacements).
  - If there are certain conservation measures from the BO that Midpen thinks should not apply to a certain activity, that should be indicated in the mini-BA, for USFWS approval (e.g., for some projects, exclusion fencing is not necessary or appropriate).
  - Send via email for USFWS "yea" or "nay" regarding inclusion in the Program BO. This will make approval process much quicker.
- The USACE may approve this approach as long as they do not need to do extra work.
  - EBRPD implements a similar approach
- The only reason to amend the BO would be the addition of new listed species.

V. Biological Assessment Preparation

- Special-status plants anticipated to have a "not likely to adversely affect" determination.
  - Leif recommends including a few avoidance and minimization measures to protect plants.
  - Include mapping of where the plants are known to occur to show avoidance and support determination.
- Butterflies do not need to be included in the BA at this time unless they are reintroduced, in which case they could be added to the BO.
- Midpen has a reproducing San Francisco garter snake population only at Mindego Ranch; the species could potentially occur at other preserves, but trapping surveys have not detected them elsewhere.
- NMFS consultation not anticipated at this time given location of most activities within upper watershed tributaries and that in-stream work would be a recovery nexus.

VI. Action Items

1. Leif will contact Frankie Malamud-Roam at the USACE to review the BO approach discussed today.
2. Leif will follow-up with Sarah Markegard regarding Section 7 versus Section 10 coverage.
3. Leif to provide examples of well written mini BAs for Midpen staff to review.
4. Midpen and consultant team will assess Program activities and determine which would fall under Section 7 versus Section 10.

Midpeninsula Regional Open Space District

Routine Maintenance and Facilities Improvements Program

SF RWQCB Pre-Application Review Meeting

Location: Conference Call
Date: June 27, 2019
Time: 2:30pm-4:00pm

Attendees:

Tahsa Sturgis (SFB RWQCB)
Aaron Hébert (Midpen)
Jeff Thomas (Horizon)
Bridget Lillis (Horizon)

Meeting Notes/Action Items

I. **Scale of Individual Maintenance Project Site Work**

- Midpen is requesting a larger cy limit to replace poorly designed culverts with adequately sized and aligned ones within the channel which usually requires digging deeper within the channel. The current CDFW permit includes these larger cy limits (75-80 cy) as opposed to the current RWQCB order which has a 25-cy limit.
- RWQCB said that these larger limits do make sense for Midpen to encourage better design.
    - Generally, upsizing culverts is OK where it makes sense geomorphically in the channel/creek. These larger culverts can improve beneficial uses.
    - Need to balance beneficial use with net loss. Arched culverts and bridges with natural beds are good design and allow fish passage; the bottom of the culvert should be buried to encourage natural low flow streams.
- Ensure no net loss policy. The RWQCB would normally limit by linear distance and acreage versus yardage. Annual and program limits in linear feet and acreage by activity type need to be developed for the Program.
- The 2010 WQ Order is outdated and this new permit will not be able to include everything that was included in the old order. The new permit will be different.

II. **Scale of Restoration Work**

- Midpen would like to streamline permitting for road decommissioning (or road and trail conversion) and stock pond restoration.
- Permitting restoration projects is new to RWQCB stream maintenance program permits. The RWQCB said that they would need more information on the stock ponds and other restoration projects. Tahsa felt that Hendry's Creek, as an example, was too large of a project to permit consistently through a program for the RWQCB and would require individual project review.
- Regarding structure of Program, there could be a larger USACE permit with individual RWQCB and CDFW executive review on annual basis for these projects to ensure they are within the general parameters included in the Program.

  - Tahsa will need to discuss with management to confirm if the Board could approve a general structure up front.
- SWRCB is developing a statewide general order for restoration which should speed up the permitting process for restoration projects. The order is anticipated to be completed by Summer 2020.

III. Season of Work and Working in Water

- Extending the work window for in-channel work and allowing work through the year to be consistent with the CDFW permit will be difficult for the RWQCB. In-channel work not historically allowed in rainy season.
  - The work window may be adjusted for different types of projects. The RWQCB will likely have some restrictions on in-channel work.
  - Possible submittal of a dewatering plan for specific activities?
  - Possible use of Regional General Permit #5 for corrective actions?
- Tahsa would like to review the existing CDFW permit.
- Midpen/Horizon/RWQCB will circle back on this topic.

IV. New Small-Scale Facilities and Improvements

- Including new small-scale facilities (e.g., new trails, waterlines) seems possible to include in the permit
  - Would not include larger infrastructure improvements
  - Tahsa will discuss with Brian.

V. New Lands and Midpen Oversight on Private Lands

- Midpen acquires new lands each year and they often require immediate work due to deleterious conditions. As long as the activities proposed on the new properties are consistent with those included in the RWQCB Order, they should be able to be covered.
  - Need to identify potential watersheds where these would occur.
- Regarding extending permit coverage to third parties, Tahsa will need to discuss with legal counsel as permits are generally issued to property owners.

VI. Annual Notification vs. Split Notifications

- RWQCB prefers an annual notification which should be streamlined to meet agency needs.
- Other urgent projects can pop up throughout the year - is there an instream ad-hoc process that could be developed?
- Need to think through process to ease review needed by RWQCB. Horizon can come up with a formatting recommendation on how to streamline the paperwork.
- Note that there would be no hard expiration date in the issued Order.

VII. Minor Portions of Central Coast RWQCB's Area

- Kim Sanders at the inter-agency meeting was supportive of the SF RWQCB handling the permits.
- Tahsa will contact Kim to discuss and confirm this approach.

Action Items:

1. **Aaron** will provide Tahsa with the most current CDFW RMA.
2. **Horizon/Midpen** will think through and develop annual limits and program limits (i.e., linear feet and acreage) for the various types of activities included in the program.

3. **Horizon/Midpen** and **RWQCB** will think through a general process for the inclusion of restoration projects in the Program with potential RWQCB officer review. **Tahsa** will discuss this idea with management.
4. **Tahsa** will review current CDFW RMA, including the work windows and think about adjusting the season of work for some types of activities.
5. **Tahsa** will discuss the inclusion of small-scale facilities and improvements projects with Brian.
6. **Horizon/Midpen** will refine what would be included in small-scale facilities.
7. **Tahsa** will check with legal counsel on the RWQCB issuing a permit that would cover third party lands that Midpen would like to do work on, and on how newly acquired lands could be incorporated within the terms of the issued Order.
8. **Tahsa** will check with Kim Sanders (Central Coast RWQCB) and confirm the approach for permitting the Program.
9. **Horizon** will develop language for annual notification process and an annual notification template to meet RWQCB' needs.
10. **Midpen/Horizon** will schedule a check-in call with RWQCB in 6 to 8 weeks.

Bridget Lillis <bridget@horizonh2o.com>

Re: [EXTERNAL] Midpen and USFWS 11/30 Meeting Notes

Lantz, Samantha M <samantha_lantz@fws.gov> Wed, Dec 16, 2020 at 2:48 PM
To: Bridget Lillis <bridget@horizonh2o.com>, "Hull, Josh" <Josh_Hull@fws.gov>, "Tattersall, Eric" <eric_tattersall@fws.gov>
Cc: Jeff Thomas <jeff@horizonh2o.com>, Aaron Hebert <ahebert@openspace.org>, Julie Andersen <jandersen@openspace.org>, Steve Rottenborn <srottenborn@harveyecology.com>, "Goude, Leif M" <leif_goude@fws.gov>

Hi all,

I just wanted to give folks a quick update that it will not be until after the holidays that we are able to discuss all of this with the relevant people within our office. Looking at the notes that Bridget sent (thank you!) and based on conversations that Josh and I have had, fuels management is something that we can cover under a recovery permit, as is structural demolition in riparian areas.

Happy holidays all and looking forward to continuing these conversations next year.

Sam

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Samantha Lantz, PhD
Fish and Wildlife Biologist
USFWS, Sacramento Field Office
Listing and Recovery Division
2800 Cottage Way W-2605
Sacramento, CA 95825-1888
Phone: 916-414-6526
Pronouns: she/her/hers

In an effort to slow the spread of the coronavirus (COVID-19), staff in the Sacramento Fish and Wildlife Office have implemented an aggressive telework schedule. At this time, we are responding to requests for information via email or phone as often as possible as we do not have the in-office capacity to support regular mail service. We appreciate your understanding.

From: Bridget Lillis <bridget@horizonh2o.com>
Sent: Wednesday, December 2, 2020 9:47 AM
To: Lantz, Samantha M <samantha_lantz@fws.gov>; Hull, Josh <Josh_Hull@fws.gov>; Tattersall, Eric <eric_tattersall@fws.gov>
Cc: Jeff Thomas <jeff@horizonh2o.com>; Aaron Hebert <ahebert@openspace.org>; Julie Andersen <jandersen@openspace.org>; Steve Rottenborn <srottenborn@harveyecology.com>; Goude, Leif M <leif_goude@fws.gov>
Subject: [EXTERNAL] Midpen and USFWS 11/30 Meeting Notes
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.

Hi all,

Meeting notes from the 11/30 call are below. Please let us know if you have any questions and/or revisions. Thank you.

USFWS 11/30 Meeting Notes

- The USFWS, Midpen and the consultant (H.T. Harvey and Horizon) team reviewed the previously prepared Section 7 and Section 10a(1)(A) table detailing which activities Midpen anticipates being covered under Section 7 vs. Recovery Permit. USFWS noted that some activities that were covered under the previous Recovery Permit will no longer be covered under the new Recovery Permit. Instead these activities will be covered under Section 7. Key discussion points are summarized below.
    - The USFWS will cover activities under the Recovery Permit if the activity directly benefits listed species or if the *intent* of the activity is to benefit listed species. Activities such as road, trail, and bridge construction, maintenance, or repair will no longer be covered under the Recovery Permit unless the activity is being performed specifically to benefit listed species.
    - Ponds: Construction of new ponds would be covered under the Recovery Permit as this activity would be considered a restoration action, though USFWS would want to review specific plans/proposals for new pond construction.
    - Water supply structures: This activity would be considered a recovery activity that benefits listed species.
    - Roads: Aaron previously prepared and submitted a memorandum describing the relationship between road maintenance/improvements and the recovery of CRLF. USFWS does not consider road maintenance/improvements recovery actions unless the roadwork is directly related to a restoration activity that benefits the species. Generally, these types of activities will not be included in the new Recovery Permit unless they are specifically for habitat maintenance, enhancement, or restoration purposes.
        - Note that road decommissioning work and maintenance of roads specifically for the purpose of enabling habitat management would be considered a recovery action.
    - Bridges: If the bridge work is considered an upgrade and would benefit the species/ restore habitat (i.e., removing instream crossing or culvert) then it would be considered a recovery action. USFWS stated that generally replacing the bridge decking or handrails would not be considered a recovery action.
        - Midpen removes lead based paint from bridges to reduce flaking in streams to improve water quality. This type of activity would be considered a benefit to the species and be covered under the Recovery Permit.
    - Roadside/trailside ditches: Generally, maintenance of roads and trails would not be covered under the Recovery Permit. However, if the activity directly benefits the species and it is being conducted for recovery purposes, it would be covered under the Recovery Permit.
    - Trails: Rerouting trails to avoid species or to be farther away from sensitive habitats would be considered a recovery activity.
    - Creeks: Vegetation management, sediment removal, and bank stabilization activities would be considered recovery actions if the purpose is to protect water quality and aquatic habitat.
    - Vegetation management/Fire fuel management: Invasive plant removal is considered a recovery action to support species. This activity is typically combined with fire fuel management work (e.g., invasive plant removal and shaded fuel break work at Bear Creek Redwoods). At Bear Creek Redwoods, the primary intent of the vegetation work is for wildland fire resiliency purposes as well as to restore the natural habitat for potential use by CRLF. Fuel breaks that are generally conducted to protect human life and structures would not be considered a recovery action. However, if the purpose of the fuel break is to benefit species or restore habitat or the natural regime, then it may be considered a recovery action. Generally, these activities have the potential for take but there is usually no federal nexus for these types of projects. **Josh Hull** will discuss fire fuel management activities internally and circle back with

Midpen/consultant team.

- New facilities and improvements:
  - Interpretive signage would not be considered a recovery action and would likely not result in any take. **Midpen** will discuss internally with Renee regarding interpretive facilities not being considered recovery.
  - USFWS agreed that ranching infrastructure and grazing management activities (e.g., maintaining infrastructure such as fences, stock ponds, etc.) would be covered by the Recovery Permit. Midpen noted that these activities would have a very low potential for take, and that it would be labor intensive and costly if avoidance and minimization measures require monitors to be present in all locations where CRLF has the potential to occur. **Josh Hull** will confirm monitoring requirements/approach for grazing management with Ryan Olah and Leif Goude. Some take is allowable as long as the level of take does not jeopardize the species.
  - Utility infrastructure would ~~likely~~ not be covered under the Recovery Permit.
  - Wildlife crossings would have a direct recovery benefit and thus would be covered under the Recovery Permit.
  - Water infrastructure work is mostly related to grazing and would enhance habitat; thus, this would be covered under the Recovery Permit.
  - Removal of in-stream infrastructure would benefit species. **Josh Hull and Sam Lantz** will discuss internally if structural demolition in riparian areas is considered a recovery action.

- USFWS noted that additional avoidance and minimization measures (AMMS) will likely not be required for activities that were previously covered under the Recovery Permit but will instead be covered under Section 7 (e.g., roadwork). USFWS's number one priority is to minimize effects to species and the Section 7 permit will include previous, effective Recovery Permit AMMs.
- For optics purposes, Midpen would prefer to keep as much work as possible under the new Recovery Permit. The manual and title of Midpen's Program will reflect that the intent of Midpen's work is to restore the ecosystem/habitat, benefiting the natural environment. **Midpen/Horizon** will discuss the how the Program and manual are presented to the public and revise as necessary.
- **Josh Hull/Sam Lantz** will schedule an internal meeting to ensure that Leif Goude and other Section 7 staff are on the same page for permitting recovery activities vs. Section 7 activities. **Midpen/Horizon/HTH** will contact Leif Goude on the Section 7 consultation after USFWS' internal meeting.
- **Midpen/Horizon/HTH** will have a general discussion on activities that have a federal nexus with the USACE and circle back with USFWS.
- **Midpen/Horizon/HTH** will prepare a revised application and BA that includes language stating that the intent of the project will direct which permit the project is covered under.
- **USFWS** will review the tiering memorandum and circle back with Midpen/consultant team if there are any follow-up issues/questions.
- **Julie Andersen** will review next year's reporting to determine which activities are no longer considered recovery actions and which activities would still be covered by the new Recovery Permit.

Attendees:

Josh Hull (USFWS)

Samantha Lantz (USFWS)

Eric Tattersall (USFWS)

Julie Andersen (Midpen)

Aaron Hebert (Midpen)

Steve Rottenborn (HTH)

Jeff Thomas (Horizon)

Bridget Lillis (Horizon)

Bridget Lillis

Horizon Water and Environment

266 Grand Ave., Suite 210

Oakland, CA 94610

(m) 408.858.9646

bridget@horizonh2o.com

See our new website at: https://horizonh2o.com/

Midpeninsula Regional Open Space District
Routine Maintenance and Facilities Improvements Program

SF RWQCB Permitting Coordination Meeting

Meeting Agenda
Friday, January 22, 2021, 10:00am-11:30am
Video Conference Call: https://global.gotomeeting.com/join/892813941

Attendees:

Tahsa Sturgis (SF Bay RWQCB)
Aaron Hébert (Midpen)
Jeff Thomas (Horizon)
Ken Schwarz (Horizon)
Bridget Lillis (Horizon)
Steve Rottenborn (H.T. Harvey)

1/22 Meeting Notes/Action Items

1. Meeting Purpose
    a. To provide an update on Program manual development
    b. To receive feedback and guidance from agency staff on permitting direction, permit application needs, and timeline
2. Program Overview
    a. Aaron led an overview presentation of the Program that included photos of representative sites proposed under the Program.
    b. Midpen's Program is generally consistent with what the RWQCB has permitted in the past; however, the Program does provide more specificity and includes a restoration component.
    c. Tahsa clarified that the RWQCB not only regulates dredge/fill activities but also activities that could potentially affect water quality. In past notifications to the RWQCB, Midpen has included impacts to riparian areas to be consistent with CDFW jurisdiction.
3. Follow-up on Outstanding Questions from June 2019 Call
    a. RWQCB input on process for the inclusion of restoration projects in the Program
        i. Midpen's Program is unique compared to other routine maintenance programs in the Bay Area in that Midpen's overall mission is to benefit the natural environment. The Midpen Program includes a restoration component to link preserve maintenance and small-scale improvement activities that may have temporary/permanent impacts to restoration work that Midpen routinely conducts.
            1. Tahsa understands the purpose of including a restoration component in the Program. However, he noted that Midpen may need to conduct additional mitigation to compensate for overall permanent impacts. Typically, out-of-kind and off-site mitigation requires a larger mitigation ratio by the RWQCB.
            2. Some of the ponds on new Midpen acquisitions were created illegally and are ecological sinks for special-status species (i.e., California red-

legged frog). Midpen decommissions these ponds and restores them to a native condition to benefit the species and habitat. The team discussed how to address no net loss of ponds when these ponds do not provide useful habitat for species and were created illegally and/or have no water rights. Tahsa agreed that the RWQCB could consider offsetting impacts through habitat enhancement; however, land acquisition would not offset these impacts. Ponds are considered jurisdictional resources.

3. The team discussed developing a measurable outcome for loss of waters and ensuring that there is a direct link of impact to mitigation and the benefits it provides. **Horizon/Midpen** will add a general description of this discussion on mitigation to the Manual.

ii. The team also discussed the possibility of Midpen being able to use land acquisition to offset riparian impacts from other Program activities. This would allow Midpen to continue to enhance and restore degraded areas.

1. Ken and Steve discussed that the Santa Clara Valley Water District's (Valley Water's) Stream Maintenance Program included acquisition, preservation, and management of upper watershed areas containing streams as mitigation for routine maintenance activities. **Tahsa** will review the 401 permit and discuss with his supervisor to see if land acquisition and management could be used as mitigation credits as part of Midpen's Program. Tahsa noted that the RWQCB will need to understand the net benefit of the land acquisition and that mitigation credits cannot be relied on solely to achieve no net loss. A crosswalk table linking impacts and mitigation could be included in the annual notifications.

2. Mitigation projects do not necessarily need to be completed within the same year to offset impacts. The RWQCB stated that if mitigation projects are completed the next year, Midpen would likely need to compensate for temporal loss until the mitigation is implemented.

b. RWQCB legal counsel input on issuing a permit that would cover third party lands that Midpen would like to do work on, and on how newly acquired lands could be incorporated within the terms of the issued Order.

i. Midpen would like the flexibility to conduct Program activities that provide a public benefit on third party lands (e.g., POST, San Mateo RCD, or private landowner). Midpen would assume ownership and responsibility for the work. Other agencies, including Sonoma County Water Agency and Napa County Flood Control, have agreements/MOUs with local entities to conduct activities on their lands. **Tahsa** will discuss this approach with legal counsel and circle back with the team.

c. Approach for permitting with Central Coast RWQCB

i. There is only a small portion of Midpen lands that are within the Central Coast RWQCB region (~2,000 acres). Midpen is working to acquire the Cloverdale Property within the next few years and would like to have coverage for Program activities conducted on this property within Central Coast RWQCB jurisdiction.

ii. The SF Bay RWQCB will take the permitting lead and the Central Coast RWQCB will likely issue an individual permit, similar to what was done for the County of San Mateo Routine Maintenance Program. **Tahsa** will coordinate with Kim Sanders (Central Coast RWQCB) on this topic.

4. RWQCB Permitting Approach

    a. Amend Order No. 2020-0034 issued to the Napa County Flood Control and Water Conservation District?

        i. The SF Bay RWQCB would prefer to roll Midpen's Program under the new Napa County, Contra Costa County, and San Mateo County 401 permit. However because Midpen's Program is unique, there is a possibility that the RWQCB will chose to issue an individual permit.

    b. Application Requirements and Timeline

        i. The Horizon, HTH, and Midpen team is currently developing the Manual and anticipates completing a draft within the next month.

        ii. The Horizon, HTH, and Midpen team has also been coordinating with USFWS on the approach for covering incidental take of listed species via Section 7 vs. Recovery Permit.

        iii. The CEQA document is currently being prepared and a public draft will likely be available in the next few months.

        iv. Tahsa noted that the RWQCB needs to public notice a public order two months before the Board meeting and CEQA will need to be complete or near complete by that time.

        v. Under the new ruling, the team will need to submit a pre-filing meeting request (refer to RWQCB website for more information on submittal requirements). A permit application can then be submitted after 30 days of the pre-filling request. **Tahsa** will touch base with Frankie (USACE) to discuss the timing for the submittal to ensure he has enough time to review all of the Program materials. **Horizon/Midpen** will email Tahsa with the proposed timing of the Manual, permit apps, and CEQA. Tahsa suggested that the team reach out to him via Microsoft Teams chat for a quicker response.

5. Action Items

    a. **Horizon/Midpen** will add a description of linking impacts to mitigation to the Manual.

    b. **Tahsa** will review the 401 permit for Valley Water's Program and discuss with his supervisor to see if land acquisition could be used as mitigation credits as part of Midpen's Program.

    c. **Tahsa** will discuss the possibility of Midpen being able to work on third party lands under the Program with legal counsel and circle back with the team.

    d. **Tahsa** will coordinate with Kim Sanders (Central Coast RWQCB) on the permitting approach for the Program.

    e. **Tahsa** will touch base with Frankie (USACE) to discuss the timing for the submittal to ensure he has enough time to review all of the Program materials.

f. **Horizon/Midpen** will email Tahsa with the proposed timing of the Manual, permit apps, and CEQA.

Midpeninsula Regional Open Space District
Open Space Maintenance and Restoration Program

SF RWQCB Pre-Application Meeting

Tuesday, May 11, 2021, 2:00pm-3:30pm
Video Conference Call via GoToMeeting

Attendees:

Tahsa Sturgis (SF Bay RWQCB)
Aaron Hébert (Midpen)
Jeff Thomas (Horizon)
Bridget Lillis (Horizon)

5/11 Meeting Notes/Action Items

1. Meeting Purpose
    a. To receive feedback and guidance from RWQCB staff on the permitting process and timeline.
2. Schedule
    a. The Horizon, Midpen, and RWQCB team discussed the overall schedule for the 401 certification. Working backwards, the order must be publicly noticed two months prior to the Board meeting. The public notice period is 30 days and the RWQCB must respond to any public comments and revise the order accordingly within this time period.
    b. According to the new rule, the RWQCB has 60 days to act on a 401 permit application once it has been submitted. **Tahsa** will circle back with the team on what constitutes an action from the USACE standpoint (i.e., if issuing the public notice is considered an action by the USACE).
    c. CEQA and the application/project fees must be submitted to the RWQCB before the order can be publicly noticed. The Manual will also need to be finalized at this time.
        i. **Bridget** will estimate the total project fee based on the estimated expected acreage of impacts conducted for the Program under the 5-year permit term. Aaron will need approval from Midpen's board if over $50k.
        ii. RWQCB may submit comments on the Program through the CEQA process.
    d. **Tahsa** will review the Manual and provide comments back to Midpen/Horizon between 5/21-5/28.
3. Permit Application
    a. Because this Program's IS/MND relies on the analysis conducted in other Midpen programs CEQA documents, the permit application should include all relevant CEQA documents.
    b. Almost all of Midpen's projects would occur within Santa Clara and San Mateo counties, within the SF Bay RWQCB jurisdiction. Currently Midpen only owns one parcel within Santa Cruz County (within Central Coast RWQCB jurisdiction). Tahsa recommends applying for any projects in the Central Coast RWQCB jurisdiction separate from the Program to simply the permitting process.

c. Because the RWQCB only has 60 days to act on the submitted 401 permit application, Tahsa recommends that Midpen hold off on submitting the permit application until Midpen is farther along in the CEQA process (i.e., document is going out for public review) to avoid a denial letter from the RWQCB. Tahsa mentioned that Midpen could also withdraw their permit application to avoid a denial.

    i. Midpen/Horizon anticipate the public draft IS/MND going out for public review in June/July with a potential certification by Midpen's Executive Officer in August. **Midpen/Horizon** will circle back with Tahsa on the CEQA schedule.

d. RWQCB permit fees are increased in October of each year. However, the permit fees that were in place at the time that the permit application was submitted would apply to the project.

4. <u>RWQCB Permitting Approach</u>

    a. The Contra Costa, San Mateo, and Napa County 401 permit (Order No. 2020-0034) would likely be amended to include Midpen's Program. Although the mission of Midpen and their work is different than a flood control district, Midpen is generally supportive of this approach as the permit language refers to each agencies' Program Manual. **Aaron** will review the 401 permit to ensure there are no red flags in the San Mateo, Contra Costa, and Napa County 401 permit.

    b. Tahsa let the team know that the RWQCB is comfortable with extending Midpen's existing certification for another year while Midpen moves through the permitting process for the Program. **Tahsa** will provide Midpen with an extension letter.

    c. Midpen is submitting permit applications to the USACE and CDFW in addition to the RWQCB. The team discussed submitting the USACE permit application to the USACE prior to submitting the 401 application to the RWQCB. **Horizon** will work on the USACE permit application.

        i. **Jeff** will contact Frankie (USACE) to confirm that she is still the appropriate staff person assigned to this permit.

        ii. Midpen has been working closely with USFWS to iron out special-status species issues.

        iii. Midpen will apply for a CDFW permit concurrently with the RWQCB permit. Midpen will be following up with CDFW on their preferred permitting process as the activities conducted under the Program would be similar to the types of activities conducted under the RMA. CDFW staff has changed; the new CDFW staff member working on San Mateo County projects is Wesley Stokes.

5. <u>Follow-up on January 2021 Action Items</u>

    a. RWQCB legal counsel input on land acquisition being used as mitigation credits under Midpen's Program

        i. The team also discussed the possibility of Midpen being able to use land acquisition to offset riparian impacts from other Program activities. This would allow Midpen to continue to enhance and restore degraded areas. **Tahsa** will discuss with legal counsel to see if land acquisition and management could be used as mitigation credits as part of Midpen's Program. Tahsa also mentioned

that this approach could be included as part of the mitigation package but Midpen should not rely solely on acquisition for mitigation credits.

1. Tahsa stated that the RWQCB's preferred approach would be for mitigation to be implemented prior to impacts to avoid temporal loss. **Bridget** will add a description in the Manual on the preferred approach for timing of mitigation.

b. RWQCB legal counsel input on issuing a permit that would cover third party lands that Midpen would like to do work on

i. Midpen would like the flexibility to conduct Program activities that provide a public benefit on third party lands (e.g., POST, San Mateo RCD, or private landowner). Midpen would assume ownership and responsibility for the work. Other agencies, including Sonoma County Water Agency and Napa County Flood Control, have agreements/MOUs with local entities to conduct activities on their lands. **Tahsa** will discuss this approach with legal counsel and circle back with the team.

6. <u>Action Items</u>

a. **Tahsa** will circle back with the team on what constitutes an action from the USACE standpoint (i.e., if issuing the public notice is considered an action by the USACE).

b. **Bridget** will estimate the total project fee based on the estimated expected acreage of impacts conducted for the Program under the 5-year permit term.

c. **Tahsa** will review the Manual and provide comments back to Midpen/Horizon between 5/21-5/28.

d. **Midpen/Horizon** will circle back with Tahsa on the CEQA schedule.

e. **Tahsa** will provide Midpen with an extension letter to conduct work this summer while Midpen moves through the programmatic permitting process for the Program.

f. **Jeff** will contact Frankie (USACE) to confirm that she is still the appropriate staff person assigned to this permit.

g. **Tahsa** will discuss with legal counsel to see if land acquisition and management could be used as mitigation credits as part of Midpen's Program.

h. **Bridget** will add a description in the Manual on the preferred approach for timing of mitigation.

i. **Tahsa** will discuss issuing a permit that allows Midpen to conduct work on third party lands with legal counsel and circle back with the team.

Appendix C Cultural Resource Sensitivity Maps

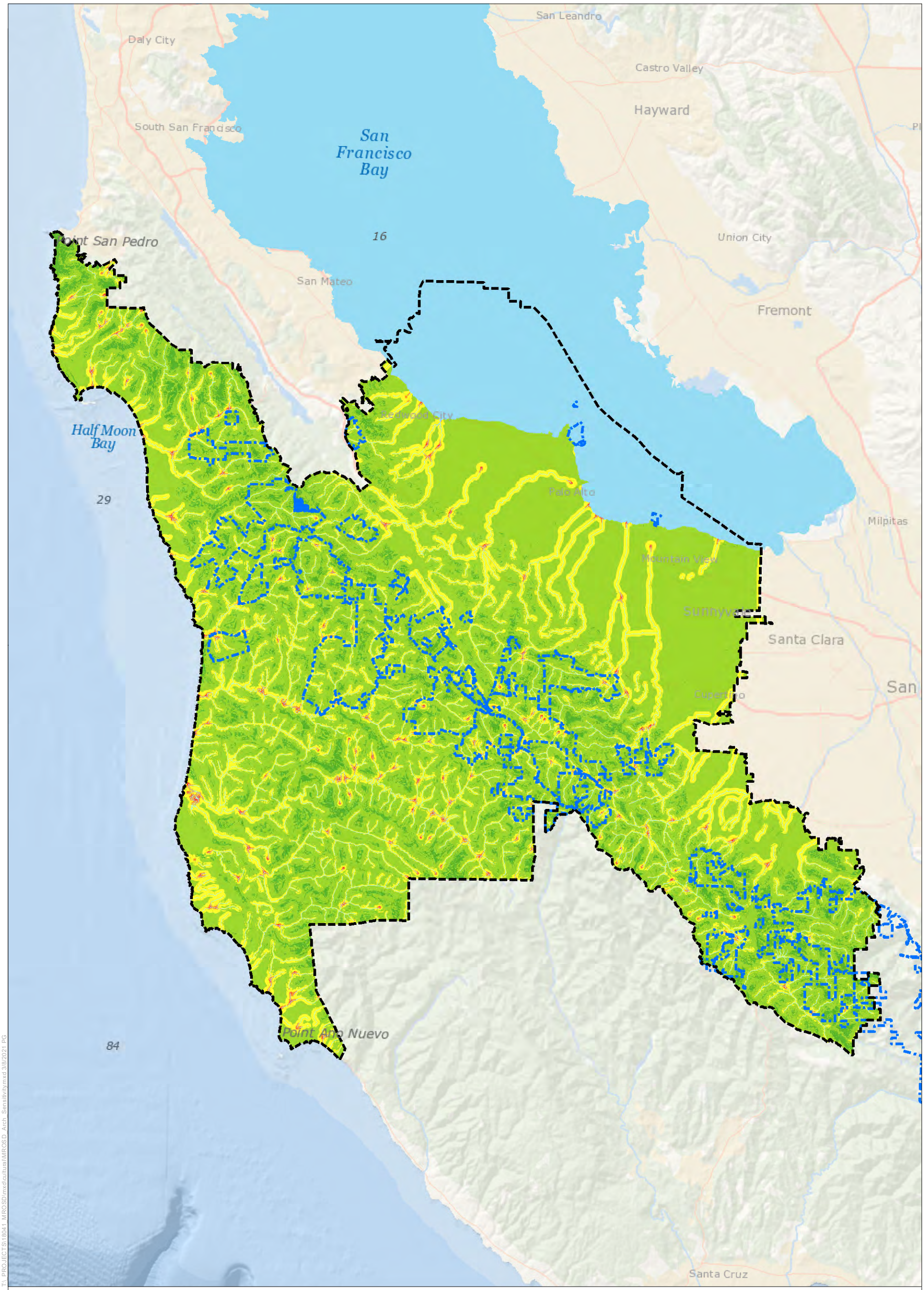


Figure 1
Surface Archaeological Sensitivity

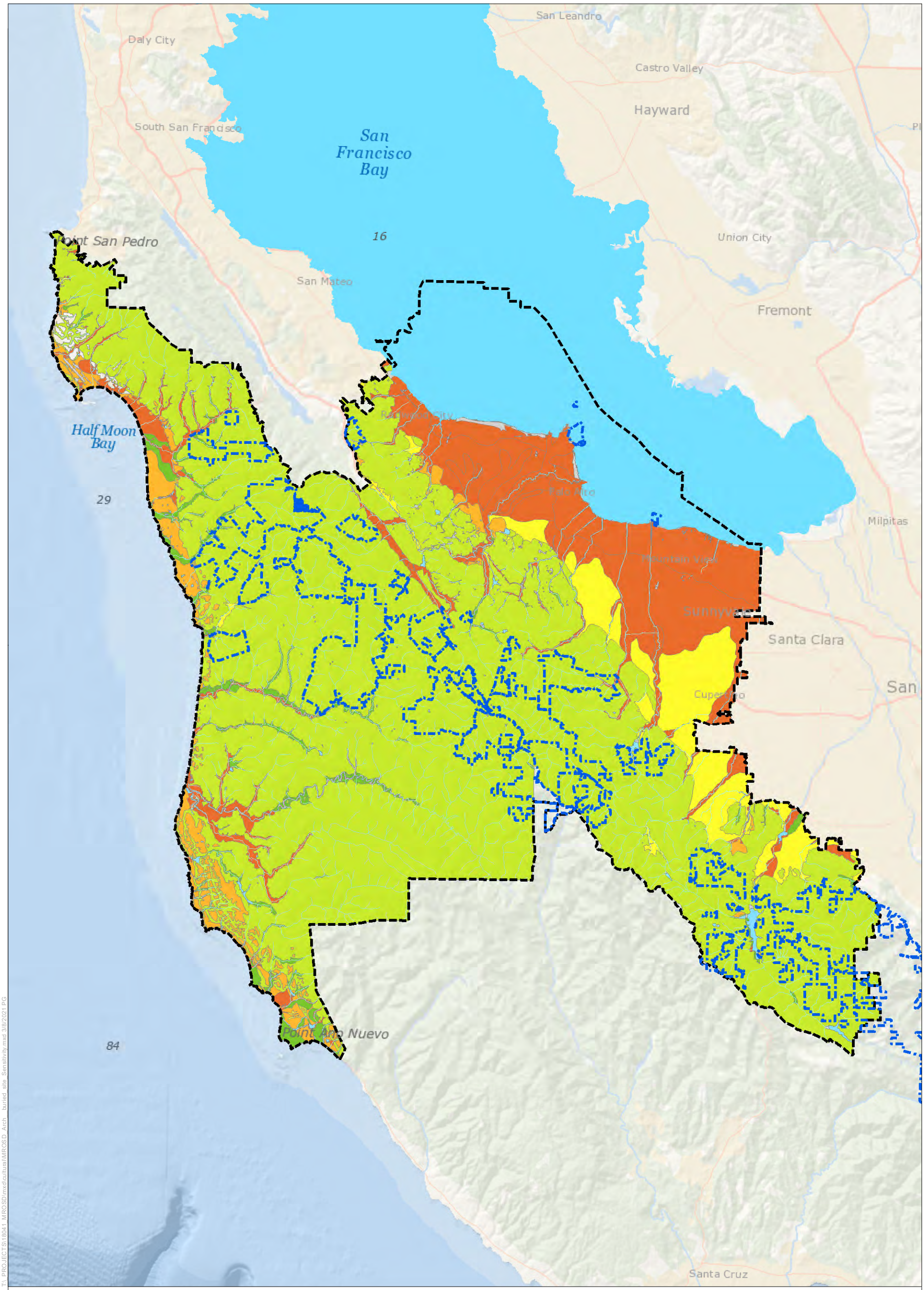


Figure 2

Buried Archaeological Sensitivity

Appendix D Midpen's BMPs for Routine Maintenance Activities in Water Courses

Regional OpenSpace | Midpeninsula Regional Open Space District

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT

BEST MANAGEMENT PRACTICIES (BMPs) FOR ROUTINE MAINTENANCE ACTIVITES IN WATER COURSES

Sources

*	California Salmonid Stream habitat Restoration Manual, State of California Resources Agency, Department of Fish and Game (2002)
+	Timothy C. Best, Certified Engineering Geologist (CEG), Engineering Geology and Hydrology, Santa Cruz, California (2006-2012)
^	Erosion Draw 5.0, Bio Draw 3.0, Environmentally-Sensitive Streambank Restoration (ESenSS), John McCullah, Salix Applied Earthcare, Redding California (2004)
°	Midpeninsula Regional Open Space District (2007)

Page #	Source	BMP#	BMP Title	Detail
1	*	1	Characteristics of Storm-proofed Roads	N
2	*	2	Road Upgrading Treatments	N
3	*	3	Culvert and Trash Rack Installation	Y
5	+		Permanent Culvert Typical Specifications	Y
7	+		Embedded Culvert Typical Specifications	Y
9	*	4	Ford and Armored Fill Stream Crossings	Y
10	*		Armored Fill Crossings	Y
11	+		Rock Ford (Road) Typical Specifications	Y
13	+		Rock Ford (Trail) Typical Specifications	Y
14	*	5	Removal of Unstable Sidecast Material	Y
15	+		Perched Fill Removal Typical Specifications	Y
16	*	6	Outsloping Pitch for Roads	N
16	*	7	Ditch Relief Culverts	Y
17	+		Ditch Relief Culverts Typical Specifications	Y
18	+	8	Downspout Typical Specifications	Y
19	+	9	Subdrain	Y
20	*	10	Rolling Dip Installation Instructions	N
21	*		Rolling Dip Specifications	Y
22	+		Reverse Grade Dip, Existing Road/Trail	Y
23	+		Reverse Grade Dip, New Trail Construction	Y
24	+	11	Waterbar Typical Specifications	Y
25	+		Large Waterbar Typical Specifications	Y
26	^	12	Brushlayering with Soil Wrap	Y
30	^	13	Brushlayering with Rock Toe Protection	Y
32	^	14	Brush Mattress (Brush Mat)	Y
37	^	15	Coir Rolls with Brushlayering	Y
40	^	16	Energy Dissapater	Y

42	*		Energy Dissapater Typical Specification	Y
43	^	17	Erosion Control Blankets and Mats	Y
48	^	18	Grass-lined Channels	Y
51	^	19	Instream Diversion Techniques	Y
54	^	20	Instream Isolation Techniques	Y
59	°	21	Large Woody Debris Management and Removal	N
61	^	22	Live Pole Drains	Y
64	^	23	Live Siltation	Y
66	^	24	Modified Live Siltation	Y
68	^	25	Live Staking	Y
71	^	26	Pole Planting	Y
73	^	27	Riprap	Y
76	*	28	Riprap Revetment	Y
77	^	29	Rootwad Revetment with Vegetated Riprap	Y
81	^	30	Silt Fence Installation	Y
85	*		Straw Silt Fence Typical Specifications	Y
86	^	31	Slope Drain	Y
88	^	32	Straw Rolls	Y
90	*		Straw Roll Placement Typical Specifications	Y
91	^	33	Structural Streambank Stabilization	Y
94	^	34	Temporary Diversion Dike	Y
96	^	35	Vegetated Mechanically Stabilized Earth	Y
99	^	36	Vegetated Riprap	Y
106	^	37	Wattle (Live Fascines)	Y
110	*	38	Trail Puncheons	Y
111	*	39	Bridge Abutment Armor	Y
112	*	40	Temporary Splitter Stream Crossing	Y
113	*	41	Knick	Y
114	*	42	Inside Ditch	Y
115	*	43	Trail Cross Slopes	Y
116	*	44	Cross Vane Structure Typical Specifications	Y
117	*	45	Rock Chute/Step Pool Typical Specifications	Y
121	*	46	Log Grade Check Typical Specifications	Y
122	*	47	Erosion Control Notes	N
123	*	48	Crossing Removal	Y
124	*	49	Rock Grade Check Typical Specifications	Y
125	*	50	Wood Grade Check Typical Specifications	Y

Characteristics of Storm-proofed Roads

Storm-proofed stream crossings

- All stream crossings have a drainage structure designed for the 100-year flow (with debris).
- Stream crossings have no diversion potential (functional critical dips are in place).
- Stream crossing inlets have low plug potential (trash barriers & graded drainage).
- Protect stream crossing outlets from erosion (extended, transported or dissipated).
- Culvert inlet, outlet and bottom are open and in sound condition.
- Undersized culverts in deep fills (greater than backhoe reach) have emergency overflow culvert.
- Bridges have stable, non-eroding abutments and do not significantly restrict 100-year flood flow.
- Fills are stable (unstable fills are removed or stabilized).
- Road surfaces and ditches are "disconnected" from streams and stream crossing culverts.
- Class I stream crossings meet DFG and NMFS fish passage criteria (Part IX).

Storm-proofed fills

- Unstable and potentially unstable road and landing fills are excavated or structurally stabilized.
- Excavated spoil is placed in locations where it will not enter a stream.
- Excavated spoil is placed where it will not cause a slope failure or landslide.

Road surface drainage

- Road surfaces and ditches are "disconnected" from streams and stream crossing culverts.
- Ditches are drained frequently by functional rolling dips or ditch relief culverts.
- Outflow from ditch relief culverts does not discharge to streams.
- Gullies (including those below ditch relief culverts) are dewatered to the extent possible.
- Ditches do not discharge (through culverts or rolling dips) onto active or potential landslides.
- Decommissioned roads have permanent drainage and do not rely on ditches
- Fine sediment contributions from roads, cutbanks and ditches are minimized by utilizing seasonal closures and installing a variety of surface drainage techniques including berm removal, road surface shaping (outsloping, insloping or crowning), rolling dips, ditch relief culverts, water bars and other measures to disperse road surface runoff and reduce or eliminate sediment delivery to the stream.

Figure X-9. Common characteristics of storm-proofed roads.

Road Upgrading Treatments

In general, road upgrading consists of stream crossing upgrades, excavation of selected unstable or potential unstable fillslopes, and dispersion of road runoff (Figure X-9).

Stream Crossing Upgrading

- Eliminate stream diversion potential by dipping the entire stream crossing fill or by installing a critical dip (Figure X-13). A critical dip is a rolling dip that is constructed on or close to the down-road hinge line of a stream crossing that displays a diversion potential.
- Upgrade stream crossings by installing culverts sized for the 100-year flood flow, including sufficient capacity for expected wood and sediment (Figure X-13 and Figure X-14). These requirements are determined by both field observation and calculations using a procedure such as the Rational Formula (PWA 1994). Where necessary, install inlet protection (trash barriers) to prevent culvert plugging on non-fish bearing streams.
- Replace large high-risk culverts with bridges. Consider replacing any culvert greater than 72 inches in diameter with a bridge, especially in Class 1 streams.
- Replace culverted fills with hardened fords or armored fills (Figure X-15 and Figure X-16) on non-fish bearing streams where regular winter inspections and culvert maintenance is not feasible, or on steep gradient stream crossings where the culvert plug potential will always be high.
- Install armored crossings (Figure X-15 and Figure X-16) in areas where debris torrents are common, can be expected or where small steep gradient streams cross the road. Armored fill crossings are for sites where it will be very difficult to prevent frequent culvert plugging due to high amounts of transported sediment and debris. The treatment requires excavating the fill in the stream crossing and leaving a very broad dip in the axis of the natural channel, with long and gently sloping ramps into and out of the stream crossing. This treatment may be most appropriate along roads built on a floodplain and terrace, or where roads cross steep gradient stream channels with relatively small depths of fill at the outboard edge of the road.

Excavation of Unstable Fillslope

Remove unstable sidecast and fill materials from steep slopes (Figure X-17), steep headwater swales, and along road approaches to deeply incised stream channels, where there is potential for sediment delivery.

Stream Crossing Culvert Installation for Non-fish Bearing Streams

- Align culverts with the natural stream channel orientation to ensure proper function, prevent bank erosion and minimize debris plugging problems.
- Place culverts at the base of the fill and at the grade of the original streambed or install a downspout past the base of the fill (Figure X-14).
- Culverts should be set slightly below the original stream grade so that the water drops several inches as it enters the pipe.
- Culvert beds should be composed of rock-free soil or gravel, evenly distributed under the length of the pipe.
- Compact the base and sidewall material before placing the pipe in its bed.
- To allow for sagging after burial, an upward camber should be between 1.5 to 3 inches per 10 feet culvert pipe length.
- Backfill material should be free of rocks, limbs or other debris that could dent or puncture the pipe or allow water to seep around the pipe.
- Cover one end of the culvert pipe, then the other end. Once the ends are secure, cover the center.
- Tamp and compact backfill material throughout the entire process, using water as necessary for compaction.
- Backfill compacting will be done in 0.5 – 1.0 foot lifts until 1/3 of the diameter of the culvert has been covered (Figure X-14). A gas powered tamper or sheep's foot roller should be used for this work.
- Armor inlets and outlets with rock, or mulch and seed with grass as needed (not all stream crossings need to be armored).
- Install a trash rack (only on non-fish bearing streams) upstream from the culvert inlet where there is a high hazard of floating debris plugging the culvert.
- Push layers of fill over the crossing to achieve the final design road grade, at a minimum of one-third to one-half the culvert diameter.

Trash Racks

All trash racks require on-going maintenance. Two efficient trash rack designs include:

- On streams with culverts 48 inches diameter or greater, build a grate or sieve across the entire channel to collect the large material that would otherwise plug the culvert inlet. Locate the trash rack anywhere from five to 25 feet upstream from the culvert inlet.
- On streams with culverts under 48 inches diameter, set a single post vertically in the steam bed, centered directly upstream from the culvert inlet, and located one culvert diameter distance upstream from the inlet. Size the post and set the post deep into the streambed to withstand the size of woody debris transported by the stream during extreme runoff events.

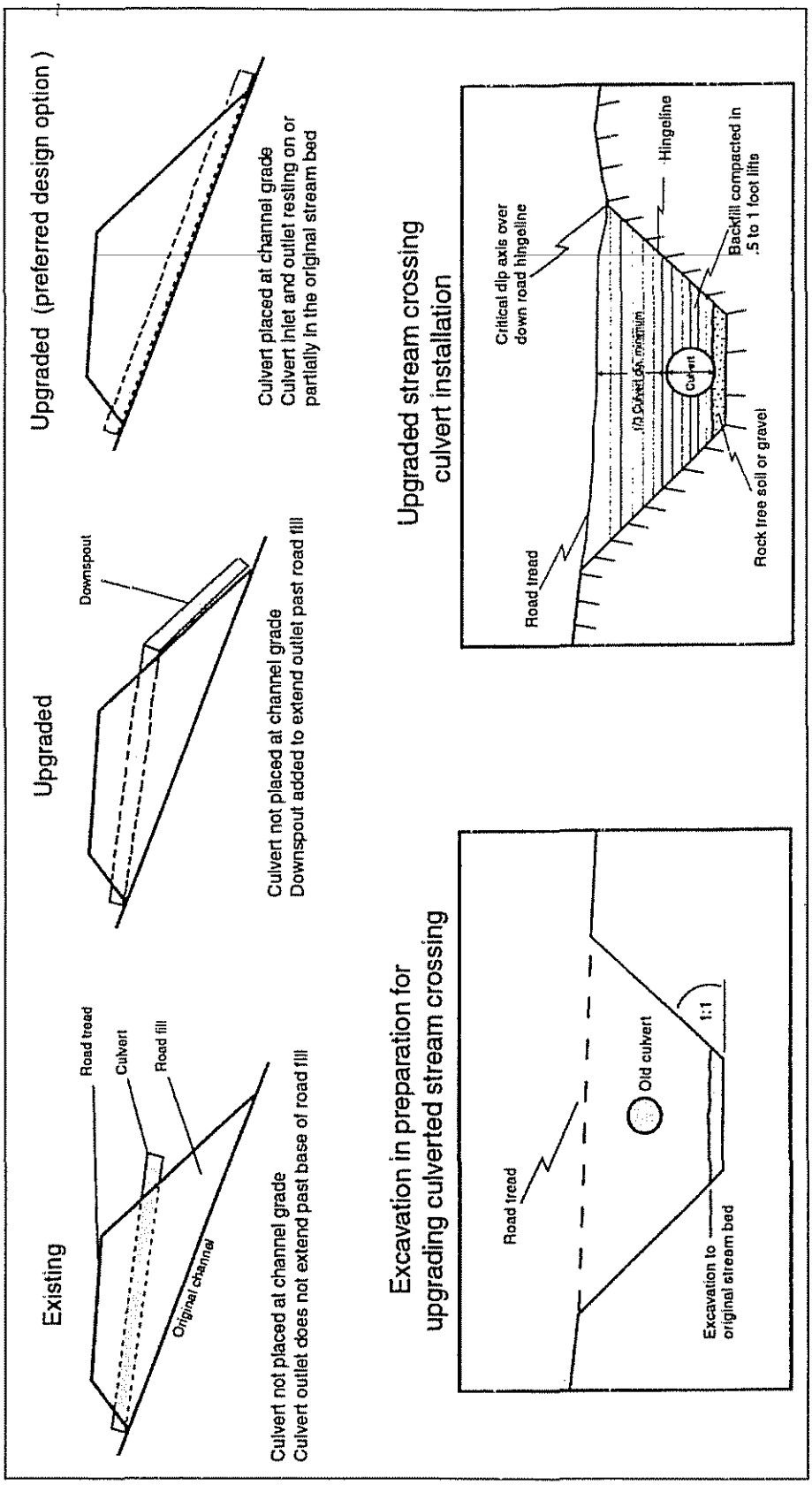
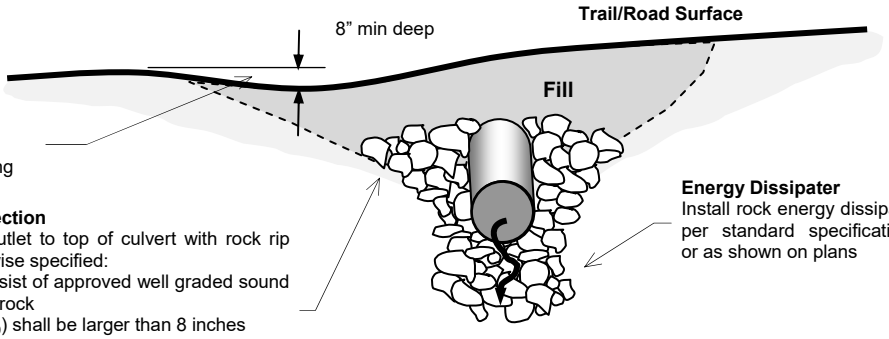


Figure X-14. Typical culvert installation on non fish-bearing streams.

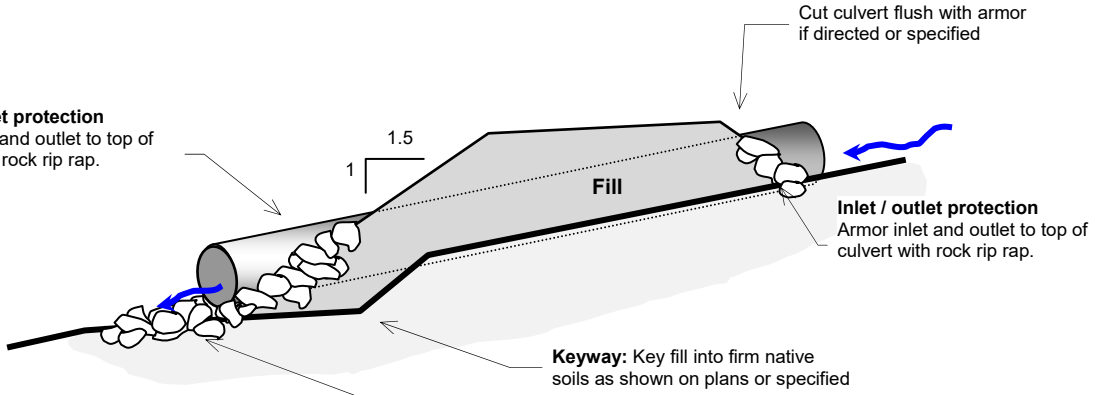
5A PERMANENT CULVERT- RURAL ROAD
NTS



Critical Dip
Install 8” (min) dip on downroad side of crossing

Inlet / outlet protection
Armor inlet and outlet to top of culvert with rock rip rap. Unless otherwise specified:
- Riprap shall consist of approved well graded sound durable angular rock
- 50% of rock (D_{50}) shall be larger than 8 inches minimum diameter
- Rock shall be keyed minimum 1.5 times diameter into bed and banks

Energy Dissipater
Install rock energy dissipater per standard specifications or as shown on plans

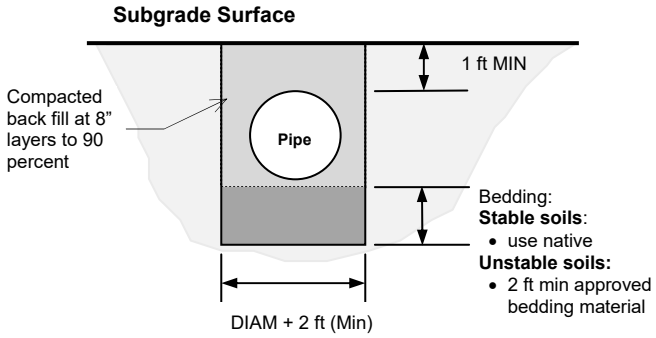


Inlet / outlet protection
Armor inlet and outlet to top of culvert with rock rip rap.

Inlet / outlet protection
Armor inlet and outlet to top of culvert with rock rip rap.

Keyway: Key fill into firm native soils as shown on plans or specified

Energy Dissipater
- Install rock energy dissipater per standard specifications or as shown on plans



TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

PERMANENT CULVERT
TYPICAL SPECIFICATIONS

Standard Detail 5A

Date: May 3, 2009

NOTES

- **Culvert Orientation**
  - Culvert should be installed at the natural stream level, grade and orientation
- **Culvert bed**
  - The width of trenches shall permit satisfactory joining and through tamping of the backfill material
  - The culvert bed shall be clean and free of large woody debris and large rocks. Unsuitable material shall be replaced with selected granular foundation material and compacted to obtain uniform bed
  - Where rock, hardpan, or other unyielding material is encountered, it shall be removed below the foundation grade for a depth of at least 1 foot and a width of at least 2 feet plus the culvert diameter. This material shall be replaced with selected engineer fill.
  - The inlet to the culvert should be a countersunk 10% of the pipe diameter below stream grade so that the water falls into the culvert inlet.
- **Laying Pipe**
  - Culvert shall be laid in center of trench on uniform grade line to conform to the flow line of the stream. The entire length of pipe shall be in contact with the culvert bedding
  - Unless otherwise specified, the culvert shall have a minimum grade of 2%.
  - Culvert shall be joined and anchored per manufactures guidelines
- **Backfill**
  - Fill shall be keyed and bench into firm native soils. Areas to receive fill shall be stripped to remove vegetation, near surface roots, brush, highly organic soils and other unsuitable fill material.
  - Select mineral soil shall be used for culvert back fill. The back fill shall have no rocks greater than 3 inches in any dimensions placed closer than 1 foot to the culvert.
  - Backfill shall be adequately compacted throughout the entire process to a degree greater than the surrounding materials (approximately 85 percent relative compaction). During placement and compaction of fill, the moisture content of the materials being placed shall be maintained.
  - Fill shall be brought up to grade at a 1.5:1 slope unless otherwise specified
- **Culverts**
  - Culverts shall be smooth bore, double wall (ASTM D3350 and AASHTO M294, Type S)
  - Culverts distorted more than 10% of normal dimension, ruptured or broken shall be replaced
  - Culverts shall be cut flush with armored embankment/headwall if directed or specified
- **Inlet/outlet protection**
  - Armor inlet and outlet to top of culvert with rock rip rap
  - Riprap shall consist of approved well graded sound durable angular rock unless otherwise specified
  - 50% of rock (D_{50}) shall be larger than 8 inches minimum diameter unless otherwise specified
  - Rock shall be keyed minimum 1.5 times diameter into bed and banks unless otherwise specified
- **Energy dissipater**
  - Culvert shall discharge onto rock apron per general specifications
- **Erosion Control**
  - On running streams, water will be pumped or diverted past the crossing and into the downstream channel during the construction process.
  - Critical dip (8” min) shall be installed on the down road side of crossing
  - Exposed soils shall be mulched per standard specification. Install coir roll at base of exposed soils
- **Department of Fish and Game Agreement**
  - Conform to Department of Fish and Game 1600 agreement where applicable

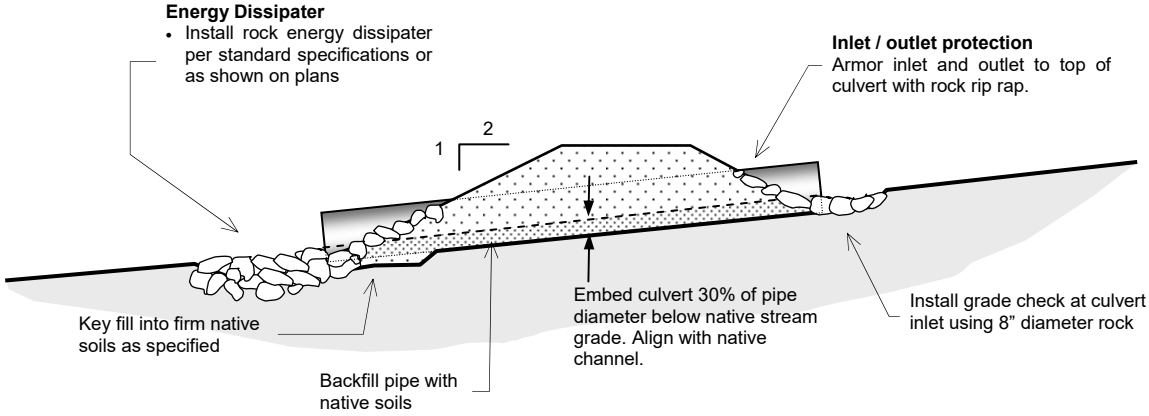
TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

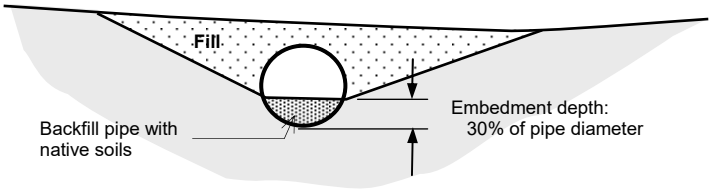
PERMANENT CULVERT NOTES
TYPICAL SPECIFICATIONS

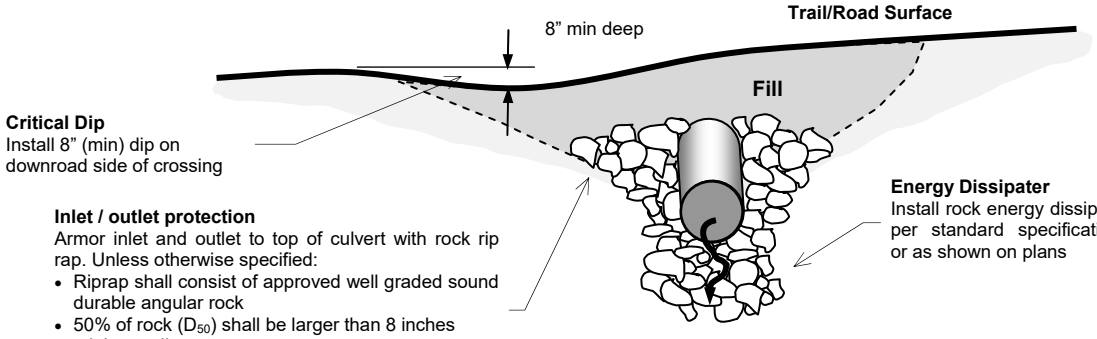
Standard Detail 5A

Date: May 3, 2009

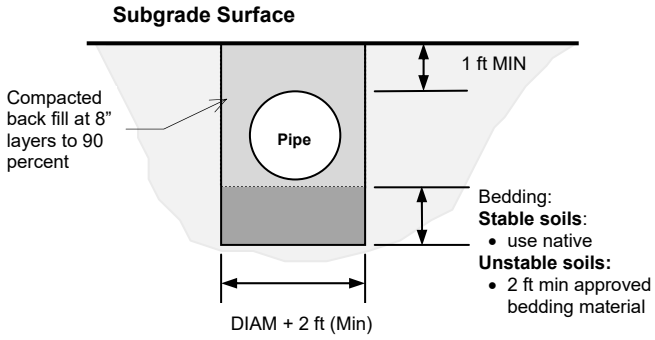
5B EMBEDDED CULVERT
NTS







Inlet / outlet protection
Armor inlet and outlet to top of culvert with rock rip rap. Unless otherwise specified:
- Riprap shall consist of approved well graded sound durable angular rock
- 50% of rock (D_{50}) shall be larger than 8 inches minimum diameter
- Rock shall be keyed minimum 1.5 times diameter into bed and banks



TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

EMBEDDED CULVERT
TYPICAL SPECIFICATIONS

Standard Detail 5B

Date: May 3, 2009

NOTES

- **Culvert Orientation**
  - Culvert should be installed at the natural stream level, grade and orientation
- **Culvert bed**
  - The width of trenches shall permit satisfactory joining and through tamping of the backfill material
  - The culvert bed shall be clean and free of large woody debris and large rocks. Unsuitable material shall be replaced with selected granular foundation material and compacted to obtain uniform bed
  - Where rock, hardpan, or other unyielding material is encountered, it shall be removed below the foundation grade for a depth of at least 1 foot and a width of at least 2 feet plus the culvert diameter. This material shall be replaced with selected engineer fill.
  - The bottom of the culvert shall be buried (embedded) into the native channel not less than 30%
- **Laying Pipe**
  - Culvert shall be laid in center of trench on uniform grade line to conform to the flow line of the stream. The entire length of pipe shall be in contact with the culvert bedding
  - The bottom of the culvert shall be buried (embedded) into the native channel not less than 30% of the culvert diameter and backfilled with approved native soil
  - Culvert shall be joined and anchored per manufactures guidelines
- **Backfill**
  - Fill shall be keyed and bench into firm native soils. Areas to receive fill shall be stripped to remove vegetation, near surface roots, brush, highly organic soils and other unsuitable fill material.
  - Select mineral soil shall be used for culvert back fill. The back fill shall have no rocks greater than 3 inches in any dimensions placed closer than 1 foot to the culvert.
  - Backfill shall be adequately compacted throughout the entire process to a degree greater than the surrounding materials (approximately 85 percent relative compaction). During placement and compaction of fill, the moisture content of the materials being placed shall be maintained.
  - Fill shall be brought up to grade at a 1.5:1 slope unless otherwise specified
- **Culverts**
  - Culverts shall be smooth bore, double wall (ASTM D3350 and AASHTO M294, Type S)
  - Culverts distorted more than 10% of normal dimension, ruptured or broken shall be replaced
  - Culverts shall be cut flush with armored embankment/headwall if directed or specified
- **Inlet/outlet protection**
  - Armor inlet and outlet to top of culvert with rock rip rap
  - Riprap shall consist of approved well graded sound durable angular rock unless otherwise specified
  - 50% of rock (D_{50}) shall be larger than 8 inches minimum diameter unless otherwise specified
  - Rock shall be keyed minimum 1.5 times diameter into bed and banks unless otherwise specified
  - Install rock grade check at culvert inlet using 8 inch minimum diameter rock. Extend rock 2 times culvert diamter upstream.
- **Energy dissipater**
  - Culvert shall discharge onto rock apron per general specifications
- **Erosion Control**
  - On running streams, water will be pumped or diverted past the crossing and into the downstream channel during the construction process.
  - Critical dip (8” min) shall be installed on the down road side of crossing
  - Exposed soils shall be mulched per standard specification. Install coir roll at base of exposed soils
- **Department of Fish and Game Agreement**
  - Conform to Department of Fish and Game 1600 agreement where applicable

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

EMBEDDED CULVERT NOTES
TYPICAL SPECIFICATIONS

Standard Detail 5B

Date: May 3, 2009

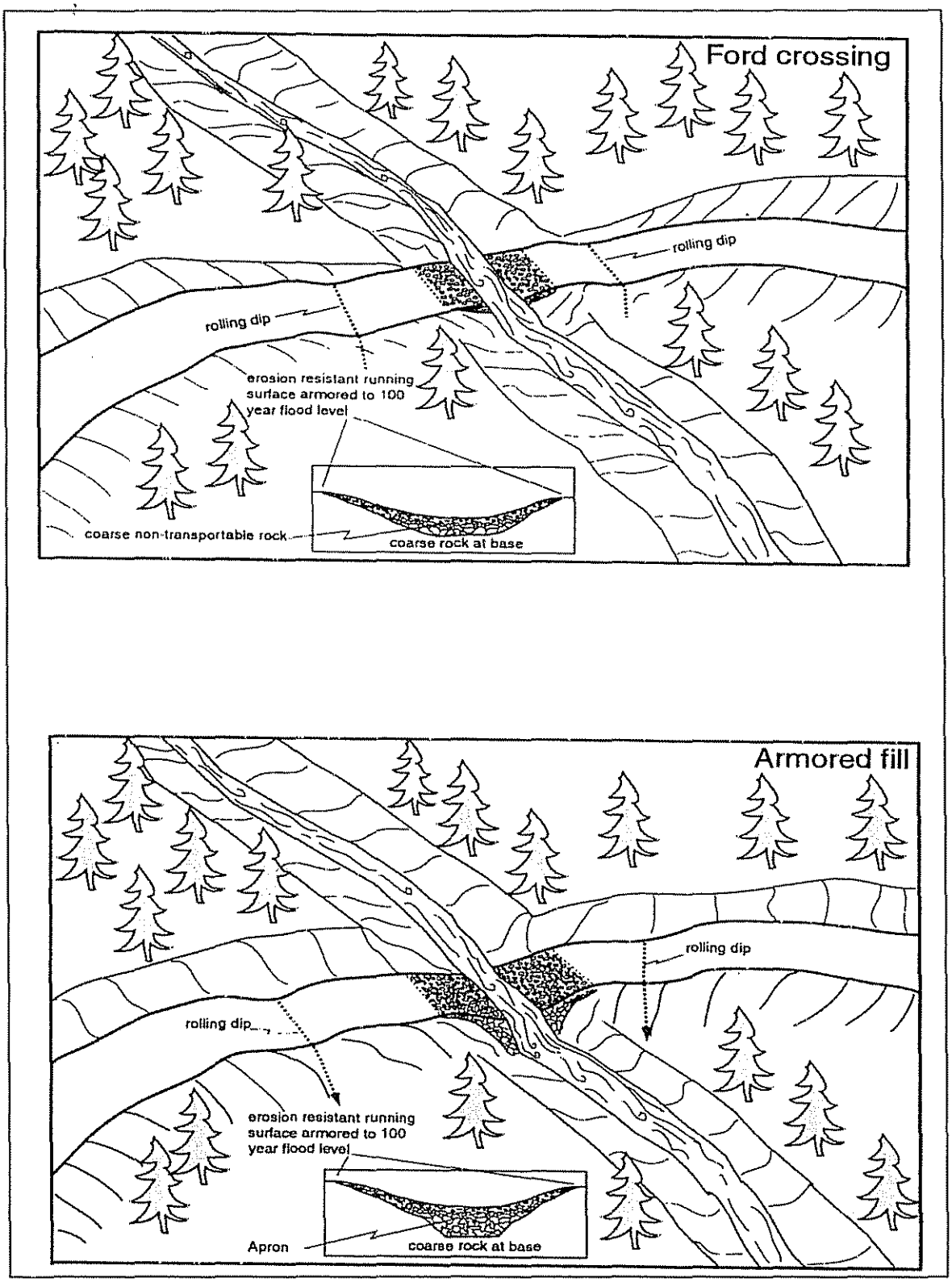
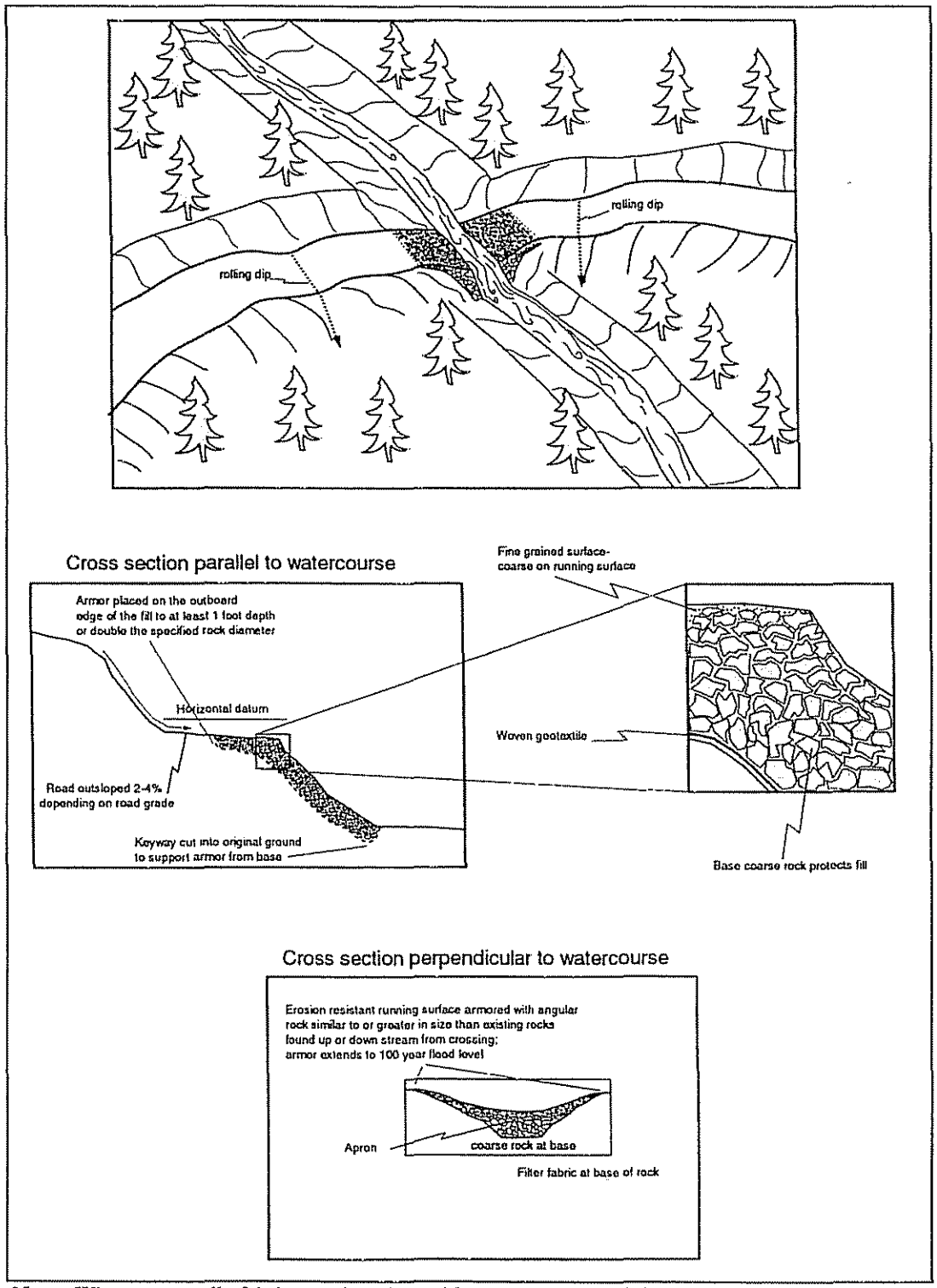


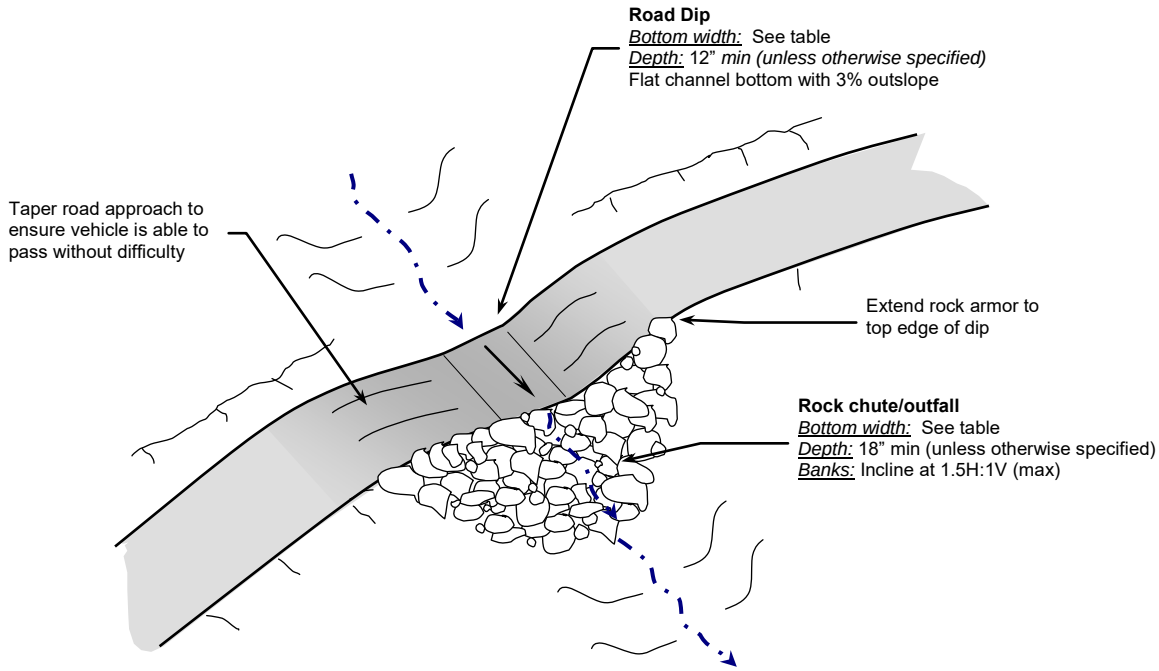
Figure X-15. Typical ford and armored fill stream crossings.



Note: Where geotextile fabric may interfere with passage of amphibians in any Class 2 or 3 crossing, bury geotextile fabric with at least 6 inches of rock. Do not use geotextile fabric in fish-bearing streams.

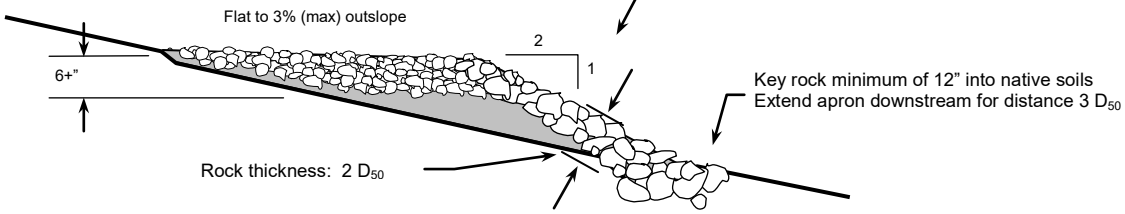
Figure X-16. Installation and specification of typical armored fill crossing.

5C ROCK FORD – FOREST ROAD
NTS



AGGREGATE ROAD BASE:
- See table for rock size
- Place rock minimum 6" deep
- *Note: If specified separate base from native with woven geotextile fabric (Mirifi 700X or equivalent)*

OUTFALL ARMOR:
- See table for D_{50} rock size *(unless otherwise specified)*.
- Rock rip-rap shall consist of approved sound durable angular rock
- Rock should generally be well graded (incorporating mix of sizes: See table for range)
- Voids shall be filled with smaller rock to prevent piping around the larger rock.
- Larger rock to be placed at base of apron
- $2D_{50}$ minimum rock thickness
- Incline no steeper than 2H:1V



TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

ROCK FORD – FOREST ROAD
TYPICAL SPECIFICATIONS

Standard Detail 5C-1

Date: February 22, 2012

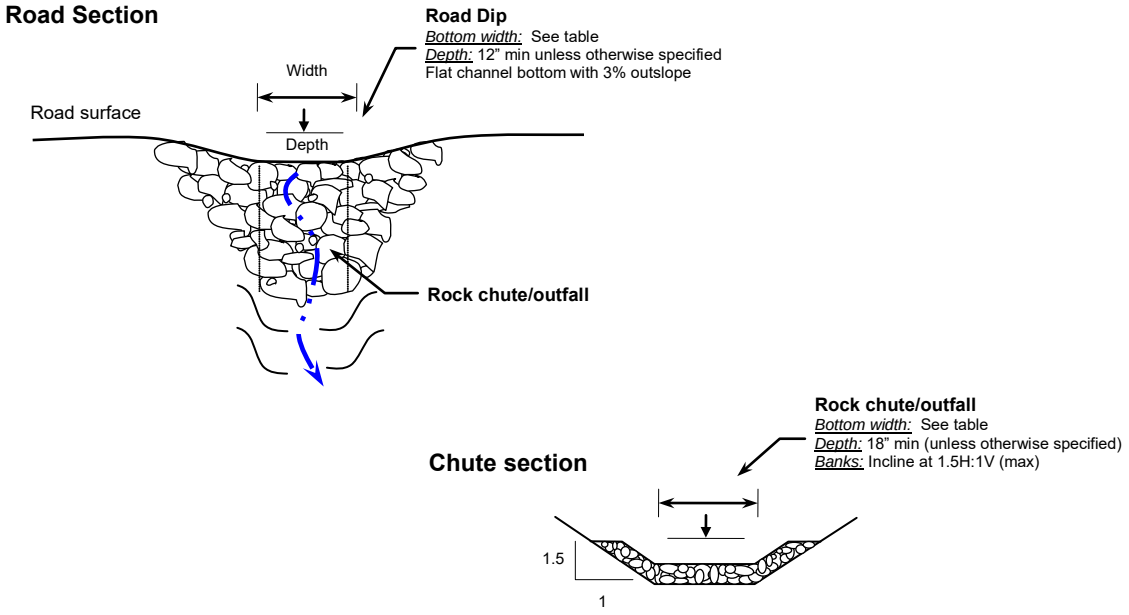


TABLE 1
CHANNEL WIDTH AND ROCK SIZE

Peak Discharge Q (Cfs)	Minimum Channel Bottom Width (ft)	Rock Chute/outfall		Road surface
		Median rock diameter D_{50} (in)	Range $D_{10} – D_{85}$ (in)	Median Rock diameter D_{50} (in)
2	2'	6"	5" - 8"	3" minus
5	2'	9"	6" - 12"	3" minus
10	2'	12"	10" - 16"	3" minus
15	2'	14"	10" - 18"	3" minus
20	4'	14"	10" - 18"	3" minus
30	4'	16"	12" - 20"	3" – 6"
40	4'	18"	12" - 24"	3" – 6"
>40	Site specific design required			

NOTE

- **Details are typical and intended for use as a guideline. Adjustments may be required to local site conditions.**
- **It is the responsibility of the RPF or design professional to ensure the applicability of these specifications at any given site.**
- Specifications apply to low to moderate gradient watercourses where the outfall of the ford is inclined no steeper than 2H:1V (50%) and where the maximum discharge is less than 40 cfs.
- Rock fords are not recommended on roads steeper than 15% grade due to the difficulty in installing an adequate sized dip.
- The design specifications here are based on *Design of Rock Chutes* (Robinson et al., 1998), US Forest Service publications *Low-water Crossings: Geomorphic, Biologic and Engineering Design Considerations* (Clarkin et al., 2006) and *Low-Volume Roads Engineering: Best Management Field Guide* (Keller and Sherar, 2003),

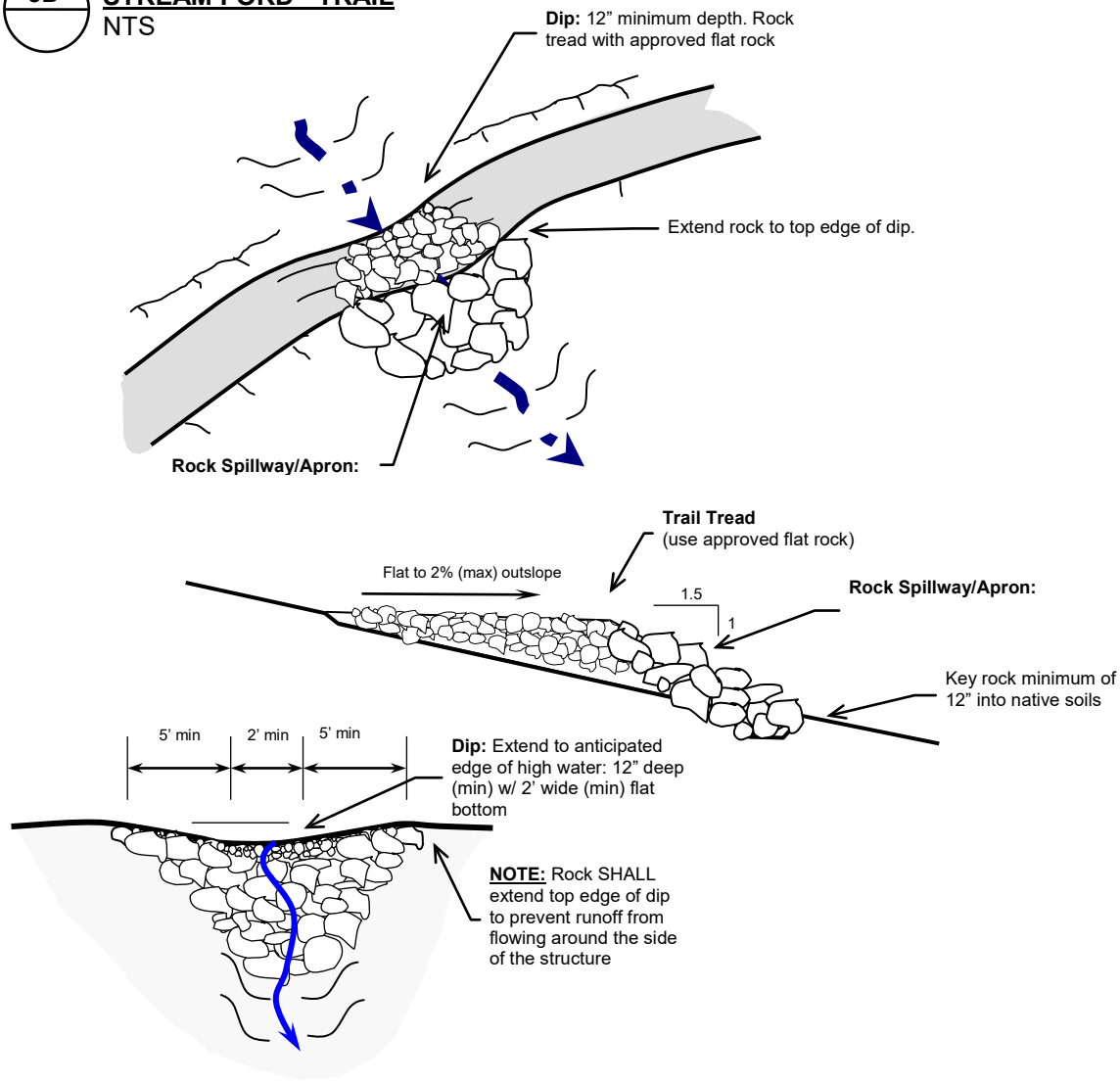
TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

ROCK FORD – FOREST ROAD
TYPICAL SPECIFICATIONS

Standard Detail 5C-2

Date: February 22, 2012

5D STREAM FORD - TRAIL
NTS



NOTES

- Construct trail to dip through watercourse.
  - Dip to extend to anticipated edge of high water
  - Minimum1 2 inches deep and 4 feet wide unless otherwise specified or directed
  - Establish well defined spillway at dip outlet
- Armor outside trail edge with rock to form apron in the spillway
  - Rock shall consist of approved sound durable angular rock
  - 50% (D_{50}) of rock shall be greater than 18 inches minimum diameter *(unless otherwise specified)*
  - Rock should generally be well graded (incorporating mix of sizes)
  - Voids shall be filled with smaller rock to prevent piping around the larger rock
  - Larger rock to be placed at base of apron
  - Extend rock to top edge of dip or above anticipated edge of high water to prevent high flows from eroding around the edge of the rock. Place rock to form a well defined spillway.
  - Rock to be placed no steeper than 1.5:1
- Armor trail tread with rock
  - Use 6” or larger diameter sound durable rock (unless otherwise specified). Place flat to create even trail tread
  - Backfill with compacted soil or base rock for smooth tread surface.
- Specifications are intended only as guideline, modifications may be made in the field by geotechnical consultant or designee

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

ROCK FORD - TRAIL
TYPICAL SPECIFICATIONS

Standard Detail 5D

Date: November 29, 2011

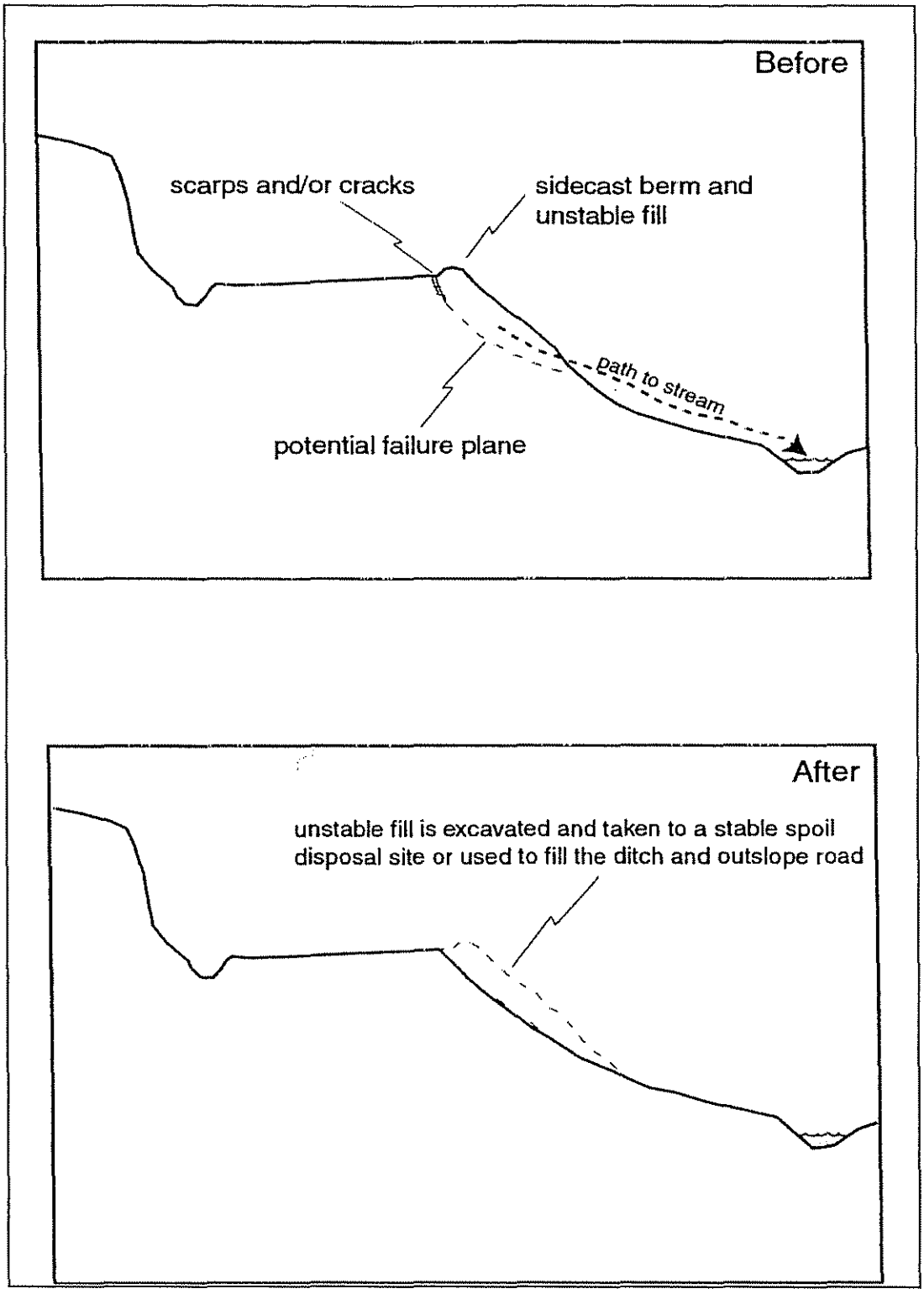
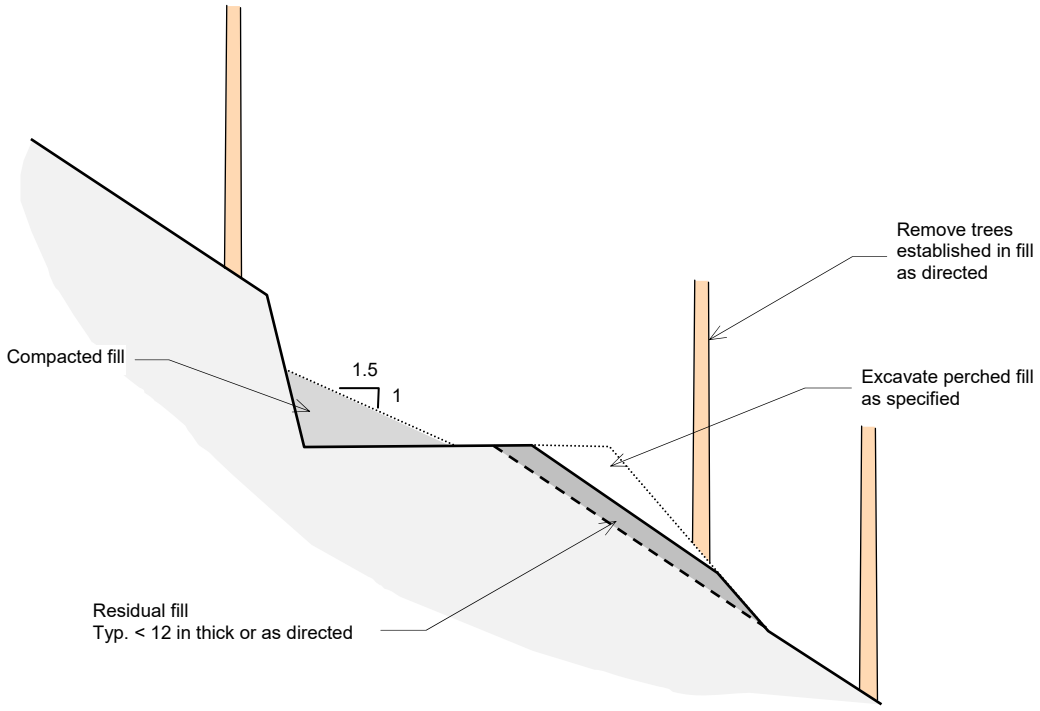


Figure X-17. Removal of unstable sidecast materials.



NOTES

- Remove trees established in roadway and in fill as directed
  - Trees greater than 6 inch diameter shall be marked by District prior to removal
- Excavate perched fill as specified and directed
  - Limits of fill removal to be identified in the field by project geologist or designee
- Spoils shall be compacted along inboard edge of road
  - Spoils shall not be placed in any areas where seasonal bank seeps or wet areas are present
  - Areas to receive fill shall be cleared of vegetation
  - Spoils shall be placed in thin lifts not to exceed 8 inches in maximum thickness and compacted (minimum 85 percent relative compaction). Compacting may include track walking with a dozer, bucket of the excavator, roller or hand tamper. Spoils may need to be moisture conditioned to achieve a suitable level of compaction.
  - Spoils shall be placed a maximum of 5 feet deep with an embankment face inclined no steeper than 1.5:1 (65%) unless otherwise directed or specified
  - Project geotechnical consultant or designee shall approve all spoil sites prior to fill placement
- Specifications are indented only as guideline, modifications may be made in the field by project geotechnical consultant or designee

9A **PERCHED FILL REMOVAL**
NTS

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

PERCHED FILL REMOVAL
TYPICAL SPECIFICATIONS

Standard Detail 9A

Date: May 3, 2009

Outsloping pitch for roads up to 12% grade		
Road Grade	**Outslope Pitch forUnsurfaced roads**	**Outslope Pitch for Surfaced Roads**
4% or less	3/8" per foot	½" per foot
5%	½" per foot	5/8" per foot
6%	5/8" per foot	¾" per foot
7%	¾" per foot	7/8" per foot
12% or more	1" per foot	1-1/4" per foot

Table X-6. Outsloping pitch for roads up to 12% grade.

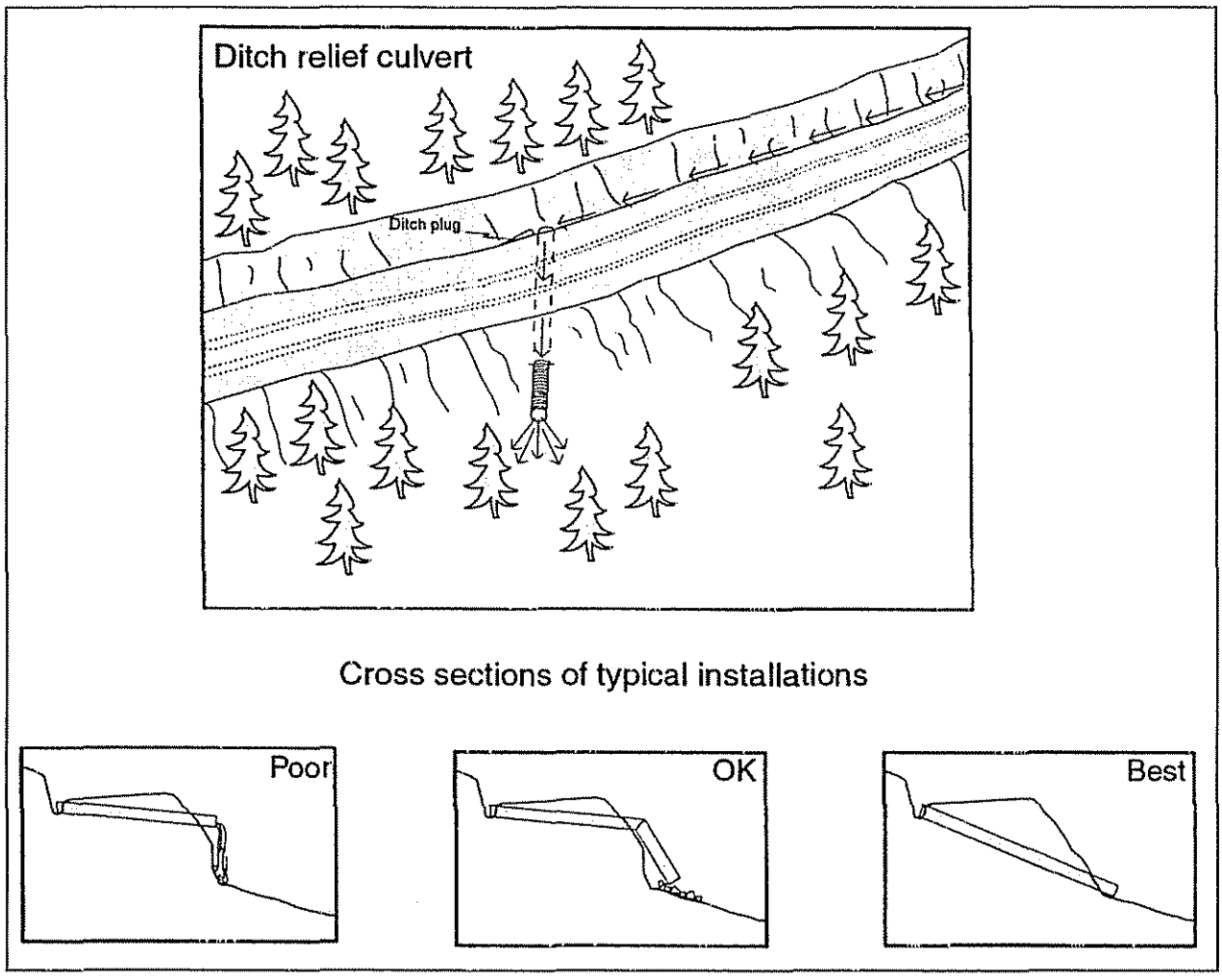
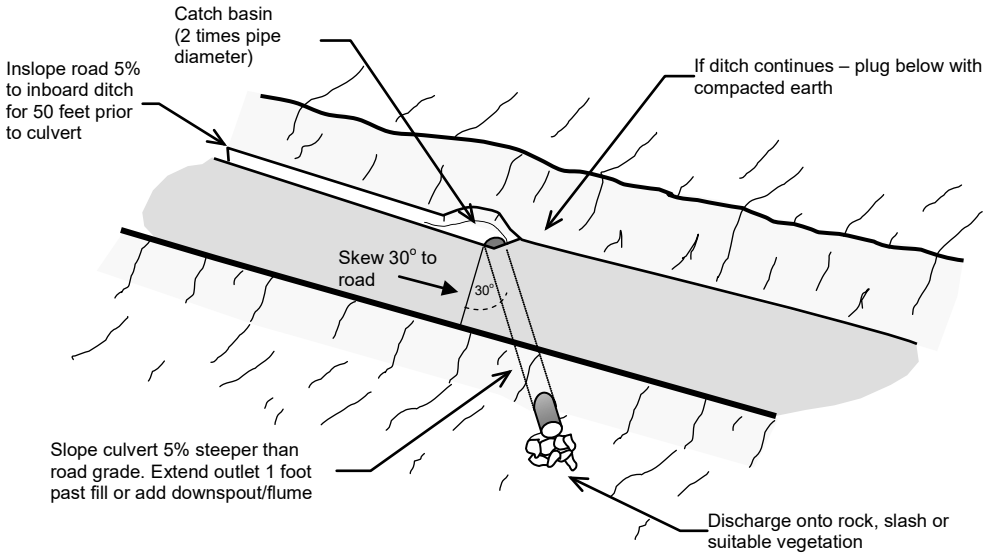
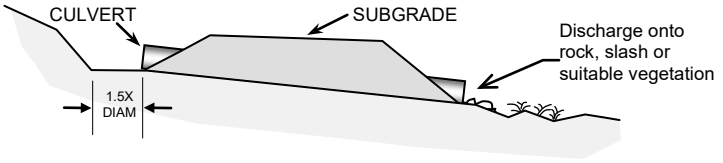
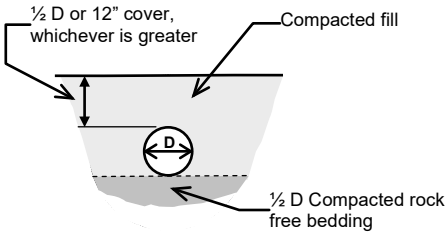


Figure X-19. Typical ditch relief culvert installation.







NOTES

- Ditch relief culverts shall be installed flagged locations or as identified on plans. The maximum spacing of culverts shall be 150 feet unless otherwise specified or directed.
- Culverts shall be 12-inch diameter smooth bore, double wall HDPE (ASTM D3350 and AASHTO M294, Type S) unless otherwise specified
- The culverts shall be placed at a 30 degree skew angle down grade (where allowable) with a gradient 5% steeper than that of the road. Culverts should extend a minimum of 1' beyond base of road fill.
- Where necessary, outlet ditch shall be constructed at a steeper gradient than the culvert, at least one pipe diameter in width, and with bank tapered back to a 1:1 slope.
- The culvert bed shall ½ diameter of the culvert and be clean and free of large woody debris and large rocks. Trench shall be adequate width to facilitate compaction.
- Select approved mineral soil shall be used for culvert back fill. The back fill shall have no rocks greater than 3 inches in any dimensions placed closer than 1 foot to the culvert. Backfill shall be adequately compacted throughout the entire process to 95 percent ASTM 1557 unless otherwise specified. During placement and compaction of fill, the moisture content of the materials being placed shall be maintained.
- Compacted fill coverage shall be minimum ½ pipe diameter or 12 inches, whichever is greater
- Rock, slash or suitable vegetation should be used at discharge point as directed or specified
- A ditch block shall be placed immediately downslope of the culvert intake to prevent ditch flow from bypassing the pipe inlet.
- Specifications are intended only as guideline, modifications may be made in the field by geotechnical consultant or designee

6D **DITCH RELIEF CULVERT (Typical)**
NTS

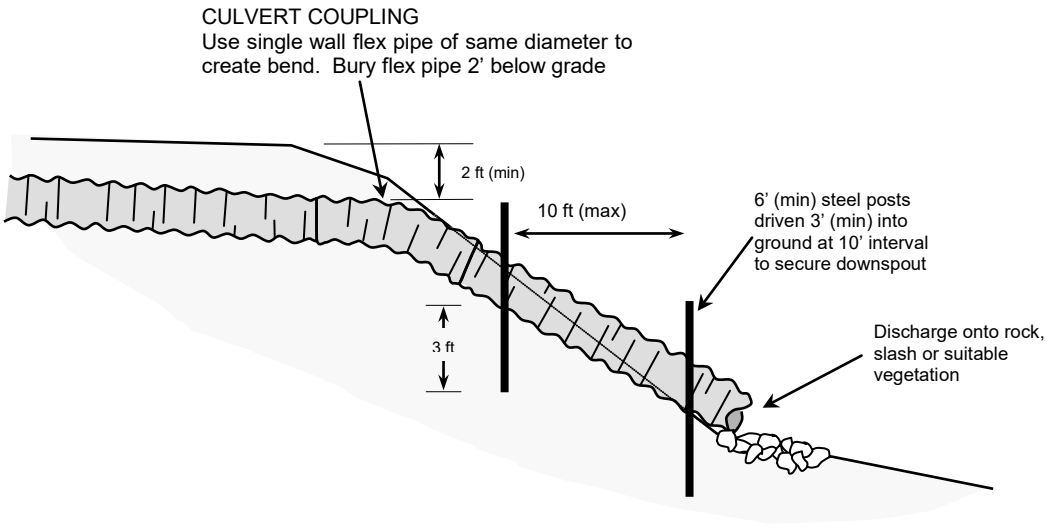
TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

DITCH RELIEF CULVERT
TYPICAL SPECIFICATIONS

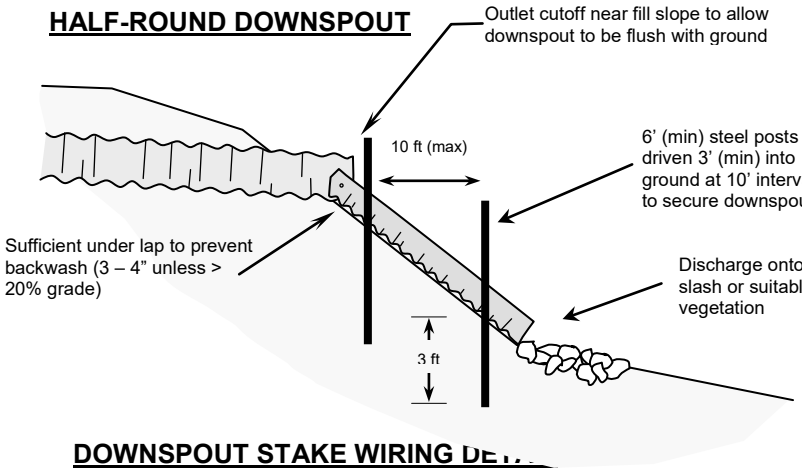
Standard Detail 6D

Date: May 3, 2009

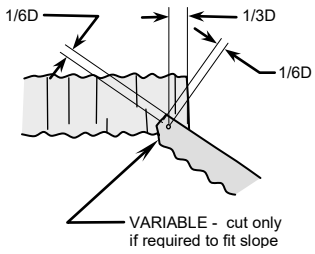
FULL-ROUND DOWNSPOUT



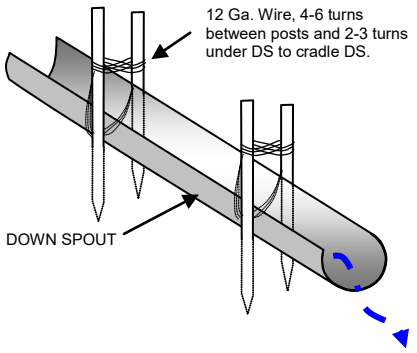
HALF-ROUND DOWNSPOUT



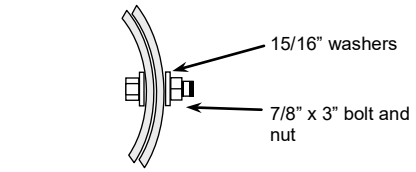
HALF ROUND CONNECTION



DOWNSPOUT STAKE WIRING DE



BOLT DETAIL



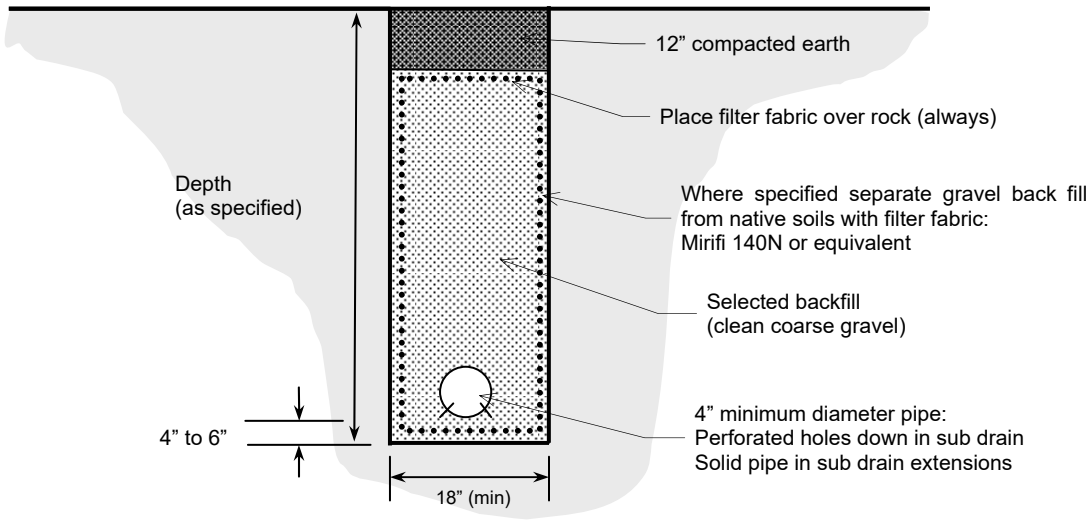
5G **DOWNSPOUT STANDARD PLAN**
NTS

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

DOWNSPOUT
TYPICAL SPECIFICATIONS

Standard Detail 5G

Date: March 9, 2009



NOTES

- Excavate 12+” wide trench as specified. Trench should have positive gradient to discharge point.
- Where specified, line trench with approved filter fabric (Mirifi 180N or equivalent)
- Place perforated pipe 4” to 6” from bottom of trench. Solid pipe should extend from trench to discharge point.
- Back fill trench with clean coarse gravel to within 12” of grade
- Place fabric over top of gravel back fill
- Cap with 12” of compacted earth
- Discharge in a reasonable and controlled manner

6G **SUBDRAIN (Typical)**
NTS

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

SUBDRAIN
TYPICAL SPECIFICATIONS

Standard Detail 6G

Date: May 3, 2009

Dispersion of Road Runoff

Disperse and disconnect road surface runoff from streams. Road cutbanks and road ditches are known to deliver substantial volumes of fine sediment to streams in some watersheds (e.g., Reid 1981; Reid and Dunne 1984) and they have been found to significantly affect watershed hydrology (Wemple 1994). Relatively simple treatments can be performed to upgrade road drainage systems to significantly reduce or largely eliminate this source of fine sediment delivery to streams. Sediment may be minimized by utilizing seasonal closures or traffic restrictions, and dispersing road runoff. Choose from a variety or combination of surface drainage techniques including berm removal, water bars (Figure X-10), road surface shaping (outsloping, insloping or crowning (Figure X-18 and Table X-6), ditch relief culverts (Figure X-19), rolling dips (Figure X-20), and other measures that effectively disperse road surface runoff and reduce or eliminate sediment delivery to the stream. To be effective, they must effectively disperse most road runoff and ditch flow before it reaches the stream. It is critical that all road surface drainage techniques effectively drain the road surface and be drivable for the expected traffic.

Road Upgrading Installation Instructions

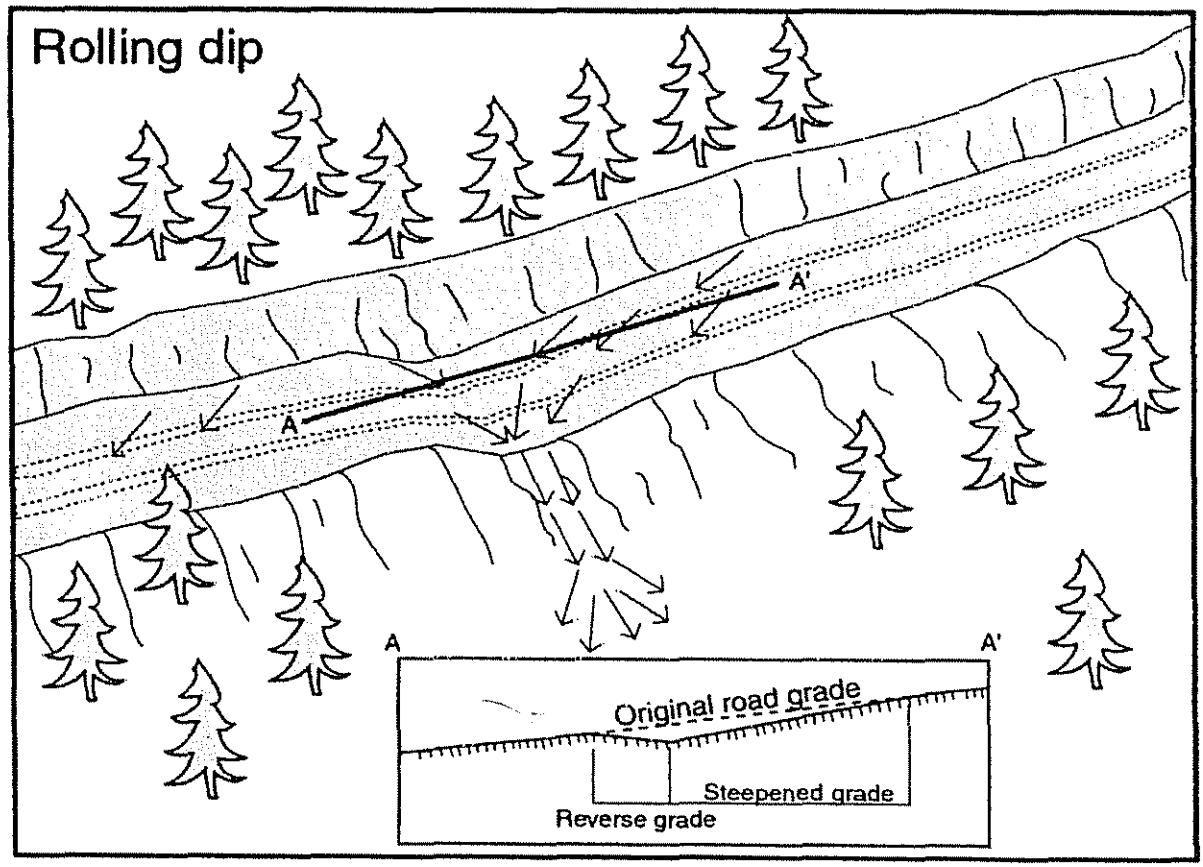
The following summarizes standard road upgrading techniques. For more detail, see *Handbook for Forest and Ranch Roads* (PWA 1994) or the corresponding video *Forest and Ranch Roads* (PWA 2003).

Rolling Dip Installation

- Install rolling dips in the roadbed as needed to drain the road surface. Rolling dips can be sloped either into the ditch or to the outside of the road edge as required to properly drain the road and disperse surface runoff.
- If the rolling dip is designed to divert both road surface and ditch runoff, block the down-road ditch with compacted fill.
- Rolling dips are usually built directly across the road alignment with a cross grade at least one percent greater than the grade of the road (so that it will drain).
- Excavate the rolling dip with a medium size bulldozer (D-7 size) with rippers or with a grader.
- Begin excavation of the dip approximately 50 to 100 feet up-road from the proposed axis of the dip (Figure X-18). Progressively excavate material from the roadbed, with the grade becoming steeper, until reaching the axis (Figure X-20).
- Determine the depth of the dip, by the grade of the road (Figure X-18). In all cases, rolling dip dimensions must be consistent with the type of vehicles that will be using the road (Figure X-20).
- On the down-road side of the rolling dip axis, install a grade change to prevent runoff from continuing down the road. Carry the rise in grade for about 15 to 25 feet, or more, and then fall back to the original slope (Figure X-20). The axis of the dip must be a broad "u" shape to facilitate good driveability.
- In all cases, the rolling dip must be driveable and not significantly inhibit traffic and road use. It must also effectively drain the road surface.

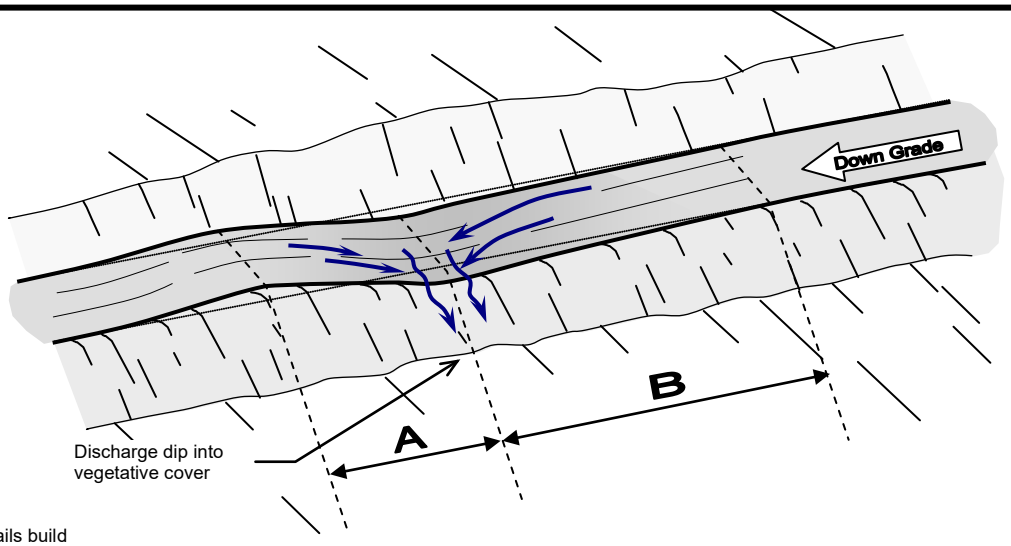
Table of Rolling Dip Dimensions				
Road grade %	**Upslope approach (distance from up-road start of rolling dip to trough) (ft)**	**Reverse grade (distance from trough to crest)**	**Depth below average road grade at discharge end of trough (ft)**	**Depth below average road grade at upslope end of trough (ft)**
<6	55	15-20	0.9	0.3
8	65	15-20	1.0	0.2
10	75	15-20	1.1	.01
12	85	20-25	1.2	.01
>12	100	20-25	1.3	.01

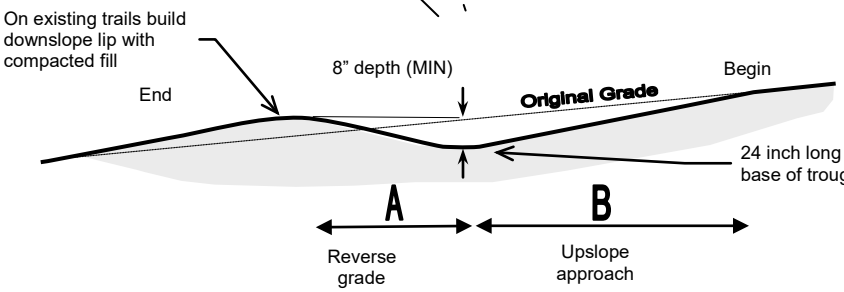
Table X-7. Table of rolling dip dimensions.

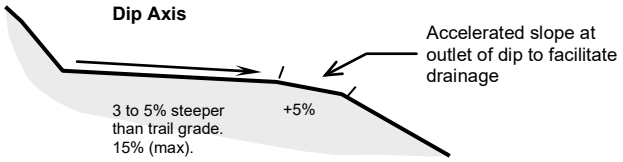


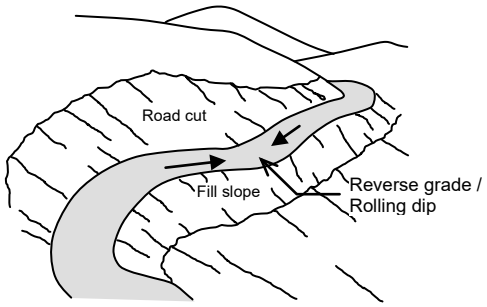
Note: Rolling dips must drain the road surface and be driveable for the expected traffic.

Figure X-20. Specifications and use of rolling dips to reduce ditch erosion and surface runoff.









ROAD GRADE (%)	TROUGH	A: REVERSE GRADE	B: UPSLOPE APPROACH	
	Min.depth below downslope crest	Min. distance and grade from trough axis to downroad crest (ft)	Distance from up-road start of rolling dip to trough axis (ft)	Grade (%)
<5%	8"	7 feet at 10% to 15 feet at 5%	17	10%
10%			30	15%
15%			60	20%

NOTES:

- A reverse grade dip (or rolling dip) is a broad long permanent dip constructed into native soils. It is intended to drain the trail/road while not significantly impeding traffic.
- On existing trails/roads the dip is cut into the existing tread with the down road dip built up on compacted fill.
- The dip shall be a minimum of 8 inches deep and incorporate a 2-foot long flat reach at the base of the trough (unless otherwise directed).
- The down road reverse grade of the dip shall generally sloped 5% for minimum 7 feet to 10% for minimum of 15 feet to form the minimum 8 inch deep dip. On roads/trail steeper than 15% a steeper reverse grade dip may be required
- The dip axis should be out sloped 3% greater than trail grade to maximum 15%.
- Dip outlets should be located to drain into areas with adequate sediment filter quality and non-erodible material such as rock, slash, brush, etc. Where specified, the bottom of the outfall of the dip will be surface rocked.
- Where natural slopes exceed 50%, fill shall not be pushed over the dip outlet. A backhoe or excavator may be required to pull back fill at outlet of existing dips.
- Dips shall be placed as specified in the plans. If not specified then dips shall be placed at maximum 75 foot spacings.

6A1

REVERSE GRADE DIP (Typical)

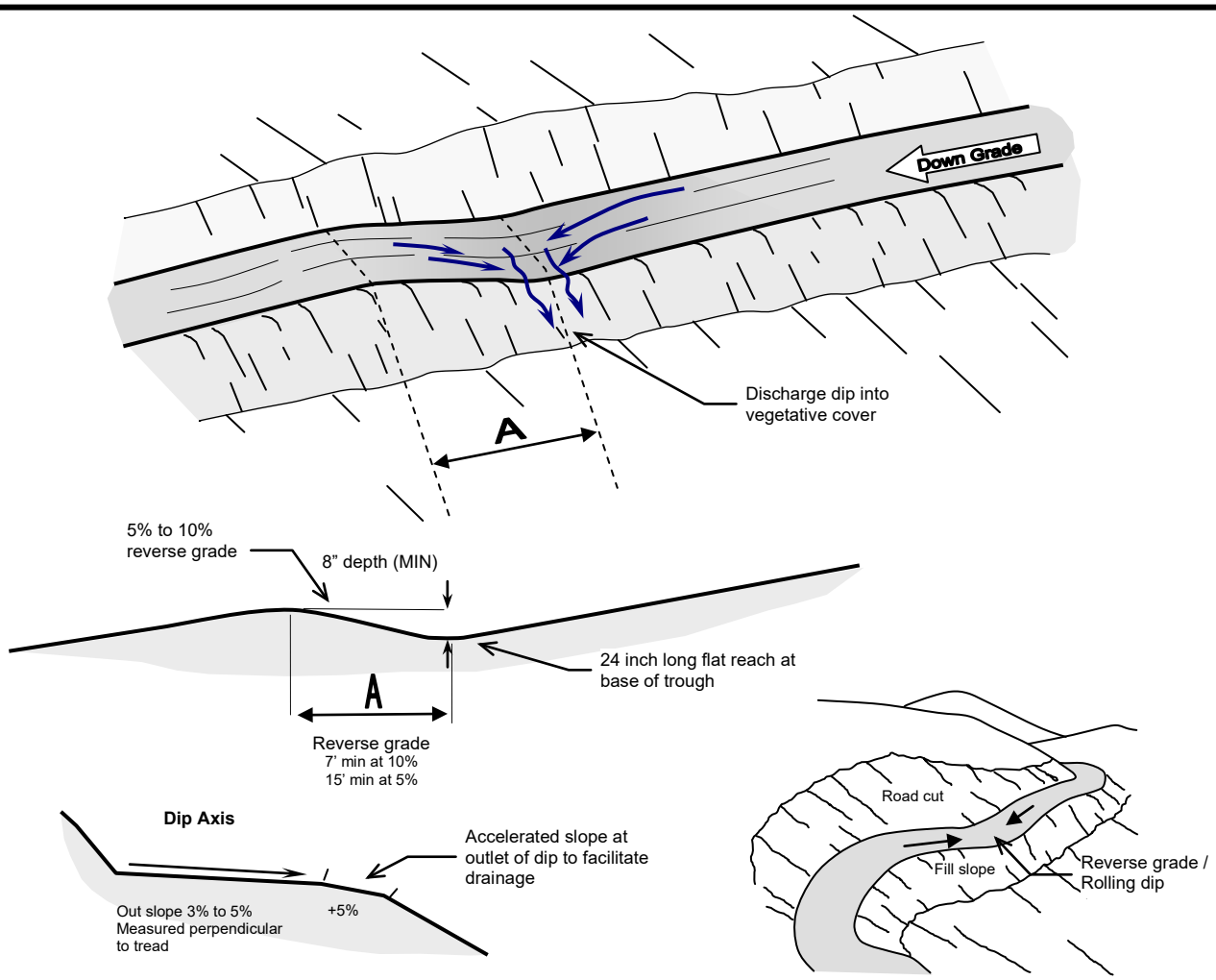
EXISTING ROAD OR TRAIL

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

REVERSE GRADE DIP:
EXISTING ROAD / TRAIL

Standard Detail 6A1

Date: November 29, 2011



TRAIL GRADE (%)	TROUGH	A: REVERSE GRADE	
	Min. Depth below downslope crest	Min. distance from trough axis to down trail crest (ft)	Grade (%)
0-5%	8"	15	-5%
0-15%	8"	7	-10%
>15%	As directed		

NOTES:

- A reverse grade dip (or rolling dip) is a broad long permanent dip constructed into native soils. The dip is long to prevent breaking down over time. On new trails the dip is incorporated into the trail at the time of construction.
- The dip shall be a minimum of 8 inches deep and incorporate a 2-foot long flat reach at the base of the trough (unless otherwise directed).
- The reverse grade shall be sloped 5% for minimum 15 feet to 10% for minimum of 7 feet to form the minimum 8 inch deep dip.
- The dip axis should be out sloped (measured perpendicular to trail) 3% to 5% unless otherwise specified or directed.
- Dip outlets should be located to drain into areas with adequate sediment filter quality and non-erodible material such as rock, slash, brush, etc. Where specified, the bottom of the outfall of the dip will be surface rocked.
- Where natural slopes exceed 50%, fill shall not be pushed over the dip outlet. A backhoe or excavator may be required to pull back fill at outlet of existing dips.
- Dips shall be placed as directed or specified in the plans. If not specified then dips shall be placed at maximum 75 foot spacings.

6A2

REVERSE GRADE DIP (Typical)

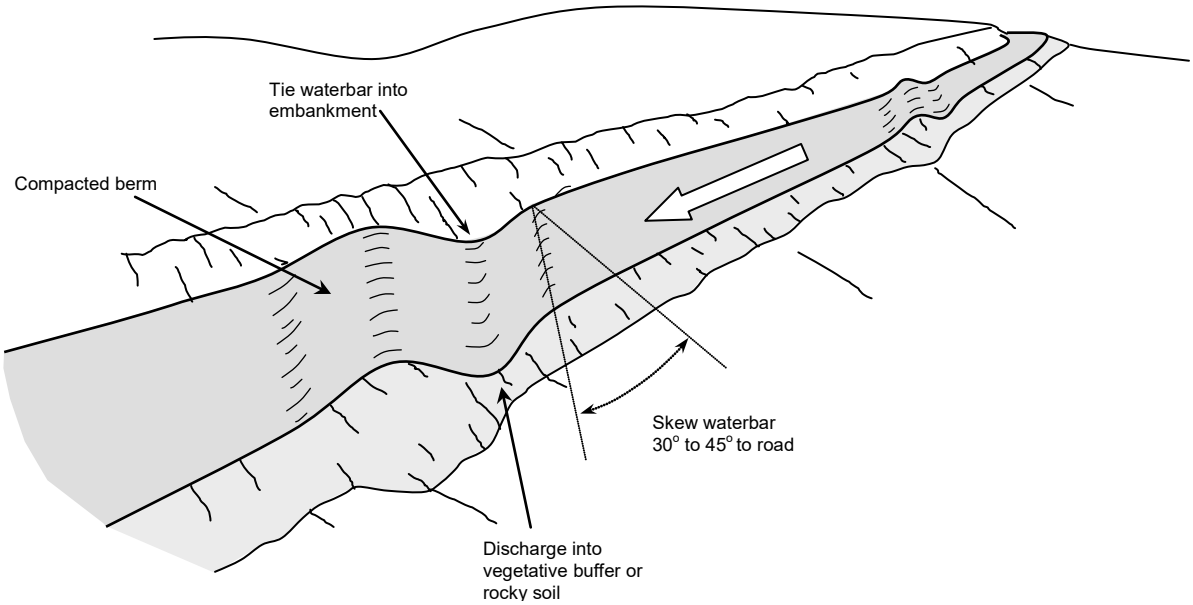
NEW TRAIL CONSTRUCTION

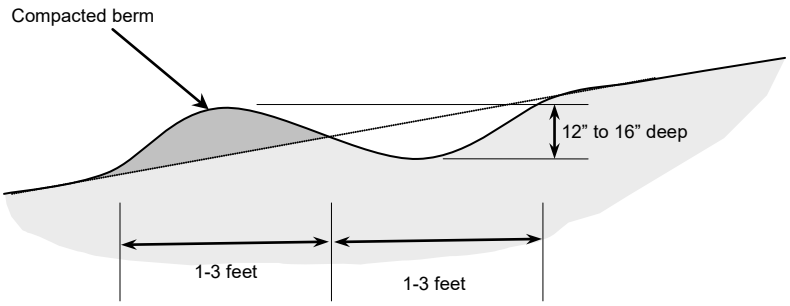
TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

REVERSE GRADE DIP:
NEW TRAIL CONSTRUCTION

Standard Detail 6A2

Date: November 29, 2011





NOTES

- Identify waterbar locations that take advantage of natural drainage features and minimize the amount of disturbance required for waterbar construction
- All waterbars shall begin at the intersection of the roadbed surface and the cut slope and run the entire width of the road surface prism.
- Waterbar length shall not exceed 1.5 times the width of the road surface.
- Acceptable waterbars shall be skewed 30 to 45 degrees.
- All waterbars shall have free flowing outlets with minimum 2% grade in the bottom of the channel that discharge onto vegetative surfaces or less erodible material where possible.
- Native materials used to construct downslope berm shall be compacted with equipment to minimize wear resulting from trespass and/or administrative use.
- Waterbar depth measured from the bottom of the waterbar channel to the top of the compacted berm must be between 12" and 16" high.
- Compacted waterbars must be passable in a 4WD vehicle unless otherwise specified in the contract.

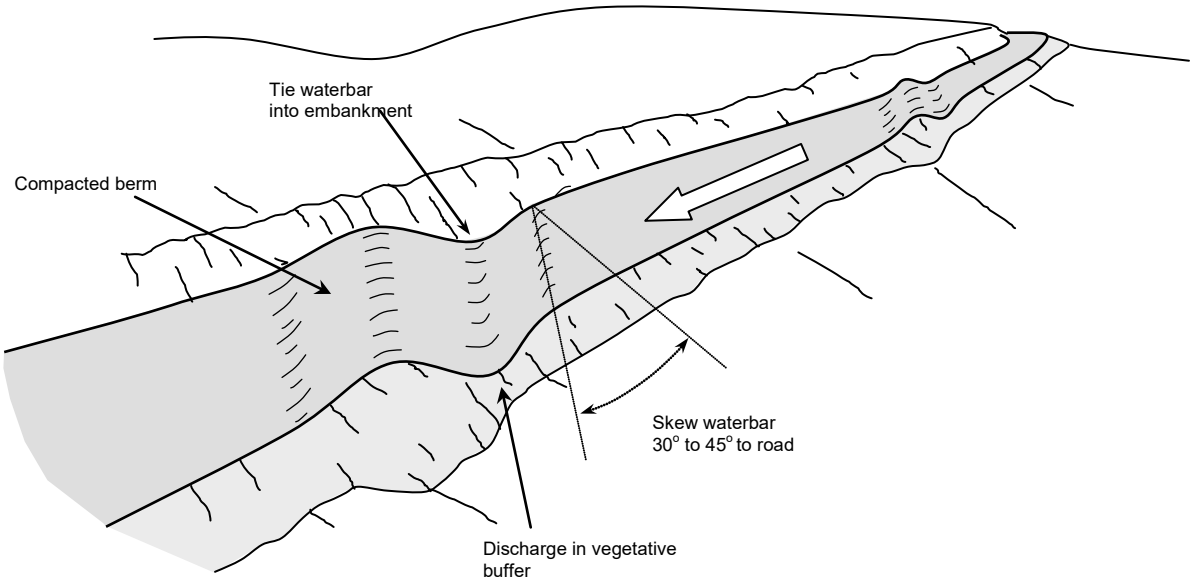
6C **WATERBAR (Typical)**
NTS

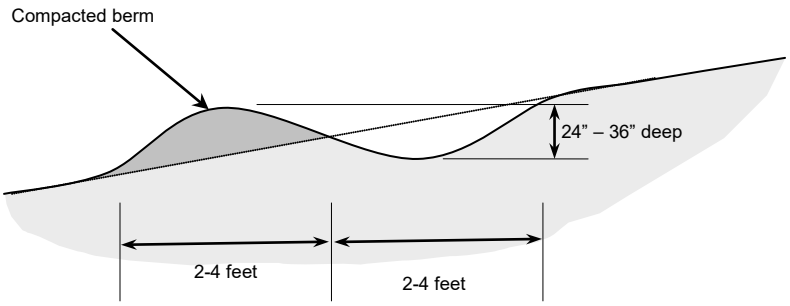
TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

WATERBAR
TYPICAL SPECIFICATIONS

Standard Detail 6C

Date: May 3, 2009





NOTES

- Large waterbars are to be used on roads proposed for abandonment to correct drainage and prevent vehicle access
- Identify waterbar locations that take advantage of natural drainage features and minimize the amount of disturbance required for waterbar construction
- Acceptable waterbars shall be skewed 30 to 45 degrees.
- All waterbars shall have free flowing outlets with minimum 2% grade in the bottom of the channel that discharge onto vegetative surfaces or less erodible material where possible. Pull back perched fill at dip outlet
- Native materials used to construct downslope berm shall be compacted with equipment to minimize wear resulting from trespass.
- Waterbar depth measured from the bottom of the waterbar channel to the top of the compacted berm must be between 24" and 36" high.

9E **LARGE WATERBAR (Typical)**
NTS

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

LARGE WATERBAR
TYPICAL SPECIFICATIONS

Standard Detail 9E

Date: March 22, 2012

Brushlayering with Soil Wrap

This technique consists of live cut branches (brushlayers) interspersed between layers of soil wrapped in natural or synthetic geotextile materials. The brush is placed in a crisscross or overlapping pattern so that the tips of the branches protrude just beyond the face of the fill, where they act as horizontal drains and improve slope stability by redirecting the flow direction. Natural geofabrics, such as coir netting, are typically wrapped around the soil layer to provide additional soil surface protection and reinforcement.

Conditions Where Practice Applies

Brushlayering with geotextile soil wraps can be used to stabilize very steep slopes. They provide an alternative to vertical retaining structures for grade separation purposes and in situations that require avoiding right-of-way encroachment at the base or top of slopes. Geotextile soil wraps can also be used to protect slopes that are subject to periodic scour or tractive stresses, such as drainage channels or upper portions of streambanks.

Materials

Long branches of trees and brush which are capable of vegetative propagation, usually willows. The length of the branches will vary with the type of application (embankment or buttress fill) and desired depth of reinforcement; ideally they should be long enough to reach the back of a buttress fill. The inert construction material consists of natural geofabrics such as coir netting, or synthetic, polymeric geogrids. Natural geofabrics or geogrids are then wrapped around the soil layers to protect the slope face and provide a stable planting surface.

Implementation

Begin at the base of the slope and proceed upward. See typical drawing below for the step by step procedures of brushlayering with soil wrap. The vegetated soil wrap structure should be supported on a rock toe or base and be battered or inclined at an angle of at least 10 to 20 degrees to minimize lateral earth forces. A trench should be excavated to a competent horizon as well as below the likely depth of scour.

The fabric is installed by placing it on top of the soil so that at least 0.5 m (3 feet) can be anchored by wooden stakes to the soil-gravel layer. Allow 2 m (6 feet) of fabric to extend beyond the brushlayer so that it will lap over and cover the soil-gravel mix , then stake into place. Crisscross layers of dormant cuttings and/or transplants on top of the soil wrap, placing the cut ends into the slope with the tips extending beyond the edge of the bench (no more than ¼ of the total branch length). Care should be taken to place the branches at random with regard to size and age and species composition. Deposit a layer of topsoil over the cuttings and tamp into place.

Brushlayering with Soil Wrap (continued)

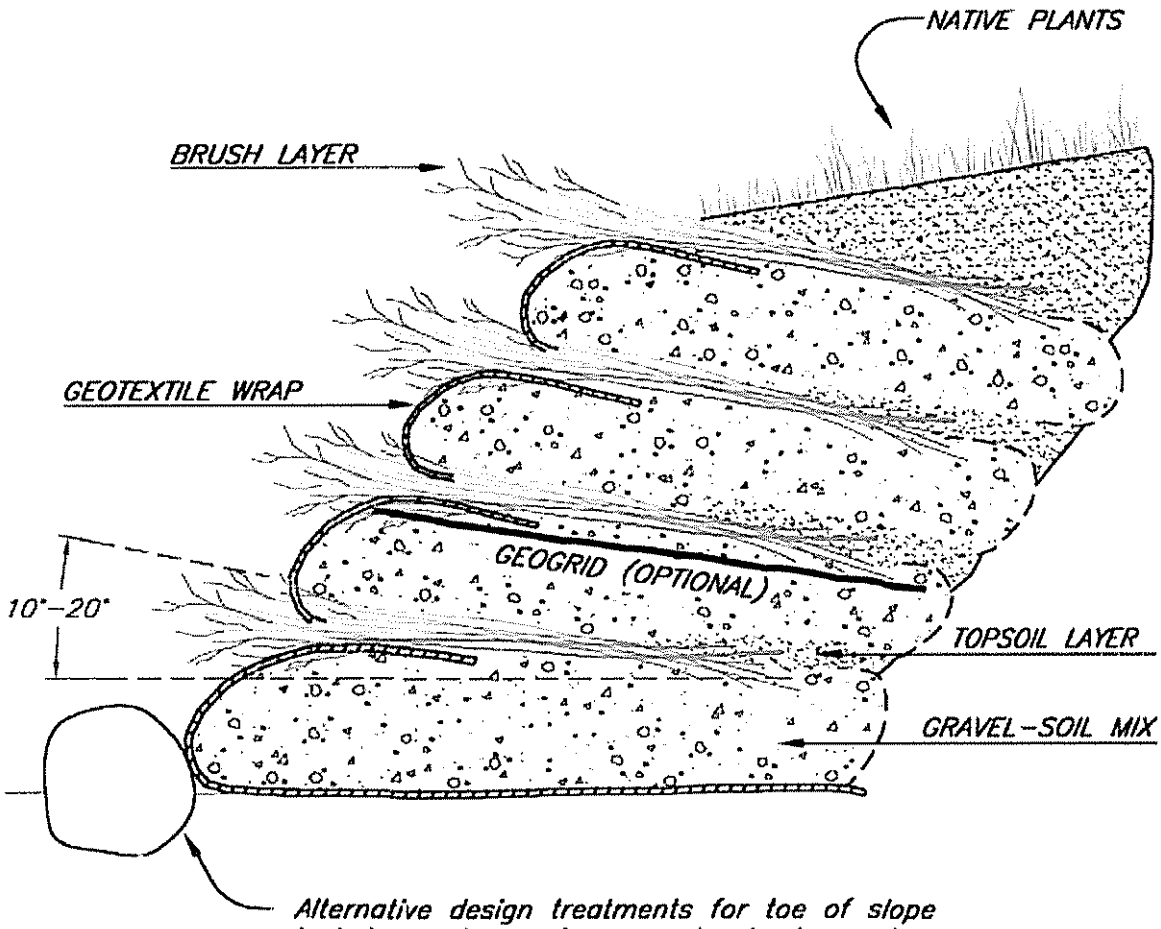
Repeat the branch, topsoil, and wrapped soil-gravel mix layering sequence until the desired bank height is achieved. Fill slopes can be created at the same time a brushlayer is installed. On a cut slope and existing streambanks, each layer is excavated at the time the brush layer is installed.

BRUSHLAYERING

Construction Specifications:

- Cuttings shall be harvested and planted when the willows, or other chosen species, are dormant. This period is generally from late fall to early spring.
- Choose plant materials that are adapted to the site conditions from species that root easily.
- Branch cuttings shall be 4-8 feet (1.2-2.5 m) long, 3/4-2 inches (20-50 mm) in diameter.
- Pre-soak cuttings for a minimum of 24 hours before installing.
- The surface of the bench shall be sloped so the outside edge is higher that the inside so the butt ends angle down slightly into the slope.
- Place branch cuttings, 3-8 inches (76-203 mm) thick, in a crisscross or over lapping configuration. The growing tips shall protrude 6-12 inches (152-305 mm) from the slope face with the butt end dipping into the slope.
- Immediately cover brushlayer with 6 inches (152 mm) of fill soil and compact according to construction specifications. Water the soil cover immediately to wet the cuttings and achieve adequate compaction.
- Earth moving equipment shall not travel directly over the cuttings. Six inches (152 mm) of soil must be maintained between the brushlayer and equipment at all times.
- Fill and compact the soil placed above the brushlayer in successive lifts, maximum 6-8 inches (152-203 mm) deep.
- Install the next brushlayer 3-8 feet (1-2.5 m) above the previous row.
- Seed and mulch slope. Shallow slopes, generally 3:1 or flatter may be seeded and mulched by hand. Steeper slopes should have seed applied hydraulically and the mulch shall be anchored with tackifier or other approved methods.

Inspection and Maintenance: Regular inspection and maintenance of bioengineering installations should be conducted, particularly during the first year. Prompt correction of any failures is essential to prevent major problems from developing.



NOTES:

1. Brush layers, geofabrics and geogrids are tensile inclusions, which modify shear stress.

2. Additionally, once established the root systems bind the entire system together as a coherent mass.

3. Live brush layers act as horizontal drains and improve slope stability by redirecting the flow direction.

4. Cut branches 3' to 12' long from appropriate salix, cornus or populus species.

5. Branches up to 12' long can be used on fillslope installations. Branches for cutslope installation can be 2' to 10' long depending on the bench excavation.

6. Natural geofabrics (coir netting) or geogrids can be wrapped around soil layers to provide additional soil reinforcement.

BRUSHLAYERING WITH GEOTEXTILE SOIL WRAP

© 1999 JOHN McCULLAH

FILE: SOILWRAP

Brushlayering with Rock Toe Protection

Brushlayers with rock toe are rows of live woody cuttings that are layered, alternating with successive lifts of soil fill, to construct a reinforced slope or embankment above a rock toe that armors the bank until the vegetation becomes established.

Conditions Where Practice Applies

Streambanks with low velocities, and slopes up to 2:1 that are susceptible to shallow mass movement. Sea or lake shores with light to moderate wave energy.

Materials

Live willow branches (or cuttings of other adventitiously-rooting species) at least 6 ft long, with a minimum diameter of ¾ in. Rock sized appropriately to resist velocities at design discharge.

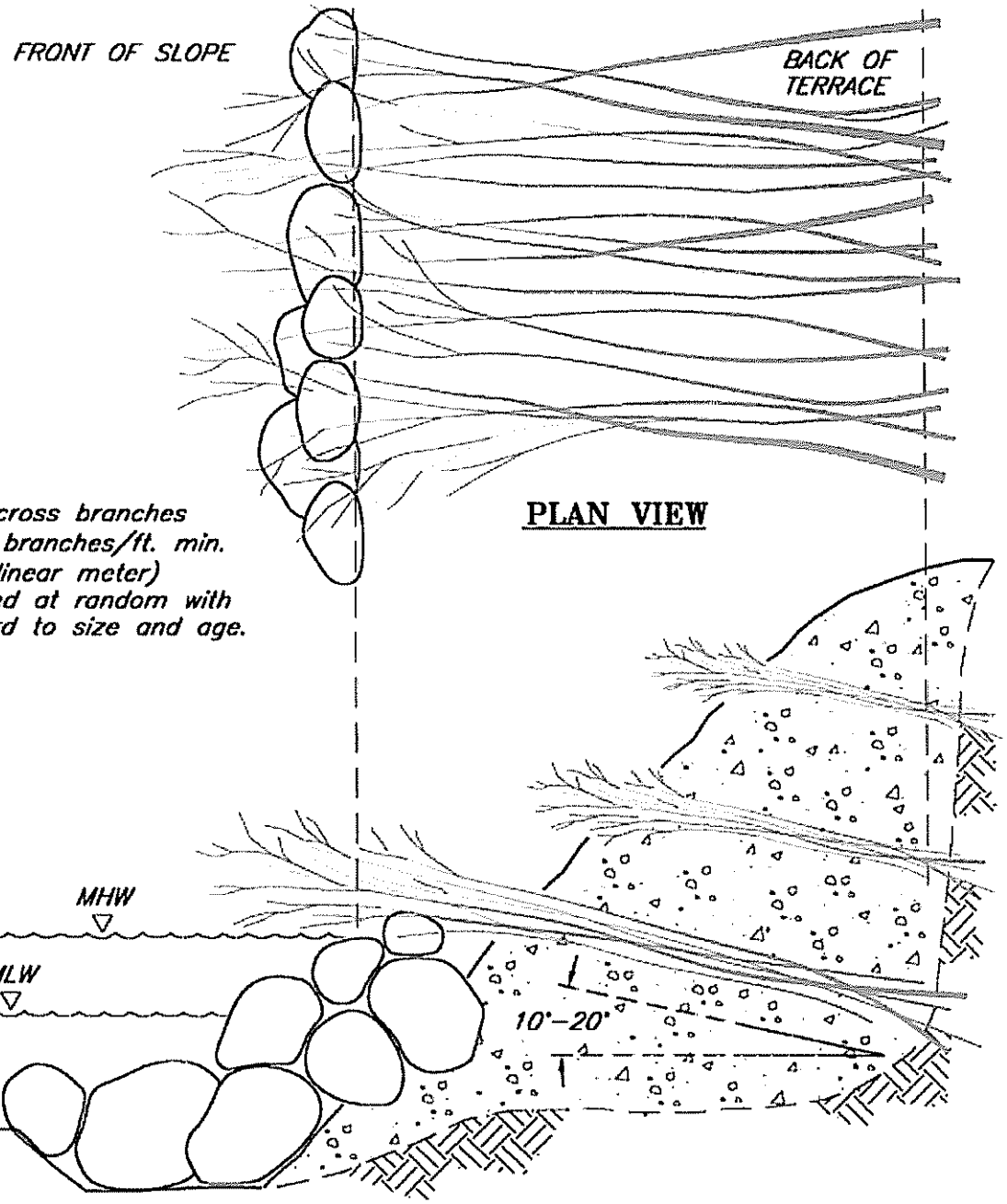
Advantages

Brushlayering involves relatively simple construction. Among the ground stabilizing techniques, the brushlayer has an immediate impact, its protective and stabilizing effect extending into lower soil horizons. At extreme sites where erosion, deposition, and rockfall are particular hazards, brush layers and the pioneer vegetation that develops with them gradually eliminate these problems. Fast establishment of a stable soil-root complex is possible. Relatively short and spreading branches of the scrub willows growing in mountainous regions can be used. Simultaneous brushlayering construction during fill operations is possible. It is one of the best techniques for revegetating and stabilizing streambanks and slopes. Living and non-living brush layers along streambanks also provide valuable fish habitat.

Brushlayers also provide a flexible strengthening system to fills. A bank can sag or distort without pulling apart the brushlayers. The brushlayers will “stretch” because they are laid in to the slope on a diagonal, and are also self-repairing to the extent that they regrow roots in the case of a shear failure. Brushlayers act as horizontal drains and favorably modify the soil water flow regime.

Implementation

Place rock as designed. The rock should extend up the bank to the expected mean high water. Construct by excavating or filling a terrace above the rock protection. The terrace must slope back into the slope 10-20 degrees minimum. Place branches at least 6 ft long on the terrace. Branches shall crisscross at random with regard to size and age. Place 5-8 branches per linear foot (20/linear m), and 8-18" should protrude beyond the face of the slope. Cover and compact (add water if necessary) the brush layer with 6-18" of soil and construct another terrace and brushlayer. Proceed up the bank as desired.



NOTES:
1. Tilt branches down into the slope 10°–20° min.
2. Brushlayering may be constructed with non–compacted or compacted backfill without damage to the brush layer.
3. Branches irrespective of length, should protrude 8–18in. (0.20–0.50 meters) beyond the face of the slope.

BRUSHLAYERING WITH ROCK TOE PROTECTION

© 1999 JOHN McCULLAH

FILE: BRLAY–RT

Brush Mattress (Brush Mat)

A brush mattress or brush mat is a revegetation technique that provides a protective covering to a slope or streambank as soon as it is installed. A brush mattress is typically constructed using live willow branches or other species that root easily from cuttings, but can also be constructed with any brushy, woody branches in order to provide immediate and effective slope protection.

Conditions Where Practice Applies

Brush mattresses are ideal for eroding streambanks or slopes where immediate protection is needed. Streambanks which are in jeopardy of being scoured due to high erosive forces can be rapidly stabilized by installation of a brush mattress along the eroding reach. Because of the dense layer of brush, the brush mattress can deflect water from the bank and protect it from scouring, while also providing habitat directly along the waters' edge. Brush mattresses also work well for shoreline protection. The density of the mat will break the impact of waves and instantly provide a thick protective layer of brush along the shoreline. If the desire is to stabilize and revegetate an eroding streambank or shoreline and discourage foot trails along sensitive areas, brush mats work well as impenetrable barriers, giving time for vegetation to become established. On slopes, brush mattressing provides rapid protection against surficial erosion. Brush mats are often combined with other soil stabilization techniques such as vegetated riprap, wattles, live Fascines, root wads, live siltation, or coir logs, which may be needed to secure the toe of the slope. The brush mattress technique is usually most effective on slopes no steeper than 2H:1V.

Advantages

Brush mattresses quickly stabilize a slope or streambank by providing a dense network of branches which prevent surficial erosion, while also collecting soil and native seeds. The overlapping branches provide an ideal environment for native seeds to germinate and establish. As the live branches root and grow, the soil is reinforced with an underground matrix of spreading roots. If used on streambanks, a brush mat will trap sediments during high water, and eventually the plant growth on the stabilized streambank will provide aquatic habitat. Brush mattresses work well for stabilizing reconstructed stream channels, as they provide immediate cover for fish and instant bank protection, even before they become established and grow.

Of all the streambank biotechnical practices, brush mattresses can withstand the highest velocities. Studies conducted by Christoph Gerstgraser, Universitat fur Bodenkultur, Vienna, Austria, demonstrated that brush mattresses stabilized the bank in a test flume against velocities exceeding 7 m/s (20 f/s), while other techniques, even rock riprap, failed.

Brush Mattress (Brush Mat) (continued)

Disadvantages

Large numbers of cuttings are required, probably more than any other biotechnical method, and the availability of plant material should be carefully evaluated before including this technique in a revegetation design. Brush mat installation is a labor-intensive construction method. As with most biotechnical projects, if using live cuttings, brush mattresses must be installed during the dormancy period of species used. In areas which receive little rainfall, brush mattresses installed on dry slopes may not survive long, as this technique does not entrench the branches deeply into the soil.

Implementation

- Prepare the slope or streambank by clearing away large debris, and the slope should be graded so that branches will lay flat on the bank. Do not disturb the slope or bank any more than necessary. Excavate a horizontal trench, 8 to 12 inches deep, at the toe of the streambank or at the base of applicable area on the slope. The basal ends of the branches should extend into moist soil.

- Lay the cuttings flat against the graded slope, slightly crisscrossed, with the basal ends placed as deeply into the trench as possible. Continue to lay the cuttings along the face of the bank or slope until about 80% groundcover is achieved (about 6-12 inches thick). If the length of the slope or bank is longer than the cuttings, stagger and overlap the cuttings so the entire area has adequate coverage. Rooted plants can be planted within the brush mattress, but these should be planted before the branches are laid, as it is too difficult to plant through the mattress afterward.

- Pound in a grid of 24 to 36 inch long stakes into the mattress at 3 to 4 foot centers. Do not pound the stakes completely in, as this will be done after tying. Use longer stakes in less cohesive (sandy) soil. Secure the brush mattress by using cord, rope, or 10-12 gauge galvanized wire tied in a diamond pattern between each row of stakes. (Tie the cord or wire to the stakes in such a manner that if it breaks, the integrity of the remaining cord or wire is still maintained). Notching or drilling stakes may make securing cord or wire to stakes easier, but is not necessary.

- After networking the mattress with cord or wire, drive the stakes in further to compress the mattress tightly against the slope. If constructing a brush mattress on a streambank, be careful not to leave loose overhanging branches which may catch on material floating down the stream channel. The mattress may be ripped from the streambank if this occurs.

Brush Mattress (Brush Mat) (continued)

- Secure the toe of the mattress using the technique best suitable for the site conditions. To secure the toe of the mattress using a willow wattle, first construct a wattle the length of the area to be treated (see wattle technique). Make sure the wattle is tied together tightly. Place the wattle in the trench over the cut ends of the brush mattress. Secure the wattle with 18 to 48 inch long wedge-shaped wooden stakes every 3-4 feet. In some cases, such as small streams or gentle slopes, simply placing large locally collected rocks around and on top of the basal ends of the cuttings is enough to secure the toe of the mattress. Other techniques which may be used include vegetated riprap, wattles, live fascines, rootwad revetments, live siltation, or coir logs.

- Backfill around and in between the branches of the mattress by using material excavated from the trench, working the soil in well. Buckets of water will help to wash the soil down into the stems. It is most important for the thicker, basal ends of the mattress to get good soil cover for rooting, but generally cover at least 1/4 of the depth of the mattress with soil. If installed along a stream, make sure the upstream end of the mattress and wattle is keyed into the streambank to prevent high flows from scouring behind the mattress. It is also a good idea to protect this area with some revetment, large rocks, or tree trunks. If possible, tie the mattress to existing vegetation or roots on the bank for extra security.

Maintenance

It is important to monitor the brush mattress after it has been installed. Periodic monitoring of the project will provide valuable insight into the stabilization process and may offer important information for future biotechnical projects. If the willow does not grow, the mattress will still provide stability, especially if it is backfilled and seeded with native grasses, sedges, or rushes.

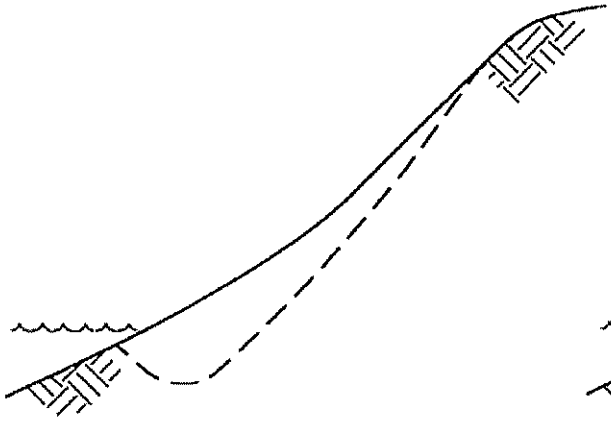
Periodic maintenance includes making sure the stakes and cord/wire are still securing the mattress to the streambank. The upstream end should be carefully checked to make sure flows are not getting behind the mattress. To ensure the highest success for the treated area, determine the land management practices that created the eroded streambanks and modify those practices as necessary (From Bentrup and Hoag, 1998).

If the area is grazed, restrict livestock from treated area to allow the eroded section of the streambank to heal. Exclosure fences are the most efficient means to accomplish this goal. Managers should resist the temptation to put the exclosure fences at the high water line. The exclosure area should include enough of the

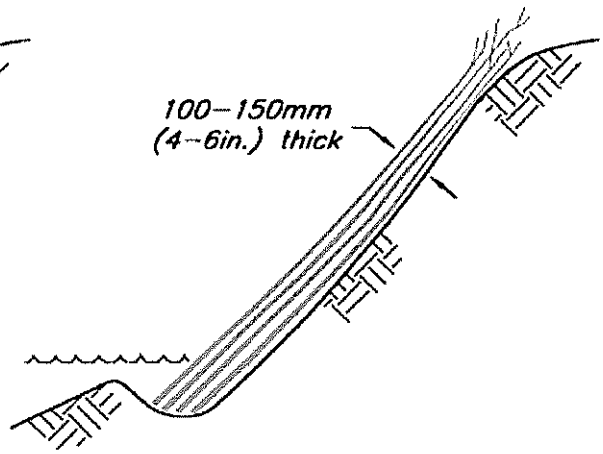
riparian zone to allow the stream to shift naturally over time.

If the area is farmed, a riparian buffer strip should be established and maintained. A buffer strip on both sides of the stream should be set aside to allow for natural riparian vegetation and stream function. A wider buffer strip is strongly encouraged and will yield greater benefits.

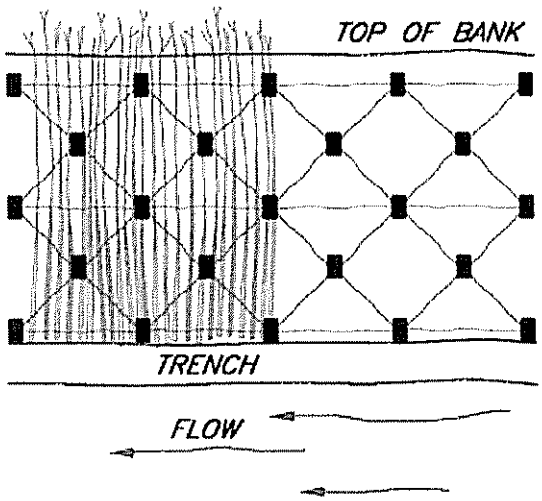
Finally, a stream is an interconnected system. Land use practices both upstream and downstream will affect the success of your bioengineering work.



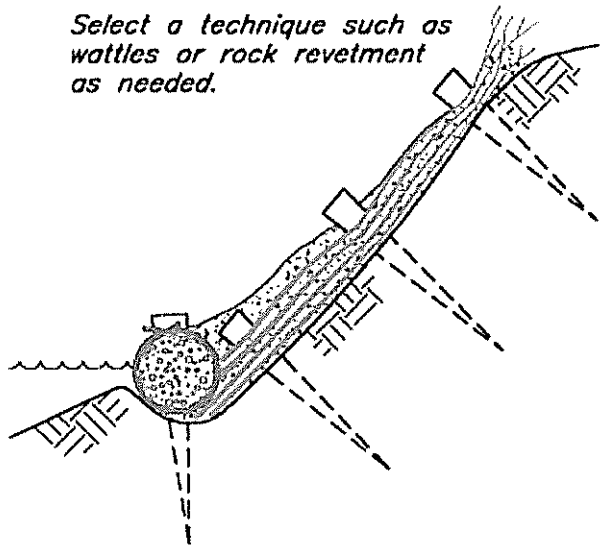
Step 1: Excavate trench and grade bank.



Step 2: Place willow branches making sure that the butt ends reach the bottom.



Step 3: Place stake (notched) on 1.0m (3ft.) centers and secure the mattress with twine, rope or wire.



Step 4: Drive the stakes deeply into the bank to tightly compress the branches against the soil. Cover and partially bury the mattress to encourage rooting.

BRUSH MATTRESS

© 2000 JOHN McCULLAH

FILE: BRSHMATT

Coir Rolls with Brushlayering

Coir logs (also called coir rolls or fiberschines) are long cylindrical tubes that are composed of interwoven coconut fibers which are bound together with durable coir netting. Coir rolls are particularly applicable for wetland, streambank, and shoreline projects. Coir rolls are most commonly available in 12 inch diameters and 20 foot lengths. These rolls can be linked together to form longer tubes, and are often used in combination with other biotechnical techniques, such as brushlayering or live siltation. Coir logs encourage siltation and wetland/floodplain creation.

Conditions Where Practice Applies

The tough, long-lasting coconut fibers make coir rolls appropriate for wetland, streambank, and shoreline applications. Coir rolls work well when immediate erosion control is needed. Brushlayers work well with coir roll applications, adding further stabilization with a live root system, while also providing excellent habitat features. The coir roll provides a base for the brushlayer cuttings to be laid upon at an appropriate angle which benefits the growth of cuttings. The cuttings provide further protection from breaking waves and high flows.

Materials

Coir rolls of the appropriate size and length, live cuttings for brushlayering, and strong rope and wooden stakes are necessary. Also needed is machinery and/or tools for leveling and compacting soil. If using a soil wrap, material (blanket or mats) appropriate to the application conditions is needed. If planning to plant coir rolls with container plants, suitable plant material such as wetland grasses are needed.

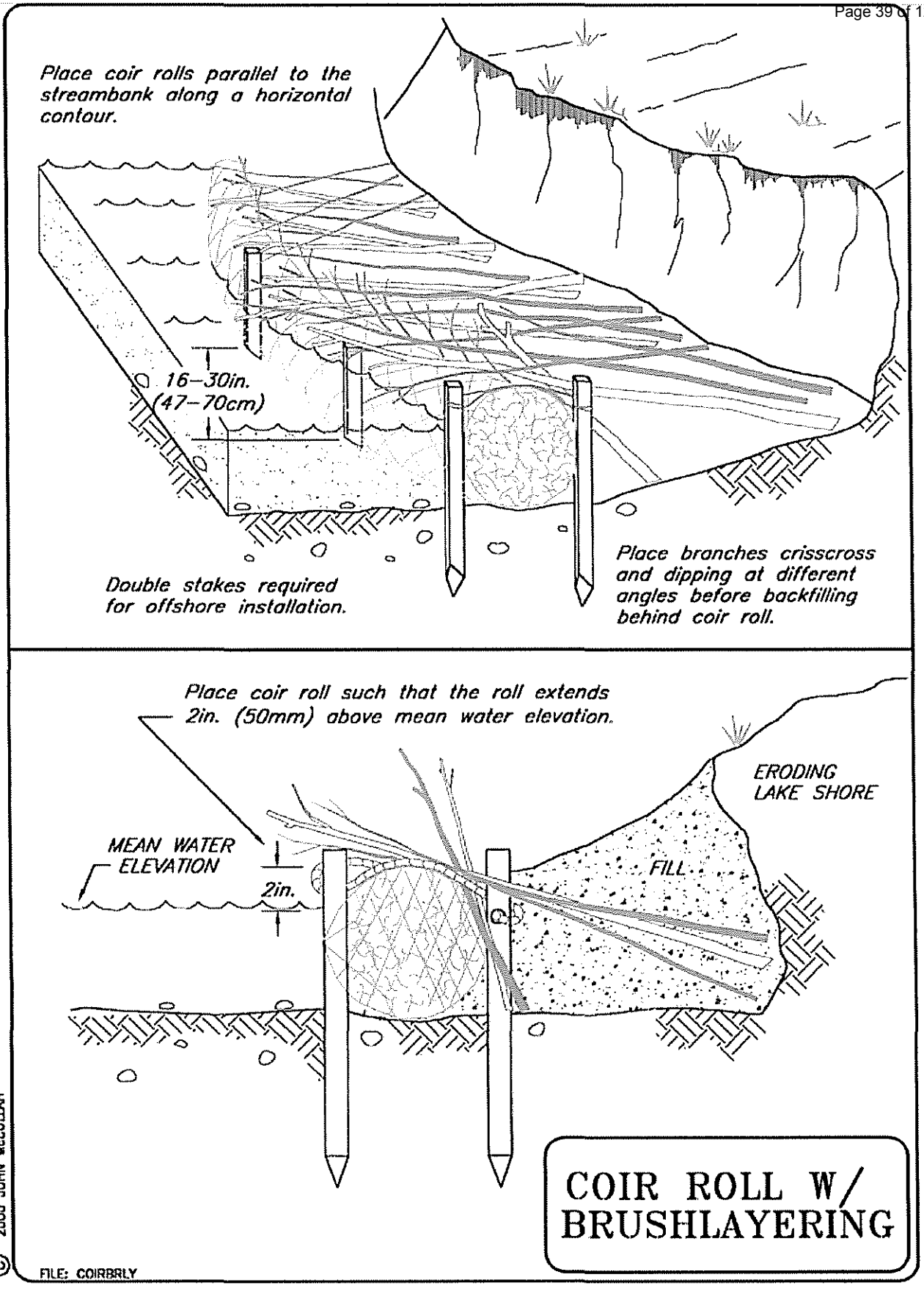
Advantages

Provides a "soft" engineering method for shoreline and streambank stabilization as opposed to "hard" engineering such as gabions and riprap alone. This makes coir rolls with brushlayering more appropriate for recreational use areas where swimmers could be injured by wire or rocks, or critical fisheries where habitat-friendly streambank stabilization is needed. The coir roll/brushlayering combination provides immediate shoreline and streambank protection, with additional benefits of riparian enhancement when the cuttings become established.

Implementation

Clear debris away and level area of application. Install coir rolls as specified (see fiberschines/coir rolls for implementation information). Prepare soil bed behind installed coir rolls for laying brushlayer cuttings. Determine soil level by laying a straight cutting on the coir roll with approximately 20% of the cutting sticking out past the roll, and with the basal ends dipping down into the soil. It is important that the bud ends of the live cuttings angle up to some degree from the basal ends. Lay cuttings in this fashion, slightly crisscrossed for additional strength. (See Brushlayering).

Next, backfill over cuttings with soil, covering the lower 80% of the branches. At this time, soil can be leveled and prepared for a soil wrap for additional height and soil stability. If simply covering the cuttings with soil, compact slightly and grade slope to appropriate angle. Use water to wash soil in between branch layers. Mulch and seed exposed areas with native species.

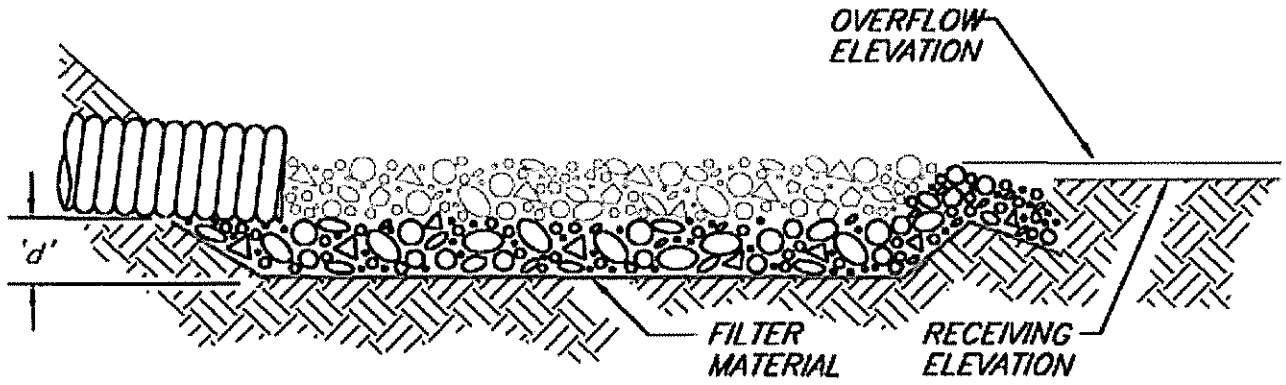

Place coir rolls parallel to the streambank along a horizontal contour.
16–30in. (47–70cm)
Double stakes required for offshore installation.
Place branches crisscross and dipping at different angles before backfilling behind coir roll.
Place coir roll such that the roll extends 2in. (50mm) above mean water elevation.
MEAN WATER ELEVATION
2in.
ERODING LAKE SHORE
FILL
COIR ROLL W/ BRUSHLAYERING
© 2000 JOHN McCULLAH
FILE: COIRBRLY

ENERGY DISSIPATOR

Construction Specifications:

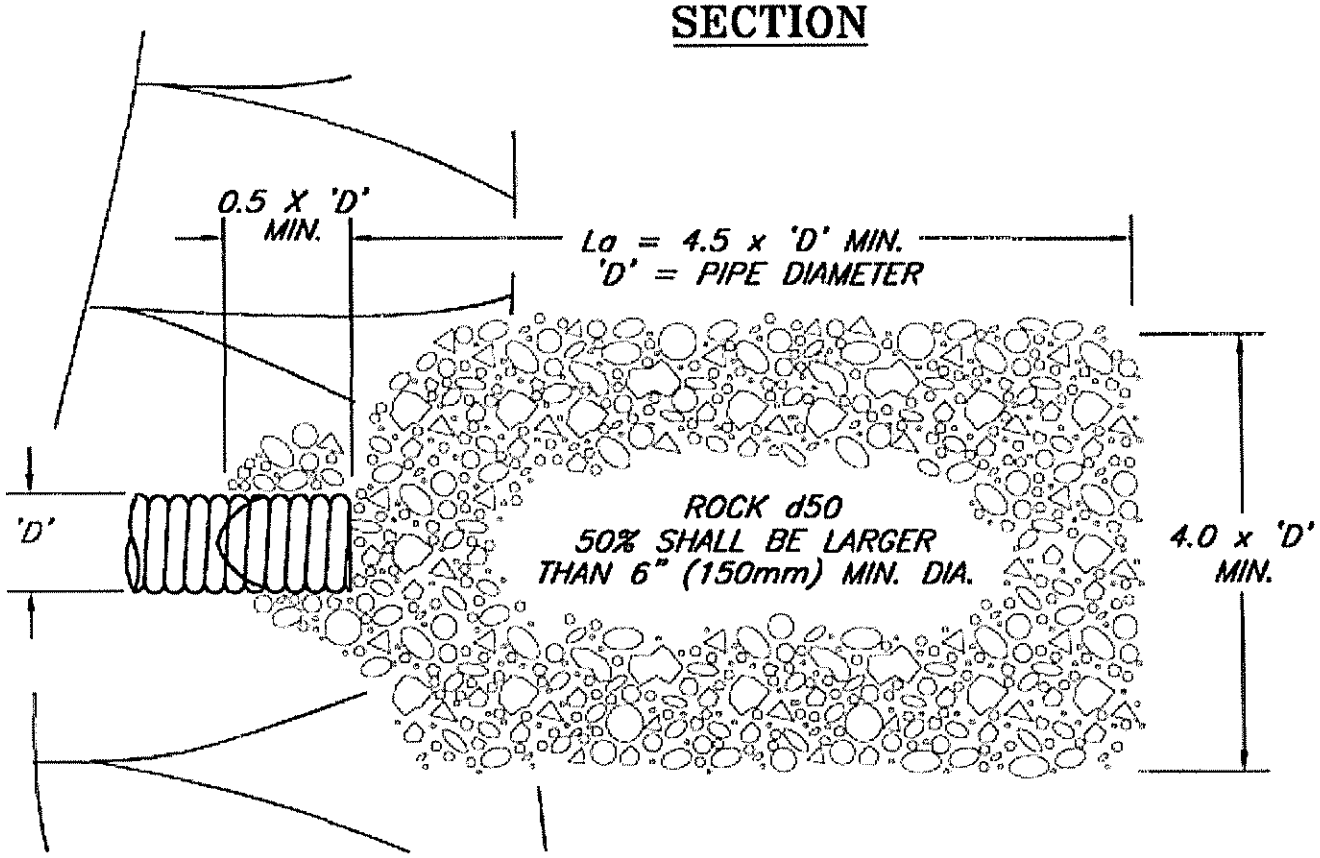
- Ensure that the subgrade for the filter and riprap follows the required lines and grades shown in the plan. Compact any fill required in the subgrade to the density of the surrounding undisturbed material. Low areas in the subgrade on undisturbed soil may also be filled by increasing the riprap thickness.
- The riprap and gravel filter must conform to the specified grading limits shown on the plans.
- Filter cloth, when used, must meet design requirements and be properly protected from punching or tearing during installation. Repair any damaged fabric by removing the riprap and placing another piece of filter cloth over the damaged area. All connecting joints should overlap a minimum of 1 foot (0.3 m). If the damage is extensive, replace the entire filter cloth.
- Riprap may be placed by equipment, but take care to avoid damaging the filter.
- The minimum thickness of the riprap should be 1.5 times the maximum stone diameter.
- Riprap may be field stone or rough quarry stone. It should be hard, angular, highly weather-resistant and well graded.
- Construct the apron on zero grade with no overfall at the end. Make the top of the riprap at the downstream end level with the receiving area or slightly below it.
- Ensure that the apron is properly aligned with the receiving stream and preferably straight throughout its length. If a curve is needed to fit site conditions, place it in the upper section of the apron.
- Immediately after construction, stabilize all disturbed areas with vegetation.

Inspection and Maintenance: Inspect riprap outlet structures after heavy rains to see if any erosion around or below the riprap has taken place or if stones have been dislodged. Immediately make all needed repairs to prevent further damage.



THICKNESS ('d') = 1.5 x MAX. ROCK DIAMETER – 6" (150mm) MIN.

SECTION



PLAN

NOTES:

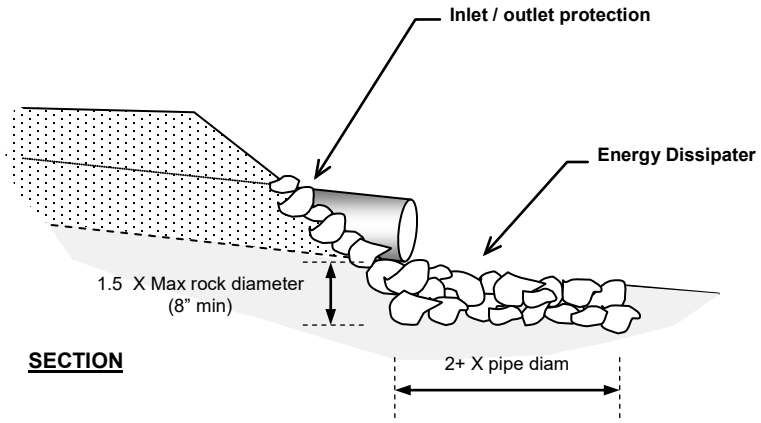
1. 'La' = LENGTH OF APRON. DISTANCE 'La' SHALL BE OF SUFFICIENT LENGTH TO DISSIPATE ENERGY.
2. APRON SHALL BE SET AT A ZERO GRADE AND ALIGNED STRAIGHT.
3. FILTER MATERIAL SHALL BE FILTER FABRIC OR 6" (150mm) THICK MINIMUM GRADED GRAVEL LAYER.

ENERGY DISSIPATOR

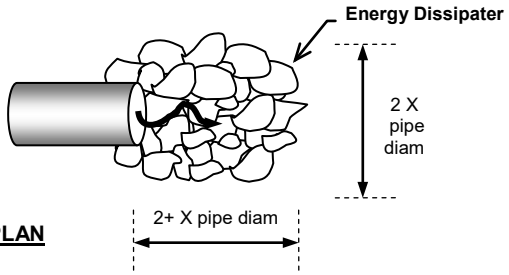
© 1994 McCULLAH

FILE: ENRGYDIS

Date of last revision: 12/20/2012



SECTION



PLAN

NOTES

- **Inlet/outlet protection**
  - Armor inlet and outlet to top of culvert with rock rip rap
  - Riprap shall consist of approved well graded sound durable angular rock unless otherwise specified
  - 50% of rock (D_{50}) shall be larger than 8 inches minimum diameter unless otherwise specified
  - Rock shall be keyed minimum 1.5 times diameter into bed and banks unless otherwise specified

- **Energy dissipater**
  - Culvert shall discharge onto rock energy dissipater / apron aligned with native channel as shown on plans or directed
  - Unless otherwise specified in plans or directed by geotechnical consultant, armor shall consist of approved sound durable angular rock adequately sized for design flow. Preliminary rock size is specified in Table C.
  - Rock apron shall extend a minimum of 2 time pipe diameter downstream of outlet and be a minimum of 2 times pipe diameter wide. Apron may taper downstream on steeper gradient channels.
  - Rock shall be embedded into channel a minimum of 1.5 times maximum rock diameter. Subexcavate channel bed and banks in areas to receive rock. Rock shall be placed to form a uniform grade at the pipe outlet in a manner to prevent flow from eroding around the edge of the apron.
  - Separate rock from native soils with approved geotextile fabric if specified on plans or directed
  - Compact loose soils adjacent to rock rip rap

TABLE C

Pipe Diameter	D_{50} Rock Size (50% of rock larger than specified)	
	Diameter	Weight
< 18"	8+"	Gabion+
24"	12"	¼ T
36"	24"	½ T
48"	36"	1½ T

5H **ENERGY DISSIPATER (Typical)**
NTS

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

ENERGY DISSIPATER
TYPICAL SPECIFICATIONS

Standard Detail 5H

Date: May 3, 2009

EROSION CONTROL BLANKETS AND MATS

Construction Specifications:

Site Preparation:

- Proper site preparation is essential to ensure complete contact of the protection matting with the soil.
- Grade and shape area of installation.
- Remove all rocks, clods, vegetative or other obstructions so that the installed blankets, or mats will have direct contact with the soil.
- Prepare seedbed by loosening 2-3 inches (50.8-76.2 mm) of topsoil above final grade.
- Incorporate amendments, such as lime and fertilizer, into soil according to soil test and the seeding plan.

Seeding:

- Seed area before blanket installation for erosion control and re-vegetation. Seeding after mat installation is often specified for turf reinforcement application. When seeding prior to blanket installation, all check slots and other areas disturbed during installation must be reseeded.
- Where soil filling is specified, seed the matting and the entire disturbed area after installation and prior to filling the mat with soil.

Anchoring: U-shaped wire staples, metal geotextile stake pins, or triangular wooden stakes can be used to anchor mats to the ground surface. Wire staples should be a minimum of 11 gauge. Metal stake pins should be 3/16 inch (4.8 mm) diameter steel with a 1 1/2 inch (38.1 mm) steel washer at the head of the pin. Wire staples and metal stakes should be driven flush to the soil surface. All anchors should be 6-8 inches (0.2-0.5 m) long and have sufficient ground penetration to resist pullout. Longer anchors may be required for loose soils.

Installation on Slopes:

- Begin at the top of the slope and anchor its blanket in a 6 inch (0.2 m) deep x 6 inch (0.2 m) wide trench. Backfill trench and tamp earth firmly.
- Unroll blanket downslope in the direction of the water flow.
- The edges of adjacent parallel rolls must be overlapped 2-3 inches (51-76 mm) and be stapled every 3 feet (0.9 m).
- When blankets must be spliced, place blankets end over end (shingle style) with 6 inch (0.2 m) overlap. Staple through overlapped area, approximately 12 inches (0.3 m) apart.
- Lay blankets loosely and maintain direct contact with the soil - do not stretch.
- Blankets shall be stapled sufficiently to anchor blanket and maintain contact with the soil. Staples shall be placed down the center and staggered with the staples placed along the edges. Steep slopes, 1:1 to 2:1, require 2 staples per square yard. Moderate slopes, 2:1 to 3:1, require 1-2 staples per square yard (1 staple 3' o.c.). Gentle slopes require 1 staple per square yard.

Installation in channels:

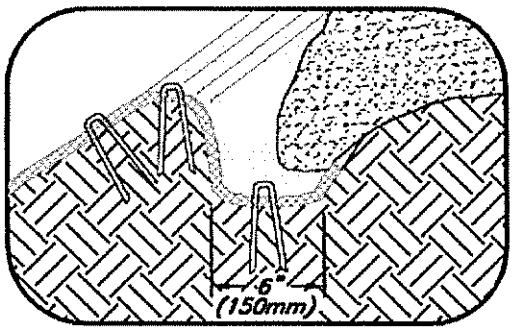
- Dig initial anchor trench 12 inches (0.3 m) deep and 6 inches (0.2 m) wide across the channel at the lower end of the project area.
- Excavate intermittent check slots, 6 inches (0.2 m) deep and 6 inches (0.2 m) wide across the channel at 25-30 foot (7.6-9.1 m) intervals along the channel.
- Cut longitudinal channel anchor slots 4 inches (101 mm) deep and 4 inches (101 mm) wide along each side of the installation to bury edges of matting. Whenever possible extend matting 2-3 inches (51-76 mm) above the crest of channel side slopes.
- Beginning at the downstream end and in the center of the channel, place the initial end of the first roll in the anchor trench and secure with fastening devices at 1 foot (.3 m) intervals. **Note**: matting will initially be upside down in anchor trench.
- In the same manner, position adjacent rolls in anchor trench, overlapping the preceding roll a minimum of 3 inches (7.6 cm).
- Secure these initial ends of mats with anchors at 1 foot (0.3 m) intervals, backfill and compact soil.
- Unroll center strip of matting upstream. Stop at next check slot or terminal anchor trench.
- Unroll adjacent mats upstream in similar fashion, maintaining a 3 inch (76 mm) overlap.
- Fold and secure all rolls of matting snugly into all transverse check slots. Lay mat in the bottom of the slot then fold back against itself. Anchor through both layers of mat at 1 inch (25.4 mm) intervals, then backfill and compact soil. Continue rolling all mat widths upstream to the next check slot or terminal anchor trench.
- Alternate method for noncritical installations: place two rows of anchors on 6 inch (0.2 m) centers at 25-30 feet (7.6-9.1 m) intervals in lieu of excavated check slots.
- Shingle-lap spliced ends by a minimum of 1 foot (0.3 m) with upstream mat on top to prevent uplifting by water or begin new rolls in a check slot. Anchor overlapped area by placing two rows of anchors, 1 foot (0.3 m) apart on 1 foot (0.3 m) intervals.
- Place edges of outside mats in previously excavated longitudinal slots, anchor using prescribed staple pattern, backfill and compact soil.
- Anchor, fill and compact upstream end of mat in a 12 inch (0.3 m) x 6 inch (0.2 m) terminal trench.
- Secure mat to ground surface using U-shaped wire staples geotextile pins or wooden stakes.
- Seed and fill turf reinforcement matting with soil, if specified.

Soil filling if specified for turf reinforcement:

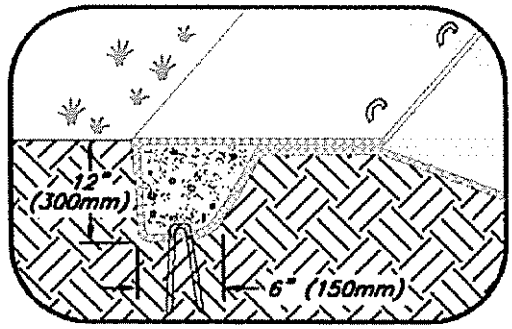
- After seeding, spread and lightly rake 1/2-3/4 inches (12.7-19.1 mm) of fine topsoil into the mat apertures to completely fill mat thickness. Use backside of rake or other flat implement.
- Spread topsoil using lightweight loader, backhoe, or other power equipment. Avoid sharp turns with equipment.
- Do not drive tracked or heavy equipment over mat.
- Avoid any traffic over matting if loose or wet soil conditions exist.
- Use shovels, rakes or brooms for fine grading and touch up.
- Smooth out soil filling, just exposing top netting of matrix.

Inspection and Maintenance:

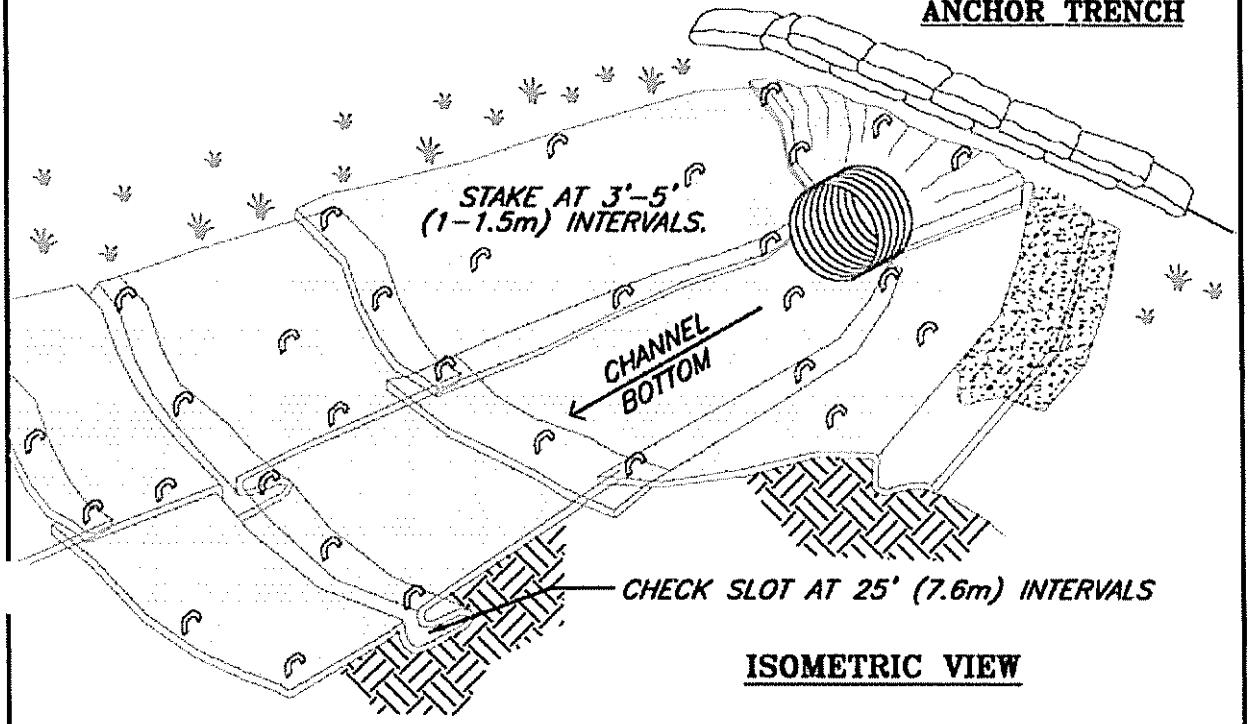
- All blanket and mats should be inspected periodically following installation.
- Inspect installation after significant rainstorms to check for erosion and undermining. Any failure should be repaired immediately.
- If washout or breakage occurs, re-install the material after repairing the damage to the slope or drainageway.



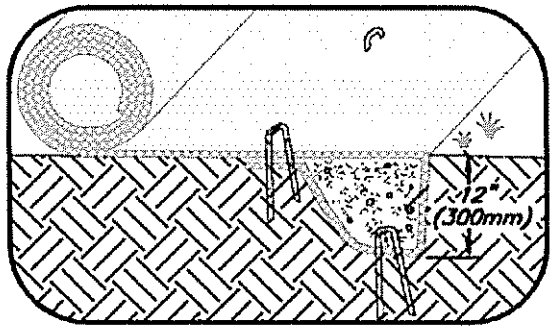
LONGITUDINAL ANCHOR TRENCH



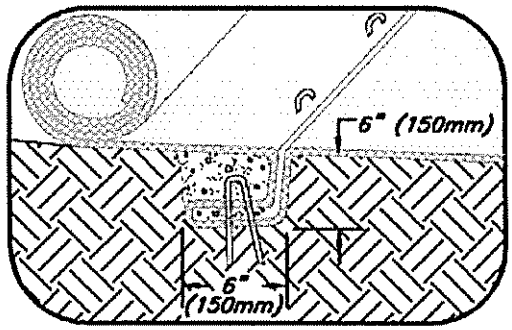
TERMINAL SLOPE AND CHANNEL ANCHOR TRENCH



ISOMETRIC VIEW



INITIAL CHANNEL ANCHOR TRENCH



INTERMITTENT CHECK SLOT

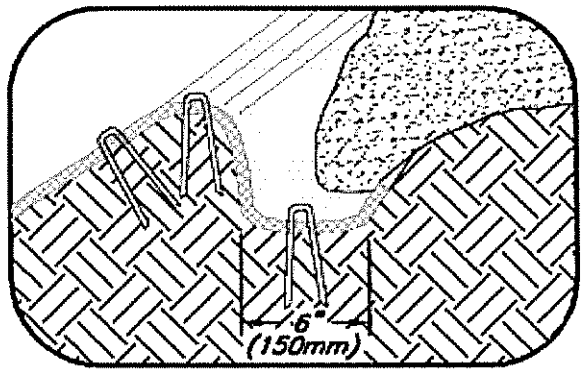
NOTES:

1. CHECK SLOTS TO BE CONSTRUCTED PER MANUFACTURERS SPECIFICATIONS.
2. STAKING OR STAPLING LAYOUT PER MANUFACTURERS SPECIFICATIONS.

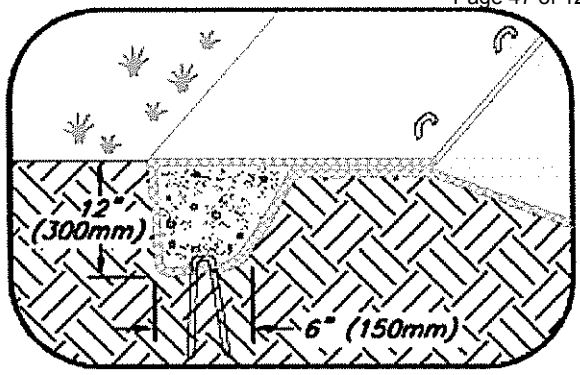
EROSION BLANKETS & TURF REINFORCEMENT MATS CHANNEL INSTALLATION

© 1994 JOHN McCULLAH

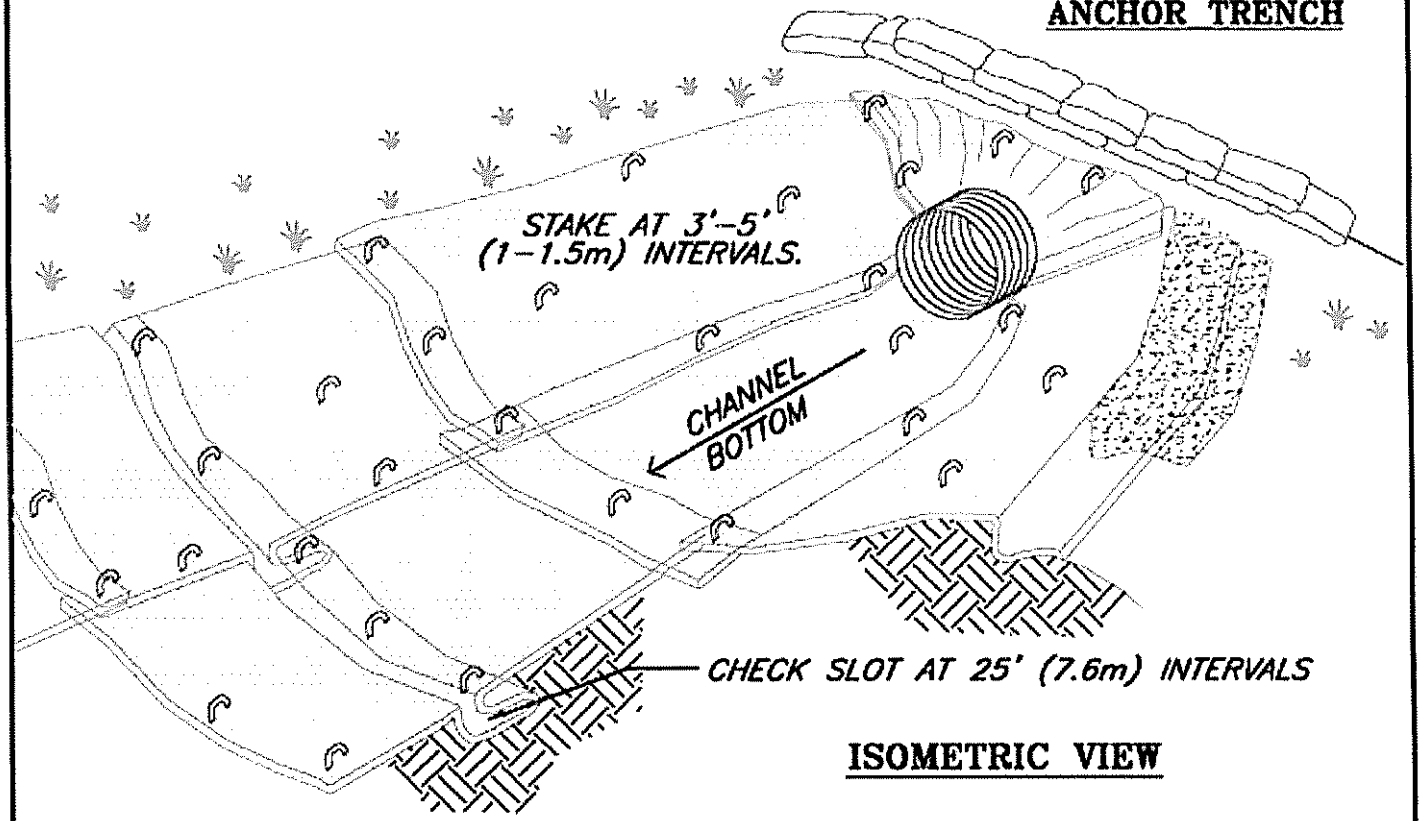
FILE: BLNKTCHA



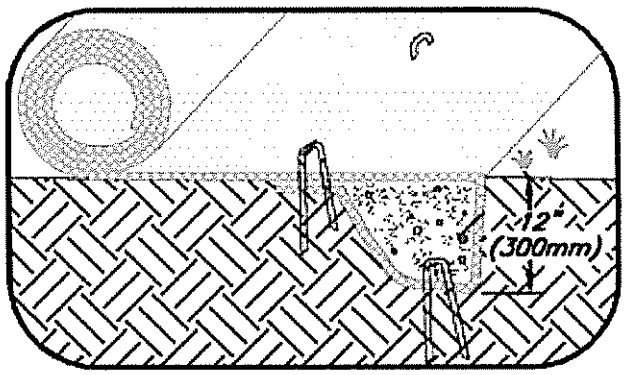
LONGITUDINAL ANCHOR TRENCH



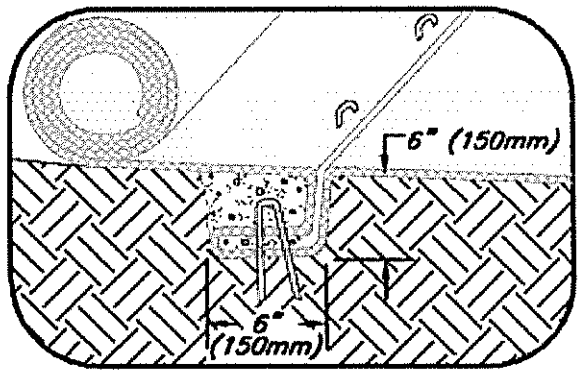
TERMINAL SLOPE AND CHANNEL ANCHOR TRENCH



ISOMETRIC VIEW



INITIAL CHANNEL ANCHOR TRENCH



INTERMITTENT CHECK SLOT

NOTES:

1. CHECK SLOTS TO BE CONSTRUCTED PER MANUFACTURERS SPECIFICATIONS.
2. STAKING OR STAPLING LAYOUT PER MANUFACTURERS SPECIFICATIONS.

EROSION BLANKETS & TURF REINFORCEMENT MATS CHANNEL INSTALLATION

© 1994 J. L. McCULLAH

FILE: BLNKTCHA

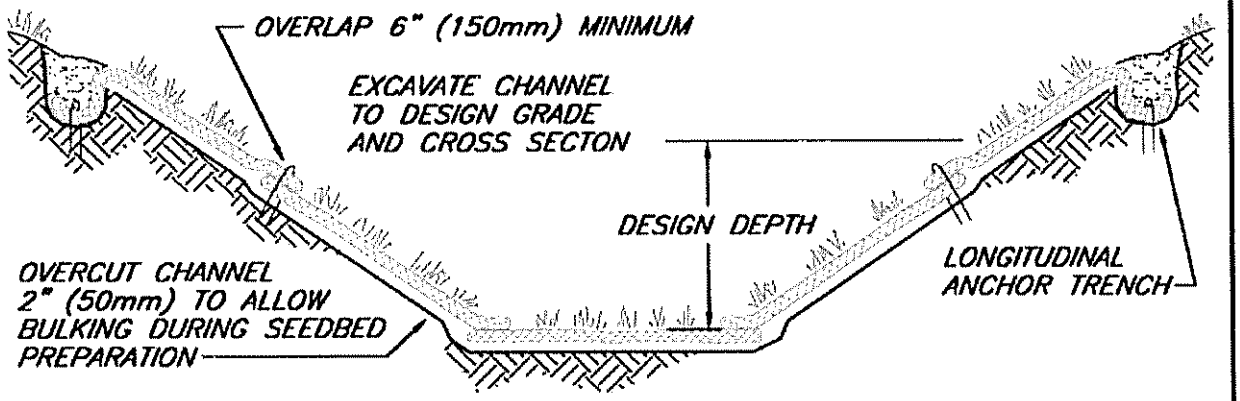
Date of last revision: 12/20/2012

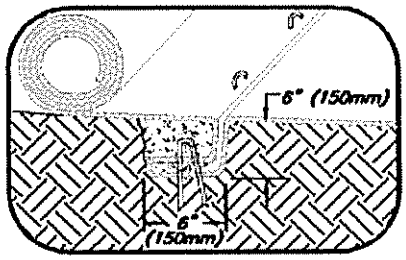
GRASSED-LINED CHANNELS

Construction Specifications: See Permanent Seeding and Erosion Control Blankets and Mats BMPs.

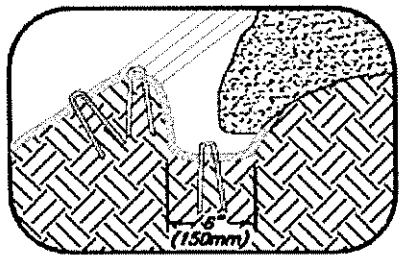
Inspection and Maintenance:

- During the initial establishment, grass-lined channels should be repaired and grass re-established if necessary.
- After grass has become established, the channel should be checked periodically to determine if the channel is withstanding flow velocities without damage.
- Check the channel for debris, scour, or erosion and immediately make repairs. It is particularly important to check the channel outlet and all road crossings for bank stability and evidence of piping or scour holes and make repairs immediately.
- Remove all significant sediment accumulations to maintain the designed carrying capacity.
- Keep the grass in a healthy, vigorous condition at all times, since it is the primary erosion protection for the channel.
- Permanent grassed waterways should be seasonally maintained by mowing or irrigating, depending on the type of vegetation selected.





TYPICAL INSTALLATION WITH EROSION CONTROL BLANKETS OR TURF REINFORCEMENT MATS

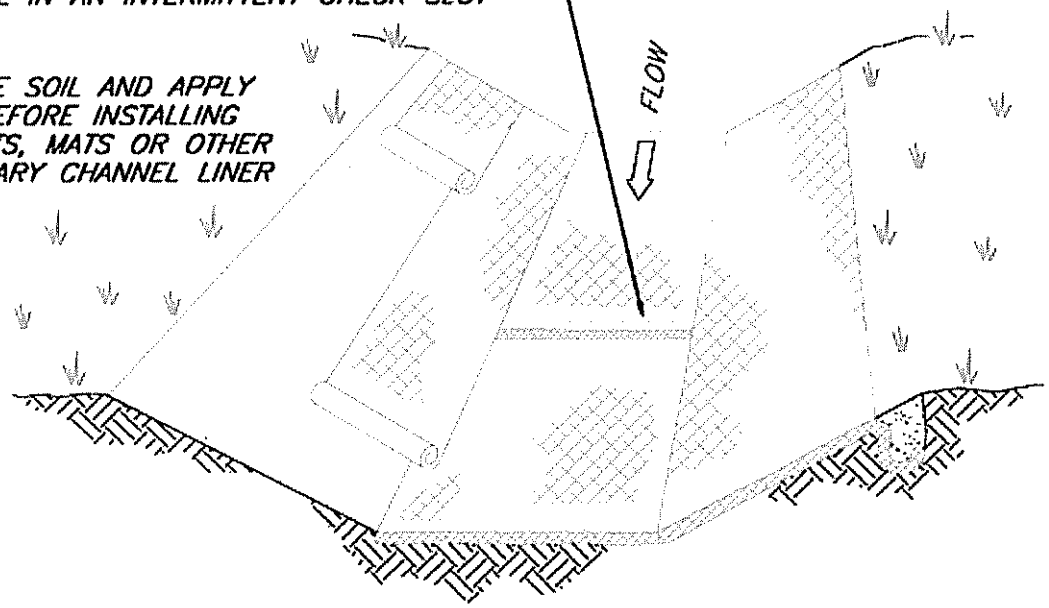


INTERMITTENT CHECK SLOT

LONGITUDINAL ANCHOR TRENCH

SHINGLE-LAP SPLICED ENDS OR BEGIN NEW ROLL IN AN INTERMITTENT CHECK SLOT

PREPARE SOIL AND APPLY SEED BEFORE INSTALLING BLANKETS, MATS OR OTHER TEMPORARY CHANNEL LINER SYSTEM



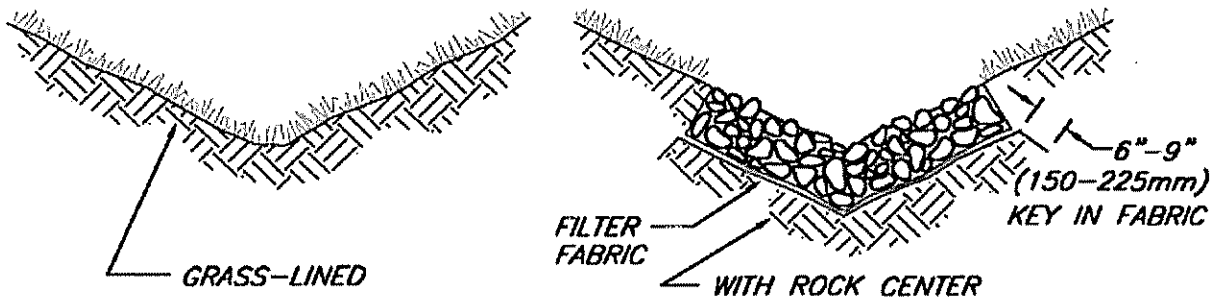
NOTES:
1. DESIGN VELOCITIES EXCEEDING 2 FT/SEC (0.5m/sec) REQUIRE TEMPORARY BLANKETS, MATS OR SIMILAR LINERS TO PROTECT SEED AND SOIL UNTIL VEGETATION BECOMES ESTABLISHED.
2. GRASS-LINED CHANNELS WITH DESIGN VELOCITIES EXCEEDING 6 FT/SEC (2m/sec) SHOULD INCLUDE TURF REINFORCEMENT MATS.

NOT TO SCALE

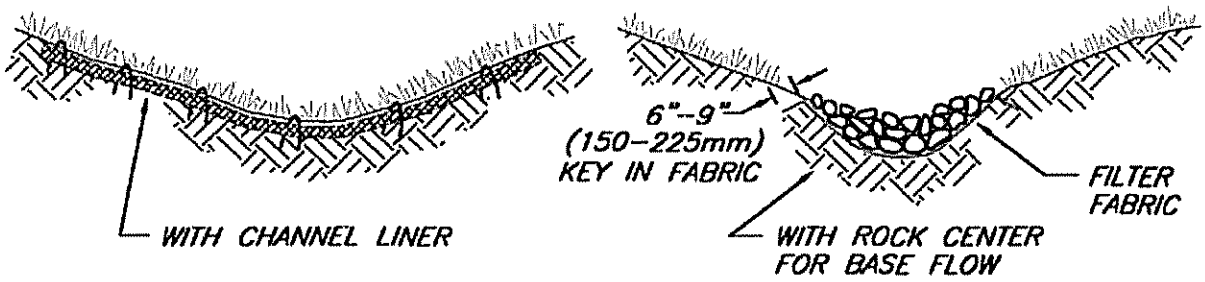
GRASS-LINED CHANNEL
TYPICAL INSTALLATION

© 1996 JOHN McCULLAH

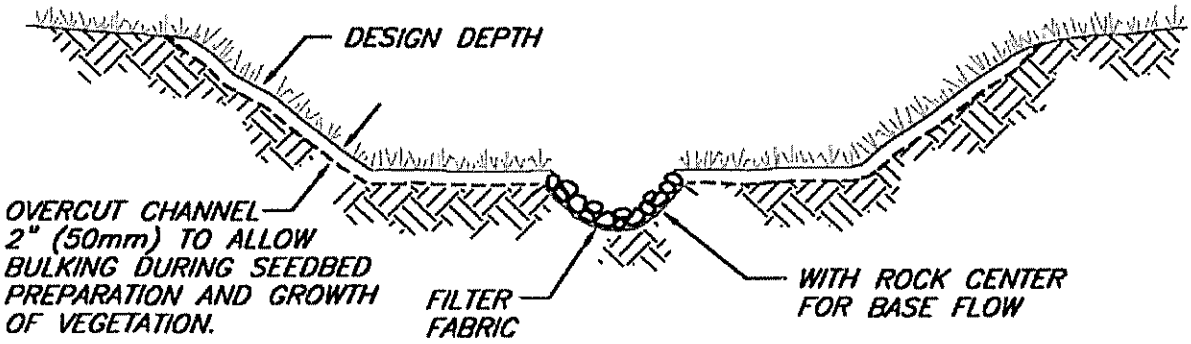
FILE: GRSSINST



TYPICAL V-SHAPED CHANNEL CROSS-SECTION



TYPICAL PARABOLIC CHANNEL CROSS-SECTION



TYPICAL TRAPEZOIDAL CHANNEL CROSS-SECTION

GRASS-LINED CHANNEL TYPICAL CROSS SECTIONS

© 1996 JOHN McCULLAH

FILE: GRASS-XS

Instream Diversion Techniques

Definition: A stream diversion is a temporary bypass through a pipe, flume, or excavated channel that carries water flow around work areas. Stream diversion is commonly used during culvert installation or replacement. Where possible, a stream diversion should be the first choice to control erosion and sediment during the construction of culverts or other instream structures.

Purpose: During construction in a watercourse, particularly culvert installation and repair, these temporary water bypass structures are an effective sediment and erosion control technique.

Design Considerations: The selection of which stream diversion technique to use will depend upon the type of work involved, physical characteristics of the site, and the volume of water flowing through the project.

Advantages of a pumped diversion include:

- Downstream sediment transport can almost be eliminated
- De-watering of the work area is possible
- Pipes can be moved about to allow construction operations
- The dams can serve as temporary access.
- Increased flows can be managed by adding more pumping capacity.

Some disadvantages of a pumped diversion are:

- Flow volume is limited by pump capacity
- Requires 24-hour monitoring of pumps
- Sudden rain could overtop dams
- Minor in-stream disturbance to install and remove dams

Advantages of excavated channels and flumes are:

- Isolates work from water flow and allows dewatering
- Can handle larger flows than pumps

Disadvantages of excavated channels and flumes are:

- Bypass channel or flume must be sized to handle flows, including possible floods
- Channels must be protected from erosion
- Flow diversion and then re-direction with small dams causes in-stream disturbance and sediment

Stream diversions should not be used:

- Without identifying potential impacts to the stream channel
- In or adjacent to water bodies until all necessary permits have been obtained

Instream Diversion Techniques (continued)

Construction Specifications:

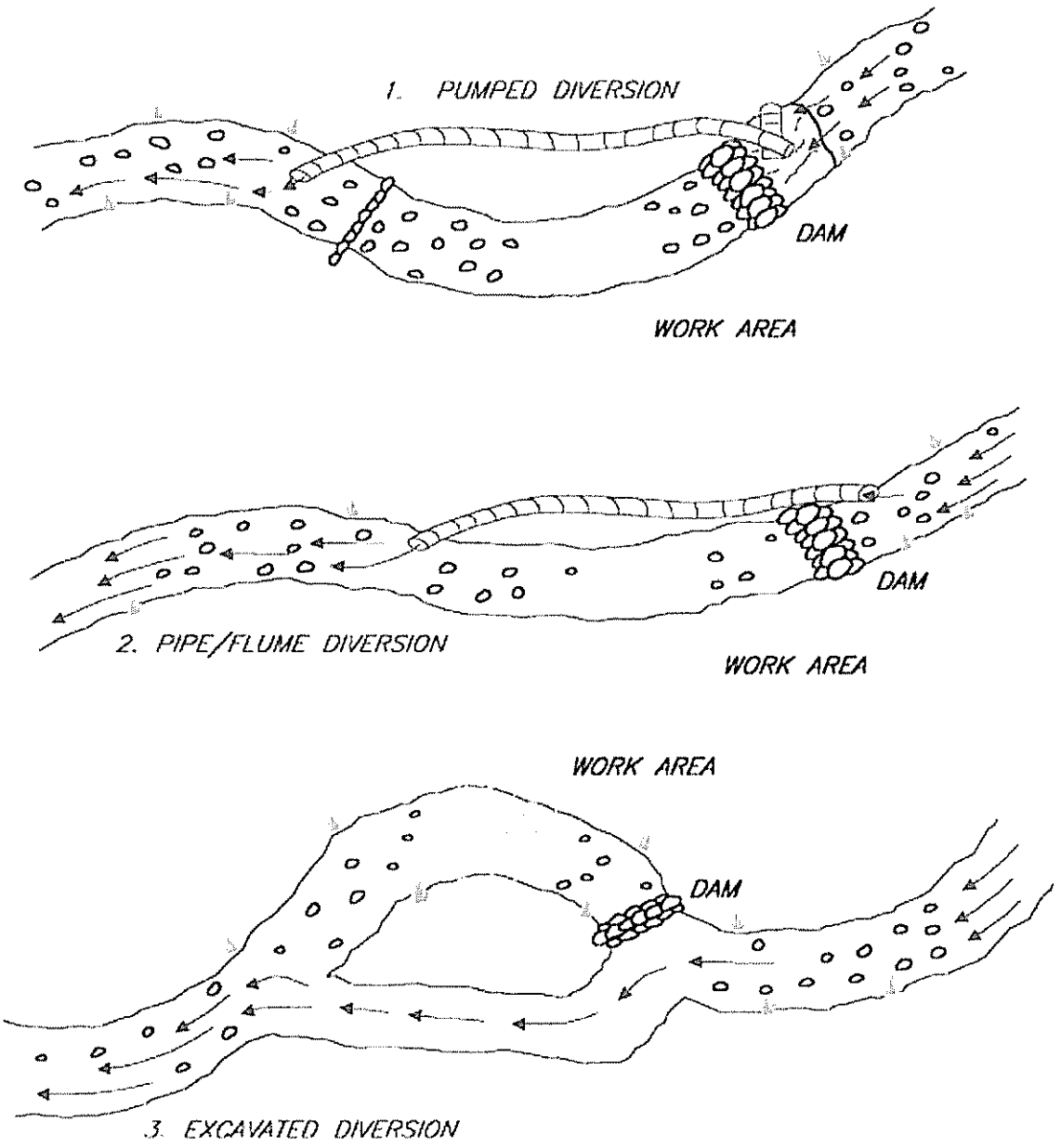
Guidelines will vary based on existing site conditions.

The pumped diversion is suitable for intermittent and low flow streams that can be pumped. Pump capacity must be sufficient for design flow. The upper limit is about $10ft^3$/sec, the capacity of two 8 inch pumps. A temporary dam is constructed upstream and downstream of the work area and water is pumped through the construction project in pipes. Dam materials should be selected to be erosion resistant, such as steel plate, sheetpile, sandbags, continuous berms, inflatable water bladders, etc.

A temporary bypass channel can also be constructed by excavating a temporary channel or passing the flow through a heavy pipe (called a "flume), and excavating a trench under it. Typical stream sizes are less than 20 ft wide and less than 100 ft^3/sec.

Inspection and Maintenance:

- All stream diversions must be closely maintained and monitored
- Pumped diversions require 24-hour monitoring of pumps
- Upon completion of the work performed, the stream diversion should be removed and flow should be re-directed through the new culvert or back into the original stream channel.



TYPICAL STREAM DIVERSION TECHNIQUES

© 2001 JOHN McCULLAH

FILE: STREAM DIVERSION

Instream Isolation Techniques

Definition: An instream isolation technique is a temporary structure built into a waterway to enclose a construction area and reduce sediment pollution from construction work in or adjacent to water. The structures may be made of rock, sand bags, wood or water-filled geotextiles (aqua barriers).

Purpose: During construction in a watercourse, these structures are designed to reduce turbidity and sediment discharge, allowing contractors to follow clean water regulations.

Design Considerations: Isolation structures may be used in construction activities such as streambank stabilization, culvert installation, bridges, piers or abutments. It may be used in combination with other methods such as clean water bypasses and/or pumps.

This technique should not be used:

- If there is insufficient streamflow to support aquatic species
- In deep water unless designed or reviewed by an engineer
- To completely dam streamflows

Construction Specifications: When used in watercourses or streams, cofferdams must be used in accordance with permit requirements. Materials for cofferdams should be selected based on ease of maintenance and complete removal following construction activities.

Inspection and Maintenance:

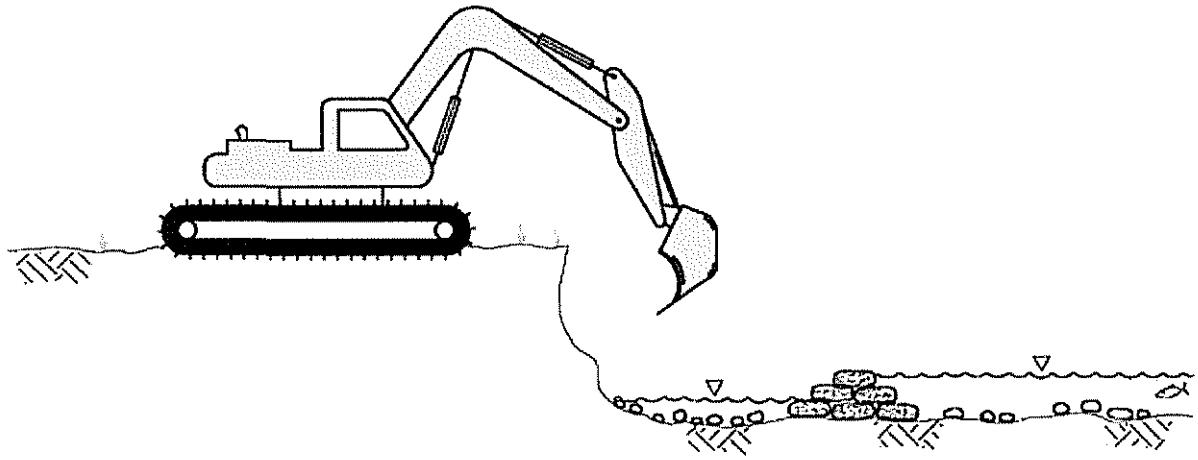
- During construction, inspect daily during the work week.
- Schedule additional inspections during storm events.
- Immediately repair any gaps, holes or scour.

Upon construction completion, the structure is removed.

- Remove sediment buildup.
- Remove structure. Recycle or re-use if applicable.
- Revegetate areas disturbed by cofferdam removal if applicable.

BENEFITS/LIMITATIONS

- *Difficult to dewater*
- *Inexpensive*
- *Labor intensive to install and remove*
- *Sand may be deposited in stream if bags break, better to use clean gravel*



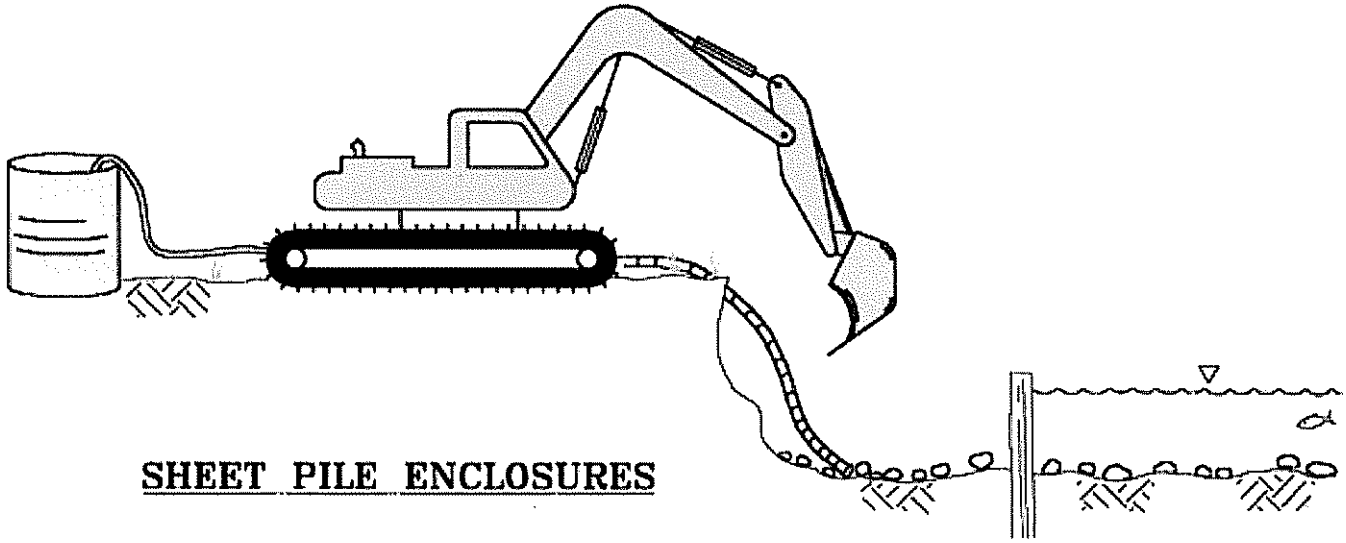
SAND BAG/GRAVEL BAG TECHNIQUE

© 2001 JOHN McCULLAH

INSTREAM EROSION AND SEDIMENT CONTROL ISOLATION TECHNIQUES

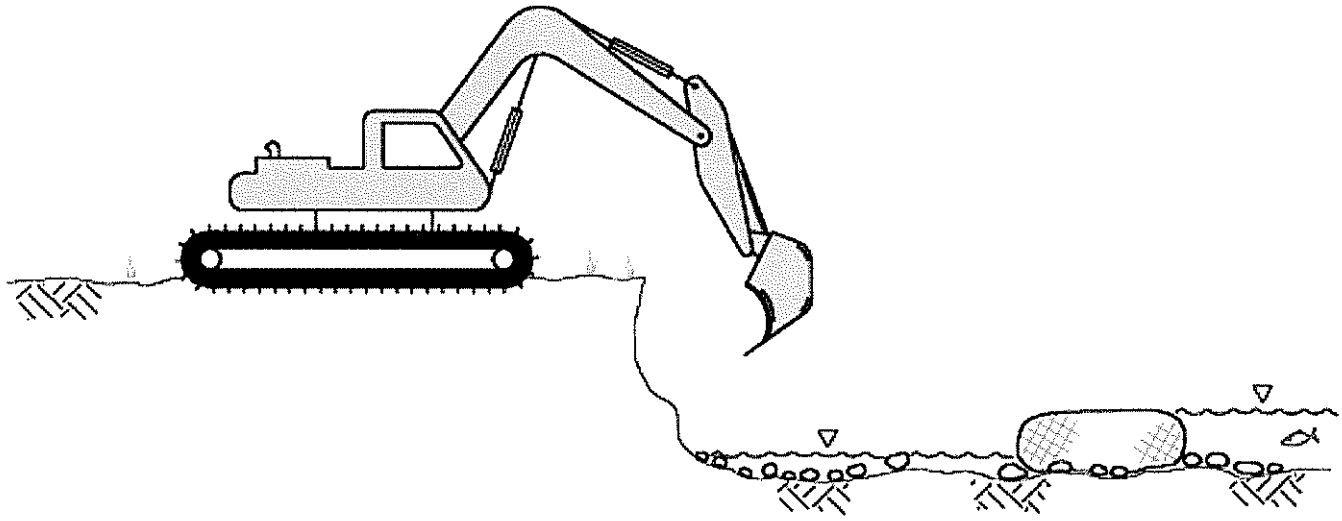
FILE: INSTREAM TECHNIQUES3

BENEFITS/LIMITATIONS
- *Allows full dewatering*
- *Relatively expensive*
- *Useful in large rivers, lakes, high velocity*
- *Not really appropriate for small streams*
- *Requires staging and heavy equipment access areas*



SHEET PILE ENCLOSURES

BENEFITS/LIMITATIONS
- *Allows partial dewatering*
- *Moderately expensive*
- *Ease of installation and removal unknown*
- *Can be designed for small streams to large rivers*

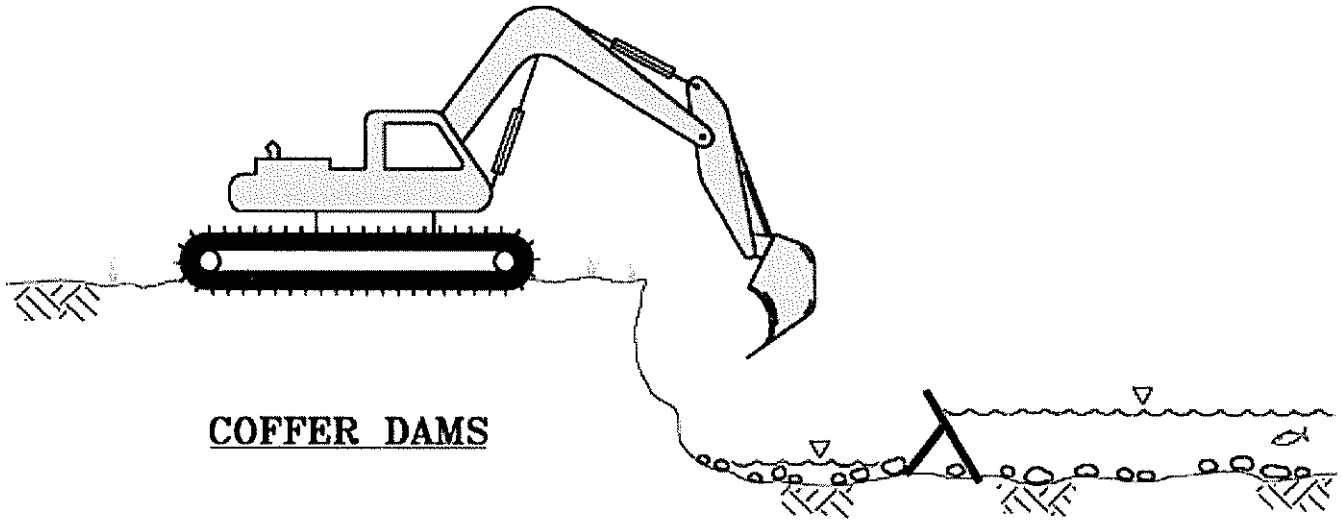


WATER-FILLED GEOTEXTILE (AQUA DAM)

INSTREAM EROSION AND SEDIMENT CONTROL ISOLATION TECHNIQUES

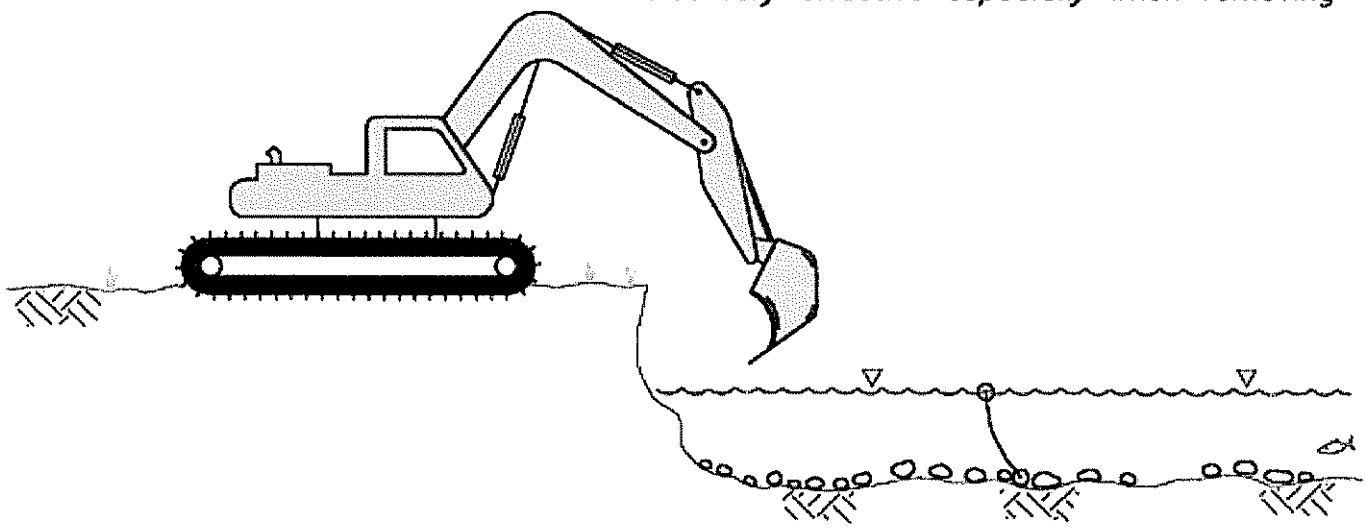
© 2001 J. McCULLAH

BENEFITS/LIMITATIONS
- *Allows partial dewatering*
- *Many different types available*
- *Relatively expensive*
- *Can be designed for large and small streams*
- *Ease of installation and removal unknown*



COFFER DAMS

BENEFITS/LIMITATIONS
- *Does not allow dewatering*
- *Inexpensive*
- *Used in slow water or lakes only*
- *Not very effective especially when removing*

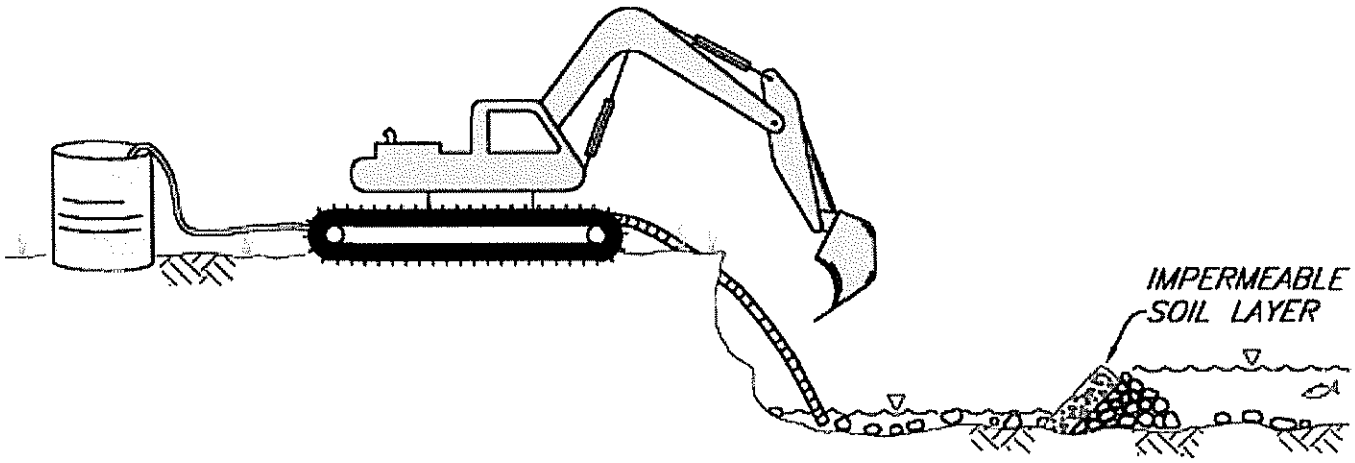


GEOTEXTILES, SILT BARRIERS, CURTAINS

INSTREAM EROSION AND SEDIMENT CONTROL ISOLATION TECHNIQUES

© 2001 JL McCULLAH

BENEFITS/LIMITATIONS
- *Allows partial dewatering*
- *Relatively inexpensive*
- *Useful for small streams*
- *Minimal TSS when removed*



NOTES:

Step 1. Install clean gravel

Step 2. Place impermeable soil

Step 3. Do work

Step 4. Decommission berm by removing soil layer first

Step 5. Pump work area. Head differential will cause turbid water to flow into work area through gravel

Step 6. Remove or spread gravel

GRAVEL/SOIL BERM INSTREAM ISOLATION TECHNIQUE

© 2001 J. McCULLAH

Large Woody Debris Management and Removal

Large woody debris (LWD) in streams has many positive benefits to the aquatic environment, including increased habitat complexity for resident trout, amphibians, and birds, as well as a host of plants and fungus. Large wood also performs geomorphic functions within stream channels such as grade control, bank stabilization, and stream bedload (cobbles and gravel) scour and sorting. The goal of large wood management is to retain as much wood as possible. Large wood is defined as logs with a diameter of 6" or greater and a length of 10' or longer, rootwads and stumps.

There are, however, situations where large wood maintenance can be in conflict with the maintenance of District infrastructure such as roads, bridges, and culverts. These conflicts arise when LWD accumulates around bridge footings, culvert inlets and outlets, and adjacent to roads or structures. Redirection of flow, and streambed elevation changes associated with the LWD accumulation, towards District facilities, can lead to the catastrophic failure of these facilities. In these limited circumstances, LWD will need to be managed or removed. Planning and Operations staff will confer regarding the specific course of action.

Management and removal will be undertaken only as a last resort to mitigate ongoing or imminent damage. Locations will be assessed for sensitive species prior to beginning any work at the site. LWD shall be managed to maintain as much LWD in the stream channel as possible. Often, smaller branches and logs accumulate on a few large key log pieces, and it is possible to pick through the smaller material maintaining the large key pieces for habitat and geomorphic function. LWD can also be rearranged or relocated within the stream channel, to decrease hazard to District infrastructure, and maintain LWD within the channel. These become sites that will need periodic maintenance and is the preferred method of LWD management on District Preserves.

There are also isolated circumstances where LWD has to be removed from the channel where the potential for catastrophic failure of District infrastructure is so great that no other alternative exists to protect the infrastructure. This option will only be employed where an evaluation has been made by Planning and Operations staff, which concludes that LWD management as described in the paragraph above is not sufficient to address the heightened level of concern. Again, the volume of LWD removed will be minimized to maintain as much LWD in channel as possible. LWD removed from the channel that cannot be immediately incorporated within the stream at a nearby location, shall be stockpiled for future use. LWD removed shall be left as large as possible for incorporation into future projects, particularly large logs and rootwads with attached bole. Smaller pieces of LWD shall be removed to above the high water mark of the channel, and can be stacked or spread for terrestrial habitat.

All work involving in-channel LWD will be completed by hand crews. No heavy equipment will be operated within the stream channel, or live flowing water. Hand crews may be aided by heavy equipment if it can be operated from an existing access road adjacent to the project site. No fueling of chain saws will occur within the stream channel, and will be done at a location where fuel can not enter the watercourse.

LWD project sites will be surveyed by a qualified biologist prior to beginning any work to determine if any sensitive species are present. Appropriate agency consultations will be conducted if listed species are identified during pre-construction surveys or encountered during construction.

Live Pole Drains

A live pole drain is a biotechnical and reclamation technique which is intended to drain excess moisture away from an unstable site. The plants used to construct the bundles (willow) will sprout and grow, with the moisture continuing to drain from the lower end. The bundles of cuttings are usually placed in shallow trenches in a manner that they intersect and collect excessive slope moisture. That excess water is then allowed to drain onto a stabilized area.

Conditions Where Practice Applies

Unstable slopes, landslides, and small slumping gullies can often be successfully treated with live pole drains. This is a good technique to initiate the process of natural healing.

Materials

Use fascine or wattle techniques to construct the bundles. Keep some of the twigs and branches on the cuttings, as this will add bulk and aid drainage. Live pole drain bundles can be constructed using branches which are longer than those typically used for wattles or fascines. Live pole drains require construction stakes and/or live stakes in order to secure them firmly to the slope. Sometimes large rocks may also be used to hold the drains down.

Advantages

If constructed from willow species, live pole drains will provide cover for the site and initial stabilization while allowing other species to invade. The pole drains will continue to grow for an extended period, while allowing drainage to occur.

David Polster, M.Sc., R.P. Bio. Plant Ecologist, British Columbia, has been extremely successful using live pole drains for landslides and gullies. He has completed projects where the pole drains have provided initial stability and then drained water for years after establishment.

Disadvantages

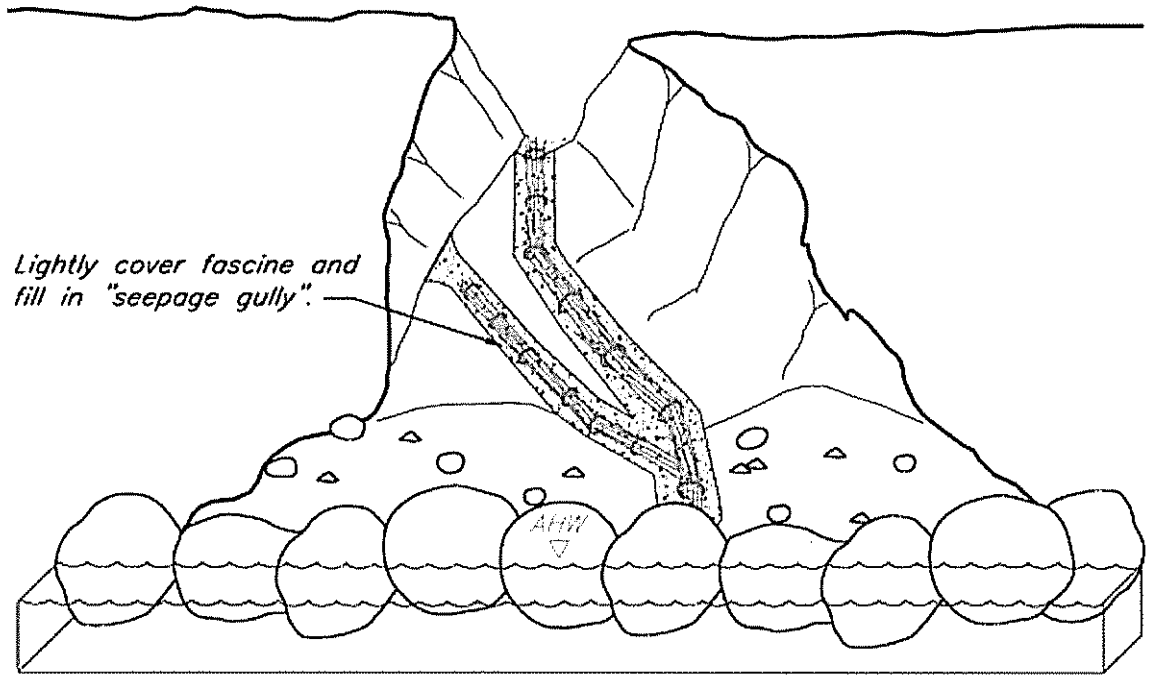
Live pole drains are not effective in larger, well defined channels with concentrated flows, as the pole drains will simply plug the channel and cause more erosion as the channel adjusts to maintain capacity. Biotechnical projects are typically conducted at times of the year when weather conditions are cool and moist and the plant material is dormant. Timing constraints can sometimes be ameliorated by irrigation, storage of plant materials, or a combination of the above. However, some reduction of plant establishment and vigor should be anticipated.

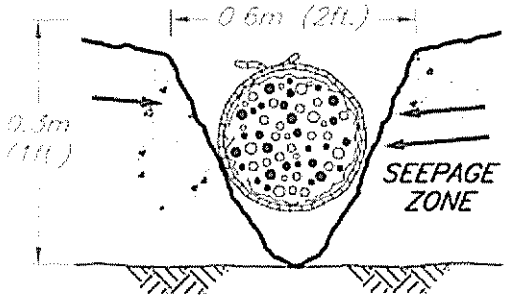
Live Pole Drains (continued)

Implementation

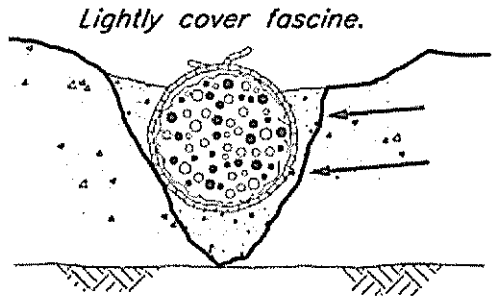
The key to successful pole drain construction is to install the drains in the areas of seepage, either by excavating a shallow trench or utilizing an existing drainage gully, so the drains intercept and control the excess moisture. Use fascine or wattle techniques to construct the bundles. The bundles should be tied tightly with twine or rope. Place the bundle of cuttings in the trench. Construct side drains as needed. It is important to key the bundles into each other by jamming the ends firmly together.

Use construction stakes and/or live stakes to hold the fascines in place. Insert the stakes adjacent to the rope ties for additional support. Stake the pole drains at 1-2 m intervals. Lightly backfill the bundles with native soil. Some twigs and branches should be left above the ground as the willow material requires some sunlight exposure to grow.





Excavate a shallow trench or utilize existing "seepage gully" (small<2ft.^{2}).



Place bundle of cuttings (fascine) in the trench and lightly backfill with native material.

NOTES:
1. Live pole drain is a biotechnical technique which drains excess moisture from the bank and provides an initial cover of woody vegetation.
2. The cuttings used to form the fascines are intended to sprout and grow while the excess moisture continues to drain from the lower end.

LIVE POLE DRAIN

© 2004 SALIX

FILE: LPD

Live Siltation

Live siltation is a revegetation technique used to secure the toe of a streambank, trap sediments, and create fish rearing habitat. The system can be constructed as a living or a non-living brushy system at the water's edge.

Conditions Where Practice Applies

Live siltation is a biotechnical technique for the edges of rivers and streams. This technique is useful along stream reaches where it is desired to encourage deposition and siltation, such as floodplains and along inner banks. It would not be an appropriate practice along an outer bend without sufficient scour or toe protection.

Materials

Natural stone, willow wattles, logs or root wad revetments are needed for toe and scour protection. The live siltation will require live branches of shrub willows of 1-1.5 m length. The branches should be dormant, and need to have the side branches still attached. Any woody plant material, such as alder, can be installed for a non-living system.

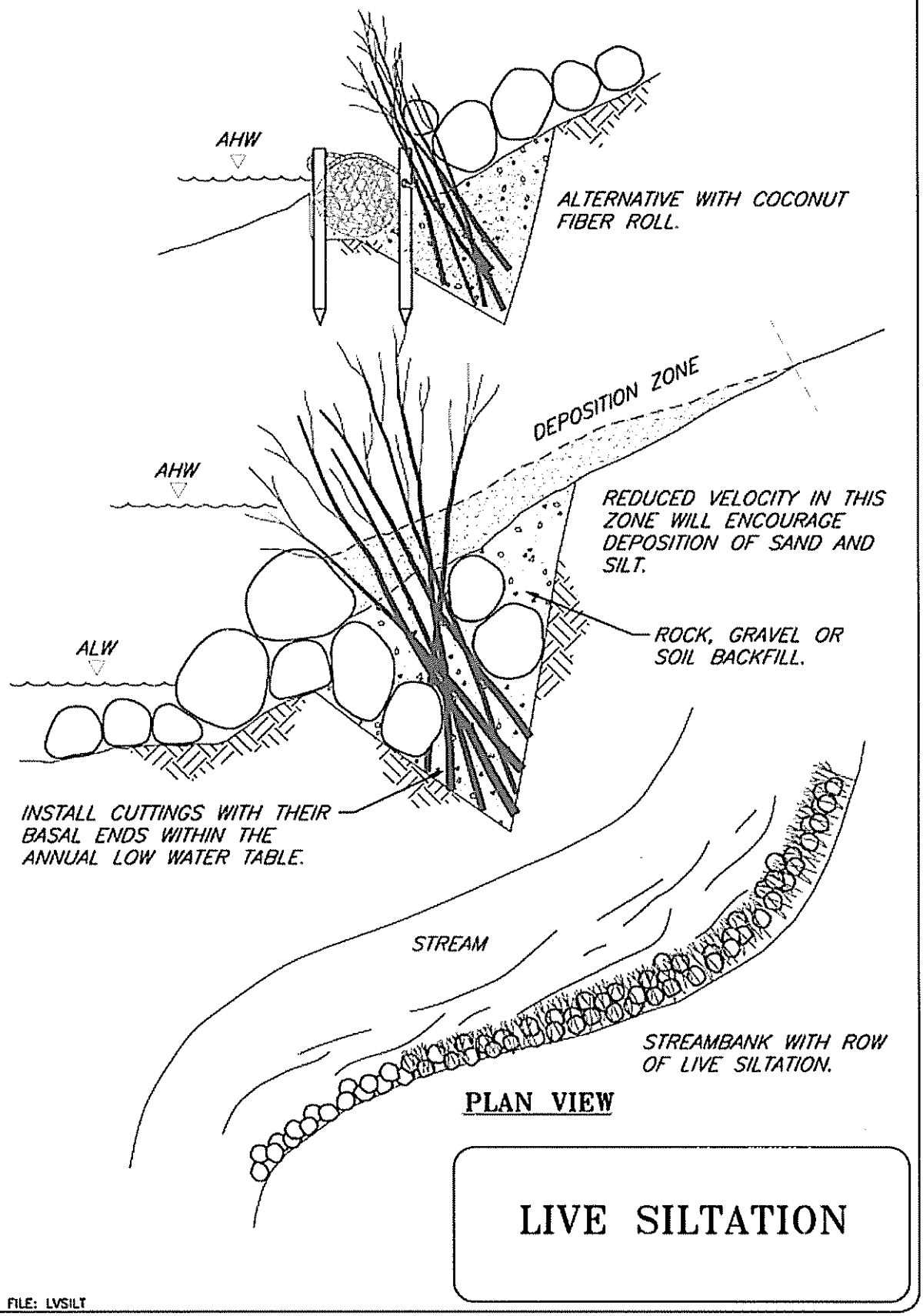
Advantages

This is a very effective and simple conservation method using local plant materials. This technique is particularly valuable for providing immediate cover and fish habitat while other revegetation plantings become established. The protruding branches provide roughness, slow velocities, and encourage deposition of sediment. The depositional areas are then available for natural recruitment of native riparian vegetation.

Implementation

Construct a V-shaped trench at the mean high water (MHW) level, with hand tools or a backhoe. Excavate a trench so that it parallels the toe of the streambank and is approximately 2 feet deep. Lay a thick layer of willow branches in the trench so that 1/3 of the length of the branches is above the trench and the branches angle out toward the stream. Place a minimum of 40 willow branches per meter in the trench.

Backfill over the branches with a gravel/soil mix and secure the top surface with large washed gravel, bundles/coir logs, or carefully placed rocks. Both the upstream and downstream ends of the live siltation construction need to transition smoothly into a stable streambank to reduce the potential for the system to wash out. More that one row of live siltation can be installed. A living and growing siltation system typically is installed at MHW. A non-living system can be constructed below MHW during low water levels. If it is impossible to dig a trench, the branches can be secured in place with logs, armor rock, bundles made from wattles, or coir logs.



LIVE SILTATION

© 2004 SALIX

FILE: LVSILT

Modified Live Siltation

Conditions Where Practice Applies

Use modified live siltation for the inner bends of streams or areas periodically flooded.

Modified live siltation can be placed in a manner which can direct high flows toward the center of the stream, while providing hydraulic roughness which will encourage deposition and siltation.

Materials

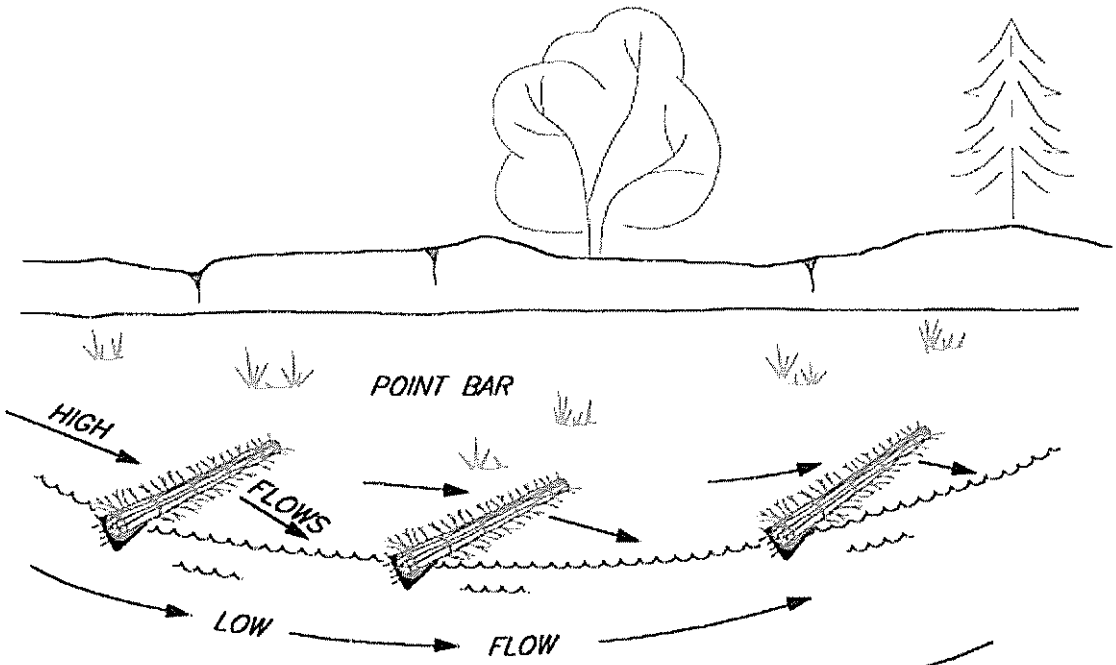
Primarily willow species are used for live siltation, however, even dead branches and non-living bundles can provide the desired hydraulic roughness. The willow species will generally thrive in depositional areas. Use willow wattles and live staking or poles. Rope will be needed for bundles, and wooden stakes will be needed to secure wattles.

Advantages

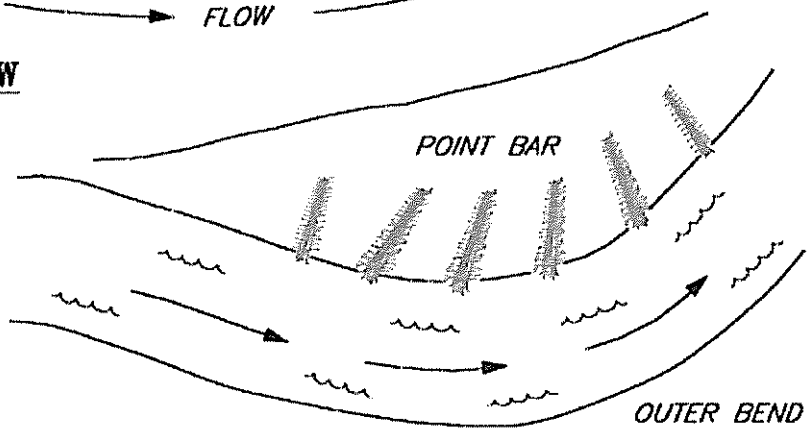
This is an inexpensive revegetation and stream stabilization technique which provides habitat enhancements and encourages deposition.

Implementation

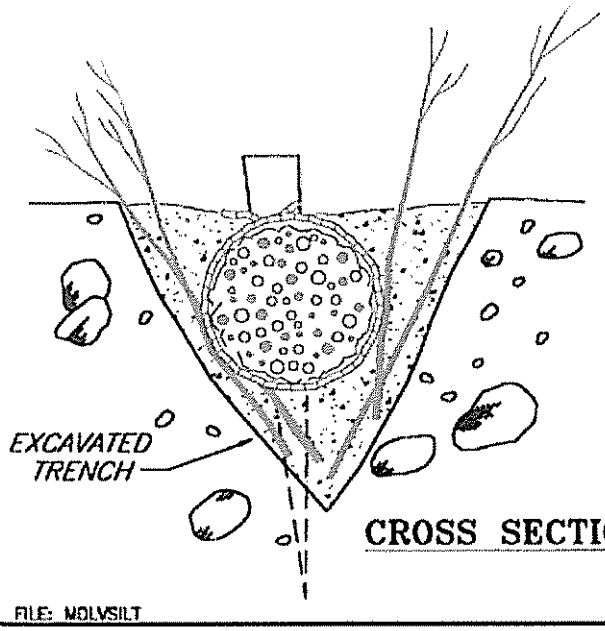
Prepare trenches. Trenches for modified live siltation should point in a slight upstream direction, no more than 20 degrees. Lay live willow bundle or dead branch bundle into trench. Secure the bundle firmly using wooden stakes. Lay in branches for live siltation. Backfill trench with soil and rock.



FRONT VIEW



PLAN VIEW



CROSS SECTION

NOTES:
1. Modified live siltation is a revegetation technique intended to encourage deposition (reduce erosion and scour) of the inner bend (point bar formation).
2. The vegetated spurs or live veins are angled slightly into the flow such that high flows will be redirected toward the center of the stream.

MODIFIED LIVE SILTATION

© 2000 JOHN McCULLAH

FILE: MOLVSILT

LIVE STAKING

Construction Specifications:

Harvesting:

- Stakes shall be harvested and planted when the willows, or other chosen species, are dormant. This period is generally from late fall to early spring, or before the buds start to break.
- When harvesting cuttings, select healthy, live wood that is reasonably straight.
- Use live wood at least 1 year old or older. Avoid suckers of current years growth as they lack sufficient stored energy reserves to sprout consistently. The best wood is 2-5 years old with smooth bark that is not deeply furrowed.
- Make clean cuts with unsplit ends. Trim branches from cutting as close as possible. The butt end of the cutting shall be pointed or angled and the top end shall be cut square.
- Identification of the top and bottom of cutting as accomplished by angle cutting the butt end. The top, square cut, can be painted and sealed by dipping the top 1-2 inches (25-51 mm) into a 50-50 mix of light colored latex paint and water. Sealing the top of stake will reduce the possibility of desiccation and disease caused mortality, assure the stakes are planted with the top up, and makes the stakes more visible for subsequent planting evaluations.

Diameter:

- Cuttings should generally be 3/4 inch (19 mm) or larger depending on the species. Highest survival rates are obtained from using cuttings 2-3 inches (51-76 mm) in diameter. Larger diameter cuttings are needed for planting into rock riprap.

Length:

- Cuttings of small diameter (up to 1 1/2 inches (38 mm)) shall be 18 inches (0.5 m) long minimum. Thicker cuttings should be longer.
- Cuttings should be long enough to reach into the mid-summer water table, if possible.
- No less than 1/2 total length must be into the ground.
- Stakes should be cut so that a terminal bud scar is within 1-4 inches (25-101 mm) of the top. At least 2 buds and/or bud scars shall be above the ground after planting.

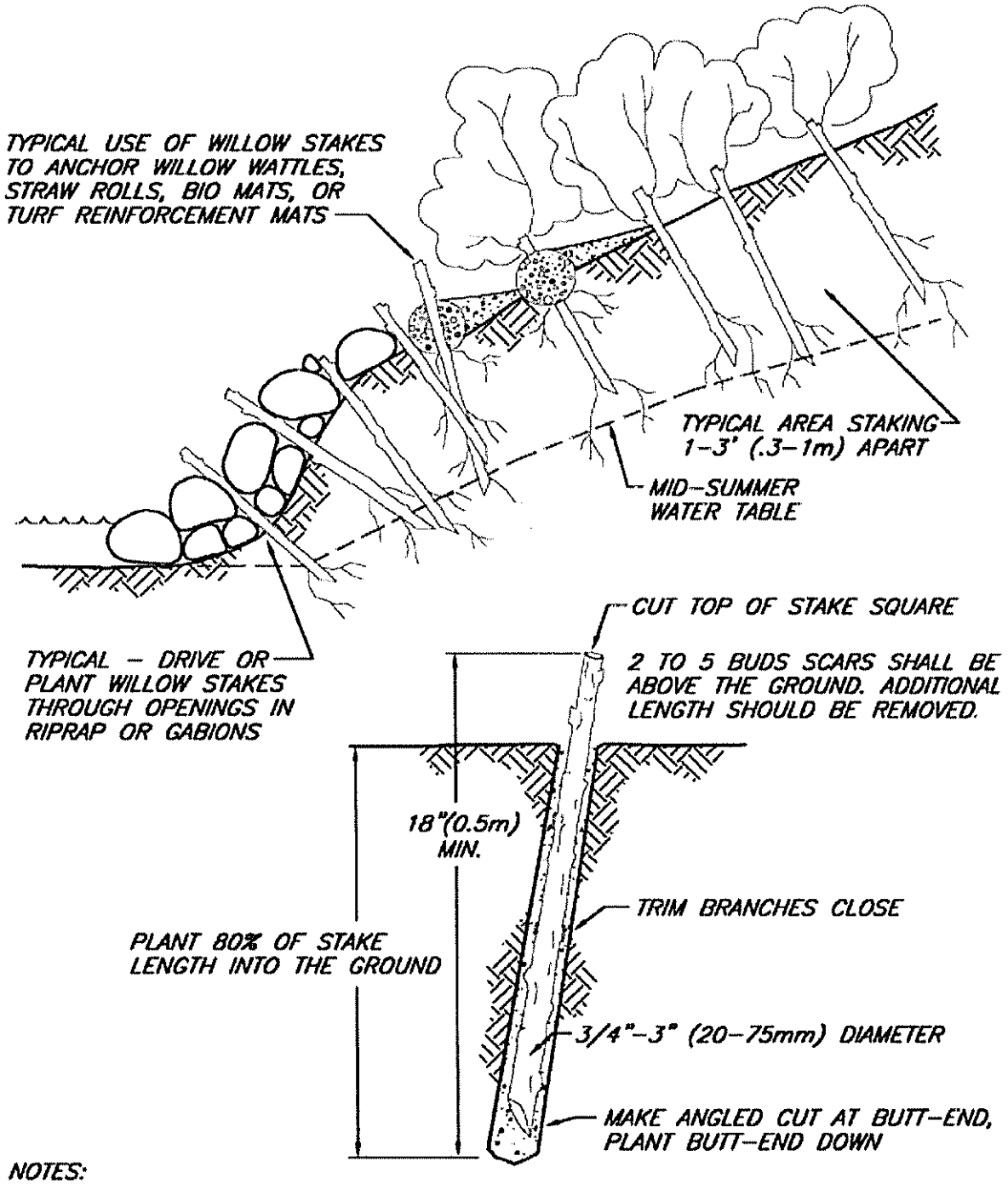
Installation:

- Stakes must be planted with butt-ends into the ground. Leaf bud scars or emerging buds should always point up.
- Stakes must not be allowed to dry out. All cuttings should be soaked in water for a minimum of 24 hours. Soaking significantly increases the survival rate of the cuttings, however they may be planted the same day they are harvested.
- Plant stakes 1-3 feet (0.3-1 m) apart.
- Set the stake as deep as possible into the soil, preferably with 80 percent of its length into the soil and in contact with mid-summer water table.
- It is essential to have good contact between the stake and soil for roots to sprout. Tamp the soil around the cutting.

- Use a iron stake or bar to make a pilot hole in firm soil.
- Do not damage the buds, strip the bark or split the stake during installation.
- Split or damaged stakes shall be removed and replaced.

Inspection and Maintenance:

- All temporary and permanet erosion and sediment control practices shall be maintained and repaired as needed to assure continued performance of their intended function.
- Streambanks and steep slopes are highly susceptible to erosion and damage from significant storm events. Willow stakes alone provide very little initial site protection during the establishment period.
- Periodic inspection repair and maintenance will be required during the first two years or until the vegetation is established.
- All temporary or permanent erosion control practices shall be maintained and repaired as needed to assure continued performance of their intended function.



NOTES:
1. HARVEST AND PLANT STAKES DURING THE DORMANT SEASON.
2. USE HEALTHY, STRAIGHT AND LIVE WOOD AT LEAST 1 YEAR OLD.
3. MAKE CLEAN CUTS AND DO NOT DAMAGE STAKES OR SPLIT ENDS DURING INSTALLATION, USE A PILOT BAR IN FIRM SOILS.
4. SOAK CUTTINGS FOR 24 HOURS (MIN.) PRIOR TO INSTALLATION.
5. TAMP THE SOIL AROUND THE STAKE.

NOT TO SCALE

LIVE STAKING

© 1996 JOHN McCULLAH

FILE: LIVESTK

POLE PLANTING

Construction Specifications:

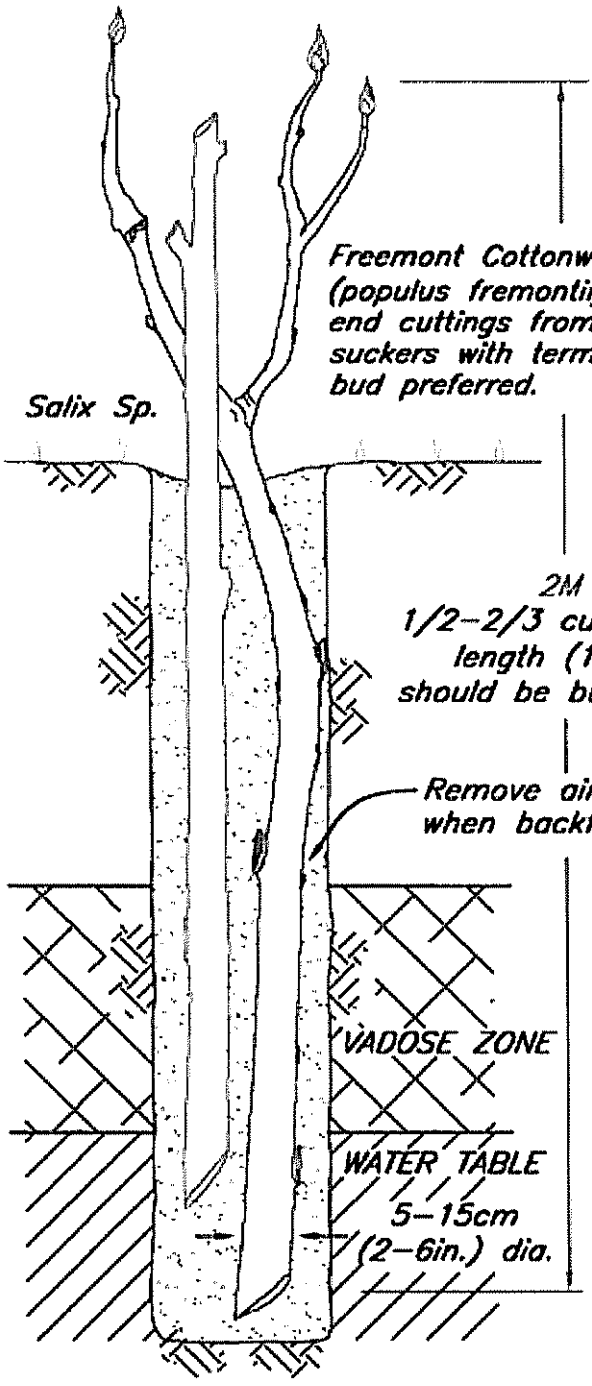
Collect and harvest cuttings (ideally during the dormant season) and then soak the poles for 5 to 7 days. Plant poles into an augered, "punched", or excavated hole. The holes should extend to approximately 1 foot above the water table and through the vadose zone. This depth can be difficult to determine in areas with reservoirs and streams with widely fluctuating seasonal water levels. In this case, ensure that the ends of the poles reach the low waterline at the time of planting if possible.

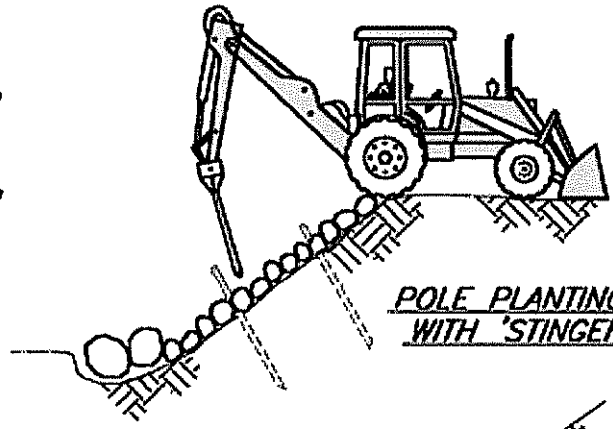
Pole plantings should ideally be installed during the construction of any structural appurtenances. For instance, plant the poles with the placement of riprap, especially into any trenches excavated for keyways or scour trenches. Another example is to plant the poles during riprap placement such that the poles extend through the riprap and backfill and into contact with the "native" bank. The backfill can be placed over and around the poles rather than having to "punch" holes through the riprap. Another method is to plant the poles during gabion construction.

The pole plantings, especially the basal ends, must have good contact with the soil. "Mudding" (filling the hole with water and then adding soil to make a mud slurry) can remove air pockets.

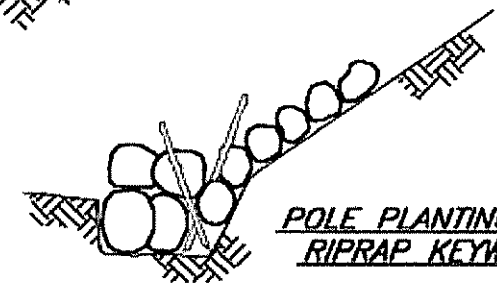
CONSTRUCTION TECHNIQUES

Plant poles deeply during construction of biotechnical streambank work.

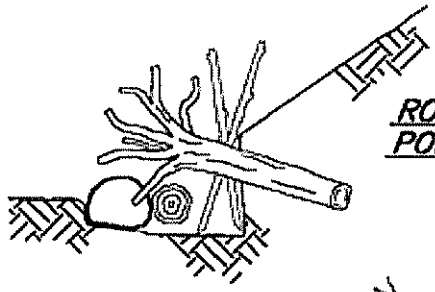




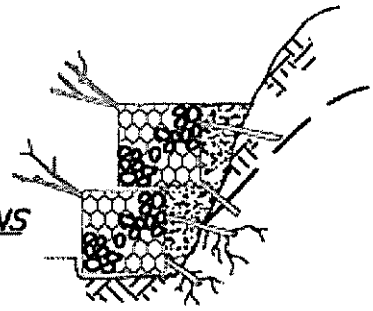
POLE PLANTING WITH 'STINGER'



POLE PLANTING IN RIPRAP KEYWAY



ROOTWAD WITH POLE PLANTING



VEGETATED GABIONS WITH POLES

NOTES:

1. *Pole cuttings of willow or cottonwood are longer and have a larger diameter than branch cuttings or live stakes.*
2. *Larger diameter cuttings have a greater supply of stored energy (stored photosynthesis) than smaller diameter cuttings.*
3. *Pole cuttings are better suited for highly erodible areas and sites with fluctuating water levels.*
4. *The pole cuttings should extend through the vadose zone and into the permanent water table. At least 1/2 to 2/3 of the pole should be below the ground, at least 1.0m (3 ft.), and long enough to emerge above adjacent vegetation.*
5. *"Muddying" – filling the hole with water and then soil to make a mud slurry can remove air pockets.*

POLE PLANTING

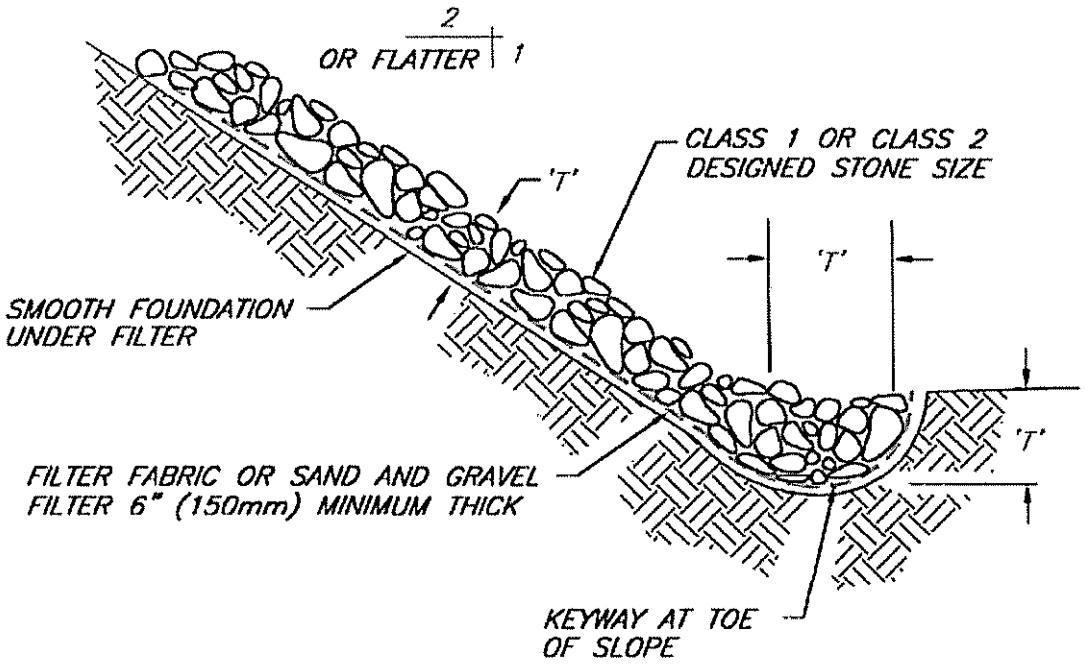
© 2000 [illegible] McCULLAH

RIPRAP

Construction Specifications:

- Before laying riprap and filler, prepare the subgrade to the required lines and grades shown on the plans. Compact any fill required in the subgrade to a density approximating that of the surrounding undisturbed material.
- Overfill depressions with riprap.
- Remove brush, trees, stumps, and other objectionable material.
- Cut the subgrade sufficiently deep so that the finished grade of the riprap will be at the elevation of the surrounding area. Channels should be excavated sufficiently to allow placement of the riprap in a manner such that the finished inside dimensions and grade of the riprap meet design specifications.
- Place the sand and gravel filter blanket immediately after the ground foundation is prepared. For gravel, spread filter stone in a uniform layer to the specified depth. Where more than one layer of filter material is used, spread the layers with minimal mixing.
- Place the filter fabric directly on the prepared foundation. Overlap the edges by at least 12 inches (0.3 m), and space anchor pins every 3 feet (0.9 m) along the overlap. Bury the upper and lower ends of the cloth a minimum of 12 inches (0.3 m) below ground. Take care not to damage the cloth when placing riprap. If damage occurs remove the riprap and repair the sheet by adding another layer of filter material with a minimum overlap of 12 inches (0.3 m) around the damaged area. If extensive damage is suspected, remove and replace the entire sheet.
- Where large stones are used or machine placement is difficult, a 4 inch (101 mm) layer of fine gravel or sand may be needed to protect the filter fabric.
- Placement of riprap should follow immediately after placement of the filter. Place riprap so that it forms a dense, well-graded mass of stone with a minimum of voids. The desired distribution of stones throughout the mass may be obtained by selective loading at the quarry and controlled dumping during final placement.
- Place riprap to its full thickness in one operation.
- Do not place riprap by dumping through chutes or other methods that cause segregation of stone sizes.
- Take care not to dislodge the underlying base or filter when placing the stones.
- The toe of the riprap slope should be keyed to a stable foundation at its base.
- The toe should be excavated to the depth about 1.5 times the design thickness of the riprap and should extend horizontally from the slope.
- The finished slope should be free of pockets of small stone or clusters of large stones. Hand placing may be necessary to achieve the proper distribution of stone sizes to produce a relatively smooth, uniform surface. The finished grade of riprap should be apparent.

Inspection and Maintenance: Properly designed and installed riprap requires very little maintenance. Riprap should be inspected periodically for scour or dislodged stones. Control of weed and brush growth may be needed in some locations.



TYPICAL SECTION

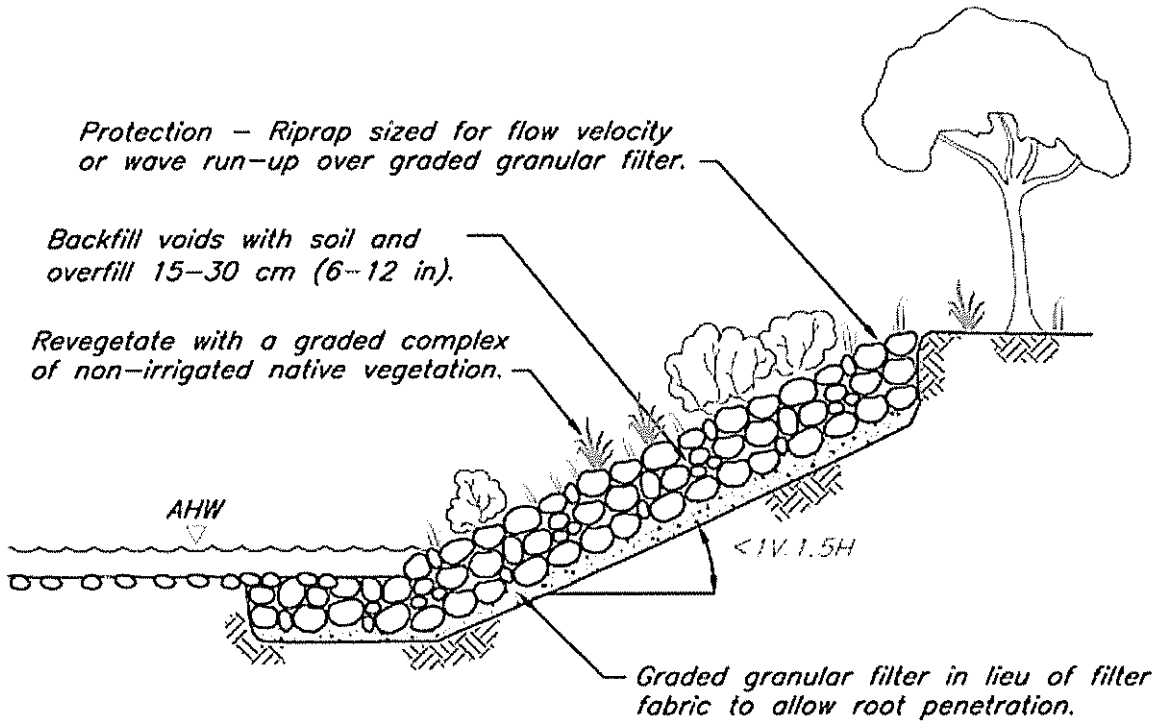
NOTE:
'T' = THICKNESS: THICKNESS SHALL BE DETERMINED BY THE ENGINEER.

MINIMUM THICKNESS SHALL BE 1.5x THE MAXIMUM STONE DIAMETER, NEVER LESS THAN 6" (150mm).

RIPRAP PROTECTION

© 1994 JOHN McCULLAH

FILE: RIPRAP



NOTES: CLASS 2 PERMEABLE MATERIAL

Permeable material for blankets or other subdrainage purposes shall consist of hard, durable, clean sand, gravel or crushed stone and shall be free from organic material, clay balls, or other deleterious substances.

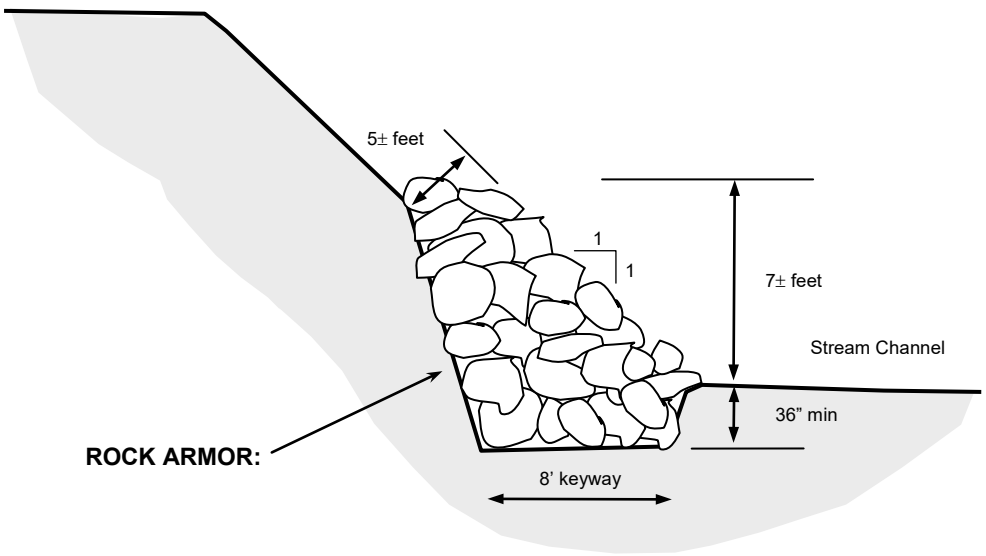
Class 2 permeable material shall have a Durability Index of not less than 40 and a Sand Equivalent value of not less than 75.

SIEVE SIZES	PERCENTAGE PASSING
1–Inch	100
3/4–Inch	90–100
3/8–Inch	40–100
No. 4	25–40
No. 8	18–33
No. 30	5–15
No. 50	0–7
No. 200	0–3

RIPRAP
W/ SOIL AND GRASS OR GROUND COVER

© 2004 SALIX

FILE: RRSG



Notes

Keyway

- Rip rap shall be keyed a minimum of 3 feet below channel bottom and into the bank at the upstream and downstream end.
- The base keyway shall be a minimum of 8 feet wide and sloped into the hillside a minimum of 5%
- Clean keyway of loose organic debris and other unsuitable material prior to placing rock
- Remove only the portions of the log jam that extend into the construction area, the remainder of the log jam shall be undisturbed unless otherwise approved b DFG

Rock

- Rip rap shall consist of angular sound durable rock free of fracture or joint plans.
- Rock shall be graded (mix of sizes) with 50% of the rock (D50) greater than 30 inches minimum diameter.

Rock Placement

- Rock shall be carefully placed to optimize strength
- Rock shall be placed a minimum of 2 layers thick (5 feet).
- Rock shall extend 7 vertical feet above the channel bottom and be inclined no stepper than 1:1 slope
- Voids shall be filled with earth and smaller rocks to facilitate vegetation growth between the rocks. Earth may be placed at the time of construction or flushed in after construction if approved by DFG.

Earthwork

- Slope above the riprap revetment structure shall be laid back to a 1:1 of gentler slope

Revegetation

- Bare ground above the rip rap revetment structure shall be planted with redwood sprouts
- Earth fill voids in the rip rap revetment structure shall be planted with redwood, willow or other approved plants
- RPF shall provide planting instructions at the time of operations

Erosion control

- A temporary silt fence shall be installed at the base of the construction area to minimize the amount of sediment that enters the stream
- Exposed soils shall be mulched and covered with approved erosion control blanket or netting.

7E **RIP RAP (Typical)**
NTS

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

RIP RAP REVETMENT
TYPICAL SPECIFICATIONS

Standard Detail 7E

Date: May 3, 2009

Rootwad Revetment with Vegetated Riprap

Native material revetments are viable alternatives to riprap armoring and gabion type structures. Root wads and logs are constructed to protect the streambank from erosion, provide in-stream and overhead cover for fish. The practice discussed here combines root wads with a layer of stones and/or boulder armoring, generally referred to as riprap revetment. The root wads and riprap are placed along a streambank and will be vegetated with pole planting, brushlayering, and live staking (joint planting).

Conditions Where Practice Applies

The implementations of root wad revetments are beneficial if these type of structures are naturally-occurring in adjacent stream reaches or in similar stream types. Analysis of channel morphology and stream type should be performed to determine if natural material revetments will achieve the desired results.

Vegetated riprap techniques should be considered with project in streams with fishery resources. See Vegetated Riprap. The inclusion of root wads and other large woody debris will enhance the fishery habitat. The root wads are intended to produce scour pools while the overhanging wood and vegetation will provide cover and shade.

Materials

The root wad should have the bole (trunk) attached to allow anchoring into the bank. The length of the bole is dependent on site conditions, however, it should be a 2-m (6 foot) minimum.

For the riprap component, the size and weight is dependant on design velocity or slope stability analysis. A filter layer, either graded aggregate or filter fabric, placed under the riprap will prevent the washout (piping) of fines through the armor layer.

Willow material for brushlayers and pole planting will be required. The length of the cuttings will depend on the depth through the riprap and filter layer to the native soil. Live cuttings can be included and should consist of relatively straight willow branches, 25-40 mm (1-1.5 inches) diameter and long enough to reach beyond the riprap and filter layer and into native ground.

Advantages

By combining boulders, logs and live plant materials to armor a streambank fish habitat is enhanced, in addition to creating a natural looking stabilization structure. Root wad revetments can be used for a wide range of fishery enhancement structures for various stream types. Vegetated rootwads combined with vegetated riprap can protect the streambank, provide in-stream and overhead cover for fish, provide shade, provide detritus and terrestrial insect habitat, look natural, and provide habitat diversity.

Rootwad Revetment with Vegetated Riprap (continued)

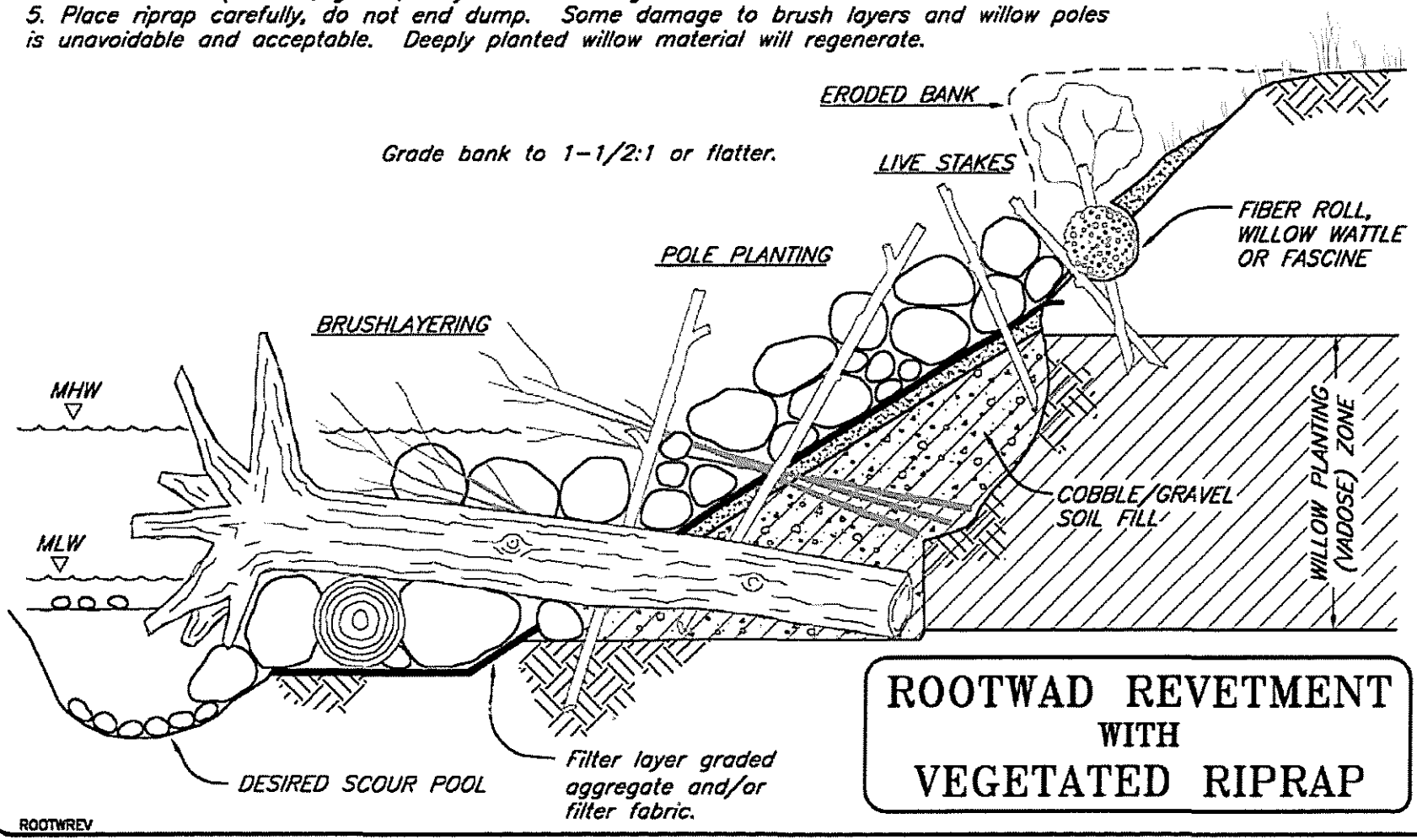
Disadvantages

The woody materials will probably not have the durability of other structural components. However, the inclusion of live woody vegetation, along with the accompanying root reinforcement, may make these structures stronger and more durable.

Implementation

Use a backhoe or excavator to set a "footer" log in a trench excavated below the thalweg (lowest point in the channel), running roughly parallel with the bank. A second log with the root wad attached is set on top of the footer log diagonally, forming an "X". The root wad end is set pointing upstream into the flow and the butt end lying downstream 45-60° degrees. The butt end of the root wad should be set in a trench excavated into the bank. Large boulders and willow poles should be used to secure the root wad, especially at the apex. Placement of the willow poles into the excavations will ensure they are deeply embedded and able to contact the water table. Further incorporation of live woody cuttings (brushlayering and pole planting) will enhance the structure.

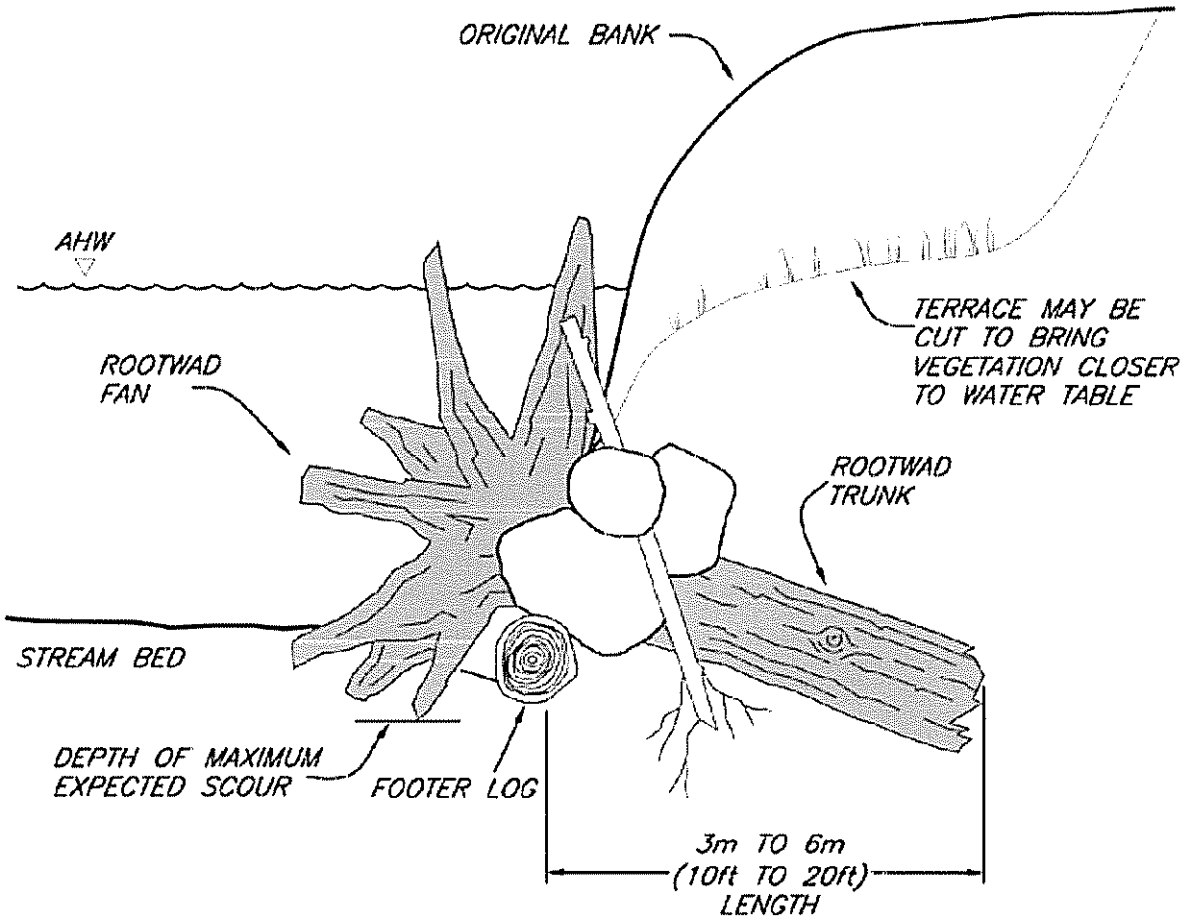
NOTES:
1. Willow pole planting and brushlayering shall be installed during bank grading and riprap placement to ensure good contact with 'native ground' and soil fill.
2. Willow poles and brush layers shall extend down into expected soil moisture zones (vadose).
3. Cut small holes or slits in filter fabric as necessary.
4. Place soil fill (cobbles, gravel, soil) around cuttings.
5. Place riprap carefully, do not end dump. Some damage to brush layers and willow poles is unavoidable and acceptable. Deeply planted willow material will regenerate.



ROOTWAD REVETMENT WITH VEGETATED RIPRAP

© 1989 JOHN McCULLAH

ROOTWREV



ROOTWAD REVETMENT CROSS-SECTION

© 2004 SALIX

FILE: RRC

Effective Silt Fence Installation

Definition

A silt fence is a temporary sediment barrier consisting of filter fabric entrenched into the soil and attached to supporting posts. Silt fence installed with a trencher or by slicing is the most effective installation method to ensure against common silt fence failures.

Purpose

Silt fence is a sediment control practice. Silt fence is intended to be installed where sediment-laden water can pond, thus allowing the sediment to fall out of suspension and separate from the runoff. It is not intended to be an erosion control practice.

Design Considerations

Typical silt fence specifications were written 25 years ago and have changed little since. Some states have recognized some of the inherent problems, such as inadequate trench depth, and implemented minor changes to improve efficacy. Time and experience has shown that the outdated construction specifications, combined with the improper application and incorrect installation of silt fences, has resulted in it being one of the most ineffective storm water pollution controls in use.

Do not install silt fences across streams, channels, or drainage ways. Silt fences cannot"filter" the volumes generated by channel flows. When installed across a concentrated flow path, undercutting or "end cutting" of the fence often occurs. Silt fences should not be designed to impound sediment or water more than 18 inches (0.5 m) high.

Construction Specifications

Silt fences have a useful life of one season. Their principal mode of action is to slow and pond the water and allow soil particles to settle. Silt fences are not designed to withstand high heads of water, and therefore should be located where only shallow pools can form. Their use is limited to situations in which sheet or overland flows are expected.

- Install silt fence material into a trench, 4” wide and at least 6” deep, with vertical sides. A preferred installation technique involves static slicing with an implement such as the "Tommy Silt Fence Machine" or equivalent. The soil should be sliced and the fabric mechanically installed into the soil.
- The trench must be backfilled and compacted.
- Install silt fences with 'smiles' or J-hooks to reduce the drainage area that any segment will impound

Effective Silt Fence Installation (continued)

- Silt fences placed at the toe of a slope shall be set at least 6 feet (1.8 m) from the toe in order to increase ponding volume.
- The soil should be sliced and the fabric mechanically installed into the soil.
- The height of a silt fence shall not exceed 36 inches (0.9 m). Storage height and ponding height shall never exceed 18 inches (0.5 m).
- The ends of the fence should be turned uphill.
- Steel support posts should be utilized, properly spaced and driven into compacted soil. Place the posts on the downstream side of the fabric/
- Post spacing shall not exceed 6 feet (1.8 m).
- The filter fabric is wire-tied directly to the posts with three diagonal ties. Filter fabric shall not be stapled to existing trees.

Inspection and Maintenance

- Inspect fence for proper installation and compaction by pulling up on the fence while kicking the toe of the fabric. If the fence comes out of the ground, do not "accept" the installation.
- If there are long, linear runs of silt fence without J-hooks or "smiles", do not "accept" the installation.
- Sediment shall be cleaned from behind the fence when it reaches 50% of the designed impoundment height (9 inch (0.2 m).

- Silt fences and filter barriers shall be inspected weekly after each significant storm (1 inch (25.4 mm) in 24 hour). Any required repairs shall be made immediately.
- Sediment should be removed when it reaches 1/3 height of the fence or 9 inches (0.3 m) maximum.
- The removed sediment shall conform with the existing grade and be vegetated or otherwise stabilized.
- Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized and any sediment stored behind the silt fence has been removed.

EFFECTIVE SILT FENCE INSTALLATION WITH SMILES

Construction Specifications:

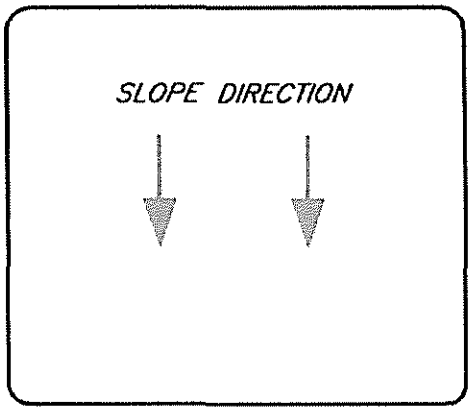
Typical silt fence specifications were written 25 years ago and have changed little since. Some states have recognized some of the inherent problems, such as inadequate trench depth, and implemented minor changes to improve efficacy. The 25 year-old specifications, referred to as the trenching method, have never been tested for efficacy and proven worthwhile. A trencher was simply the only piece of equipment available at the time capable of securing the fabric into the soil, regardless of efficacy.

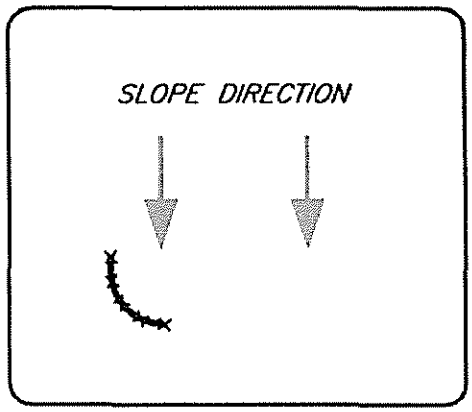
Today, many contractors just open a furrow with a blade and backfill onto the fabric with the crumbs. Loose soil, both from the trencher or the blade, absorbs water quickly and becomes saturated, easily washing out under the fabric.

- The soil should be sliced and the fabric mechanically installed into the soil
- The height of a silt fence shall not exceed 36 inches (0.9 m). Storage height and ponding height shall never exceed 18 inches (0.5 m).
- To minimize erosion, install silt fence at the head of a slope to slow velocity and to create a large storage area.
- The fence line shall follow the contour as closely as possible.
- The ends of the fence should be turned uphill.
- Steel support posts should be utilized, properly spaced and driven into compacted soil
- Post spacing shall not exceed 6 feet (1.8 m).
- The filter fabric is stapled or wired directly to the posts. Filter fabric shall not be stapled to existing trees.
- Fabric should be attached to the posts with three diagonal ties
- Silt fences placed at the toe of a slope shall be set at least 6 feet (1.8 m) from the toe in order to increase ponding volume.

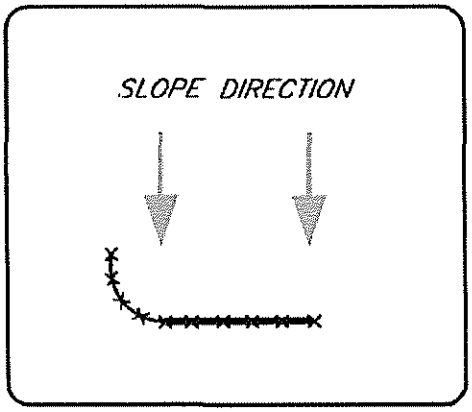
Inspection and Maintenance:

- Silt fences and filter barriers shall be inspected weekly after each significant storm (1 inch (25.4 mm) in 24 hours. Any required repairs shall be made immediately.
- Sediment should be removed when it reaches 1/3 height of the fence or 9 inches (0.3 m) maximum.
- The removed sediment shall conform to the existing grade and be vegetated or otherwise stabilized.
- Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized and any sediment stored behind the silt fence has been removed.

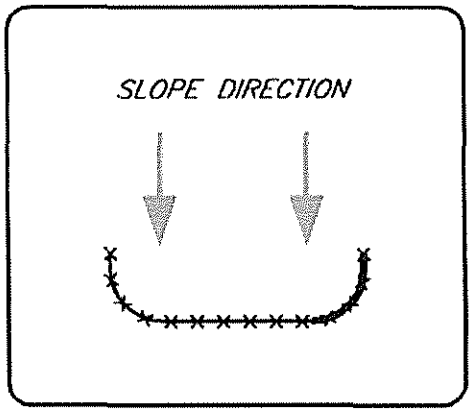




STEP 1 – CONSTRUCT LEG



STEP 2 – CONSTRUCT DAM



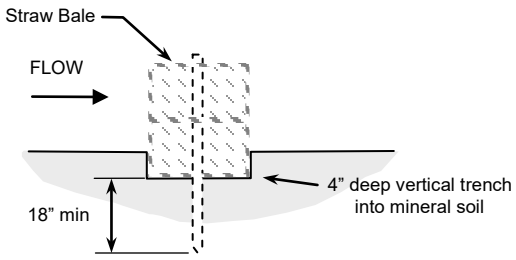
STEP 3 – CONSTRUCT LEG 2

INSTALLATION WITH J–HOOKS OR 'SMILES' INCREASE SILT FENCE EFFICIENCY.

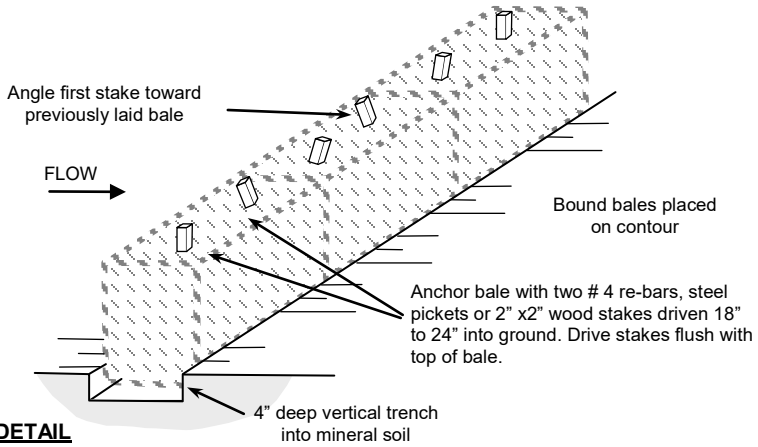
SILT FENCE
TYPICAL PLACEMENT–ONE SLOPE

© 2001 JOHN McCULLAH

FILE: SF–ONE SLOPE



BEDDING DETAILS



ANCHOR DETAIL

NOTES:

1. Bales shall be placed at contour locations as specified for slope erosion control
2. Bales shall be placed in ditches at designated locations for sediment reduction as specified.
3. Each bale shall be imbedded a minimum of 4" \.
4. Each bale shall be securely anchored in placed by either two # 4 re-bars, steel pickets or 2" x 2" wood stakes driven through the bales. The first stake in each bale shall be driven at an angle to force the bales together.
5. For bales placed on slope, stakes shall be driven a minimum of 18" into firm soils. For bales placed in inside ditches, stakes shall be driven a minimum of 6" into firm native soils.
6. Inspection shall be frequent and repair replacement shall be made promptly as needed
7. Bales shall be removed as directed

8C **STRAW SILT FENCE (Typical)**
NTS

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

STRAW SILT FENCE
TYPICAL SPECIFICATIONS

Standard Detail 8C

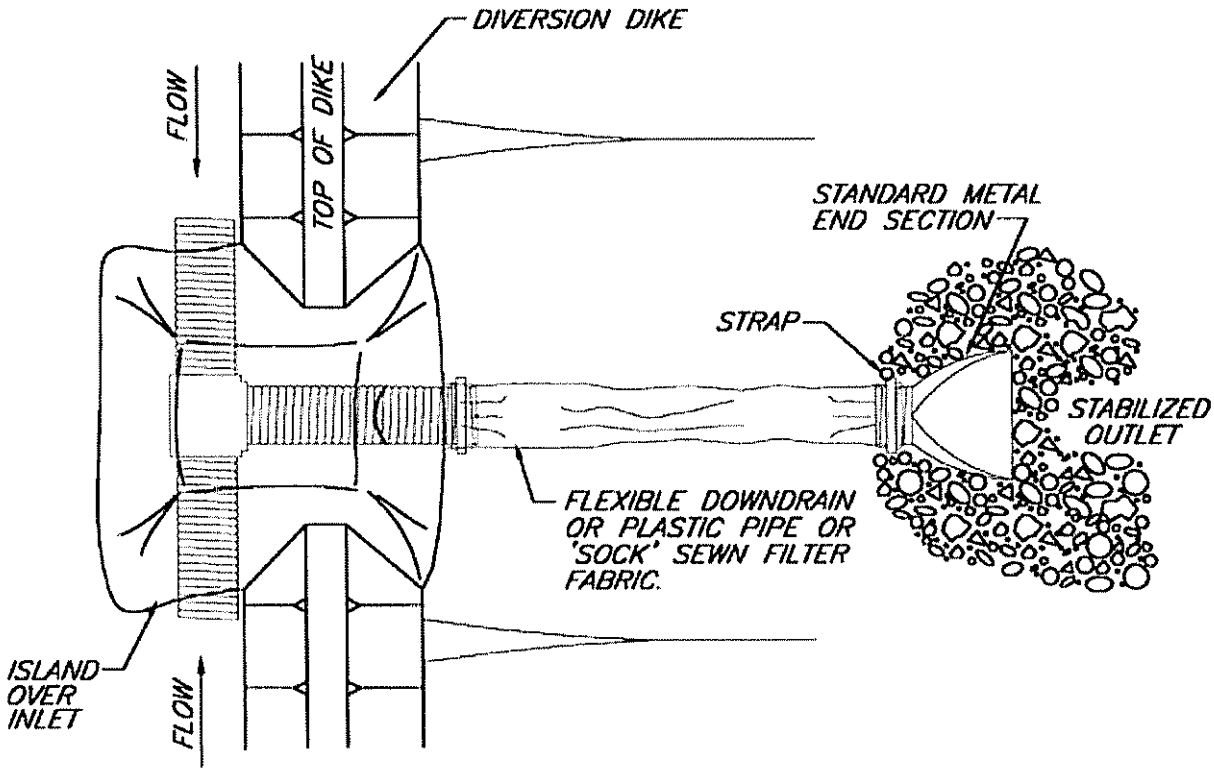
Date: May 3, 2009

SLOPE DRAIN

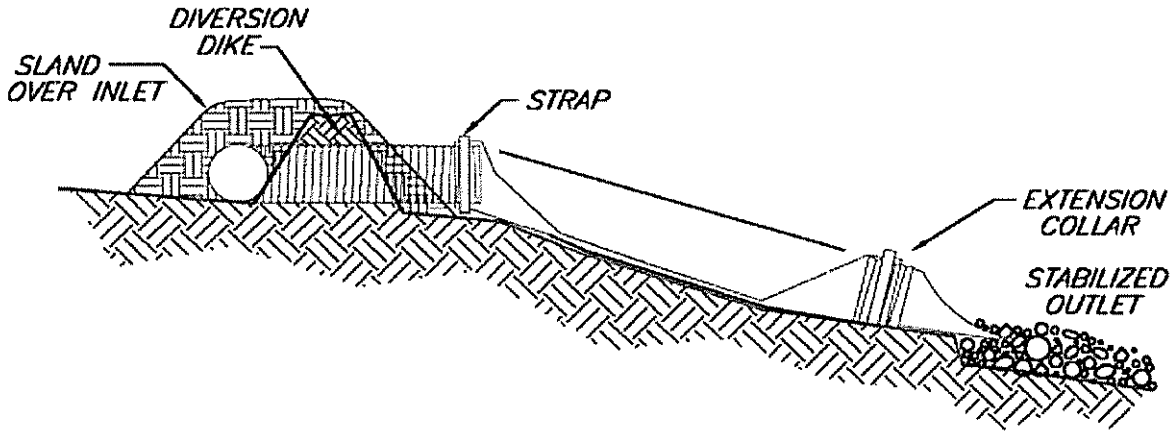
Construction Specifications: A common failure of slope drains is caused by water saturating the soil and seeping along the pipe. Proper backfilling around and under the pipe haunches with stable soil material and hand compacting in 6 inch (.2 m) lifts to achieve firm contact between the pipe and the soil at all points will reduce this type of failure.

- Place slope drains on undisturbed soil or well-compacted fill at locations and elevations shown on the plans.
- Slightly slope the section of pipe under the dike toward its outlet.
- Compact the soil under and around the entrance section in lifts not to exceed 6 inches.
- Ensure that fill over the drain at the top of the slope has a minimum depth of 1.5 feet (0.5 m) and a minimum top width of 4 feet (1.2 m). The sides should have a 3:1 slope.
- Ensure that all slope drain connections are watertight.
- Ensure that all fill material is well-compacted. Securely fasten the exposed section of the drain with grommets or stakes spaced no more than 10 feet (3.1 m) apart.
- Extend the drain beyond the toe of the slope and adequately protect the outlet from erosion.
- Make the settled, compacted dike ridge no less than 1 foot (0.3 m) higher than the top of the pipe inlet.
- Immediately stabilize all disturbed areas following construction.

Maintenance: Inspect the slope drain and supporting diversions after every significant rainfall and promptly make necessary repairs. When the protected area has been permanently stabilized, temporary measures may be removed, materials disposed of properly, and all disturbed areas stabilized appropriately.



PLAN VIEW



SECTION

SLOPE DRAIN

© 1994 JOHN McCULLAH

FILE: SLOPEDRN

Straw Rolls

Straw rolls are manufactured from straw that is wrapped in black plastic netting. They are approximately 200 mm (8 inches) in diameter by 8-9 m (25-30 feet) long. Rolls are placed and staked along the contour of newly constructed or disturbed slopes, in shallow trenches.

Conditions Where Practice Applies

Sites appropriate for straw rolls are slopes susceptible to sheet and rill erosion, slopes producing dry ravel, slopes susceptible to freeze/thaw activity, or slopes difficult to vegetate because of soil movement. Straw rolls are not intended for use in concentrated flow situations. Straw rolls will last an average of one to two years. This is an important factor when planning the optimum length of time the slope will need mechanical stabilization. Straw rolls can be staked with live stakes if site conditions warrant. The moisture retained by the straw roll will encourage cutting establishment.

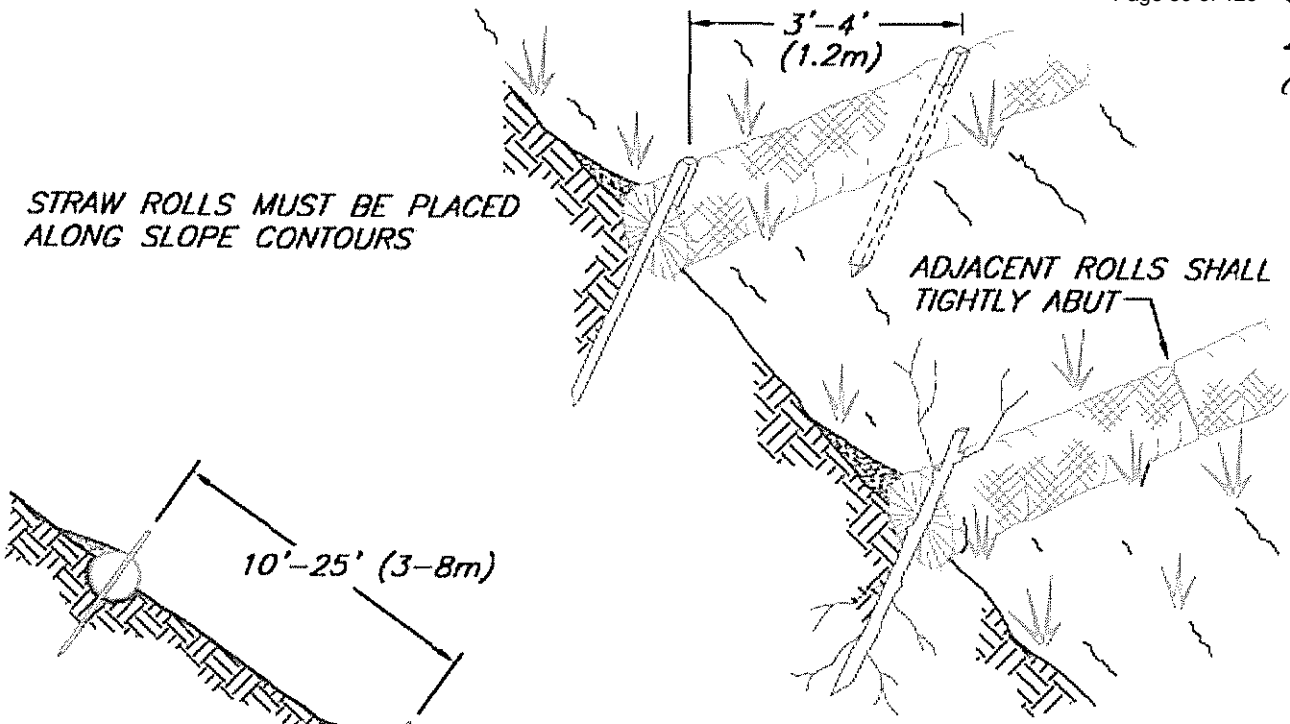
Advantages

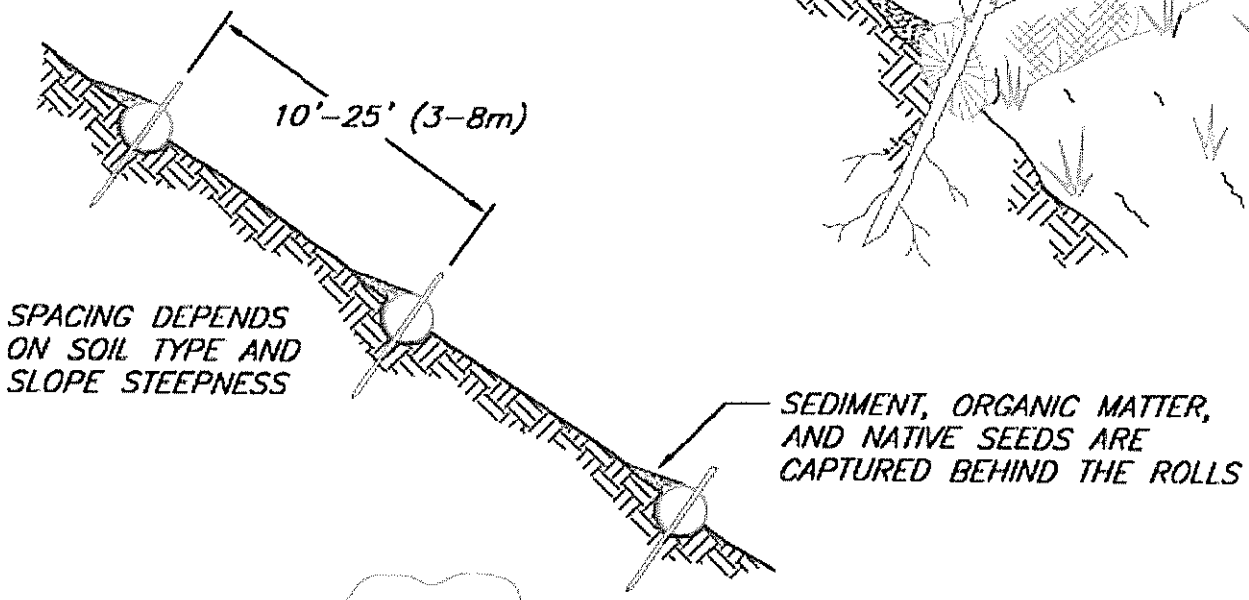
Straw rolls are a relatively low-cost solution to sheet and rill erosion problems. They better suited than silt fences or straw bales for placement on steep slopes. Straw Rolls help establish native vegetation as rolls store moisture for vegetation planted immediately upslope. The moisture retention can help in the establishment of willows from live cuttings. The plastic netting will eventually photodegrade, eliminating the need for retrieval of materials after the straw has broken down. The straw will become incorporated into the soil with time, adding organic material to the soil and retaining moisture for vegetation.

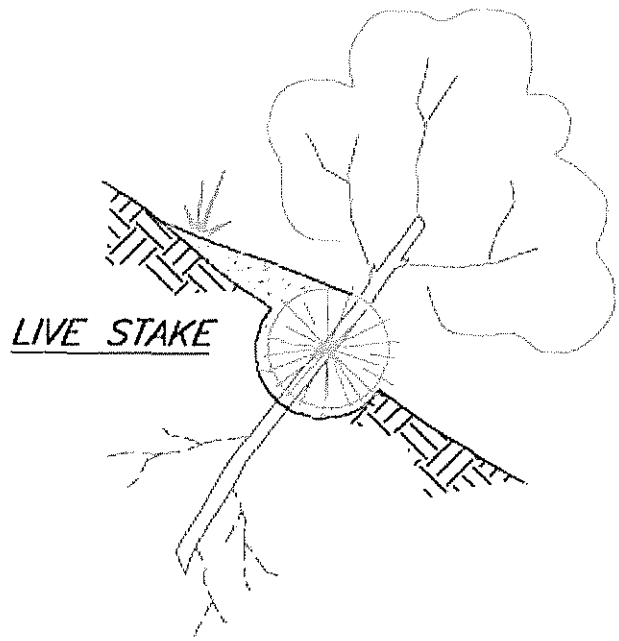
Implementation

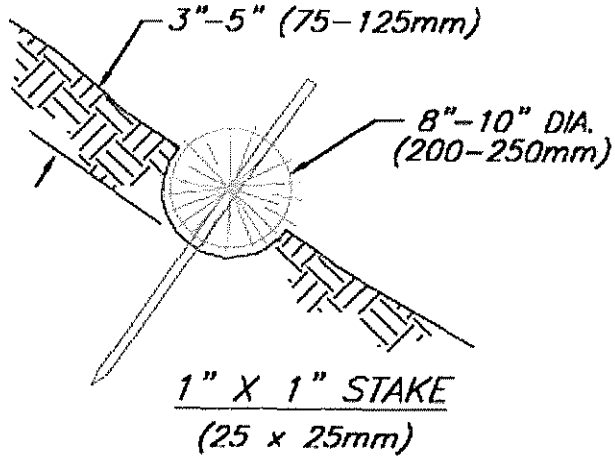
Prepare the slope before the installation procedure is started. Shallow gullies should be smoothed as work progresses. Dig small trenches across the slope on contour to place the rolls in. The trench should be deep enough to accommodate half the thickness of the roll. When the soil is loose and uncompacted, the trench should be deep enough to bury the roll 2/3 of its thickness because the ground will settle.

Start building trenches and install rolls from the bottom of the slope and work up. Construct trenches at contour intervals of 3-12 feet (1-4 m) apart depending on steepness of slope. The steeper the slope, the closer together the trenches. Make sure no gaps exist between the soil and the straw wattle. Use a straight bar to drive holes through the wattle and into the soil for the willow or wooden stakes. Drive the stake through prepared hole into the soil. Leave only 25-50 mm (1-2 inches) of stake exposed above roll. Install stakes at least every 1.2 m (4 feet) apart. Use straight willow stakes, 20-mm (3/4 inch) diameter in addition to wooden stakes.









NOT TO SCALE

NOTE:

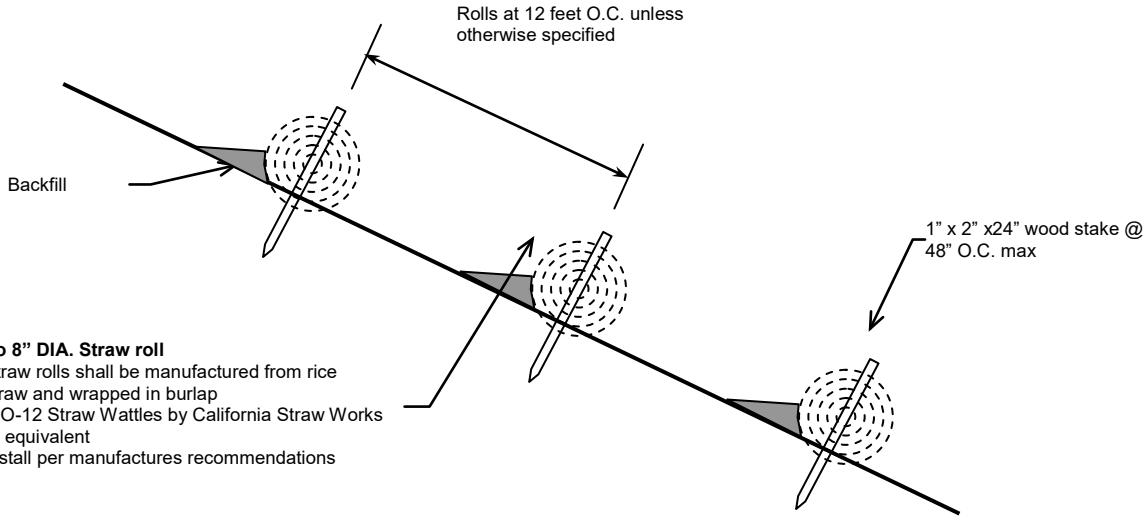
1. STRAW ROLL INSTALLATION REQUIRES THE PLACEMENT AND SECURE STAKING OF THE ROLL IN A TRENCH, 3"-5" (75-125mm) DEEP, DUG ON CONTOUR. RUNOFF MUST NOT BE ALLOWED TO RUN UNDER OR AROUND ROLL.

STRAW ROLLS

© 1996 J.L. McCULLAH

FILE: STRWROLL

Date of last revision: 12/20/2012



6" to 8" DIA. Straw roll

- Straw rolls shall be manufactured from rice straw and wrapped in burlap
- BIO-12 Straw Wattles by California Straw Works or equivalent
- Install per manufactures recommendations

NOTE:

- Location
  - Install at base of disturbed areas and at outlets of new or reconstructed reverse grades/rolling dips unless otherwise specific
  - Rolls to extend across entire width of disturbed area unless otherwise specified or directed.
- Placement
  - Install per manufactures recommendations
  - Rolls to be placed on slope contour
  - Adjacent rolls to overlap; turn ends of rolls up
  - Runoff must not be allowed to run under or around the roll

8B **STRAW ROLL (Typical)**
NTS

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

STRAW ROLL PLACEMENT
TYPICAL SPECIFICATIONS

Standard Detail 8B

Date: May 3, 2009

STRUCTURAL STREAMBANK STABILIZATION

Construction Specifications:

Riprap: Riprap is the most commonly used structural material for stabilizing streambanks. When possible, slope banks to 2:1 or flatter, and place a gravel filter or filter fabric on the smoothed slopes before installing riprap. Place the toe of the riprap at least 1 foot (0.3 m) below the stream channel bottom or below the anticipated depth of channel degradation. Where necessary, riprap the entire stream cross section. It is important to extend the upstream and downstream edges of riprap well into the bank and bottom. Extend riprap sections the entire length between well-stabilized points of the stream channel.

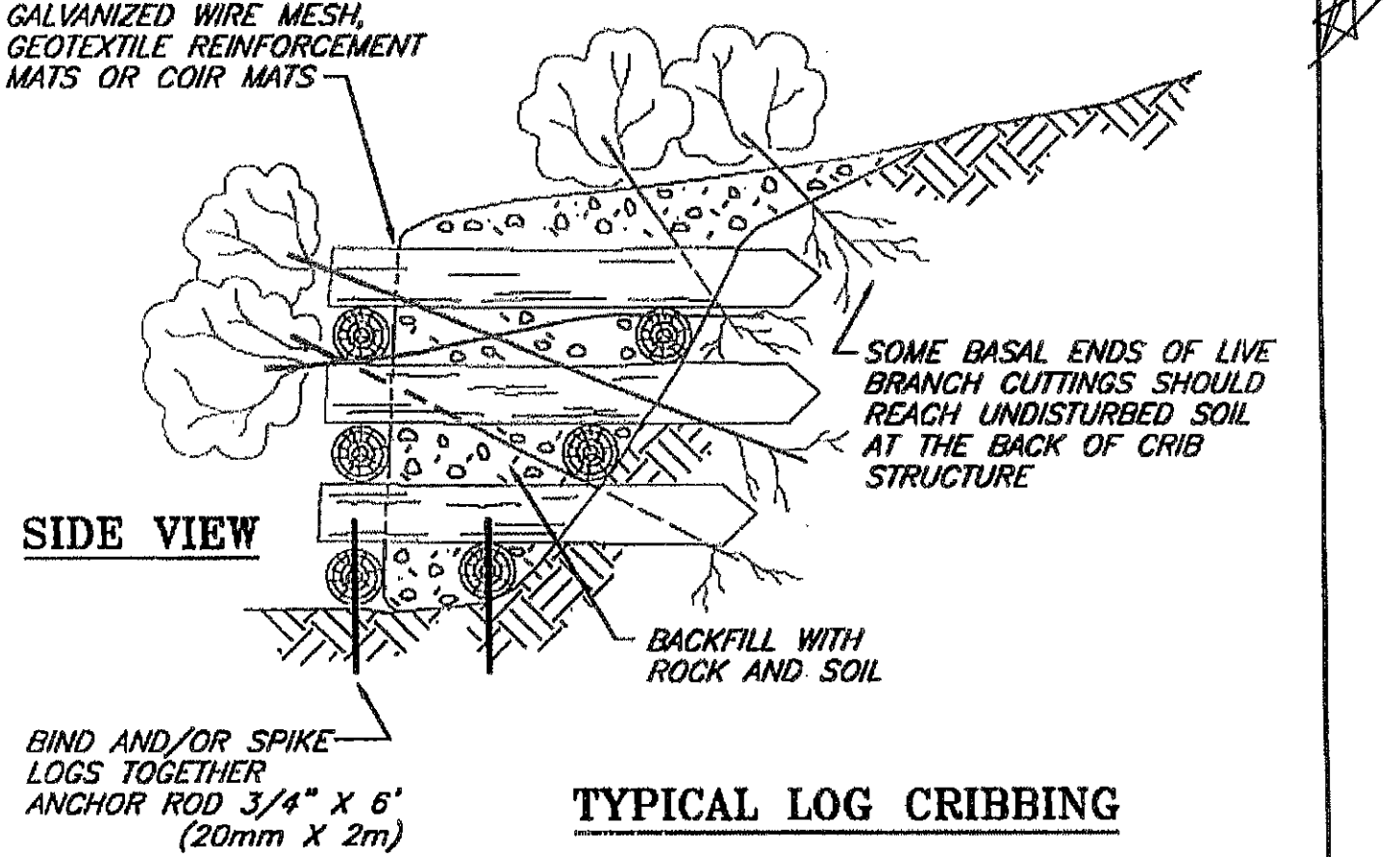
Deflectors: Deflectors are structural barriers, in the form of groins or jetties which project into the stream to divert flow away from eroding streambank sections. Stone and rock deflectors, used as instream structures, may also be useful for environmental and habitat enhancement.

- Live willow (or other riparian species) staking may be incorporated into the construction of the rock deflectors.
- The deflectors should be shaped in a 30-60-90 degree triangle with the 30 degree angle upstream and against the bank.
- The deflectors are generally spaced 3-5 times the length of its groin.
- Single wing deflectors should extend 1/4 to 1/2 of the way across the stream.
- Double wing deflectors will extend no more than 1/4 of the way across the stream, opposite each other. The narrowest point between deflector will be 1/2 of the stream width.
- In general, the first and last deflectors should be double wing deflectors and the general deflector pattern will alternate between double wing and single wing, unless structures are intended to protect an outer bend. Then non-alternating, consecutive single wings may be required.
- The rock deflector should be constructed with a 1.5 foot (0.5 m) minimum diameter rock. Larger channels will require larger rock.
- Rock deflector should be keyed into the stream bottom a minimum of 1 foot (0.3 m).
- The top of the rock should extend 1 foot (0.3m) above normal stream flow (near bank) and slope down to a height of 0.5 feet (0.2 m) above stream flow at apex.
- The deflectors should be contiguous with riprap or other streambank protection measures.

Log Cribbing is a retaining structure built of logs to protect streambanks from erosion. Log cribbing is normally built on the outside of stream bends to protect the streambank from the impinging flow of the stream. Log cribbing can have live willow (or other riparian species)

stakes be planted between the logs, behind the structure and immediately adjacent to the cribbing.

Inspection and Maintenance: All structures should be maintained in an "as built" condition. Structural damage caused by storm events should be repaired as soon as possible to prevent further damage to the structure or erosion of the streambank.



TYPICAL LOG CRIBBING

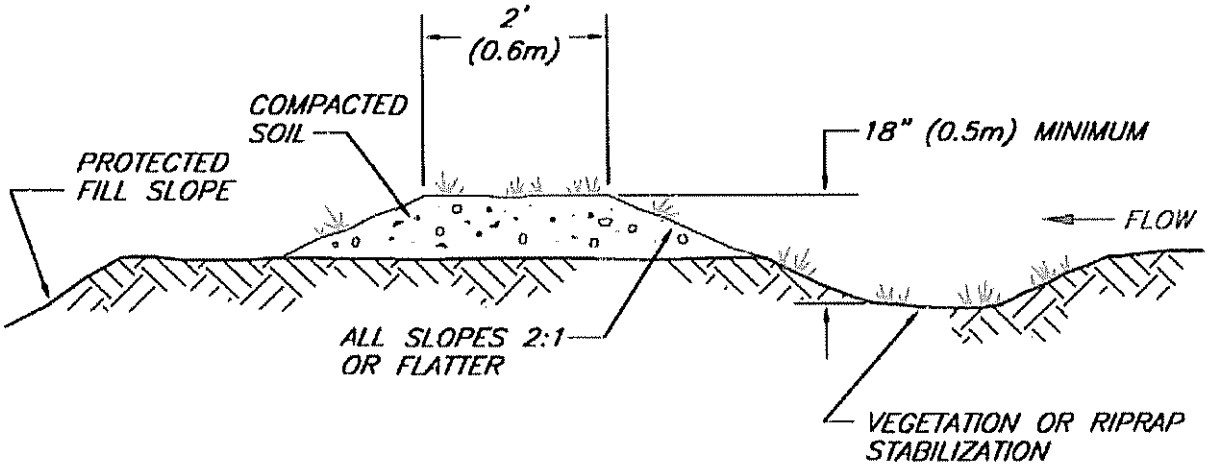
TEMPORARY DIVERSION DIKE

Construction Specifications:

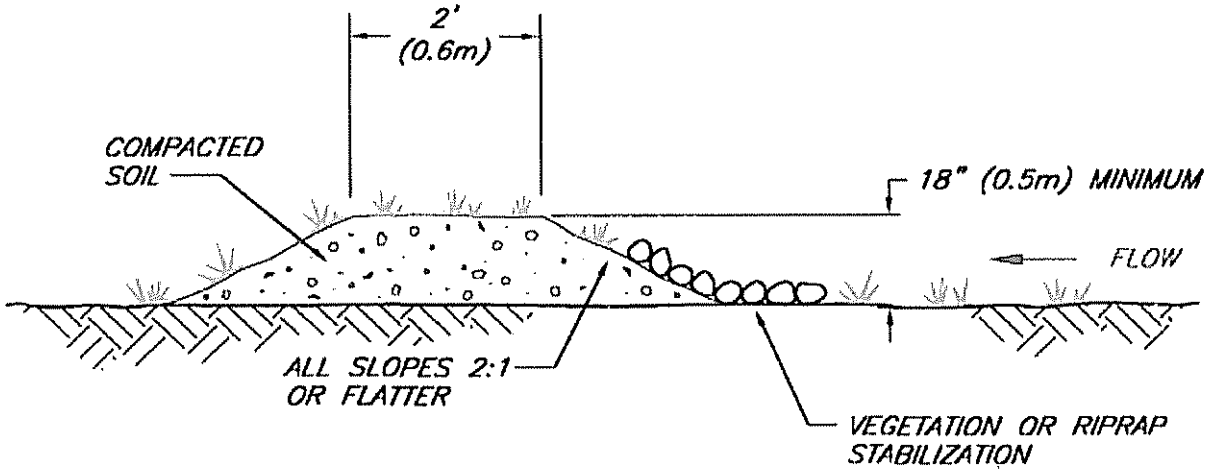
- Temporary diversion dikes must be installed as a first step in the land-disturbing activity and must be functional prior to upslope land disturbance.
- The dike should be adequately compacted to prevent failure.
- Temporary or permanent seeding and mulch shall be applied to the dike immediately following its construction.
- The dike should be located to minimize damages by construction operations and traffic.

Inspection and Maintenance:

- The measure shall be inspected after every storm and repairs made to the dike, flow channel, outlet or sediment trapping facility, as necessary.
- Once every two weeks, whether a storm event has occurred or not, the measure shall be inspected and repairs made if needed.
- Diversion Dikes used to trap sediment shall be inspected and cleaned out after every significant storm.
- Damages caused by construction traffic or other activity must be repaired before the end of each working day.
- If vegetation has not been established, reseed damaged and sparse areas immediately.



TYPICAL FILL DIVERSION



TYPICAL TEMPORARY DIVERSION DIKE

NOTES:
1. THE CHANNEL BEHIND THE DIKE SHALL HAVE POSITIVE GRADE TO A STABILIZED OUTLET.
2. THE DIKE SHALL BE ADEQUATELY COMPACTED TO PREVENT FAILURE.
3. THE DIKE SHALL BE STABILIZED WITH TEMPORARY OR PERMANENT SEEDING OR RIPRAP.

TEMPORARY DIVERSION DIKE

© 1996 JOHN McCULLAH

FILE: TEMPDIKE

Vegetated Mechanically Stabilized Earth

Description:

This technique consists of live cut branches (brushlayers) interspersed between lifts of soil wrapped in natural fabric, e.g., coir, or synthetic geotextiles or geogrids. The live brush is placed in a criss-cross or overlapping pattern atop each wrapped soil lift in a manner similar to conventional brushlayering. The fabric wrapping provides the primary reinforcement in a manner similar to that of conventional mechanically-stabilized earth (Koerner, 1998; Mitchell & Villet, 1987). The live, cut branches eventually root and leaf out, providing vegetative cover and secondary reinforcement as well. In some cases, the vegetative treatment may consist of using a coarse netting for the soil wraps and establishing an herbaceous or grass cover by simply hydroseeding through the openings in the fabric.

Purpose:

Vegetated Mechanically Stabilized Earth (VMSE) can be viewed as a union between conventional, mechanically stabilized earth methods that utilize inert, tensile inclusions, and brushlayering, a soil bioengineering technique that utilizes live, cut branches as the tensile soil inclusions. The treatments complement one another. Fabric wraps provide the primary reinforcement and mechanical stabilization, permitting much steeper slopes to be constructed than would be possible with live brushlayers alone. The vegetation shields the fabric against damaging UV radiation and provides visual and habitat benefits.

Conditions Where Practice Applies:

VMSE can be used to stabilize slopes as steep as 1V:0.5H. This technique provides an alternative to vertical retaining structures, e.g., timber pile walls, and to techniques that require slope flattening or bank lay back, which results in excessive right-of-way encroachment at the top of bank. The use of synthetic geotextiles or geogrids provides greater long-term durability and security. The fabric or geotextile wrap also provides additional protection to upper portions of streambanks that are subject to periodic scour or tractive stresses. If either steady, long term seepage or temporary bank return flows after flood events are a problem, the brushlayers act as a drainage layer or conduits that relieve internal pore water pressure, and favorably modify the groundwater flow regime within the slope to minimize slope stability problems.

Complexity:

High. VMSE is relatively complex, because it entails designing, melding together, and constructing two similar yet distinct methods, conventional MSE and live brushlayering. Both techniques are widely used and well understood, however; simultaneous use introduces complexity.

Vegetated Mechanically Stabilized Earth (continued)

Design Guidelines / Typical Drawings:

Many different types of inclusions with various shapes and properties can be used to reinforce and buttress earthen slopes. These inclusions range from imbedded metal strips, geogrids fabricated from polymeric nets, and natural or synthetic geotextiles or fabrics. Earthen slopes, embankments, or structural fills that are stabilized or reinforced with such tensile inclusions are referred to as "mechanically stabilized earth." Shear stresses that develop in the soil matrix are transferred into tensile resistance in the imbedded inclusions via friction along the soil-inclusion interface.

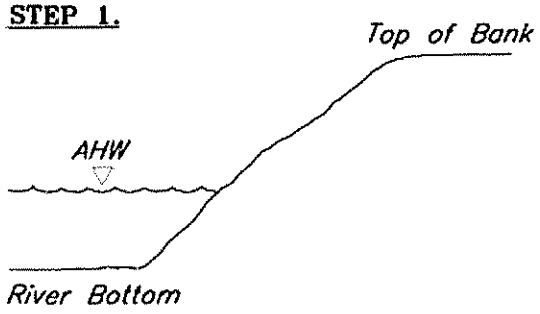
Mechanically stabilized earth retaining structures must satisfy external stability requirements, i.e., have adequate resistance to sliding, overturning, and bearing capacity failure. Internal stability requirements are also important in reinforced earth and mechanically stabilized earth structures. The tensile inclusions or reinforcements in these structures must have a sufficient unit tensile resistance and/or be placed in sufficient numbers to resist breaking in tension. The inclusions must also be sufficiently long and "frictional" enough to resist failure by pullout.

Synthetic geogrids fabricated from high-tensile strength polymeric materials are widely used in reinforced earth embankments and retaining walls. Geogrids tend to have superior pullout resistance compared to geotextile or fabric sheets because of passive resistance mobilized along the transverse elements in a mesh or geogrid. They can be used either in a wrap-around fashion to provide both backfill reinforcement and containment at the front face. This approach permits the insertion of live cuttings or branches between successive lifts of "wrapped soil" as shown schematically in Figure 1.

Live cuttings inserted in the above manner also act as tensile inclusions and help to stabilize a slope, embankment, or structural fill. Live brushlayers behave exactly in this fashion. Gray & Sotir (1992) discuss how brushlayers can be analyzed and their contribution to slope stability determined in a rational, quantitative manner. This contribution could be included as well when inert reinforcements are used in conjunction with live brushlayers such as in VMSE. In this combined approach, however, the contribution to mechanical reinforcement from the live cuttings is simply treated as a bonus, and the design analysis is focused on the fabric or geogrid reinforcements themselves.

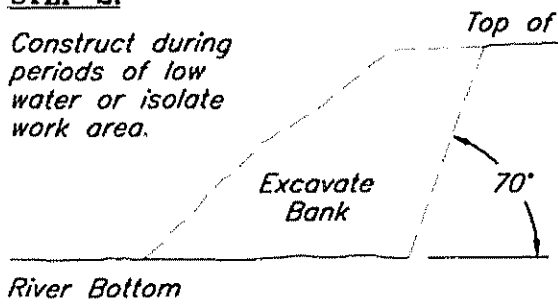
The main considerations in the design of geogrid or geotextile reinforced earthen slopes and embankment fills is the required vertical spacing (d) and total length (L) of the reinforcing layers. The total length (L) is comprised of a length or distance required to reach the expected failure surface in the backfill and an additional length, the effective or imbedment length (L_E), extending beyond the failure surface required to prevent pullout. The reader should consult with a geotechnical engineer as necessary.

STEP 1.

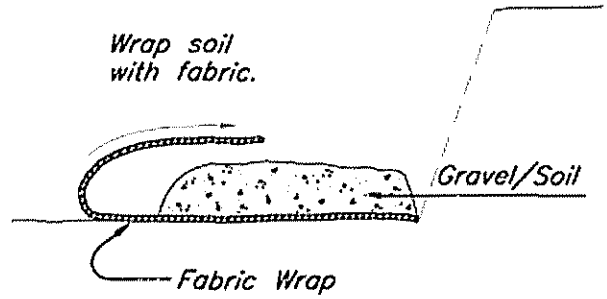


STEP 2.

Construct during periods of low water or isolate work area.

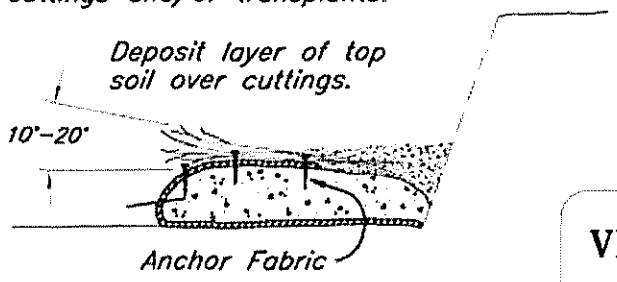


STEP 3.



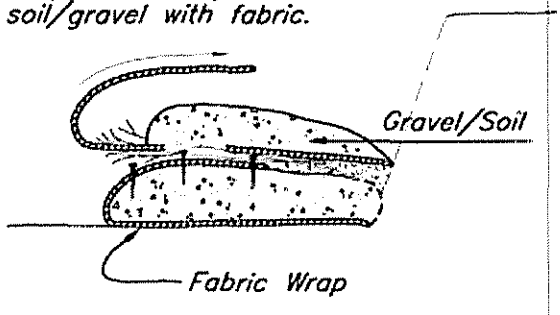
STEP 4.

Crisscross layers of dormant cuttings and/or transplants.



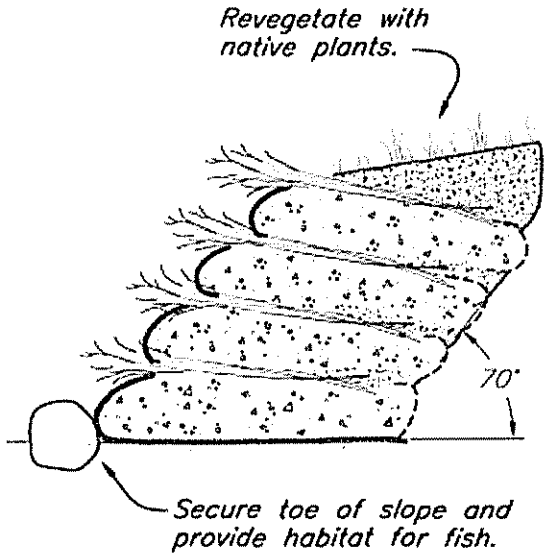
STEP 5.

Wrap second layer of soil/gravel with fabric.



STEP 6.

Repeat steps 3, 4, 5 until desired height of bank is reached.



VEGETATED MECHANICALLY STABILIZED EARTH
STEP BY STEP

© 2004 SALIX

FILE: VMSE

Vegetated Riprap

A layer of stones and/or boulder armoring, generally referred to as riprap revetment, placed along a streambank and designed to be vegetated with pole planting, brushlayering, and live staking (joint planting).

Conditions Where Practice Applies

Rock riprap is the most common and effective form of streambank protection. Rock can settle and conform if some scour should occur. Conventional riprap placement, however, does not increase wildlife habitat nor is it aesthetically pleasing. It often takes many years for riprap to become vegetated if revegetation is not planned in advance and integrated with construction. The agencies whose task it is to ensure fish habitat recognize that the continued use of riprap, gabions, and other inert streambank structures have long-term negative impacts on aquatic habitats.

This practice applies whenever there is a desire to install riprap, which is more attractive and has the potential to enhance, not degrade, fish and wildlife habitat. Additionally, woody vegetation establishment will prevent soil loss (piping) from behind the structures and increase pull out resistance. Vegetated riprap techniques should be considered with projects in streams with fishery resources.

Materials

The main elements are quarry stone or other suitable rock, the size and weight dependant on design velocity or slope stability analysis. A filter layer, either graded aggregate or filter fabric, placed under the riprap will prevent the washout (piping) of fines through the armor layer.

Willow material for brushlayering and pole planting will be required. The length of the cuttings will depend on the depth through the riprap and filter layer to the native soil. Live cuttings can be included and should consist of relatively straight willow branches, 25-40 mm (1-1.5 inches) diameter and long enough to reach beyond the riprap and filter layer and into native ground.

Vegetated Riprap (continued)

Advantages

Studies have shown that the frequency of revetment failure was lower in vegetated revetments than unvegetated sections. The vegetation's roots, particularly the fibrous willow roots, prevent washout of fines and stabilizes the native soil. Vegetation helps to anchor the armor stone to the bank and increases their lift-off resistance. In addition, vegetated revetments provide riparian benefits and wildlife habitat. Vegetated riprap has a more natural appearance and is therefore more aesthetically pleasing. Along streambanks, the vegetation will slow water velocities and encourage deposition and sedimentation. Experience has shown that environmental clearances and permits are easier to obtain if the project has biotechnical, habitat enhancement, elements incorporated into the design.

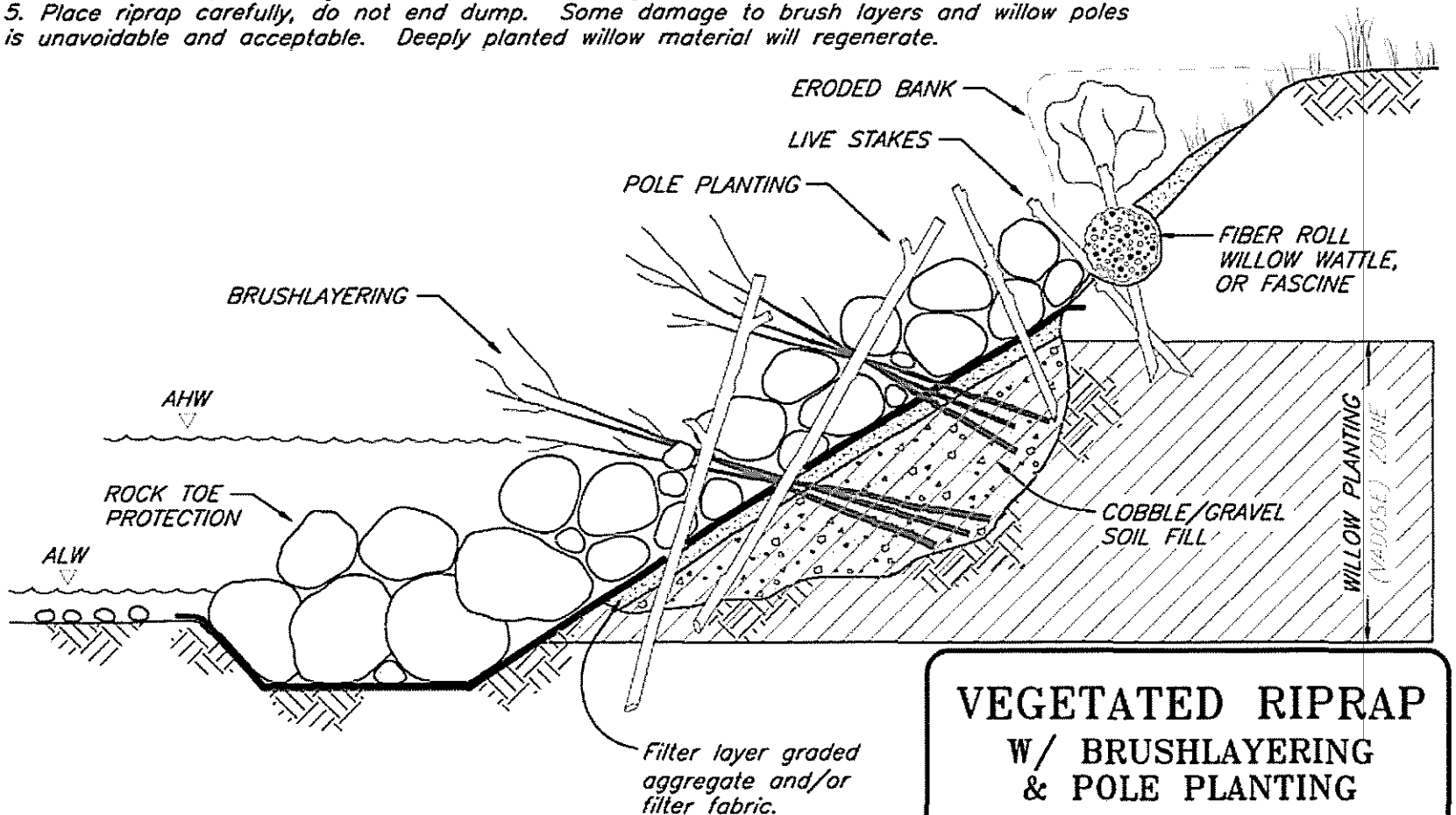
Disadvantages

It is sometimes difficult to drive the willow stakes between the rock joints, through filter fabric and into the native soil. The cuttings, brushlayering and pole planting, should be installed while the revetment is being constructed. Installation of the vegetative practices during construction will facilitate the planting but it will requires additional care when placing the rock (end dumping may damage to the cuttings).

Implementation

The branches are inserted during construction in crushed stone or riprap so that the butt ends are imbedded in the soil behind the cover to a depth of 0.3-0.5 m or into the seasonal water table or capillary fringe. The branch tips should protrude for approximately 0.5 m from the stone layer and face at an oblique angle downstream. The lowest branches are below the level of the mean summer flow and well wedged amongst the stone to prevent them from being washed out.

NOTES:
1. Install willow pole planting and brushlayering during bank grading and riprap placement to ensure good contact with 'native ground' and/or soil fill.
2. Willow poles and brush layers should extend down into expected soil moisture zones (vadose).
3. Cut small holes or slits in filter fabric as necessary.
4. Place soil fill (cobbles, gravel, soil) around cuttings.
5. Place riprap carefully, do not end dump. Some damage to brush layers and willow poles is unavoidable and acceptable. Deeply planted willow material will regenerate.

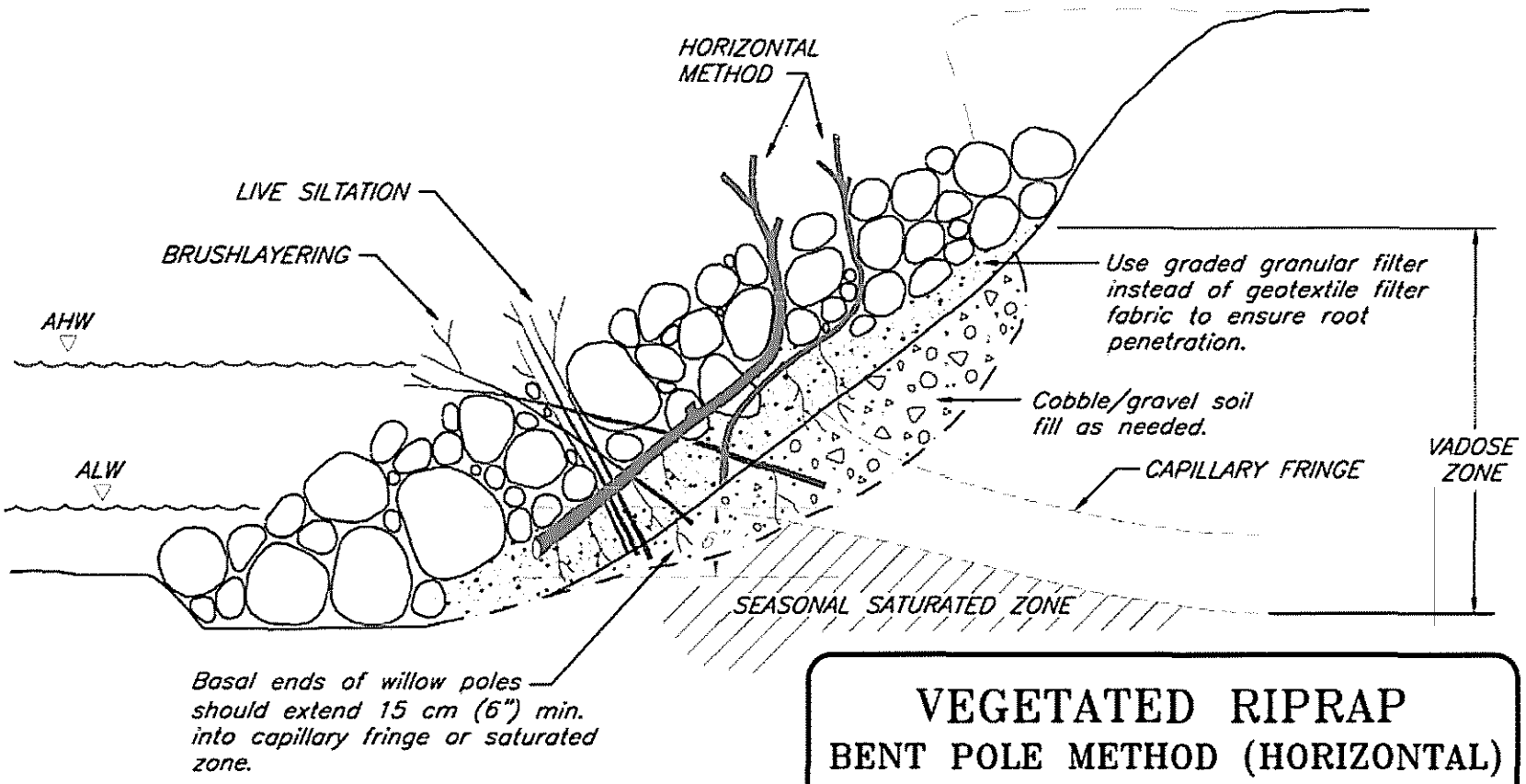


VEGETATED RIPRAP
W/ BRUSHLAYERING & POLE PLANTING

FILE: VRBLPP

© 2004 SALIX

NOTES:
1. Integrate brushlayering, pole planting and live siltation techniques during rock placement to ensure contact with native ground. Laying poles "horizontally" is an efficient and cost-effective way to maximize rooting.
2. As a general rule, place basal ends of the cuttings 15 cm (6") into the capillary fringe or seasonal saturated zone.
3. Graded, granular filter is preferable to filter fabric to improve root penetration or slip poles through slits cut into fabric.
4. Place soil fill (cobbles, gravel, soil) around cuttings and 'water in' if possible.



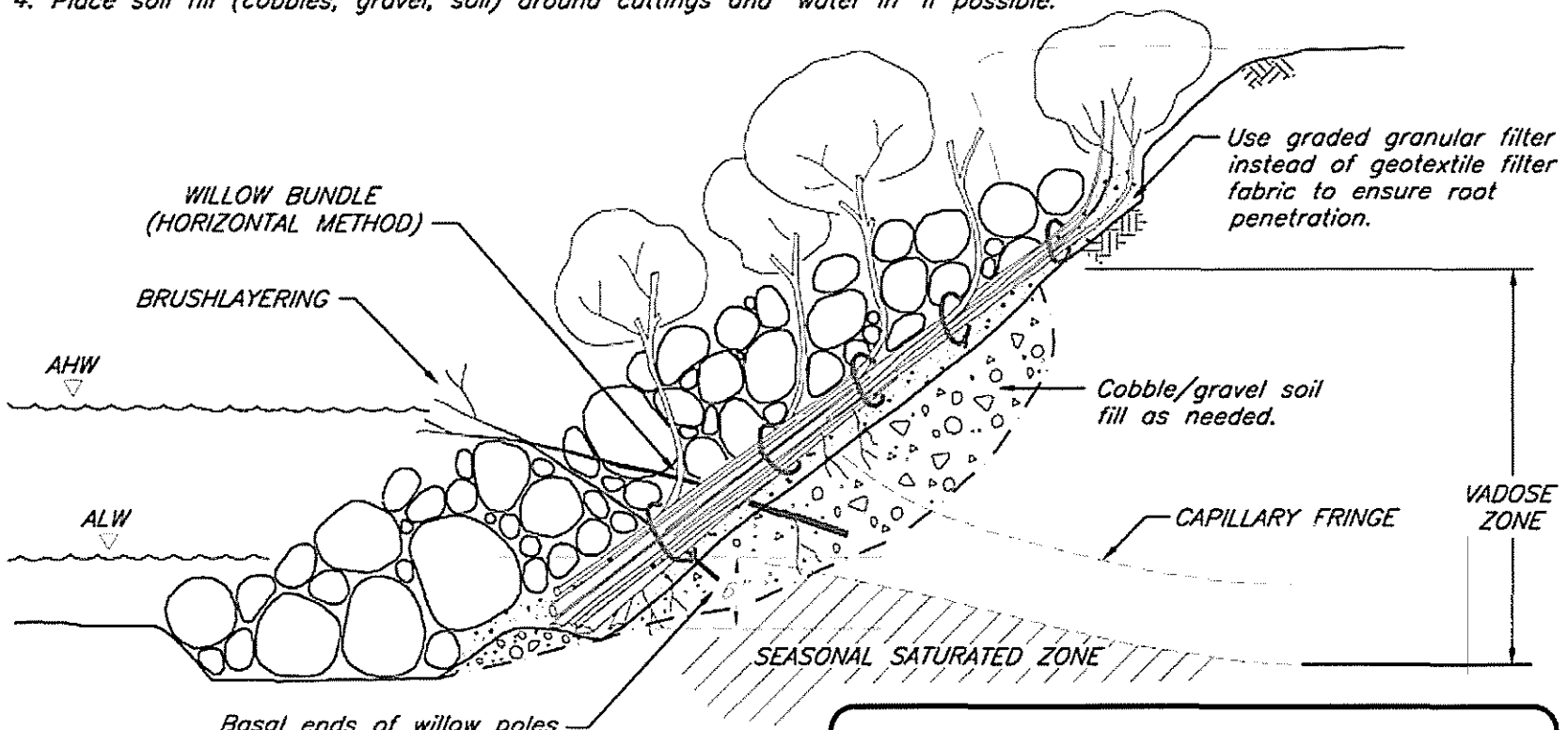
VEGETATED RIPRAP
BENT POLE METHOD (HORIZONTAL)

FILE: VRBP

© 2004 SALIX

NOTES:

1. As a general rule, place basal ends of the cuttings 15 cm (6") into the capillary fringe or seasonal saturated zone.
2. Bend individual poles up through the riprap during placement while ensuring contact of the stem with native ground. Laying poles 'horizontally" is an efficient and cost-effective way to maximize rooting.
3. Graded, granular filter is preferable to filter fabric to improve root penetration or slip poles through slits cut into fabric.
4. Place soil fill (cobbles, gravel, soil) around cuttings and 'water in' if possible.

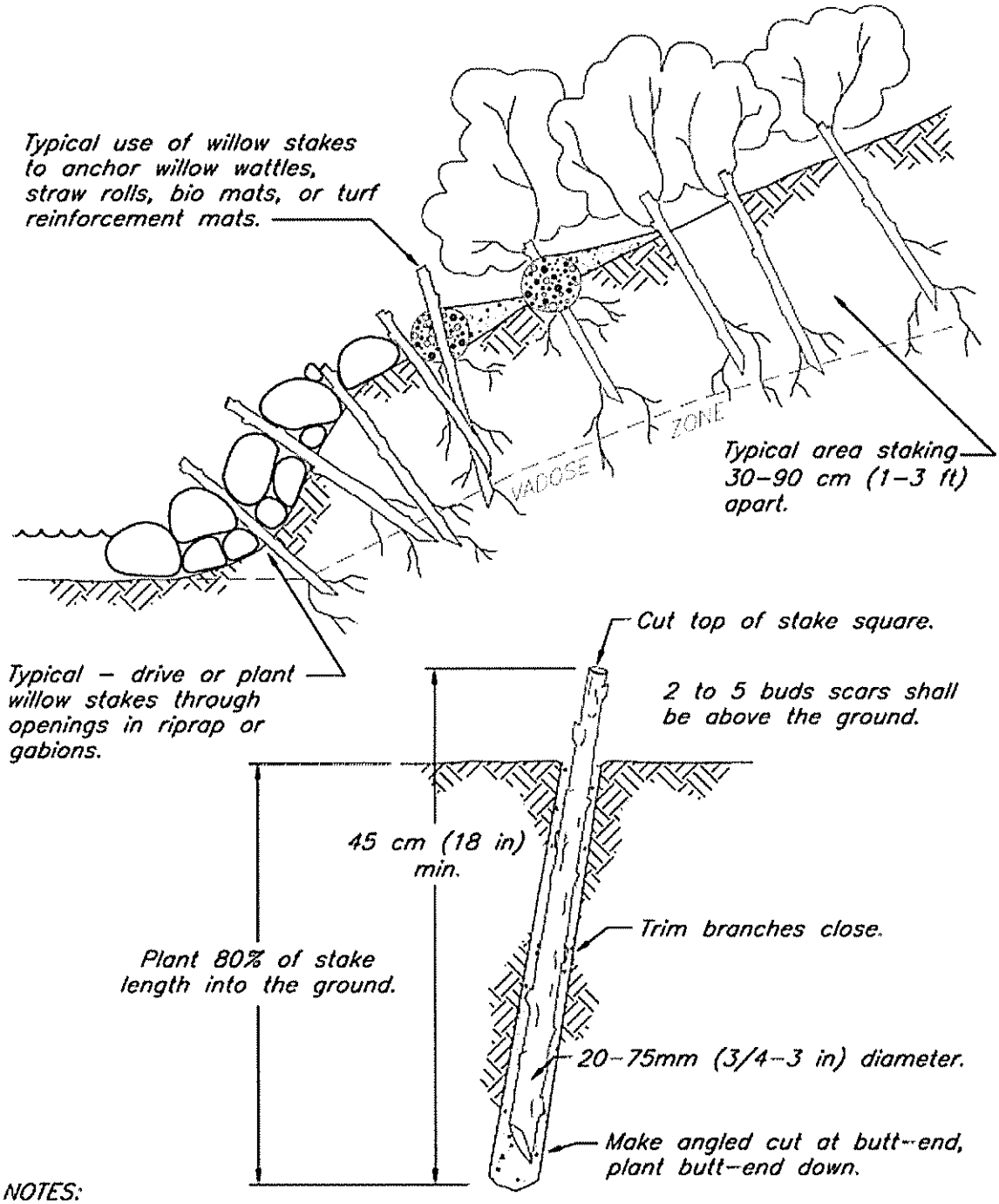


VEGETATED RIPRAP

WILLOW BUNDLE METHOD (HORIZONTAL)

FILE: VRBND

© 2004 SALIX



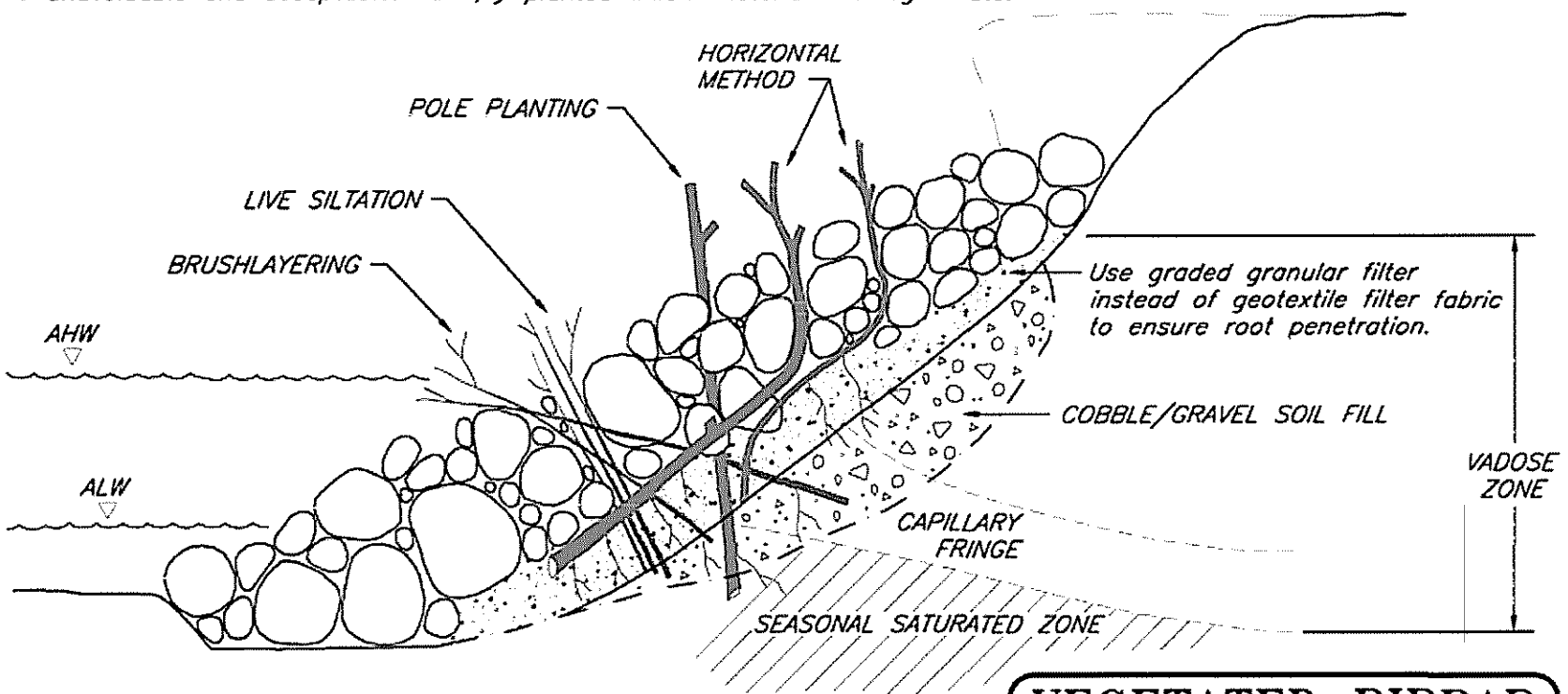
NOTES:
1. Harvest and plant stakes during the dormant season.
2. Use healthy, straight and live wood at least 1 year old.
3. Make clean cuts and do not damage stakes or split ends during installation, use a pilot bar in firm soils.
4. Soak cuttings for 24 hours (min.) prior to installation.
5. Tamp the soil around the stake.

VEGETATED RIPRAP
W/ JOINT PLANTING
(LIVE STAKING)

© 2004 SALIX

FILE: VRJP

NOTES:
1. Integrate brushlayering, pole planting and live siltation techniques during rock placement to ensure contact with native ground.
2. Plant deeply if possible. Place cuttings deeply into vadose zone, into the capillary fringe or 15 cm (6") into the seasonal saturated zone (water table).
3. Graded, granular filter is preferable to filter fabric to improve root penetration or slip poles through slits cut into fabric.
4. Place soil fill (cobbles, gravel, soil) around cuttings and 'water in' if possible.
5. Place riprap carefully, do not end dump. Some damage to brush layers and willow poles is unavoidable and acceptable. Deeply planted willow material will regenerate.



VEGETATED RIPRAP
DURING CONSTRUCTION
SUMMARY OF TECHNIQUES

FILE: VRDC

© 2004 SAJAX

WATTLES (LIVE FASCINES)

Construction Specifications:

Wattle Preparation:

- Cuttings shall be harvested and planted when the willows, or other chosen species, are dormant. This period is generally from late fall to early spring.
- Choose plant materials that are adapted to the site conditions from species that root easily. A portion (up to 50%) of the bundle may be of material that does not root easily or dead material.
- The cuttings should be long (3 feet (1 m) minimum), straight branches up to 1 1/2 inches (4 cm) in diameter. Trimmings of young suckers and some leafy branches may be included in the bundles to aid filtration. The number of stems varies with the size and kind of plant material.
- Cuttings shall be tied together to form bundles, tapered at each end, 6-30 feet (2-10 m) in length, depending on site conditions or limitations in handling.
- The completed bundles should be 6-12 inches (152-305 mm) in diameter, with the growing tips and butt ends oriented in alternating directions.
- Stagger the cuttings in the bundles so that the tips are evenly distributed throughout the length of the wattle bundle.
- Wattle bundles shall be compressed and tightly tied with rope or twine of sufficient strength and durability. Polypropolyne 'tree rope' approximately a 3/16 inch (0.5 cm) diameter provides the necessary strength and durability.
- Wattle bundles shall be tied 12-15 inches (305-381 mm) apart.
- For optimum success wattles should be pre-soaked for 24 hours or installed on the same day they are harvested and prepared. The wattles should be installed within 2 days after harvest unless pre-soaked. Wattles must be stored in the shade and under cover or under water. They are live material and should be treated as such.

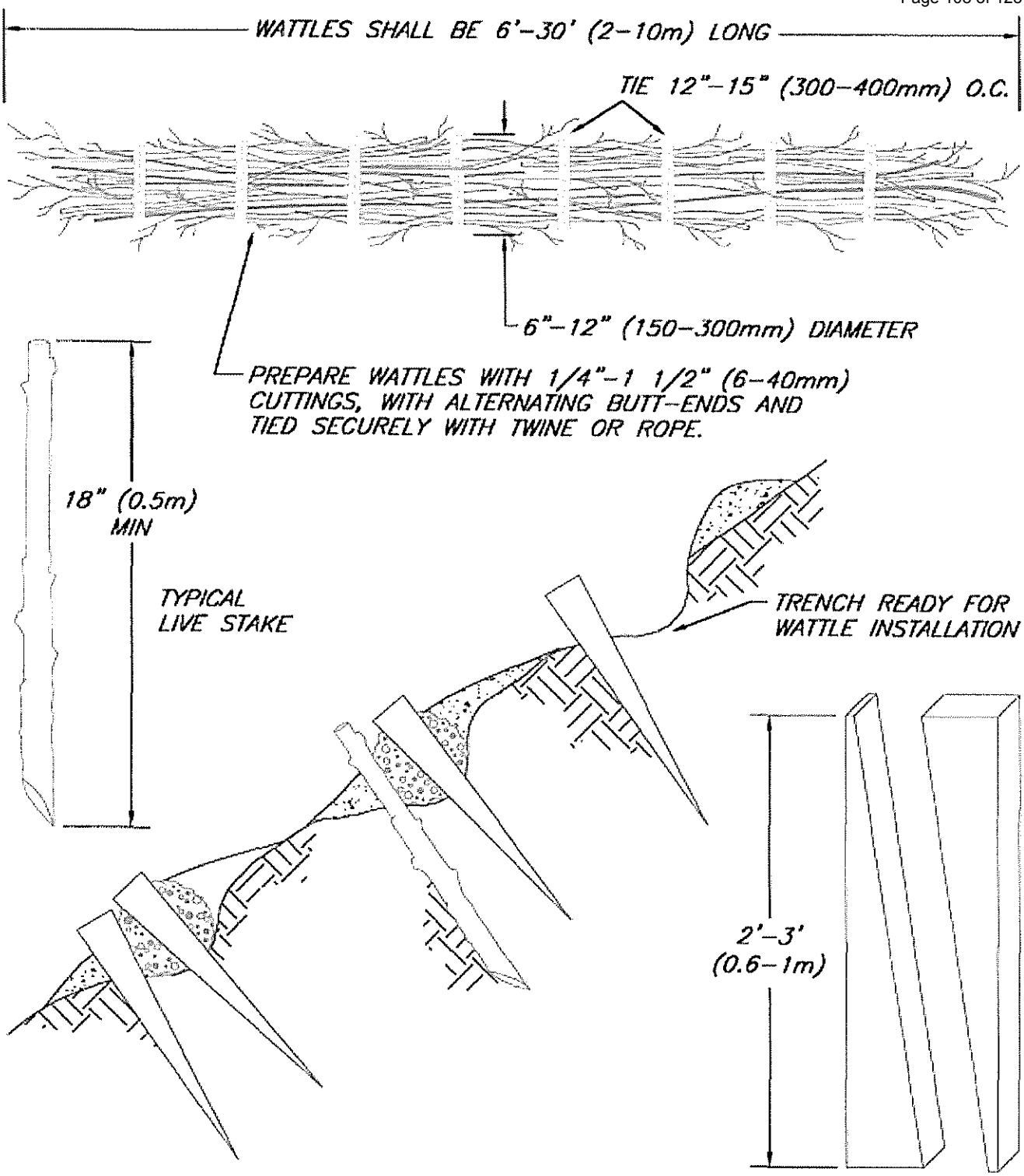
Installation:

- Work shall progress from the bottom to the top of the slope.
- Install wattles into trenches dug into the slope on contour
- Spacing of contour trenches (wattles) is determined by soil type, potential for erosion and slope steepness.
- Perform any slope repairs, such as gully repair, slope scaling, diversion dike, gabion, or toe wall construction, prior to wattle installation.
- Beginning at the base of the slope, dig a trench on contour. The trench shall be shallow, about 1/2 the diameter of the wattle. The trench width will vary from 12-18 inches (305-457 mm) depending on the slope angle.
- Place the wattles immediately after trenching to reduce desiccation of the soil.
- Wattles shall be staked firmly in place with one row of construction stakes on the downhill side of the wattling, not more than 3 feet (1m) apart. A second row of stakes shall be placed through the wattles, near the ties, at not more than 5 feet. (1.5 m) apart.

- Overlap the tapered ends of adjacent wattles so the overall wattle thickness of the wattle is uniform. Two stakes shall be used at each bundle overlap such that a stake may be driven between the last two ties of each wattle.
- Live stakes, if specified, are generally installed on the downslope side of the bundle. Drive the live stakes below and against the bundle between the previously installed construction stakes.
- Proper backfilling is essential to the successful rooting of the wattles. Backfill wattles with soil from the slope or trench above. The backfill shall be worked into the wattle interstices and compacted behind and below the bundle by walking on and working from its wattling terrace.
- Repeat the proceeding steps to the top of the slope.
- Place moist soil along the sides of the live bundle. The top of the bundle should be slightly visible when the installation is completed.
- Plant the slope as specified.
- Seed and mulch slope. Shallow slopes, generally 3:1 or flatter may be seeded and mulched by hand. Steeper slopes should have seed applied hydraulically and the mulch shall be anchored with tackifier or other approved methods.

Inspection and Maintenance:

- Regular inspection and maintenance of wattle installations should be conducted, particularly during the first year.
- Repairs shall be made promptly. Stakes that loosen because of saturation of the slope or frost action shall be re-installed.
- Rills and gullies around or under wattles shall be repaired. Perform slope scaling and brushpacking as necessary.
- Repairs to vegetative practices shall be conducted promptly.
- All temporary and permanent erosion and sediment control practices shall be maintained and repaired as needed to assure continued performance of their intended function.



TYPICAL CONSTRUCTION STAKE
SAW 2X4 (100X50mm) LUMBER
ON DIAGONAL

NOT TO SCALE

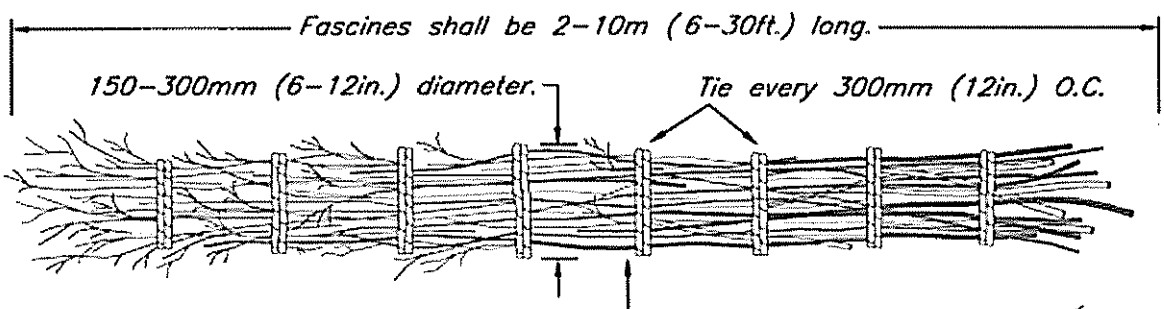
NOTES:
1. HARVEST AND INSTALL WATTLES DURING DORMANT SEASON.
2. INSTALL WATTLES ON SLOPE CONTOURS.
3. ALL WORK PROCEEDS FROM THE BOTTOM OF THE SLOPE TO THE TOP.
4. FILL OR PARTIALLY COVER WATTLE WITH SOIL FROM SLOPE OR TRENCH ABOVE.
5. COMPACT AND WORK SOIL INTO COMPLETED WATTLES.

WATTLE
(LIVE FASCINE)

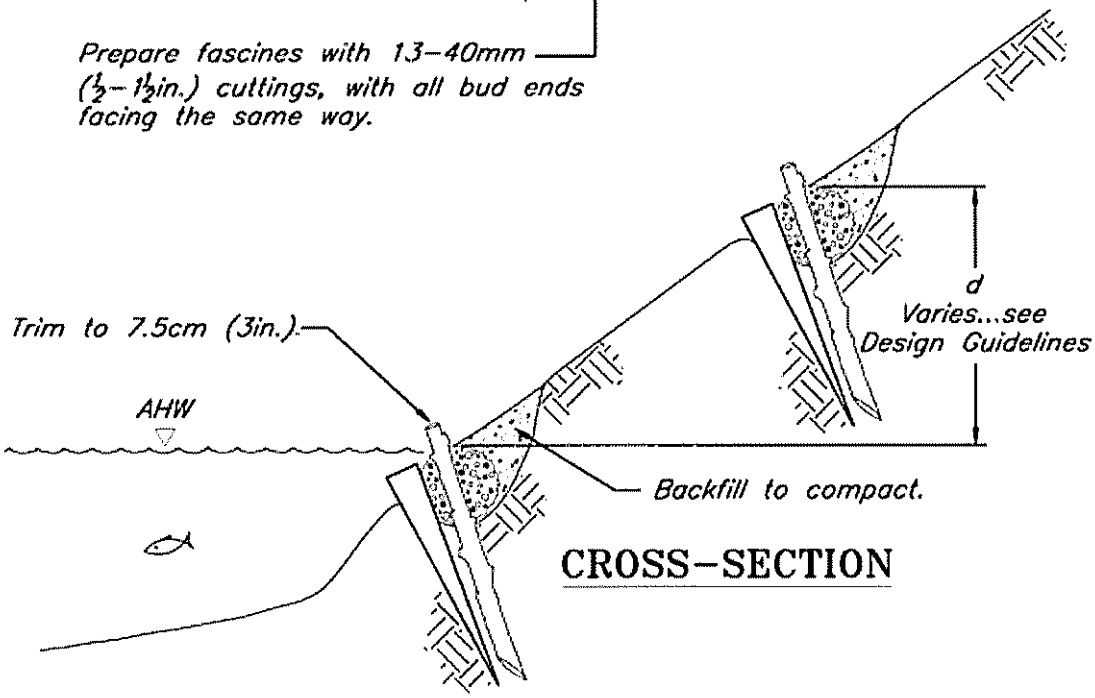
© 1996 J. McCULLAH

FILE: WATTLE

Date of last revision: 12/20/2012

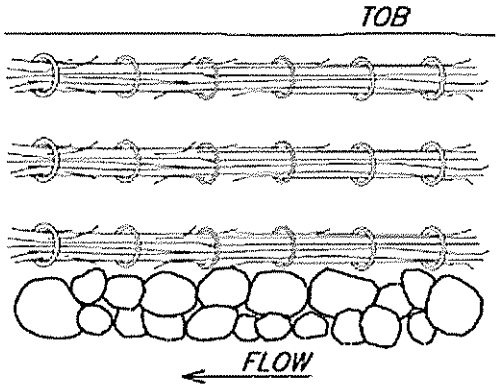


Prepare fascines with 1.3–40mm (½–1½in.) cuttings, with all bud ends facing the same way.

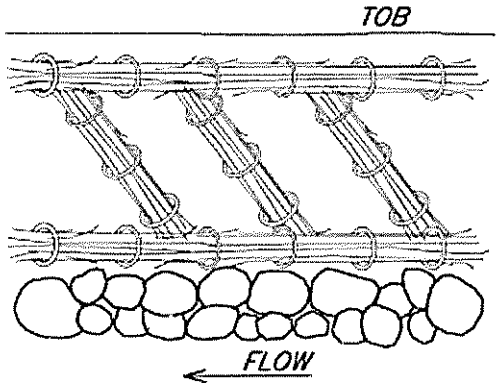


CROSS–SECTION

CONTOUR PLAN VIEW



ANGLED PLAN VIEW



NOT TO SCALE

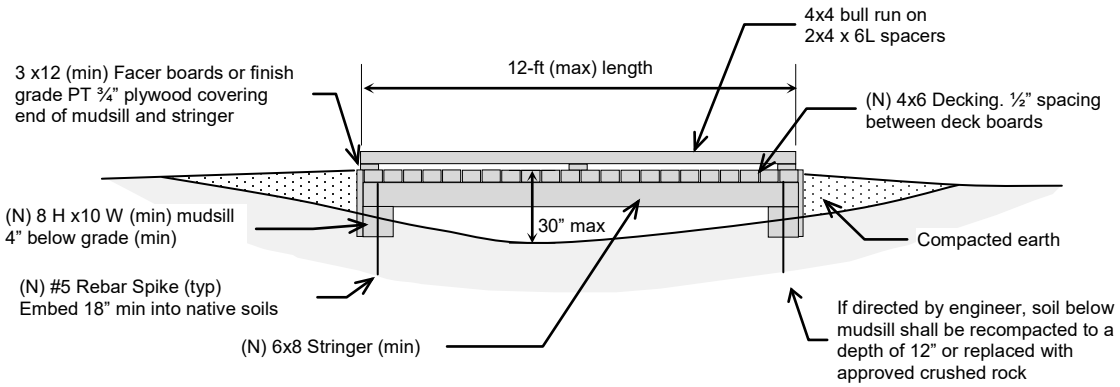
LIVE FASCINES

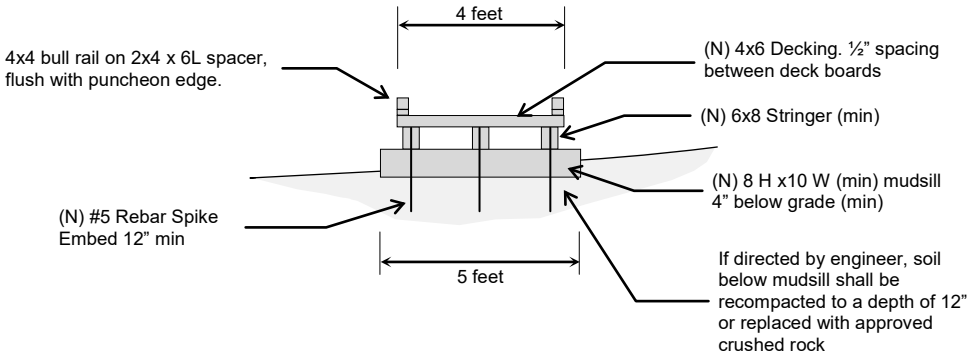
© 2004 SALIX

FILE: LVFASC

5E LOW PUNCHEON (BOARDWALK)

MROSD STANDARD SPECIFICATIONS (NTS)





NOTES:

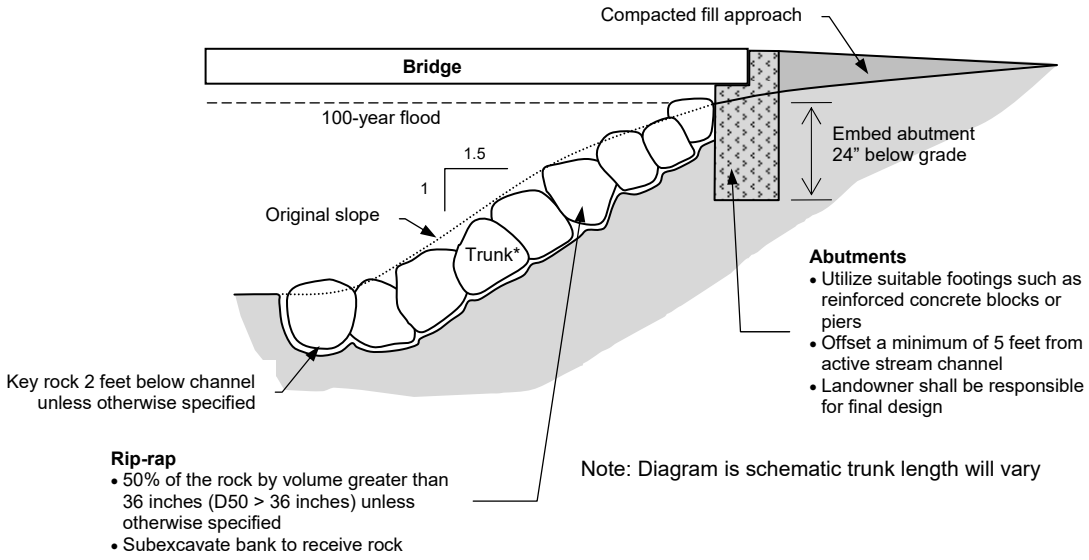
- Standard puncheon width shall be 4-feet. Refer to site plan if narrower puncheon is proposed.
- All decking, beams, mudsills and wood in contact with earth or within 1 foot of earth shall be Con Heart redwood or approved plastic
- If directed by engineer, soil below mudsill shall be recompacted to a depth of 12" or replaced with approved crushed rock
- All hardware shall be galvanized
- Anchor decking with (2) 3/8" x 8" galvanized wire spikes (typ), predrill holes for spikes
- Anchor bull rail with (2) 3/8" x 10" galvanized wire spikes (typ), predrill holes for spikes
- Maintain 2% maximum slope on puncheon

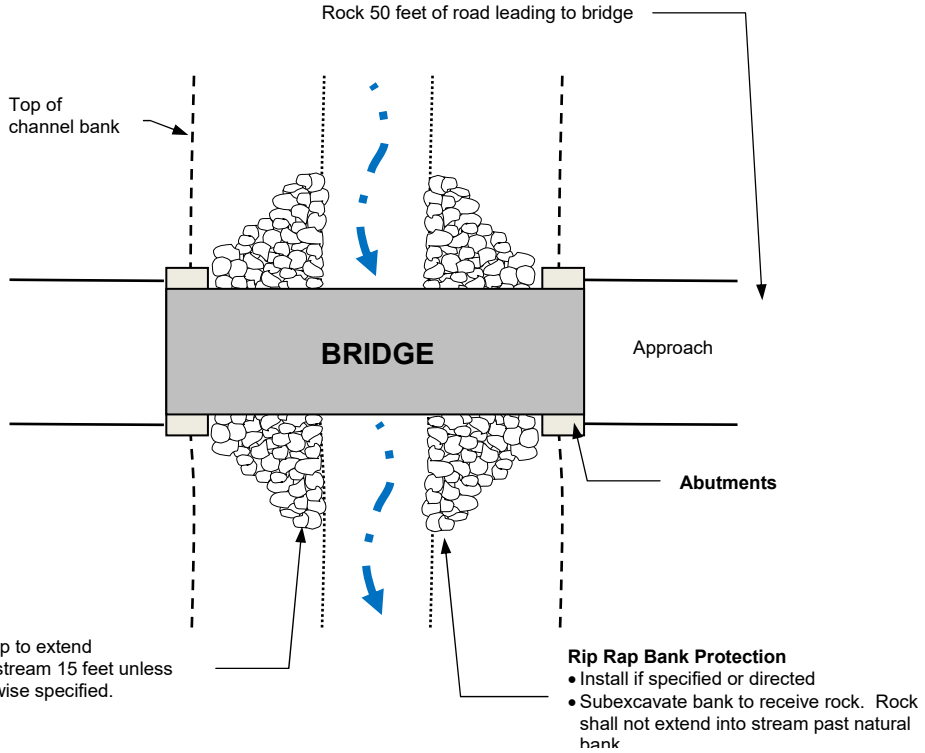
TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

TRAIL PUNCHEON
TYPICAL SPECIFICATIONS

Standard Detail 5E

Date: May 3, 2009





NOTES

- Rock rip rap shall be placed as, specified in plan and as approved in DFG 1600 agreement
- Conform to requirements of the Department of Fish and Game 1600 agreement where applicable
- Bridge placement to be supervised by project engineer

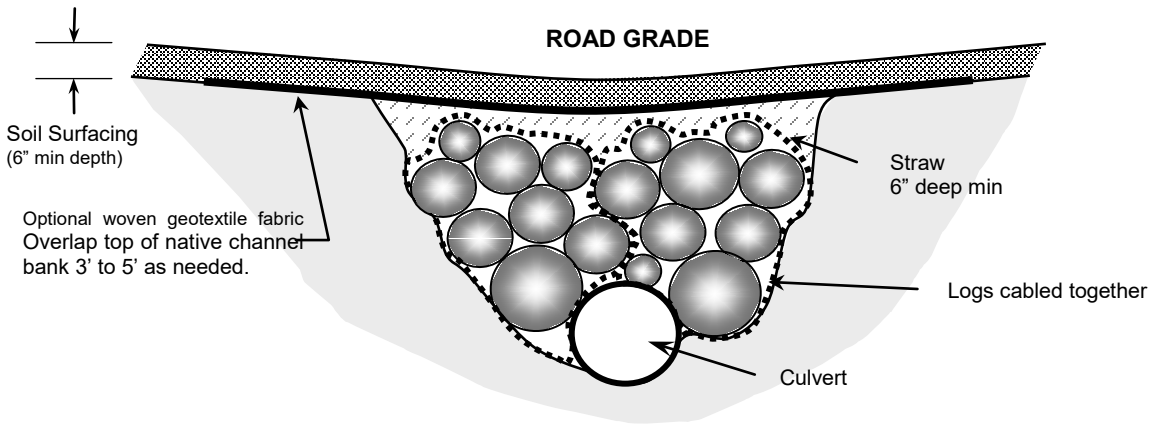
5F **BRIDGE ABUTMENT ARMOR**
NTS

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

BRIDGE ABUTMENT ARMOR
STANDARD PLAN

Standard Detail 5F

Date: March 1, 2009



NOTES

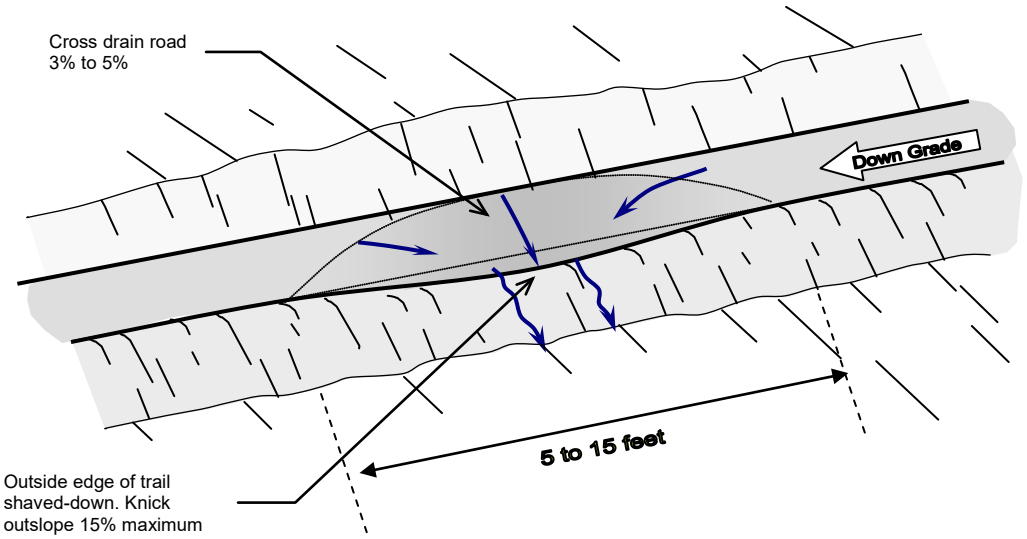
1. If there is flow in channel install 12" diameter culvert at stream grade (unless otherwise specified). This may require moving rocks or wood debris in channel. Minimize the amount of disturbance to channel banks. Pipe is not required if there is no flow at time of operations
2. Groups of logs cabled together shall be carefully placed in the axis of the channel to raise the road surface to grade. Placement of the cable logs should be done in a manner to minimize the amount of ground disturbance to the channel banks. The length of fill logs or culvert shall be 20' or greater (unless otherwise specified).
3. Equipment shall avoid operations in the channel.
4. Cables may be used to choke logs in bundles in the channel if necessary
5. Place 6" minimum layer of straw over the logs and then capped by a minimum of 6" of compacted earth to create a stable running surface. Woven geotextile fabric may be required to separate fill from straw.
6. At the conclusion of operations, first remove any soil, then straw, and finally logs and the culvert.
7. Remove soil from channel and taper channel banks if specified. Mulch disturbed ground with straw or native materials.

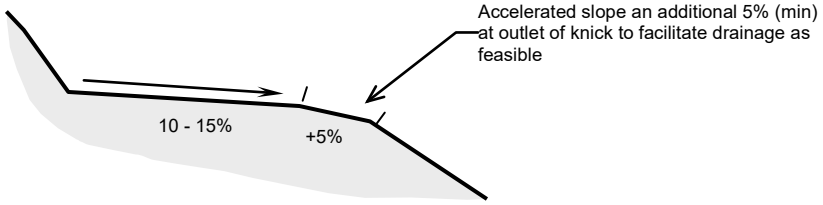
TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

TEMPORARY "SPITTLER" STREAM CROSSING

Standard Detail 5K

Date: October 3, 2010





NOTES:

- A knick is a semi-circular, shaved down section of the outside edge of the trail.
- The center of the nick is outsloped 10 - 15% which draws water off of the trail.
- Dip outlets should be located to drain into areas with adequate sediment filter quality and non-erodible material such as rock, slash, brush, etc.

6B **KNICK (Typical)**
NTS

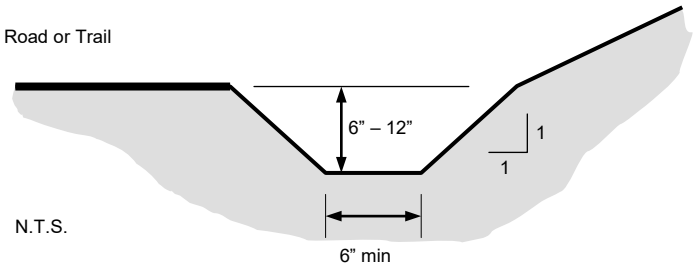
TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

KNICK
TYPICAL SPECIFICATIONS

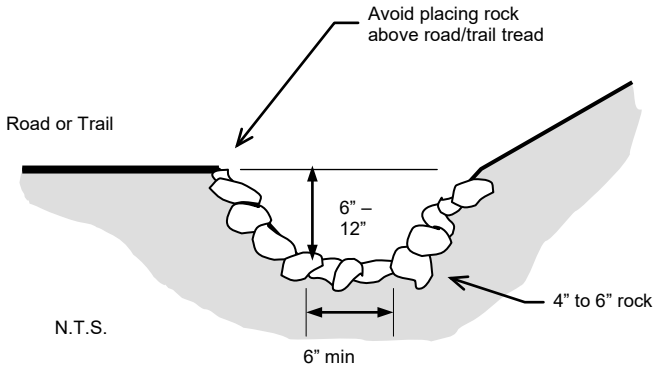
Standard Detail 6B

Date: November 29, 2011

INSIDE DITCH (native)



INSIDE DITCH (Rock lined)



NOTES:
- Slope ditch to drain 3% min
- Armor ditch where specified
- Drain ditch to ditch relief culvert inlet as specified.

6E **INSIDE ROAD DITCH (Typical)**
NTS

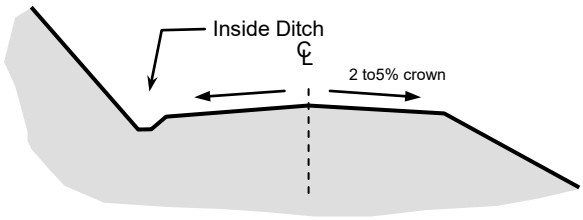
TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

INSIDE ROAD DITCH
TYPICAL SPECIFICATIONS

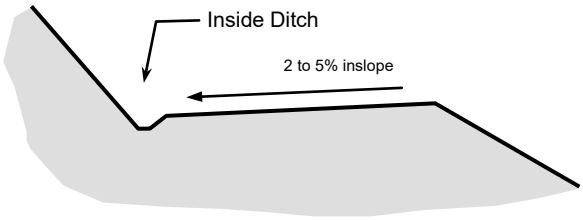
Standard Detail 6E

Date: May 3, 2009

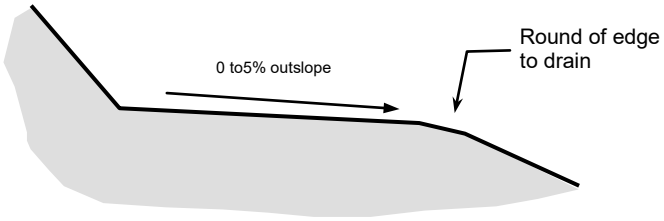
CROWNED



INSLOPED WITH DITCH



OUTSLOPED



Crowned road carries surface runoff to both sides of the road. Inslope roads carry water to the inboard (uphill) side of the roadway and therefore are constructed with a ditch and ditch relief culverts to channel runoff under the roadway. Outsloped roads shed water to the outside of the road and generally do not have a ditch on the inside edge.

NOTES:

- Crowned and insloped roads shall drained to insideditch per typical 6E.
- Ditch shall have positive flow to outlet or ditch relief culvert. See 6D Ditch Relief Culvert typical design specifications
- Drainage on outsloped roads shall be complimented with Reverse Grade Dips unless otherwise specified

6F **TRAIL CROSS SLOPES (Typical)**
NTS

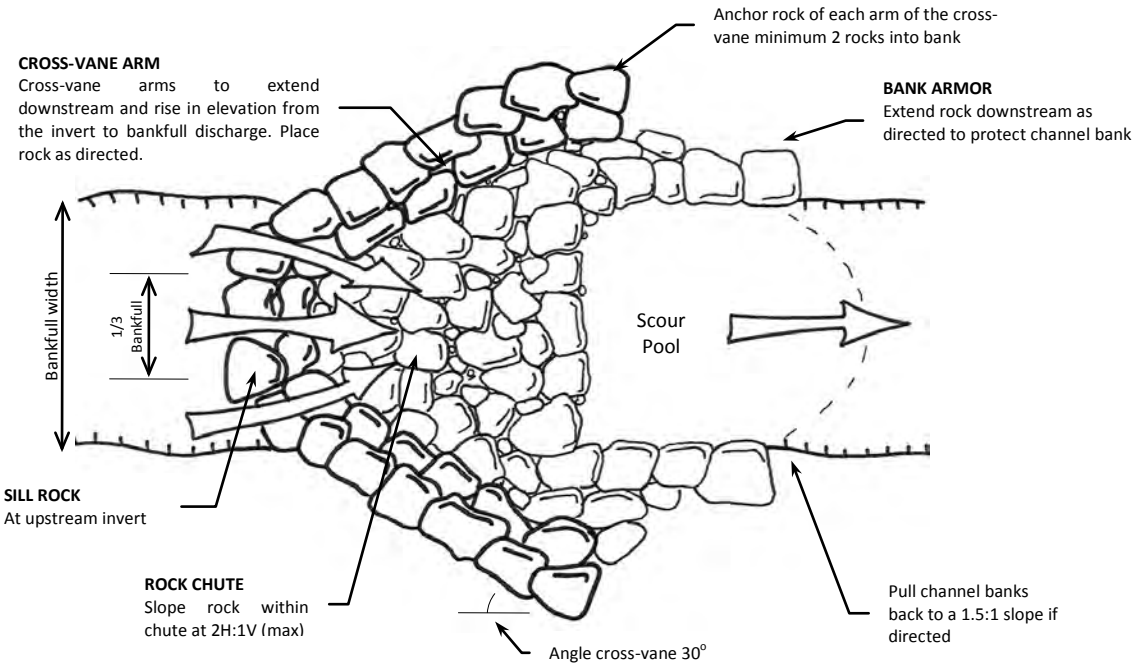
TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

TRAIL CROSS SLOPES
TYPICAL SPECIFICATIONS

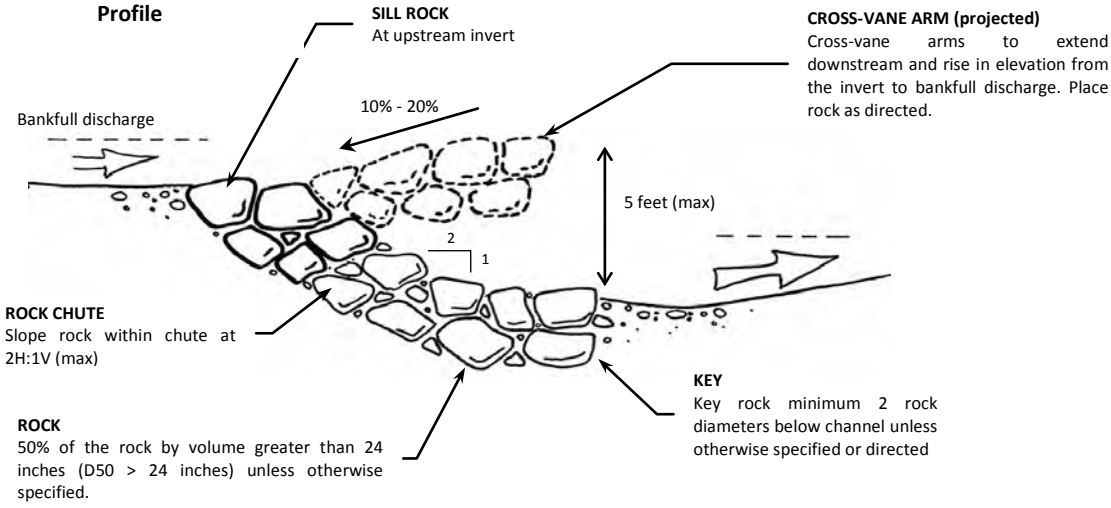
Standard Detail 6F

Date: June 6, 2009

CROSS-VANE
Plan View



CROSS-VANE
Profile



DESCRIPTION

Cross vanes are in-stream structures constructed as grade control for the streambed. The cross vane consists of a rock sill perpendicular to the stream flow located at the invert elevation of the stream. Two arms of the sill extend downstream along the banks, rising in elevation to the bankfull height as they extend downstream. The center portion of the structure is referred to as a "Rock chute"

7F **CROSS-VANE INSTREAM STRUCTURE (Typical)**
NTS

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

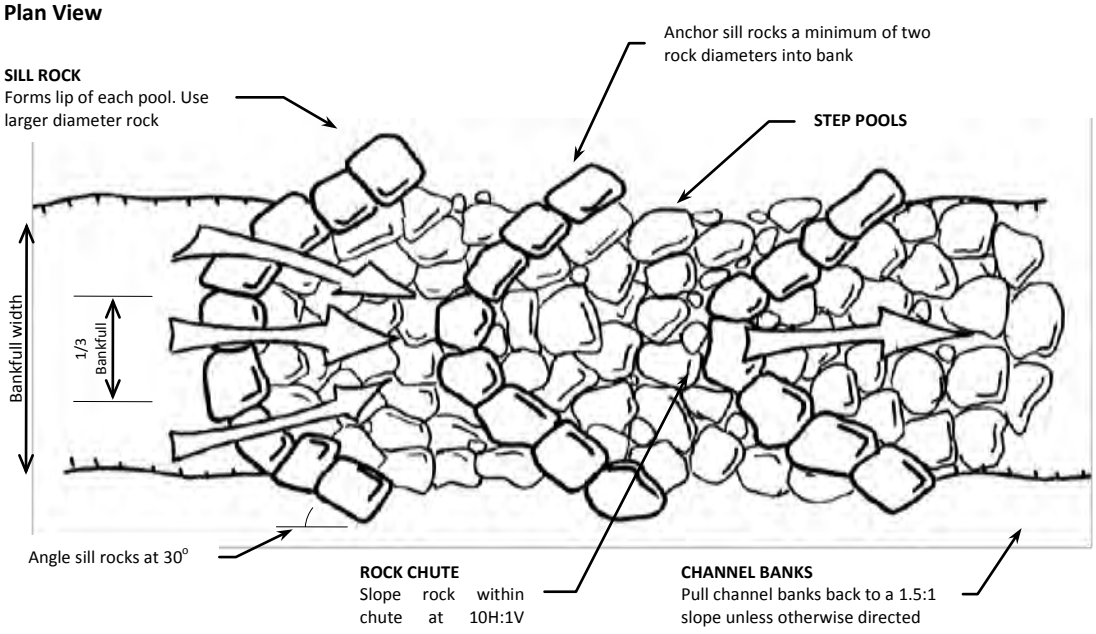
CROSS VANE STRUCTURE
TYPICAL SPECIFICATIONS

Standard Detail 7F-1

Date: August 31, 2009

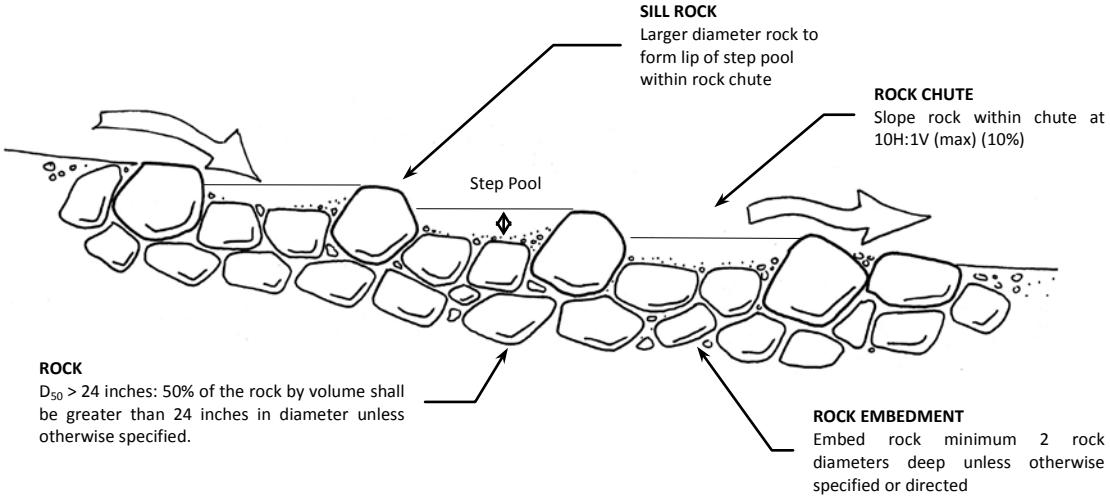
ROCK CHUTE / STEP POOL STRUCTURE

Plan View



ROCK CHUTE / STEP POOL STRUCTURE

Profile



DESCRIPTION

Rock chute and step pool structures are in-stream structures constructed as grade control for the streambed. They are permanent structures which stabilize grades in natural or artificial channels by carrying runoff from one grade to another. "V" shaped rock banks or sills form the upstream end of each step pool. The "V" should point upstream with both limbs rising in elevation to force flow to the center of the channel.

7G **ROCK CHUTE / STEP POOL STRUCTURE (Typical)**

NTS

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

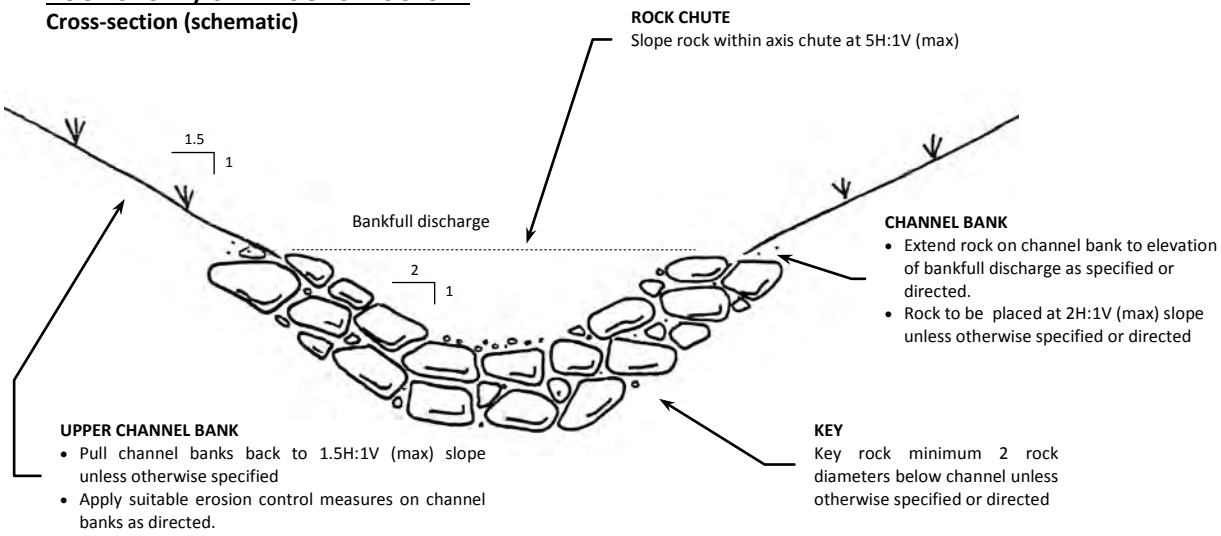
ROCK CHUTE / STEP POOL TYPICAL SPECIFICATIONS

Standard Detail 7G-1

Date: October 3, 2009

ROCK CHUTE / STEP POOL STRUCTURE

Cross-section (schematic)



NOTES

Layout

- Project geotechnical consultant or designee shall clearly layout the location and limits of the rock vane prior to construction. The structure shall be installed under direction and supervision of the project geotechnical or designee

Excavation

- The channel shall be excavated at specified with maximum channel gradient of 10H:1V (10%). Excavated slopes above the rock armor shall be no steeper than 1.5H:1V (H:V) unless otherwise specified or directed. Areas to receive rock shall be subexcavated to accommodate rock placement.

Rock

- Rock shall be graded (mix of sizes) with 50% of the rock (D_{50}) greater than 24 inches minimum diameter. Ideally, the bigger the rock, the better since big rocks are less likely to shift or become dislodged.
- Rip rap shall consist of angular sound durable rock free of fracture or joint planes. The best rock is rectangular with flat surfaces on all sides. Round river rock is the worst.
- Rock shall be carefully placed to optimize strength and be a minimum of 2 layers thick and be placed so as to have no significant gap between adjoining rock. Voids shall be chinked with small boulders, cobble or rock fragments.

Rock Chute

- Rock chute shall have a maximum channel gradient of 10H:1V (10%). The chute shall consist of a flat channel bottom (as specified) with bank laid back to a 2H:1V (50%) slope. Rock shall extend up to the elevation of bankfull discharge as specified. Step pools shall be constructed into the rock chute as specified below and to the extent feasible.

Step pools

- Rock shall be placed to form a series of shallow step pools within the axis of the rock chute. Each step shall have a maximum 18 inch drop and be spaced 2 to 3 times channel width apart.
- The steps shall be constructed from of largest diameter rock to form sills at the head of each pool. The sill rocks shall be placed to in an upstream "V"-shaped configuration with the downstream limb of each rock band/sill rising in elevation to concentrate low flow into the axis of the channel. Sill rocks shall be keyed two rock diameters into the channel bank.

Inspection

- Conform to DFG 1600 agreement
- Specifications are indented only as guideline, modifications may need to be made in the field as necessary

References

CDFG (2009). California Salmonid Stream Habitat Restoration Manual: Part XII Fish Passage Design and Implementation, California Department of Fish and Game, http://www.dfg.ca.gov/fish/Resources/HabitatManual.asp: 174.

Robinson, K. M., C. E. Rice, et al. (1998). "Design of rock chutes." ASAE **41**(3): 621 - 626

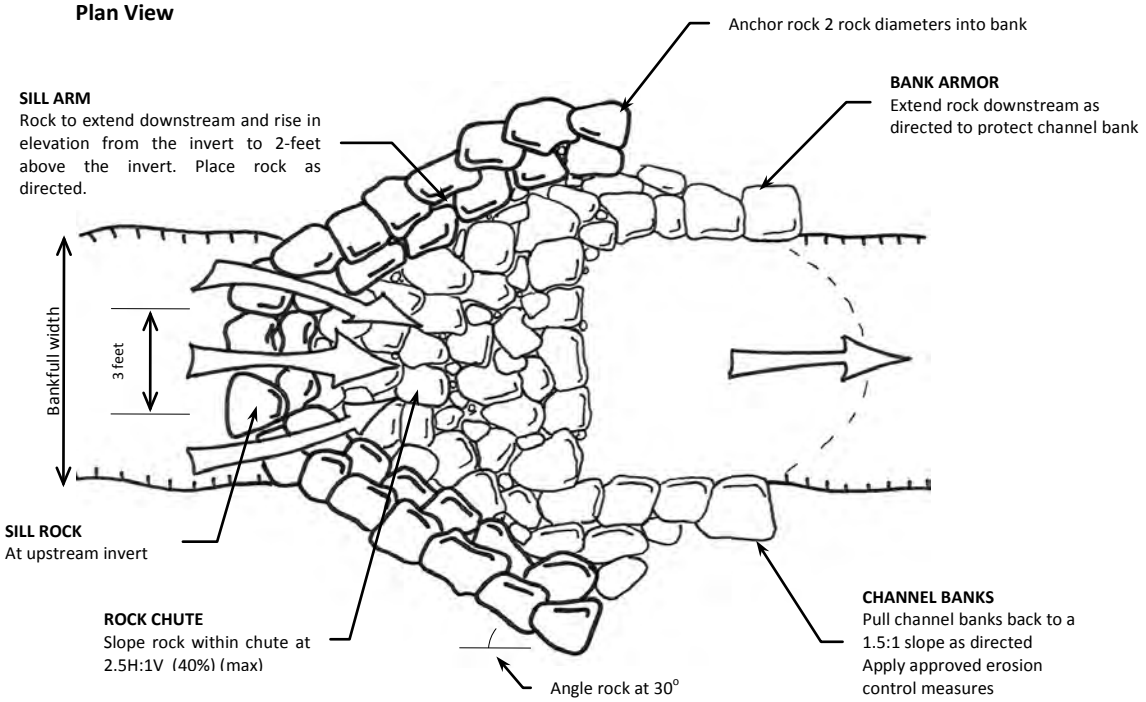
TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

ROCK CHUTE / STEP POOL TYPICAL SPECIFICATIONS

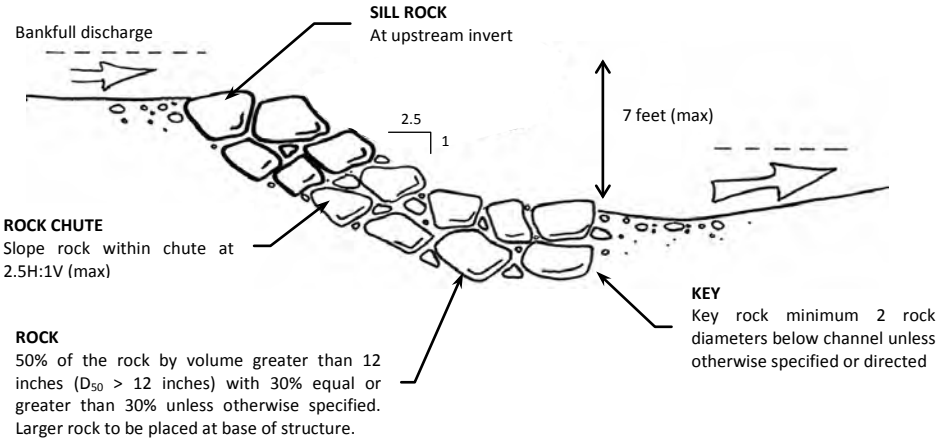
Standard Detail 7G-2

Date: October 3, 2009

ROCK CHUTE
Plan View



ROCK CHUTE
Profile



DESCRIPTION

Rock chute structures are in-stream structures constructed as grade control for the streambed. "V" shaped rock banks or sills form the upstream end of the structure. The "V" should point upstream with both limbs rising in elevation to force flow to the center of the channel.

7H **ROCK CHUTE STRUCTURE (Typical)**
NTS

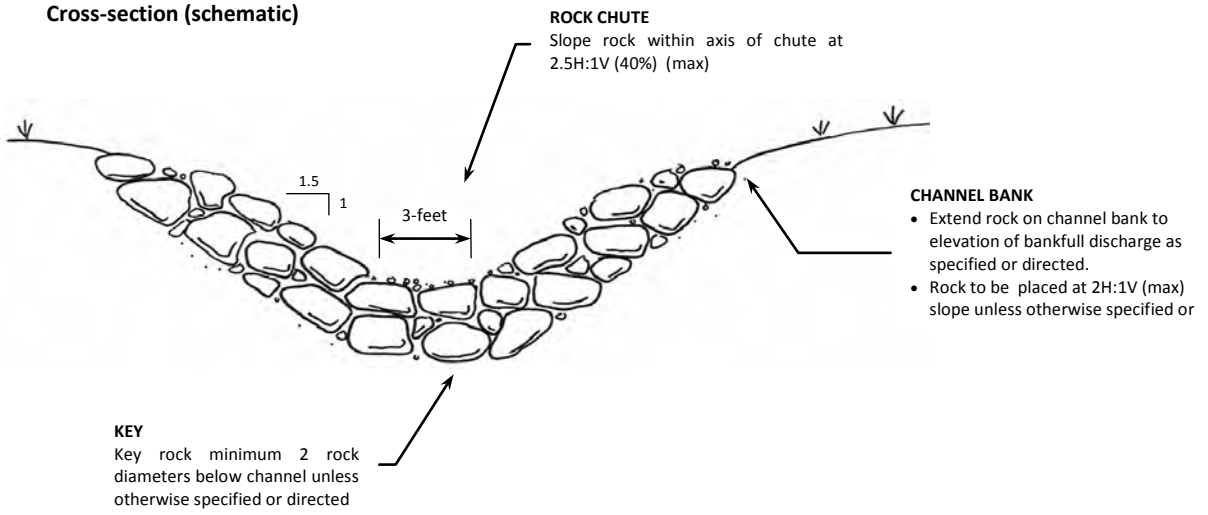
TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

ROCK CHUTE
TYPICAL SPECIFICATIONS

Standard Detail 7H-1

Date: October 24, 2009

ROCK CHUTE
Cross-section (schematic)



NOTES

Layout

- Project geotechnical consultant or designee shall clearly layout the location and limits of the rock structure prior to construction. The structure shall be installed under direction and supervision of the project geotechnical consultant or designee.

Excavation

- The channel shall be excavated at specified with maximum channel gradient of 2.5H:1V (40%). Excavated slopes above the rock armor shall be no steeper than 1.5H:1V (H:V) unless otherwise specified or directed. Areas to receive rock shall be subexcavated to accommodate rock placement.

Rock

- Rock shall be graded (mix of sizes) with 50% of the rock (D_{50}) **greater** than 12 inches minimum diameter and 30% equal or greater than 18 inches. Ideally, the bigger the rock, the better since big rocks are less likely to shift or become dislodged. The contractor shall consult with the project geotechnical consultant prior to obtaining any rock.
- Rock shall consist of angular sound durable rock free of fracture or joint planes. The best rock is rectangular with flat surfaces on all sides. Round river rock is the worst.
- Rock shall be carefully placed to optimize strength and be a minimum of 2 layers thick and be placed so as to have no significant gap between adjoining rock. Voids shall be chinked with small boulders, cobble or rock fragments.

Rock Chute

- Rock chute shall have a maximum channel gradient of 2.5H:1V (40%). The chute shall consist of a flat channel bottom (as specified) with bank laid back to a 1.5H:1V (65%) slope. Rock shall extend a minimum of two vertical feet up from the channel bottom unless otherwise specified or directed.

Inspection

- Conform to DFG 1600 agreement
- Project geotechnical consultant or designee shall supervise work
- Specifications are indented only as guideline, modifications may need to be made in the field as necessary

References

CDFG (2009). California Salmonid Stream Habitat Restoration Manual: Part XII Fish Passage Design and Implementation, California Department of Fish and Game, http://www.dfg.ca.gov/fish/Resources/HabitatManual.asp: 174.

Robinson, K. M., C. E. Rice, et al. (1998). "Design of rock chutes." ASAE **41**(3): 621 - 626

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

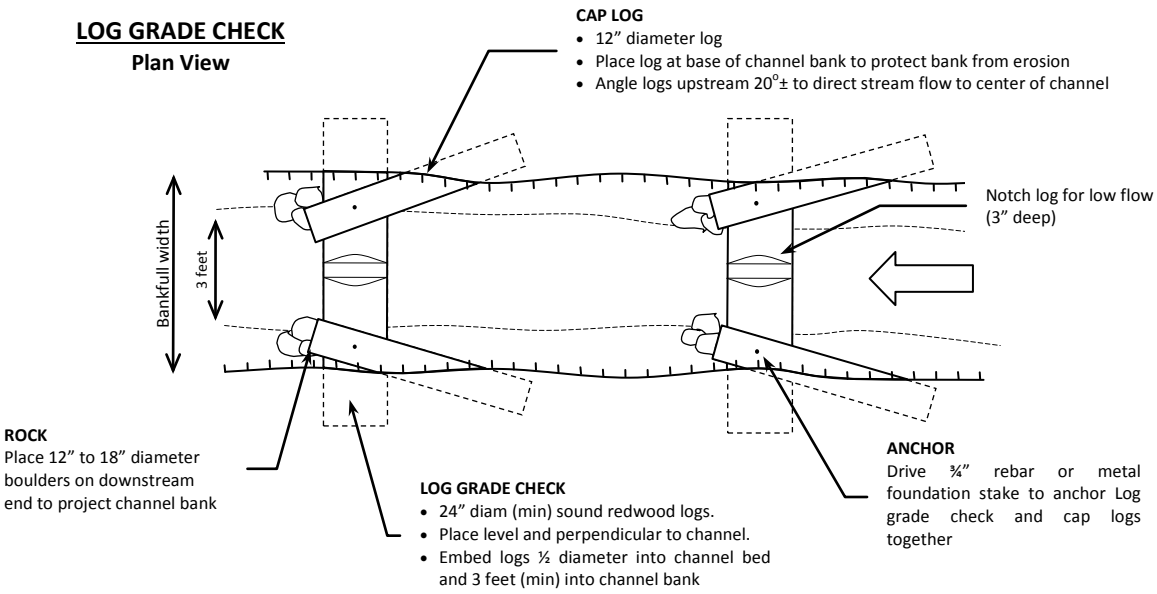
ROCK CHUTE
TYPICAL SPECIFICATIONS

Standard Detail 7H-2

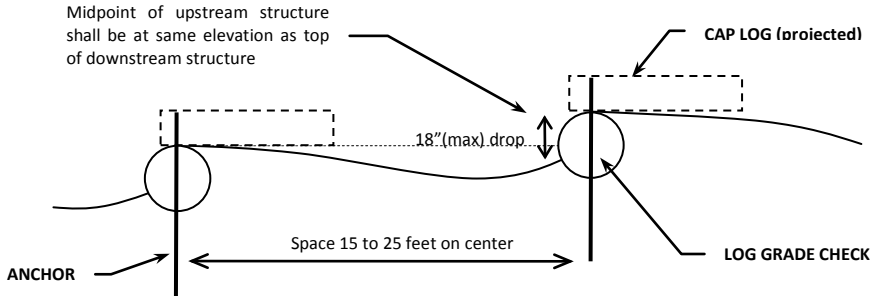
Date: October 24, 2009

LOG GRADE CHECK

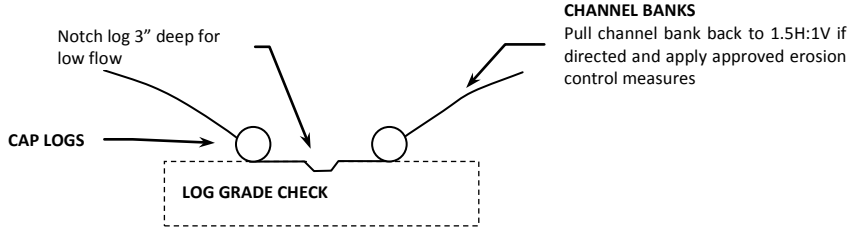
Plan View



Profile



Cross-section



DESCRIPTION

Log grade checks are in-stream structures constructed as grade control for the streambed. They consist of a large diameter log placed perpendicular to the stream and embedded into both channel banks. A cap log is placed on top of the log along both channel banks to protect both banks from erosion and to direct lower flows to the center of the channel.

NOTES

- Project geotechnical consultant or designee shall clearly layout the location and limits check dams prior to construction. The structure shall be installed under direction and supervision of the project geotechnical consultant or designee.
- Length and number of grade checks to be specified in plans or determined in the field
- Conform to DFG 1600 agreement
- Specifications are indented only as guideline, modifications may need to be made in the field as necessary

7I **LOG CHECK DAM STRUCTURE (Typical)**

NTS

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

LOG GRADE CHECK
TYPICAL SPECIFICATIONS

Standard Detail 7I

Date: October 24, 2009

EROSION CONTROL

- During project construction, the Contractor shall be responsible for implementing appropriate and necessary erosion control measures to minimize storm water runoff from the construction site, pursuant to applicable regulations and permits. The following strategies to ensure that storm water pollution is prevented shall be employed:
  - o Minimize erosion and sedimentation during construction.
  - o Eliminate pollution of storm runoff by chemicals and materials used in the construction process

- Exposed mineral soils greater than 50 square feet (sf) with less than 80% ground coverage of natural vegetation shall be seeded and mulched in order to reduce the potential for short term sheet and rill erosion.
  - o Seeding
    - Broadcast approved seed mix
  - o Mulch:
  - o Use native much were feasible
    - Where native much is unavailable and/or as directed by the geotechnical consultant or designee, mulch using 1 1/2" to 2" of approved certified weed-free straw mulch. Exposed slopes steeper than 1:1 may be covered with "Bon Terra, C2" or similar approved fabric placed in accordance with the manufacturer's recommendations and as directed by geotechnical consultant or designee.
    - If available and directed by project geotechnical consultant or designee, disturbed ground may be slash mulched using six-inch minus woody debris with 90% coverage. Slash should be packed using a dozer or the bucket of the excavator.
    - Apply mulch after seed

- Install a straw rolls across bare slopes and/or at base of disturbed areas if directed by CEG, RPF and/or designees or specifically called out in recommendations.

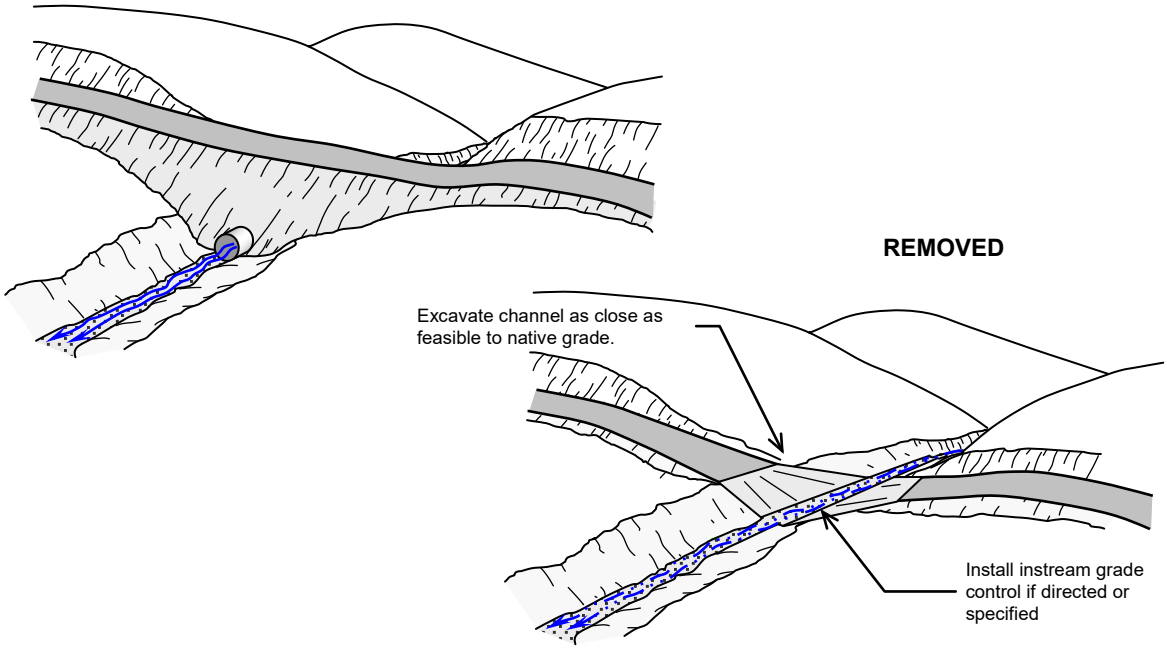
TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

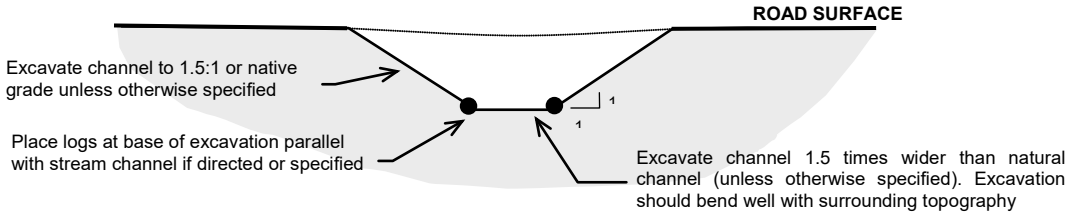
EROSION CONTROL NOTES

Standard Detail 8A

Date: May 3, 2009

EXISTING CROSSING





NOTES

- Excavate a channel that is 1.5 times wider than the natural channel (unless otherwise specified).
  - Excavated channel shall be as close as feasible to the grade and orientation of the natural channel
  - Channel banks shall be excavated to a 1.5:1 slope or native grade (whichever is steepest) unless otherwise specified in the plan or directed
  - Excavation should blend well with surrounding natural topography
  - Spoils shall be placed and compacted along a stable portion of the inboard edge of the road, unless otherwise specified. Fill shall be placed in a manner to prevent future erosion. Fill shall be compacted to 85% relative compaction unless otherwise specified or directed.
- Install instream grade control if specified in the plan or directed. Grade control shall consist of large wood or rock and is intended to prevent stream down cutting. See general specifications
- Place logs at base of excavated channel if directed. Logs to be placed parallel with stream with upstream log overlapping downstream log. Logs to be embedded into channel bank to minimize stream bank erosion. Log diameter to be determined by project geotechnical consultant or designee.
- Mulch disturbed ground
  - If available and directed by project geotechnical consultant, the excavated channel banks and spoil sites may be slash mulched using 6-inch minus woody debris with 90% coverage. Slash should be packed using a dozer or the bucket of the excavator.
- Install a straw roll at base of disturbed areas as directed by geotechnical consultant and/or District representative
- Conform to requirements Department of Fish and Game 1600 agreements where applicable
- Specifications are intended only as guideline, modifications may be made in the field by geotechnical consultant or designee

9B **STREAM CROSSING REMOVAL**
NTS

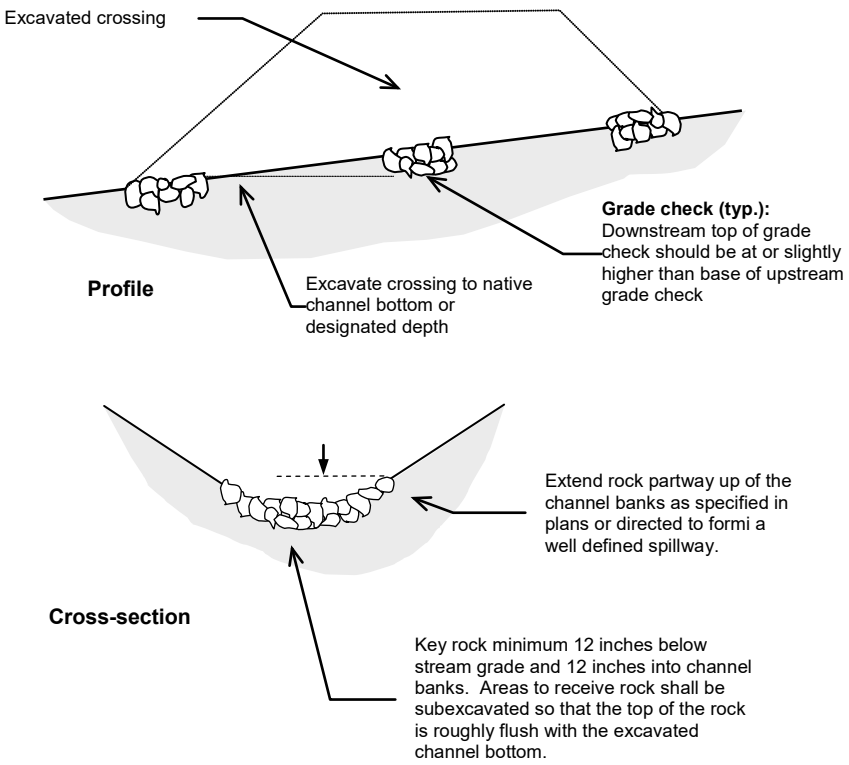
TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

CROSSING REMOVAL
TYPICAL SPECIFICATIONS

Standard Detail 9B

Date: May 3, 2009

PRELIMINARY



NOTES

- Grade check shall consist of large wood or rock rip rap as specified in plans or directed by project geotechnical consultant.
- Rock to be keyed minimum 12 inches below stream grade and 12 inches into channel banks.
- Areas to receive rock shall be subexcavated so that the top of the rock is roughly flush with the excavated channel bottom
- Rock shall extend partway up of the channel banks forming a well defined spillway to confine stream flow.
- Downstream top of grade check should be at or slightly higher than base of upstream grade check
- Length and number of grade checks to be specified in plans or determined in the field
- Specifications are indented only as guideline, modifications may be made in the field by geotechnical consultant or designee

ROCK GRADE CHECK PRELIMINARY
NTS

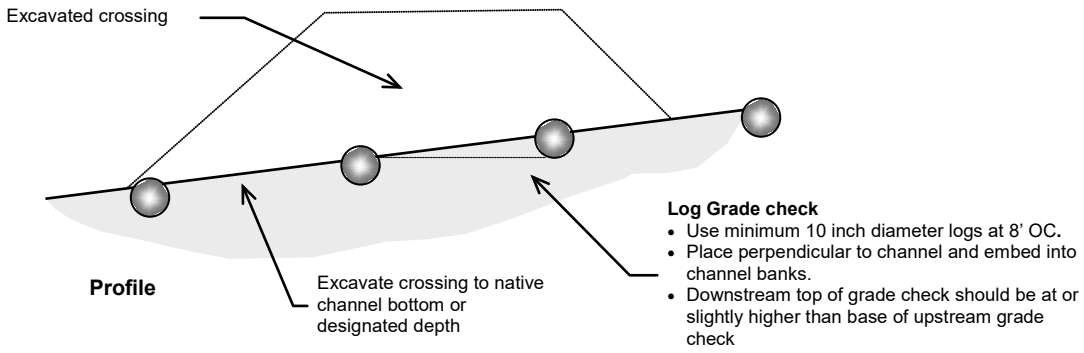
TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

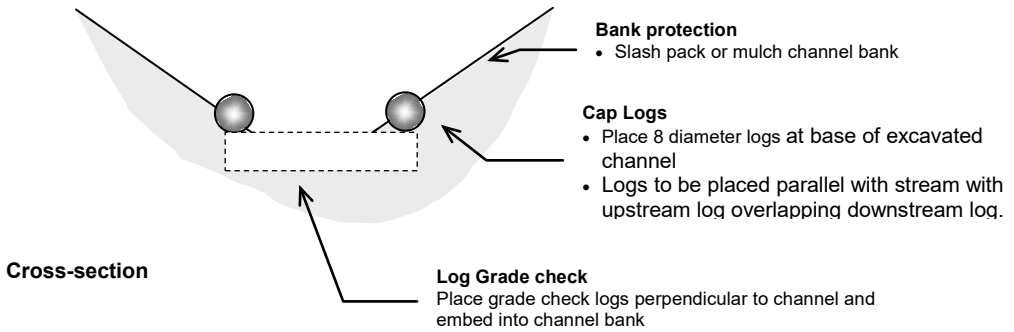
ROCK GRADE CHECK
TYPICAL SPECIFICATIONS

Standard Detail 9C

Date: May 3, 2009

PRELIMINARY





NOTES

- Grade check shall consist of large wood as specified in plans or as directed by project geotechnical consultant.
- Downstream top of grade check should be at or slightly higher than base of upstream grade check
- Length and number of grade checks to be specified in plans or determined in the field
- Specifications are indented only as guideline, modifications may be made in the field by geotechnical consultant or designee

9D **WOOD GRADE CHECK PRELIMINARY**
NTS

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

WOOD GRADE CHECK
TYPICAL SPECIFICATIONS

Standard Detail 9D

Date: May 3, 2009

Appendix E Midpen's Details and Specifications Guidelines

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT

DETAILS AND SPECIFICATIONS GUIDELINES

(DRAFT)

DISCLAIMER
This is a working document and is provided for information only.
The information contained herein is subject to change.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT
DETAILS AND SPECIFICATIONS GUIDELINES

TABLE OF CONTENTS

1. Erosion Control 6

a. Permanent Cover Practices

Acorns Collection (Specification) 7

Erosion Control Blanket/ Matting (Specification) 8

Erosion Control Options (Specification) 9

BioNet Products (Cutsheet) 10

Curlex Products (Cutsheet) 19

Planting Acorns (Specification) 27

Planting Container Stock (Specification) 28

Planting Seed (Specification) 29

b. Sediment Retention Barriers

Silt Fence (Detail) 30

Silt Fence – Placement on Slope "Smile" (Detail) 31

Straw Roll/ Wattles (Detail) 32

2. Vegetation 33

a. Maintenance

Brushing Guidelines (Detail) 34

Defensible Space Guidelines (Detail) 35

b. New Construction

Clearing Limits (Detail) 36

Pruning Procedures (Detail) 37

Tree Protection Fencing (Detail) 38

3. Roads & Trails 39

a. Trail Construction

Cut Bench Trail (Detail) 40

Full Bench Trail (Detail) 41

Partial Bench Trail (Detail) 42

Road to Trail Conversion (Detail) 43

Rock Fill Bench (Detail) 44

Stream Crossing Removal (Detail) 45

b. Trails

Switchback #1 Climbing Turns (Detail) 46

Switchback #2 Hybrid (Detail) 47

Switchback #3 (Detail) 48
Trail Aggregate Typical Surfacing (Detail) 49
Trail Cross Slopes (Detail) 50
Trail Definitions (Detail) 51
Trail Prism (Detail) 52
c. Roads
Road Aggregate Typical Surfacing (Detail) 53
Road Partial Bench Construction (Detail) 54
Road Restoration Ridge Top (Detail) 55
Road Restoration Side Slope (Detail) 56
Fire Truck Turnaround (Detail) 57
Turnouts (Detail) 58
4. Drainage 59
Permanent Culvert – Rural Road (Detail) 60
Permanent Culvert (Specification) 61
Ditch Relief Culvert (Detail) 62
Energy Dissipater (Detail) 63
Inside Drain Ditch (Detail) 64
Knick (Detail) 65
Perforated Pipe (Detail) 66
Reverse Grade Dip – Existing Trail (Detail) 67
Reverse Grade Dip – New Construction (Detail) 68
Rock Ford – Rural Road (Detail) 69
Rock Ford – Trail (Detail) 70
Temporary Stream Diversion (Detail) 71
Temporary Stream Diversion (Specification) 72
Trail Turnpike at Marshy Area (Detail) 73
Trash Rack (Detail) 74
Wet Area Trail Treatment (Detail) 75
5. Bank Stabilization 76
Brushlayering with Rock Toe Protection (Detail) 77
Vegetated Riprap with Brushlayering & Pole Planting (Detail) 78
Riprap with Soil and Grass or Groundcover (Detail) 79
Riprap Protection (Detail) 80
Rootwad Revetment with Vegetated Riprap (Detail) 81
Rootwad Revetment Cross-section (Detail) 82
6. Structures 83

a. Fencing

Double Split Rail Fence (Detail) 84
Single Split Rail Fence (Detail) 85
Switchback Barrier Fence (Detail) 86
Wire Barrier Fence (Detail) 87
Wire Fence Bracing, Ends & Corners (Detail) 88

b. Gates

Entry Gate Double Leaf Steel Pipe (Detail) 89
Entry Gate Single Leaf Steel Pipe (Detail) 90
Entry Gate No Barbed Wire (Detail) 91
Light Duty Gate (Specification) 92
Powder River Bow Gate (Cutsheet) 93

c. Stiles/ Entrance

Trailhead/ Preserve Entrance #1 (Detail) 94
Trailhead/ Preserve Entrance #2 (Detail) 95
Trail Gate Seasonal Closure #1 (Detail) 96
Trail Gate Seasonal Closure #2 (Detail) 97

d. Trail Structures

Wood Trail Steps (Detail) 98
Puncheon (Detail) 99
Retaining Wall – Rock (Detail) 100
Retaining Wall – Wood (Detail) 101
Retaining Wall – Single Log (Detail) 102
Retaining Wall – Timber Tie Back (Detail) 103

e. Visitor Features

Bench (Specification) 104
Bench – Dumor (Cutsheet) 105
Bicycle Rack (Specification) 109
Boot Brush (Specification) 110
Bike Brush (Detail) 111
Bike Brush Installation Notes (Specification) 112
Horse Hitching Rack (Detail) 113
Parking Lot Wheel Stops (Detail) 114
Picnic Table (Specification) 115
Picnic Table – Dumor (Cutsheet) 116
Vault Restroom (Specification) 120
Vault Restroom – CXT (Cutsheet) 121

7. Accessibility 127
Accessible Parking Space - Gravel Lot (Detail) 128
Accessible Parking Space - Paved Lot (Detail) 129
Easy Access Trail (Specification) 130
8. Sign Installation 131
Fault Markers (Detail) 132
Preserve Sign – Regulatory 12”x24” (Detail) 133
Preserve Sign – Regulatory 6”x6” (Detail) 134
Preserve Sign – Regulatory Sign with Mountain Lion Sign (Detail) 135
Preserve Sign – Interpretive & Trail Directional Sign Combo (Detail) 136
Preserve Sign – Interpretive or Trail Directional Sign (Detail) 137
Preserve Entrance Sign – 9’ width (Detail) 138
Preserve Entrance Sign – ALT-H Bracket 9’ Width (Detail) 139
Preserve Entrance Sign – 4.5’ width (Detail) 140
Preserve Entrance Sign – ALT-H Bracket 4.5’ Width (Detail) 141
Regulatory/ Traffic Sign – District (Detail) 142
Regulatory/ Traffic Sign – Caltrans “No Parking” (Detail) 143
Regulatory/ Traffic Sign – Caltrans “X-ing” (Detail) 144
Map and Bulletin Board (Detail) 145
Removable Literature Holder (Detail) 146
Sign Board (Detail) 147
Sign Board Layout (Detail) 148
9. Wildlife 149
Wildlife Escape Ladder for Spring Box (Detail) 150
Spring Box (Detail) 151
Spring Box Overflow Basin (Detail) 152

DETAILS AND SPECIFICATIONS GUIDELINES

SECTION 1

EROSION CONTROL

ACORN COLLECTION

1. PRESURVEY FOR OAK TREES WITH A GOOD DEVELOPING CROP OF ACORNS SHOULD BE CONDUCTED IN SEPTEMBER. OAK TREES SHOULD BE IN GENERAL VICINITY OF WHERE ACORNS WILL BE PLANTED, SAME SPECIES AS SUITABLE FOR PLANTING SITE AND SIMILAR ELEVATION, SLOPE ASPECT AND SOILS. KEEP NOTES ON AND MAP LOCATION OF GOOD ACORN TREES, SPECIES AND APPROXIMATE AMOUNT OF ACORNS (FEW, >50 OR MANY). IT IS EASIER TO PICK FROM TREES THAT HAVE LOW BRANCHES OVER SLOPES OR BRANCHES UNDER WHICH A TRUCK CAN BE DRIVEN.

2. PICK RIPE ACORNS FROM TREES IN LATE OCTOBER OR EARLY NOVEMBER. WHEN ACORNS START DROPPING TO THE GROUND, THIS IS A GOOD SIGN THAT ACORNS ON TREE ARE RIPE. RIPE ACORNS ON THE TREE ARE USUALLY BROWN OR STARTING TO TURN BROWN. IF GENTLY TWISTED, ACORN BODY WILL COME OUT OF ACORN CAP WITHOUT LEAVING ANY MEAT IN THE CAP. SELECT PLUMP ACORNS AND AVOID ANY WITH CRACKS OR HOLES. PICK FROM MANY DIFFERENT TREES RATHER THAN JUST ONE. ON ANY ONE TREE, TRY TO PICK NO MORE THAN 25% OF ACORNS SO THAT PLENTY ARE LEFT FOR WILDLIFE. KEEP A LIST AND WRITE ON EACH ZIPLOC BAG THE DATE, LOCATION AND SPECIES OF ACORNS COLLECTED. DO NOT MIX DIFFERENT SPECIES OR DIFFERENT LOCATIONS IN SAME ZIPLOC BAG.

   IF ACORNS CANNOT BE REACHED FOR HAND PICKING, LAY A TARP ON GROUND AND GENTLY KNOCK THEM DOWN WITH A POLE.

   IF NECESSARY TO COLLECT ACORNS OFF GROUND, NOTE THAT THE ACORNS THAT FIRST DROP ARE USUALLY STUNTED SPECIMENS THAT THE TREE IS SHEDDING; AVOID THESE. CHOOSE ACORNS ON THE GROUND THAT ARE GREEN OR DARK BROWN, PLUMP AND WITHOUT CRACKS OR HOLES. LIGHT BROWN ACORNS ON THE GROUND INDICATE THAT THEY HAVE BEEN ON THE GROUND LONGER AND ARE DEHYDRATED; AVOID THESE.

3. STORE ACORNS IN ONE-GALLON ZIPLOC BAGS. FILL EACH BAG ONLY ONE-HALF FULL WITH ACORNS. ADD A HANDFUL OF DRY PEAT MOSS. DO NOT SEAL BAGS. DO NOT SOAK OR MOISTEN ACORNS AT THIS STAGE. LAY OPEN BAGS ON SIDE, PREFERABLY IN VEGETABLE DRAWER IN REFRIGERATOR. BEST REFRIGERATOR TEMPERATURE IS 33-41 DEGREES F; DO NOT LET ACORNS FREEZE. DO NOT PLAN ON STORING ACORNS IN REFRIGERATOR LONGER THAN 3 TO 4 MONTHS; 1 TO 2 MONTHS IS BETTER. SOAKING OF ACORNS WILL BE DONE CLOSE TO THE ACTUAL DATE OF PLANTING. KEEPING BAGS OPEN, USING PEAT MOSS AND WAITING TO SOAK ACORNS ARE ALL IMPORTANT STEPS TO KEEPING ACORNS FROM GETTING MOLDY OR GERMINATING TOO EARLY DURING STORAGE IN REFRIGERATOR.

4. EQUIPMENT: ZIP LOCK BAGS, PERMANENT MARKER, PEAT MOSS, POLE PRUNER OR CLIPPERS, TARP, POLE, ICE CHEST, LIST OF OAK TREES AND MAP, OAK SPECIES KEY.

REGIONAL OPEN SPACE

ACORN COLLECTION SPECIFICATION

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\1A acorns collection.dwg

EROSION CONTROL BLANKET / MATTING

1. TWO PRODUCT LINES ARE APPROVED FOR USE FOR EROSION CONTROL BLANKETS/MATTING: BIONET AND CURLEX. A DISTRICT REPRESENTATIVE WILL CHOOSE THE APPROPRIATE PRODUCT FOR THE INSTALLATION. INSTALLATION WILL FOLLOW THE MANUFACTURERS' DIRECTIONS. SEE ATTACHED CUT SHEETS.

EROSION CONTROL BLANKET/MATTING SPECIFICATION

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\1A erosion control blanket matting.dwg

EROSION CONTROL OPTIONS

1. LITTER MULCH – CHIP ALL REMOVED TREES AND BRANCHES AND STOCKPILE OUTSIDE OF GRADING AREA. ALSO, PRIOR TO GRADING, YOU CAN SCRAPE OFF THE EXISTING LEAF LITTER AND/OR ORGANIC SURFACE SOIL AND STOCKPILE. FOR LONG CONSTRUCTION PERIODS, THESE STOCKPILES SHOULD BE COVERED WITH TARPS TO PREVENT INFESTATION WITH WEED SEEDS. [MAKE SURE CONTRACTORS SAVE THE CHIPS AND LITTER IN A SAFE PLACE FOR LATER USE. WE HAVE HAD CONTRACTORS CARELESSLY CHIP AND STORE THIS MATERIAL IN WAYS THAT IT COULD NOT BE RETRIEVED FOR LATER USE.] ON SMALL SITES, RAKE A PORTION OF THE LITTER FROM THE SURROUNDING FOREST ONTO THE NEWLY EXPOSED SOIL. DO NOT LEAVE EITHER THE CONSTRUCTION AREA OR THE BORROW SITE BARE; THE LITTER MOST BE SPREAD TO PROVIDE COVER SO NO BARE SOIL IS EXPOSED OR LEFT EXPOSED. SPREAD CHIPS OR LITTER SO THAT IT IS AT LEAST 1 INCH THICK ABOVE SOIL.

2. NATIVE GRASS STRAW – PURCHASE NATIVE GRASS STRAW FROM NATIVE GRASS SEED COMPANIES. NATIVE GRASS STRAW IS THE STEM PART CUT AND BALED FROM A NATIVE GRASS FIELD AFTER THE SEED HAS BEEN HARVESTED. THIS STRAW SHOULD NOT HAVE THE WEEDS THAT ARE PRESENT IN OTHER TYPES OF STRAW BALES. IN 2008, WE PURCHASED NATIVE GRASS STRAW FROM HEDGEROW FARMS AT ABOUT $15 BALE INCLUDING DELIVERY. SPREAD STRAW ACROSS SITE AFTER ALL GRADING WORK (AND SEEDING IF APPLICABLE) IS COMPLETED. STRAW MAY NEED TO BE CRIMPED INTO THE SOIL ON LARGER SITES, SUCH AS BY RUNNING A PIECE OF TRACK–WALKING EQUIPMENT ACROSS THE SPREAD STRAW. SPREAD STRAW SO THAT IT IS AT LEAST 2 INCHES THICK ABOVE SOIL.

3. WEED–FREE STRAW – PURCHASE WEED–FREE STRAW; OFTEN IT IS RICE STRAW. OUR EXPERIENCE IS THAT SOMETIMES, DESPITE THE CLAIM THAT IT IS WEED–FREE, THIS STRAW MAY NOT BE. CALIFORNIA DOES NOT HAVE A CERTIFICATION PROGRAM TO REGULATE THE QUALITY OF WEED–FREE STRAW. SOME COMPANIES PROVIDE STRAW THAT HAS BEEN CERTIFIED BY THE STATES OF WASHINGTON OR OREGON AND THESE MAY BE MORE RELIABLE. SPREAD STRAW SO THAT IT IS AT LEAST 2 INCHES THICK ABOVE SOIL.

4. NATIVE GRASS SEED MIX – SPREAD A NATIVE GRASS SEED MIX AFTER ALL GRADING AND BEFORE SPREADING STRAW OR MULCH ON THE SITE. REMOVE ALL WEEDS AND MISCELLANEOUS PLANT MATERIAL FROM SURFACE OF SOIL TO BE PLANTED. NATIVE GRASS SEED MIXES CAN BE PURCHASED FROM NATIVE GRASS SEED COMPANIES. THE SELECTION OF SPECIES IN THE MIX SHOULD BE APPROPRIATE FOR THE FIELD CONDITIONS (SUNNY, SHADY, WET, DRY, ROCKY, CLAY, SANDY) AND SHOULD BE DERIVED FROM NATIVE GRASSES COLLECTED IN THE GENERAL REGION OF THE PROJECT SITE. BEWARE OF SEED MIXES LABELED "EROSION CONTROL MIX" THAT CONTAIN NON–NATIVE SPECIES SUCH AS CLOVERS. ALTHOUGH THESE SEED MIXES MAY WORK FINE IN PASTURES AND OTHER DEVELOPED SITES, THEY ARE NOT APPROPRIATE FOR SPREADING IN NATURAL AREAS. SEED MIX SHOULD BE SPREAD AT A RATE OF 40 LBS/ACRE. SEED SHOULD BE LIGHTLY RAKED INTO SOIL AND COVERED WITH 1 TO 2 INCHES OF STRAW (SEE ABOVE). IF A NO–TILL DRILL SEEDER IS USED, SEEDING RATE CAN BE 30 LBS/ACRE, NO RAKING IS REQUIRED, BUT A STRAW MULCH LAYER SHOULD BE APPLIED. DO NOT USE "SANTA CRUZ EROSION CONTROL MIX".

5. STERILE WHEATGRASS HYBRID SEED – SPREAD STERILE WHEATGRASS HYBRID SEED (COMMERCIAL PRODUCT KNOWN AS "REGREEN") WHICH GERMINATES QUICKLY AND VIGOROUSLY ONCE IRRIGATED, BUT IS AN ANNUAL AND WILL NOT PRODUCE VIABLE SEED AFTER ONE TO TWO YEARS. THIS GRASS IS SUITABLE IN AREAS THAT ARE TOO SHADY TO SUPPORT GRASS GROWTH OVER THE LONG TERM BUT WHICH REQUIRE EROSION CONTROL COVER IN THE SHORT TERM. REMOVE ALL WEEDS AND MISCELLANEOUS PLANT MATERIAL FROM SURFACE OF SOIL TO BE PLANTED. TOTAL SEED MIX RATE SHOULD BE 50 LB/ACRE. SEED SHOULD BE LIGHTLY RAKED INTO SOIL AND COVERED WITH 1 TO 2 INCHES OF STRAW (SEE ABOVE).

6. EROSION CONTROL BLANKETS SEE SPECIFICATION

REGIONAL OPEN SPACE

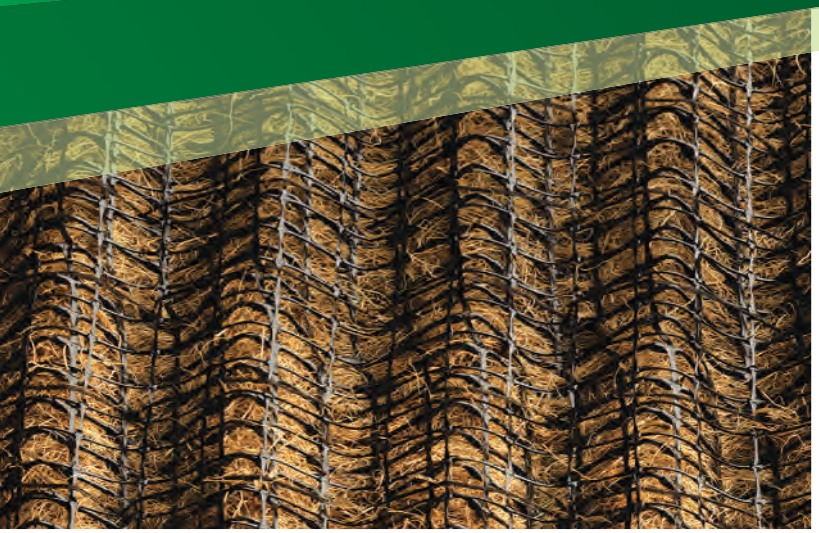
EROSION CONTROL OPTIONS SPECIFICATION

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

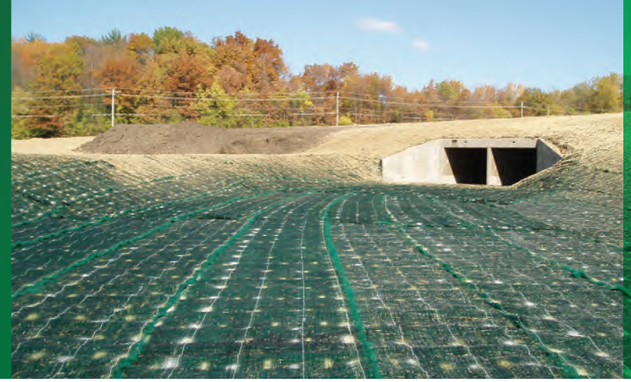
S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\1A erosion control options.dwg

NORTH AMERICAN GREEN

SYSTEMS OVERVIEW



NORTH AMERICAN GREEN®



We've Got You Covered

Erosion control, sediment control and vegetation establishment are essential to almost every construction project. A well planned solution tailored to your site can eliminate costly reconstruction of degraded slopes and shorelines; prevent damage to landscapes, water sources and wildlife; and keep you in compliance with local and federal regulations. The North American Green full line of erosion and sediment control solutions can help cover your bases.

LET'S TALK TURNKEY

North American Green is the world's leading provider of turnkey, performance-guaranteed erosion control solutions. We can handle any erosion issues, whether your site needs short-term protection or permanent vegetation reinforcement. Our specialty construction products and engineering services ensure cost-effective solutions and exceptional results.

UNMATCHED SERVICE AND SUPPORT

There are many erosion control product manufacturers out there, but none with our emphasis on customer service and technical know-how. Our interdisciplinary support team can assist with project design and product specification. Rather do it yourself? Our Erosion Control Materials Design Software® (ECMDS), the industry's first design software, allows for self-guided cost-effective material selection and project planning.

SPECIALISTS ARE STANDING BY

North American Green® Erosion Control Systems are sold exclusively through nearly 200 authorized distributors worldwide. Our Erosion Solutions Specialist program certifies our distributors and their sales representatives to design erosion control measures to help you comply with the U.S. Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) and other industry regulations.

North American Green is a proud member of the Erosion Control Technology Council (ECTC) and the International Erosion Control Association (IECA).

From project start to finish, North American Green erosion and sediment control products will keep you protected until vegetation is established.

A well planned erosion control solution tailored to your site can eliminate costly reconstruction of degraded slopes.

Yes, Erosion Control Matters

Construction usually means removing vegetation, altering the landscape and/or covering previously vegetated areas with roads, driveways or buildings. These changes often cause soil erosion and sediment deposits, which can lead to a multitude of problems.

THE ENVIRONMENTAL TOLL

- Disrupting the ecosystem can hinder the natural resources on which wildlife depend for survival.
- Storm water runoff can increase stream bank erosion and disturb aquatic habitats and lifecycles.
- Construction site soils and chemicals can wash into water supplies and compromise water quality for humans and animals.

THE ECONOMIC TOLL

- The costs to rebuild degraded slopes and shorelines and dredge sediment-filled waterways reach billions of dollars annually.
- The EPA's NPDES Phase II rule says anyone disturbing one acre or more of U.S. soil must have an NPDES permit and file a Storm Water Pollution Prevention Plan (SWPPP) with local authorities – or face hefty fines.
- Every Municipal Separate Storm Sewer System (MS4) operator must have a NPDES permit; without it, they're subject to penalties and legal action.
- EPA effluent (runoff) guidelines are based on the technology that reduces pollutants the most and is economically achievable for an industry. While the agency doesn't require facilities to install that technology, they do require the same performance.

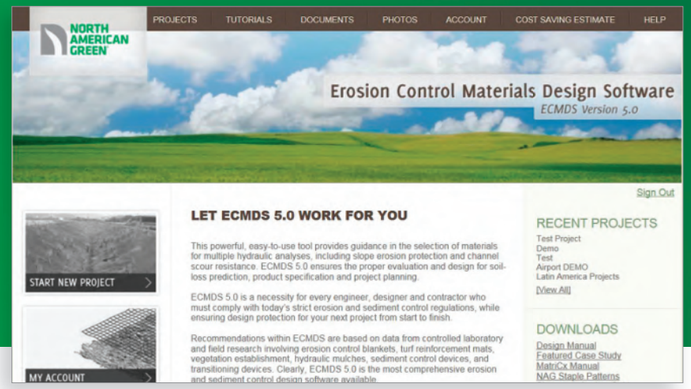
NOW FOR THE GOOD NEWS: PRACTICE MAKES PERFECT

With so much at stake, erosion control is a high priority. North American Green® Erosion and Sediment Control Systems are recognized as EPA Best Management Practices (BMPs) to help you comply with regulations and protect our (and your) most valuable resources.

Using North American Green Rolled and Hydraulic Erosion Control Products can help you reach your Leadership in Energy and Environmental Design (LEED®) Green Building Rating System™ project certification goals. For more information, visit **nagreen.com** or call **800-772-2040**.

Our full line of products offers a solution for nearly every erosion problem caused by wind and water.

North American Green Erosion Control Systems are recognized as EPA Best Management Practices (BMPs) that help you comply with regulations and protect valuable resources.



You're on Solid Ground

"Cutting edge" isn't the first thing that comes to mind when you think of erosion control – but maybe it should be. North American Green has continually advanced erosion control science and developed a full line of high-tech products backed by an industry-leading guarantee.

ALWAYS LOOKING AHEAD

The definition of proactive – *acting in advance to deal with an expected difficulty* – sums up our research and development philosophy. We conduct ongoing research at major universities and independent labs. We watch and listen to find out what customers need now and what you'll need next. We invest in innovation and product development to keep you ahead of erosion control issues with the most progressive solutions in the industry.

TESTING 1, 2, 3

To guarantee North American Green Erosion Control Systems perform under actual field conditions, we subject them to rigorous, large-scale, performance tests. We're so confident in our products, we proudly subject them to independent testing by the National Transportation Product Evaluation Program (NTPEP) of the American Association of State Highway and Transportation Officials (AASHTO). In a recent test, our ShoreMax® Transition Mat combined with a VMax® Turf Reinforcement Mat underlayment pushed channel lining performance to an all-time high.

North Amercian Green Rolled Erosion Control Products (RECPs) are also "performance verified" by QDOR (Quality Data Oversight and Review), a quality program developed by the Erosion Control Technology Council (ECTC) to raise the standard for performance testing.

THE WHOLE NINE YARDS, GUARANTEED

Our Ultimate Assurance Guarantee is the most comprehensive in the industry. If any properly specified and installed North American Green® Rolled or Hydraulic Erosion Control Product designed by a qualified engineer or by one of our technical representatives in accordance with our Erosion Control Materials Design Software (ECMDS®) fails to perform under the conditions in the Guarantee, then we will replace the failed product with our next higher-performance RECP product, along with the cost of seed, fertilizer, topsoil and other amendments lost due to such product failure. Our Guarantee warrants in accordance with its terms and conditions all registered projects designed with the latest version of our ECMDS and properly installed.

North American Green Turf Reinforcement Mats are also guaranteed to reinforce vegetation for five years after installation, and the functional longevity of these products' permanent structures is warranted for a minimum of 10 years after installation, subject to the terms and conditions set forth in the Guarantee.

As our products protect the soil and seed, a fully vegetated project site is nearer than you think.

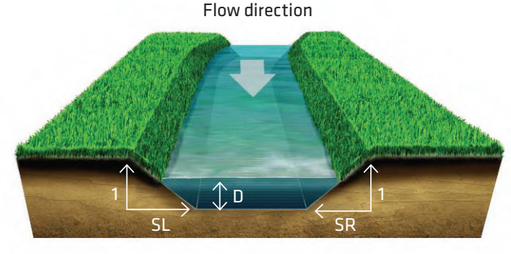
We continually advanced erosion control science and developed a full line of high-tech products backed by an industry-leading guarantee.

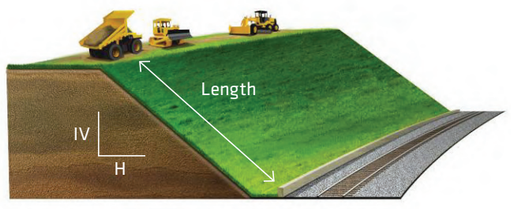
Sometimes, the Best Advice Is Free

For more than three decades, engineers, designers and contractors looking for reliable erosion control solutions have turned to North American Green first. Not only do we deliver unmatched quality and a rock-solid guarantee, our powerful Erosion Control Materials Design Software® (ECMDS) ensures proper evaluation, design, product selection and project planning.

TOOLS OF THE TRADE

ECMDS provides comprehensive site-specific erosion control analyses. Our sophisticated calculations help you develop sustainable soil protection and vegetation establishment plans. All recommendations are based on data from controlled laboratory and field research involving erosion control blankets, turf reinforcement mats, hydraulic erosion control products, and transition mats.





The channel and slope design modules are only two of the design options available in ECMDS Software.

DESIGN AND COMPLY

ECMDS is a must-have, especially if you face tough erosion and sediment control regulations. Product design recommendations are based on test data from one or more of these facilities: TRI/Environmental Inc, Texas Transportation Institute, San Diego State University, Utah State University and/or Colorado State University. ECMDS product recommendations are based on time-tested design protocol developed by the USDA and FHWA.

READY WHEN YOU ARE

ECMDS is web-based for easy access from your desktop, laptop, smart phone or notebook. And, best of all, it's completely free of charge. To learn more and access the software directly, go to **www.ECMDS.com**.

HOLD YOUR GROUND

We have top-quality solutions for every erosion control need. Our products are rigorously tested and proven effective for a wide range of real-world applications including:

- Slopes and embankments
- Landfills
- Shorelines
- Ditches and culvert outfalls
- Levees and earthen dams
- Channels and spillways
- Wetlands
- Bioengineering
- Golf courses
- Residential developments
- Military bases

ROLLMAX™
ROLLED EROSION CONTROL

Every site has unique challenges created by soil characteristics, topography, climate and other environmental conditions. The RollMax™ System Rolled Erosion Control Products (RECPs) conquer all your site challenges. Whether you need temporary or permanent protection, short-term or long-term durability, biodegradable or photodegradable solutions, our RollMax RECPs deliver a wide variety of advantages, features and benefits:

- High-performance protection of topsoil from wind and water erosion
- Support quick, healthy vegetation growth
- Protect dormant seeds during winter months
- Stabilize slope erosion to keep roads safe and clean
- Reinforce vegetation roots and stems
- Protect water quality in lakes, rivers and streams
- Conform to landscape features
- Provide easy handling and transport

PERMANENT TURF REINFORCEMENT MATS

The RollMax System of permanent Turf Reinforcement Mats (TRMs) are ideal for high-flow channels, stream banks, shorelines and other areas needing permanent vegetation reinforcement and protection from water and wind. More economical and aesthetically pleasing than rock riprap, articulated concrete blocks or poured concrete, our TRMs protect vulnerable areas with minimum maintenance and maximum durability.

VMAX® TURF REINFORCEMENT MATS

- VMax® Permanent Composite TRMs combine three-dimensional matting and fiber matrix material for all-out erosion protection, vegetation establishment and reinforcement. These products increase the permissible shear stress of many types of vegetation up to 14 pounds per square foot (0.67kN/m²) – erosion protection equal to 36 in. (900 mm) rock riprap and concrete. VMax TRMs are available with various performance capabilities and support reinforced vegetative lining development from germination to maturity.
- VMax® High-Performance TRMs (HPTRMs) utilize patent-pending woven 3-D structures that are soil-filled for use in areas experiencing high stress and strain. The VMax HPTRMs are designed to provide appropriate thickness and open area for effective erosion and vegetation reinforcement against high flow induced shear forces up to 16psf (0.77 kN/m²), and with the highest tensile strength on the market up to 5,000 lbs/ft (73 kN/m) our HPTRMs are excellent for increased bearing capacity of vegetated soils subjected to heavy loads from maintenance equipment and other vehicular traffic.

EROSION CONTROL BLANKETS

North American Green Erosion Control Blankets (ECBs) immediately prevent erosion and help establish vegetation. As vegetation takes root and stem systems stabilize the underlying soil, most ECBs gradually degrade. These products come in a range of weights and materials to accommodate low- to high-flow channels and moderate to severe slopes.

ERONET™ PHOTODEGRADABLE ECBs

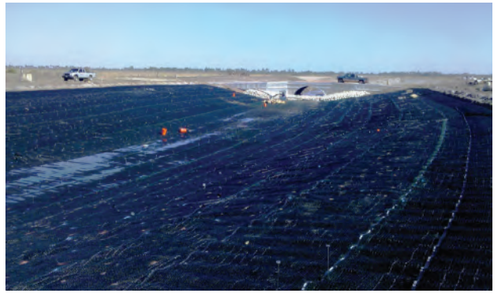
- EroNet™ Short-Term Photodegradable ECBs are designed for moderate slopes and low-flow channels. Made of 100% agricultural straw stitched to or between lightweight polypropylene netting with degradable thread, EroNet ECBs come in short-term varieties to protect and mulch soil surfaces from 45 days to 12 months.
- EroNet™ Extended-Term, Long-Term and permanent ECBs use heavy-duty double-netting and long-lasting coconut or permanent polypropylene fiber for protection and vegetation support for up to 36 months or longer. These products are available for extended- and long-term stabilization of steep slopes, medium- to high-flow channels and shorelines.

BIONET® BIODEGRADABLE ECBs

- BioNet® Short-Term Biodegradable ECBs are appropriate for bioengineering projects, environmentally sensitive sites, shaded areas, stream banks and shorelines. They're made of 100% agricultural straw stitched with biodegradable thread to 100% biodegradable jute fiber netting. Available in single- or double-net varieties, they protect for up to 12 months and leave no synthetic residues.
- BioNet® Extended-Term and Long-Term Biodegradable ECBs incorporate coconut fiber stitched with biodegradable thread between biodegradable jute fiber top and bottom nets. Great for steep slopes, medium- to high-flow channels and shorelines, a choice of two products provides erosion protection and vegetation establishment for 18 to 24 months.

GO Transit, Greater Toronto, Ontario, Canada

During construction on a Toronto commuter rail system, a steep railway embankment required stabilization to protect a nearby pond from sediment runoff. North Amercian Green® VMax® Permanent Composite SC250® TRMs were installed to prevent surface erosion and promote vegetation re-establishment.



Mary Creek, Archbold Biological Reserve, Central Florida

When earthwork to realign and protect the eroding Mary Creek failed after a major storm, it was determined the creek had to be armored to prevent major erosion. Our high-performance Turf Reinforcement Mats installed with our Earth Anchors provided a soft armor solution for permanent soil protection and vegetation reinforcement.

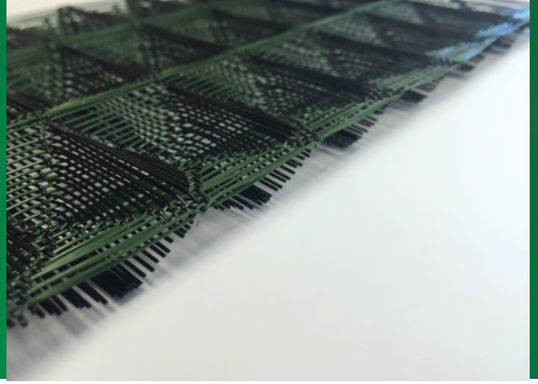
Yellowstone National Park, near Cody, Wyoming

Reconstruction of Highway 14 near Yellowstone created bare, dry rocky exposed slopes requiring erosion protection. North American Green® BioNet® SC150BN™ biodegradable erosion control blanket was selected for its extended longevity and ecological friendliness. Native vegetation was established within one growing season, preserving the natural aesthetics and preventing pollution of the nearby river.

Green Hills Tributary Improvement, Eugene, Oregon

Improvements along the streambanks were needed to improve drainage and flood control for the City of Eugene, Oregon. North American Green® BioNet® C125BN™ provided ample protection of the soil so the groundcover could be established on the slopes and the native grasses and vegetation could take root.

RollMax Product Selection Chart



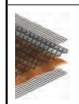
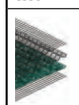
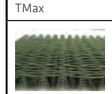
TEMPORARY

	Product Description	Longevity	Applications	Design Permissible Shear Stress lbs/ft² (Pa)	Design Permissible Velocity ft/s (m/s)
ERONET					
DS75	1.5 lb., accelerated photodegradable, polypropylene top net, 100% straw fiber matrix	45 days	Low Flow Channels 4:1 - 3:1 Slopes	Unvegetated 1.55 (74)	Unvegetated 5.0 (1.52)
DS150	1.5 lb., photodegradable, polypropylene top & bottom net, 100% straw fiber matrix	60 days	Moderate Flow Channels 3:1 - 2:1 Slopes	Unvegetated 1.75 (84)	Unvegetated 6.0 (1.83)
S75	1.5 lb., photodegradable, polypropylene top net, 100% straw fiber matrix	12 months	Low Flow Channels 4:1 - 3:1 Slopes	Unvegetated 1.55 (74)	Unvegetated 5.0 (1.52)
S150	1.5 lb., photodegradable, polypropylene top & bottom net, 100% straw fiber matrix	12 months	Moderate Flow Channels 3:1 - 2:1 Slopes	Unvegetated 1.75 (84)	Unvegetated 6.0 (1.83)
SC150	2.9 lb., UV-stable polypropylene top net, 70% straw/30% coconut fiber matrix, 1.5 lb., photodegradable polypropylene bottom net	24 months	Medium Flow Channels 2:1 - 1:1 Slopes	Unvegetated 2.0 (96)	Unvegetated 8.0 (2.44)
C125	2.9 lb., UV stable polypropylene top & bottom nets, 100% coconut fiber matrix	36 months	High Flow Channels 1:1 and Greater Slopes	Unvegetated 2.25 (108)	Unvegetated 10.0 (3.05)
BIONET					
S75BN	9.3 lb., leno woven biodegradable jute top net, 100% straw fiber matrix	12 months	Low Flow Channels 4:1 - 3:1 Slopes	Unvegetated 1.60 (76)	Unvegetated 5.0 (1.52)
S150BN	9.3 lb., leno woven biodegradable jute top net, 100% straw fiber matrix, 7.7 lb., woven biodegradable jute bottom net	12 months	Moderate Flow Channels 3:1 - 2:1 Slopes	Unvegetated 1.85 (88)	Unvegetated 6.0 (1.83)
SC150BN	9.3 lb., leno woven biodegradable jute top net, 70% straw/30% coconut fiber matrix, 7.7 lb., woven biodegradable jute bottom net	18 months	Medium Flow Channels 2:1 - 1:1 Slopes	Unvegetated 2.10 (100)	Unvegetated 8.0 (2.44)

TEMPORARY

	Product Description	Longevity	Applications	Design Permissible Shear Stress lbs/ft² (Pa)	Design Permissible Velocity ft/s (m/s)
BIONET CONT'D					
C125BN	9.3 lb., leno woven biodegradable jute top net, 100% coconut fiber matrix, 7.7 lb., woven biodegradable jute bottom net	24 mo.	High Flow Channels 1:1 and Greater Slopes	Unvegetated 2.35 (112)	Unvegetated 10.0 (3.05)
C700BN	143 lb., (700 g) woven biodegradable coir top net, 100% coconut fiber matrix, 7.7 lb., woven biodegrdable jute bottom net	36 mo.	High Flow Channels 1:1 and Greater Slopes	Unvegetated 2.35 (112)	Unvegetated 10.0 (3.05)

PERMANENT

ERONET					
P300	5.0 lb., UV-stable polypropylene top net, 100% polypropylene fiber matrix, 3.0 lb., UV-stable polypropylene bottom net	Permanent	High Flow Channels 1:1 Slopes	Unvegetated 3.0 (144) Vegetated 8.0 (383)	Unvegetated 9.0 (2.7) Vegetated 16.0 (4.9)
VMAX					
SC250	5.0 lb., UV-stable polypropylene top & bottom nets, 24.0 lb., UV-stable polypropylene corrugated center net, 70% straw/30% coconut fiber matrix	Permanent	High Flow Channels 1:1 and Greater Slopes	Unvegetated 3.0 (144) Vegetated 10.0 (480)	Unvegetated 9.5 (2.9) Vegetated 15.0 (4.6)
 C350	8.0 lb., UV-stable polypropylene top & bottom nets, 24.0 lb., UV-stable polypropylene corrugated center net, 100% coconut fiber matrix	Permanent	High Flow Channels 1:1 and Greater Slopes	Unvegetated 3.2 (153) Vegetated 12.0 (576)	Unvegetated 10.5 (3.2) Vegetated 20.0 (6.0)
 P550	24.0 lb., UV-stable polypropylene top & bottom nets, 24.0 lb., UV-stable polypropylene corrugated center net, 100% polypropylene fiber matrix	Permanent	Extreme High Flow Channels 1:1 and Greater Slopes	Unvegetated 4.0 (191) Vegetated 14.0 (672)	Unvegetated 12.5 (3.8) Vegetated 25.0 (7.6)
TMax	100% UV-stable polypropylene monofilament yarns, woven into a 3-D structure	Permanent	Extreme High Flow Channels 1:1 and Greater Slopes	Vegetated 15.0 (718)	Vegetated 25.0 (7.6)
 W3000	100% UV-stable polypropylene monofilament yarns, woven into a 3-D structure	Permanent	Extreme High Flow Channels 1:1 and Greater Slopes	Vegetated 16.0 (766)	Vegetated 25.0 (7.6)

HYDRAMAX™
HYDRAULIC EROSION CONTROL

Hydraulic Erosion Control Products (HECPs) prevent erosion and aid vegetation establishment on slopes. The North American Green® HydraMax™ System enables the application of seed, soil amendments and hydraulic mulch in one step, offering a low-cost, low-labor solution. All HydraMax System products are made with our patented blend of straw, reclaimed cotton plant material and tackifiers to ease application, enhance adhesion, retain moisture and stabilize soil. HydraMax™ HECPs also:

- Consist of a porous matrix with strong soil adhesion that forms vegetation establishment and erosion control medium
- Reduce expensive site preparation
- Can be installed three times faster than erosion control blankets with ⅓ of the labor costs
- Come in easy-to-break bales for fast mixing
- Have low water-to-mulch ratios that increase productivity by requiring fewer tank loads per site
- Grow grass quickly with increased germination and biomass production over bare soil
- Are non-toxic per EPA guidelines
- Contain only biodegradable, non-synthetic fibers

- Come in a pleasing natural green color
- Help you comply with Environmental Protection Agency (EPA) effluent guidelines without treating water with flocculants or advanced water treatment systems
- Help you earn points toward Leadership in Energy and Environmental Design (LEED) Green Building Rating System project certification goals

HIGH-PERFORMANCE HECPs

Our high-performance HECPs are effective on construction site slopes with gradients of 1:1 (H:V) or steeper.

- North American Green® HydraCX® Extreme Slope Matrix is used for long-length, steep to severe slope gradients of 3:1 to 0.5:1. It is our highest performing hydraulic mulch and has an unprecedented 100% soil protection in American Association of State Highway and Transportation Officials (AASHTO)-National Transportation Product Evaluation Program (NTPEP) testing.
- North American Green® HydraCM® Steep Slope Matrix scored 99.7% effective in reducing soil erosion when tested by AASHTO's NTPEP. Designed for medium-length, moderate to steep slope gradients of 4:1 to 1:1.

The application of our HydraMax Hydraulic Mulches will work with a wide range of mechanically agitated hydroseeding equipment, and the decreased water-to-mulch mixing ratio will get your job done faster.

The North American Green HydraMax System can be installed three times faster than erosion control blankets with 1/3 of the labor costs.

STANDARD PERFORMANCE HECPs

HydraMax standard HECPs for mild to moderate slopes are excellent alternatives to wood and/or paper mulch and blown straw, which may take two steps to apply.

- North American Green® HydraGT™ Moderate Slope Mulch Blend with Tack is ideal for short slopes with up to 2:1 gradients.
- North American Green® HydraGS® Mild Slope Mulch Blend works best on short slopes with up to 3:1 gradients.

READY, AIM, INSTALL

Our instruction guide for applying HydraMax™ System products details substrate and seedbed preparation, installation, mixing, product application, equipment cleaning and protection recommendations. A comprehensive loading chart also ensures the correct amount of material for application on your site.

HydraCX® Extreme Slope Matrix	
Slope Conditions	**Application Rate**
≥1H:1V	4,500 lbs/acre (5,100 kg/ha)
≥2H:1V and <1H:1V	4,000 lbs/acre (4,500 kg/ha)
≥3H:1V and <2H:1V	3,500 lbs/acre (3,900 kg/ha)
<3H:1V	3,000 lbs/acre (3,400 kg/ha)

HydraCM® Steep Slope Matrix	
Slope Conditions	**Application Rate**
≥2H:1V	4,000 lbs/acre (4,500 kg/ha)
≥3H:1V and <2H:1V	3,500 lbs/acre (3,900 kg/ha)
≥4H:1V and <3H:1V	3,000 lbs/acre (3,400 kg/ha)
<4H:1V	2,500 lbs/acre (2,800 kg/ha)

HydraGT™ Moderate Slope Mulch Blend with Tack		
Typical Application Rates		
Slope Conditions	**Rate (English)**	**Rate (Metric)**
>3:1 and <2.5:1	2,000 lbs/acre	2,800 kg/ha
>4:1 ≤3:1	2,000 lbs/acre	2,250 kg/ha
≤4:1	1,500 lbs/acre	1,700 kg/ha

HydraGS® Mild Slope Mulch Blend		
Typical Application Rates		
Slope Conditions	**Rate (English)**	**Rate (Metric)**
>4:1 ≤3:1	2,000 lbs/acre	2,250 kg/ha
≤4:1	1,500 lbs/acre	1,700 kg/ha

Alabama Department of Transportation

During a highway widening construction project on Interstate I-65, the Alabama DOT needed to protect many newly graded slopes from erosion. The HydraMax System HydraCX Extreme Slope Matrix was chosen for the steep slopes. Vegetation started germinating within a week of application resulting in unprecedented vegetation that even had motorists complimenting ALDOT.

Christ the King Cathedral School, Lubbock, Texas

The new site of the school's practice football field had to be completed and fully vegetated before football season a few months away. To prevent soil erosion and establish vegetation quickly, the design team applied our HydraCM Steep Slope Matrix HECP. Despite heavy rains two days later, the field showed no signs of erosion or rilling and vegetation grew within days. The field could be mowed just two weeks after application.

REVETMAX™
FLEXIBLE REVETMENT

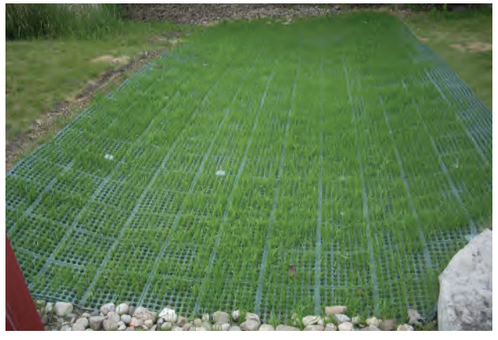
Flexible revetment mats provide cost-effective erosion protection from turbulent water flow and moderate wave attack. North American Green® RevetMax™ System is ideal for applications where riprap, articulated concrete blocks or other rigid materials are normally used. When combined with a Turf Reinforcement Mat (TRM) or other underlayment, this unique armoring solution dramatically elevates permissible shear stress and velocity protection. The RevetMax System products:

- Install easily over difficult topography and are highly flexible
- Prevent floating or uplifting in submerged conditions due to their non-buoyancy
- Feature grip lugs that bite into underlying surfaces to prevent shifting
- Facilitate vegetation growth through voids in the mat
- Require no heavy equipment for installation
- Easily maintained
- Safer for pedestrian and vehicle traffic than hard armor materials

SHOREMAX® TRANSITION MATS

Flexible, UV-stabilized RevetMax System® ShoreMax® Transition Mats protect highly erosive areas such as shoreline transition zones, channel bottoms and pipe outlets and outfalls. Our ShoreMax Mat can be used for slope drains in parking lots, roadways, mines and landfills. The RevetMax System ShoreMax Mat can provide soft armoring on shorelines and spillway applications where wave attack can reach critical stages.

The RevetMax System ShoreMax Transition Mat is a smart option to replace rock in high scour areas such as pipe outlets.



The RevetMax ShoreMax Transition Mat help vegetation growth through voids in the mat.

ShoreMax is the industry's first scour protection mat to post unvegetated performance values in American Association of State Highway and Transportation Officials (AASHTO)-National Transportation Product Evaluation Program (NTPEP) large-scale channel testing. Results showed an unvegetated ShoreMax Mat combined with a VMax® P550® TRM underlayment can withstand flow-induced shear stresses of 8.6 pounds per square foot (0.40kN/m^2) and velocities up to 19.5 ft per second (5.9m/s). This level of performance exceeds that of a full mature stand of vegetation.

SIMPLE TO INSTALL

Installation of the ShoreMax mat can be done simply and without the need for expensive equipment. The ShoreMax mat and TRM underlayment are simply installed over a prepared seeded soil and fastened into place with fasteners.

The flexibility of the ShoreMax mats allows them to be easily installed with a variety of fasteners such as the ShoreMax stake, wire staples, rebar staples, and percussion earth anchors. Since the ShoreMax mat easily self-conforms to the underlying terrain, fasteners are not required to force conformance with the underlayment materials – they only serve to hold the panels in place. Therefore, special percussion earth anchors are typically not required. They type and size of the fastener used is dependent upon the underlying soil and degree of compaction.

For details on fastener selection, stapling patterns, and installation details refer to the RevetMax Installation guide. For site-specific recommendation use the Erosion Control Materials Design Software (ECMDS) for help in selection a RevetMax System and fastening details.
Visit **www.ECMDS.com**. for more information.

Recreational Lake, Tampa, Florida

The wind and waves from boats and other marine vehicles took a toll on the shorelines of a recreational lake. To combat further erosion, the ShoreMax Transition Mat was installed over high-tensile strength TRMs. Together, they protected the shore and offered low maintenance, easy entry for pedestrians and safe small boat launches.

Dry Creek, Healdsburg, California

Storm water runoff from an old sand and gravel yard threatened Dry Creek, a spawning area for steelhead trout and Coho salmon. Typically, a shelf would be built 40 ft (12 m) above the water, and 24-30 in. (600-800 mm) riprap installed to reduce storm water impact. Officials, concerned the rock could be undermined and end up in the creek, decided to find another solution. After the ground was graded, seeded and covered with North American Green® BioNet® C125™ Erosion Control Blanket (ECB), our ShoreMax Transition Mat was placed on top. Within four months, vegetation had grown in and there was no displacement, despite above-normal rainfall.

SEDIMAX™
SEDIMENT RETENTION

Unprotected topsoil, particularly on slopes and construction sites, is vulnerable to erosion and runoff problems. Significant damage can occur until these areas are ready for permanent erosion control. The SediMax™ System can help prevent such damage and save millions spent on restoring slopes, rebuilding drainage channels and dredging ponds and streams.

SEDIMAX-FR™ FILTRATION ROLLS

North American Green® SediMax-FR™ (Filtration Rolls) create a temporary, three-dimensional sediment filtration structure perfect for forest fire rehabilitation, bioengineering projects, construction sites, ski slopes, wetland mitigation and other applications where storm water runoff is a concern. The 100% biodegradable product is made with a 70% straw and 30% coconut-fiber matrix reinforced with biodegradable netting rolled edge to edge. Other important benefits include:

- Up to 98% effective at reducing sediment migration
- 100% biodegradable
- Assists with environmental regulation compliance
- Helps earn points toward Leadership in Energy and Environmental Design® (LEED) Green Building Rating System™ project certification goals
- Can be incorporated with live planting, live staking and seeding
- Encasement net flexibility minimizes accidental wildlife entrapment

SEDIMAX-SW™ STRAW WATTLES

North American Green® SediMax-SW™ (Straw Wattles) are economical alternatives to silt fence and straw bales for sediment control and storm water runoff. They can be staked along the contour of newly constructed or disturbed slopes, wrapped around storm drain inlets and used as check dams on slopes and in swales and grass waterways. Straw wattles are recycled, compressed, agricultural straw cylinders wrapped in photodegradable synthetic netting.

INSTALLATION: ON A ROLL

Our SediMax System products are a snap to install. SediMax-FR are positioned, rolled out, re-rolled from edge to edge, and secured with wooden stakes; SediMax-SW are laid out, staked and can be used individually or tied together to achieve any length.

Roanoke, Virginia

Along the roadside of a construction site, North American Green® VMax® C350® composite Turf Reinforcement Mat (TRM) and North American Green® BioNet® S150™ Erosion Control Blanket (ECB) protected the nearby channels from erosion, filtered sediment and aided vegetation establishment.

Wenatchee National Forest, Chelan, Washington

After a forest fire in Wenatchee National Forest, the SediMax System SediMax-FR was used to trap silty, ashy soil while allowing water to pass through, greatly reducing soil migration into waterways.

Installation Made Easy

Choosing the right solution is half the battle against costly erosion. The other half is proper installation. we provide all the tools and instructions you need for quick, effective RECP installation tailored to your site.

- North American Green® Earth Anchors™ increase the veneer's mechanical strength by reaching deep into the soil strata for enhanced anchoring in the worst conditions. Earth Anchors can be used to permanently secure VMax® Turf Reinforcement Mats or RevetMax™ Flexible Revetment System products.
- Our fastener options include wire staples, the PinPounder installation tool, rebar stakes, ShoreMax® high-impact plastic stakes, environmentally friendly North American Green® BioSTAKEs® and our wooden EcoSTAKEs®.

Proper staple patterns must be used to achieve optimal results in RECP installation. We recommend the following general stapling patterns as guidance for use with our RECPs as seen in the illustration below (Figure 1). Site specific staple pattern recommendations based on soil type and severity of application may be acquired through North American Green® Erosion Control Materials Design Software (ECMDS®). Consult the full system of Installation Guides for complete installation instructions.

EXPERIENCE YOU CAN RELY ON

North American Green is the industry leader in providing comprehensive erosion and sediment control and turf reinforcement solutions. Our integrated systems and products were developed to ensure absolute customer satisfaction. Our products are backed by the most thorough quality assurance practices in the industry. And, we provide comprehensive design assistance for all of our systems.

For more information about North American Green Erosion Control Systems, visit **nagreen.com**, e-mail **customerservice-nag@nagreen.com** or call **800-772-2040**. We are happy to assist you in developing solutions for all of your erosion and sediment control and turf reinforcement projects.

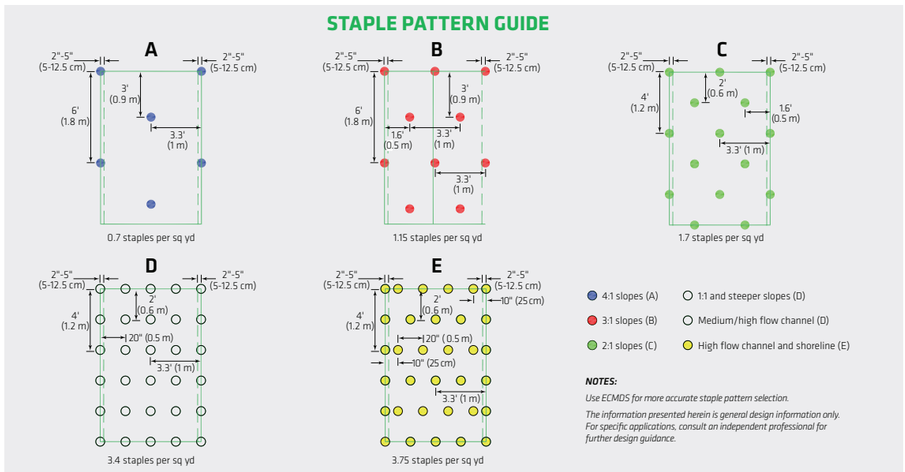


FIGURE 1

North American Green
5401 St. Wendel-Cynthiana Road
Poseyville, Indiana 47633

nagreen.com
800-772-2040

Distributed by:

©2017, North American Green is a registered trademark. Certain products and/or applications described or illustrated herein are protected under one or more U.S. patents. Other U.S. patents are pending, and certain foreign patents and patent applications may also exist. Trademark rights also apply as indicated herein. Final determination of the suitability of any information or material for the use contemplated, and its manner of use, is the sole responsibility of the user. Printed in the U.S.A.

GEN_EC_BRO_2.16

Product Description

Curlex® NetFree™

100% Biodegradable Erosion Control Blankets

American Excelsior Company is constantly researching new ideas to meet the needs of the ever-changing erosion control industry. Our latest innovation is Curlex NetFree - The first erosion control blanket (ECB) that does not use any netting material.

The manufacturing of Curlex NetFree begins with choosing the finest Great Lakes aspen. After the material is methodically shaved, the resulting Curlex excelsior fibers are stitched to form a continuous matrix. Biodegradable thread is used in the process, which makes the entire Curlex NetFree product biodegradable. Curlex NetFree loses the net, but keeps the unique and time proven benefits of the Curlex fiber.

Material Characteristics

Curlex NetFree is manufactured from Great Lakes aspen and is designed to provide protection for grass seed and topsoil from wind and water erosion, while simultaneously promoting ideal growing conditions.

Benefits of Curlex NetFree

- No more entrapment of wildlife or pets
- No more netting tangled in mowing equipment
- No more worries about future environmental risks - ***Curlex NetFree is 100% biodegradable***
- No more tripping on netting
- No more waiting for netting to decompose

Performance Capabilities

SLOPES	3H:1V & flatter
CHANNELS	48 Pa (1 lb/ft^2)

Typical Applications

Golf courses, residential projects, environmentally sensitive, commercial development, highway construction, urban drainage, slope stabilization, or other areas that do not want to deal with the potential headaches associated with ECB netting.

American Excelsior Company®
Earth Science Division
Arlington, Texas (800) 777-SOIL • www.curlex.com

MADE IN THE U.S.A.

American Excelsior Company®
Earth Science Division

Curlex® NetFree™

100% Biodegradable Erosion Control Blanket

SUGGESTED SPECIFICATIONS

General

Fibers in Curlex NetFree shall be evenly distributed over its entire area and 80% of the fibers shall be six inches or longer with consistent thickness. Biodegradable stitching shall be used to form the continuous matrix of Curlex fibers. The blanket shall be naturally seed free and not contain any foreign weed seed, chemical additives, tackifiers, or paper products that could hinder grass growth, establish unwanted evasive weed species or shorten necessary erosion protection time periods.

Product

Fiber	Great Lakes Aspen Excelsior with no weed seeds. Curled, interlocking fibers with barbed edges
Fiber Size	80% of fibers a minimum of 6 in (15.2 cm) long 0.038 in wide x 0.018 in thick (0.97 mm wide x 0.46 mm thick)
Mass per Unit Area[a]	0.73 lb/yd^2 (0.40 kg/m^2)
Thread Material	Biodegradable
Width	8.0 ft (2.4 m)
Length	90.0 ft (27.4 m)
Area	80.0 yd^2 (66.9 m^2)

[a]Weight is based on a dry fiber weight basis at time of manufacture. Baseline moisture content of Great Lakes Aspen Excelsior is 22%.

Installation

Before installing Curlex NetFree blankets, the seedbed shall be inspected by the Owner's Representative to ensure it has been properly compacted and fine graded to remove any existing rills. It shall be free of obstructions, such as tree roots, projections such as stones, and other foreign objects. The contractor shall proceed when satisfactory conditions are present. After the area has been properly shaped, seeded, fertilized, and compacted, locate the start of the roll, making sure the roll is facing toward the area to be covered, and then roll out the blanket. Blankets shall be rolled out flat, even, and smooth without stretching the material then anchored to the subgrade.

Slopes: Curlex NetFree blankets shall be installed vertically on the slope. If more than one width is required, a minimum two to four inch overlap should be used. Secure the outer most stitch of each adjoining blanket with a common row of staples. Curlex NetFree blankets shall be trenched at the head of the slope if the blanket cannot be extended three feet over the slope crest, or if overland flow is anticipated from upslope areas.

Channels: Curlex NetFree blankets shall be centered to offset a seam in the middle of the waterway. They shall be installed in the same direction as the water flow. Curlex NetFree blankets shall not be installed perpendicular to the direction of flow. The adjoining blankets shall be installed away from the center of channel and overlapped. Curlex NetFree installation shall continue up the side slopes and three feet over the crest to the flat of the final grade. Flanks exposed to runoff, or sheet flow, must be protected by a check slot. Curlex NetFree shall be trenched at the start of the channel and anchored using a staggered staple pattern at end of roll overlaps and end of roll terminations.

Disclaimer: Curlex NetFree is a system for erosion control and revegetation on slopes and channels. American Excelsior Company (AEC) believes that the information contained herein to be reliable and accurate for use in erosion control and re-vegetation applications. However, since physical conditions vary from job site to job site and even within a given job site, AEC makes no performance guarantees and assumes no obligation or liability for the reliability or accuracy of information contained herein for the results, safety, or suitability of using Curlex NetFree, or for damages occurring in connection with the installation of any erosion control product whether or not made by AEC or its affiliates, except as separately and specifically made in writing. These specifications are subject to change without notice.

MADE IN THE U.S.A.

If you would like to receive more information or consult with one of our Customer Care Center Specialists, please call us toll free at (888-352-9582)
PDF download specifications available in the Technical Support Library at www.curlex.com

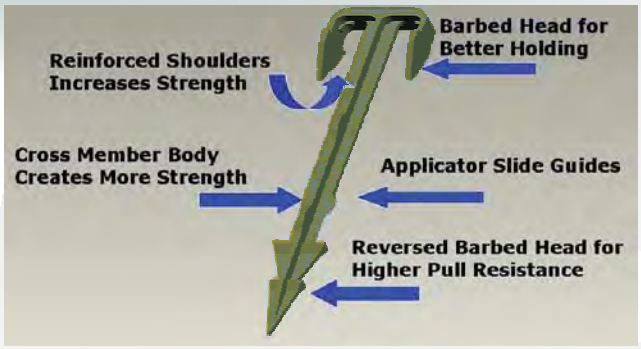
Product Description

E-STAPLE® & E-STAPLER™

A new biodegradable anchoring staple and installation system

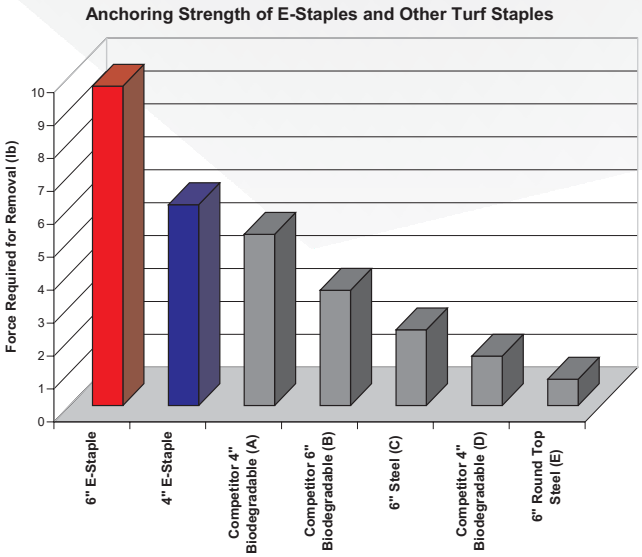
Staple Features

- 100% Biodegradable in cold (43˚F) to hot (180˚) conditions
- Water resistant and do not soften from moisture during storage
- Barbed shoulders and head for superior holding capabilities
- More environmentally friendly than wire staples



Staple Applications

- Wetland and irrigation areas
- Coastal projects
- Golf course construction
- Airport construction
- Environmentally sensitive projects
- Mowing applications
- Use with Curlex® NetFree™ for a 100% biodegradable project



Staple Certifications

- 100% biodegradation from bacteria (In accordance to ASTM 5338 and ASTM 5271)

Staple Packaging

- Available In 4 and 6 inch lengths
- Carton of 500 or 1,000

Stapler Features

- Greatly expedites installation of 4 and 6 inch E-STAPLES
- Light weight and easy to use
- Should be used for best results in hard soils

American Excelsior Company®
Earth Science Division
Arlington, Texas (800) 777-SOIL • www.curlex.com

Disclaimer: E-STAPLE is a system for providing a biodegradable anchor. American Excelsior Company (AEC) believes that the information contained herein to be reliable and accurate for use in erosion control anchoring applications. However, since physical conditions vary from job site to job site and even within a given job site, AEC makes no performance guarantees and assumes no obligation or liability for the reliability or accuracy of information contained herein for the results, safety, or suitability of using E-STAPLE, or for damages occurring in connection with the installation of any erosion control product whether or not made by AEC or its affiliates, except as separately and specifically made in writing. These specifications are subject to change without notice.

MADE IN THE U.S.A.

If you would like to receive more information or consult with one of our Customer Care Center Specialists, please call us toll free at (888-352-9582)
PDF download specifications available in the Technical Support Library at www.curlex.com

Form#058/072009E

American Excelsior Company®
Earth Science Division

Proud Participant in NTPEP and Proud Member of:

CURLEX® NetFree™ EROSION CONTROL BLANKETS INSTALLATION GUIDELINES

Before installing Curlex NetFree blankets, the seedbed shall be inspected by the Owner's Representative to ensure it has been properly compacted and fine graded to remove any existing rills. It shall be free of obstructions, such as tree roots, projections such as stones, and other foreign objects. The contractor shall proceed when satisfactory conditions are present. After the area has been properly shaped, seeded, fertilized, and compacted, remove the Curlex NetFree protective cover. Next, locate the start of the roll, making sure the roll is facing toward the area to be covered, and then roll out the product. The product shall be rolled out flat, even, and smooth without stretching the material then anchored to the subgrade. Staples should be located on a stitch line.

Slopes: Curlex NetFree blankets are to be installed vertically on the slope; however, on short slopes it may be more practical to install horizontally across the width of the application when agreed upon by the Engineer prior to installation. If more than one width is required, a minimum two-inch overlap should be used. Secure the outer most stitch of each blanket with a common row of staples. Curlex NetFree blankets shall be trenched at the head of the slope if the blanket cannot be extended three feet over the slope crest or if overland flow is anticipated from upslope areas.

Channels: Curlex NetFree blankets shall be centered to offset a seam in the middle of the waterway. They shall be installed in the same direction as the water flow. The adjoining blankets shall be installed away from the center of channel and overlapped. Blanket installation should continue up the side slopes three feet above the anticipated high water elevation. Flanks exposed to runoff, or sheet flow, must be trenched in. Curlex NetFree erosion control blankets shall be trenched at the start of the channel. Curlex NetFree shall be anchored using a staggered staple pattern at end of roll overlaps and end of roll terminations.

Disclaimer: Curlex NetFree is a system for erosion control and revegetation on slopes and channels. American Excelsior Company (AEC) believes that the information contained herein to be reliable and accurate for use in erosion control and re-vegetation applications. However, since physical conditions vary from job site to job site and even within a given job site, AEC makes no performance guarantees and assumes no obligation or liability for the reliability or accuracy of information contained herein for the results, safety, or suitability of using Curlex NetFree, or for damages occurring in connection with the installation of any erosion control product whether or not made by AEC or its affiliates, except as separately and specifically made in writing. These guidelines are subject to change without notice.

850 Avenue H East | Arlington, Texas 76011
Phone 1-800-777-SOIL | Fax 817-385-3585 | www.Curlex.com

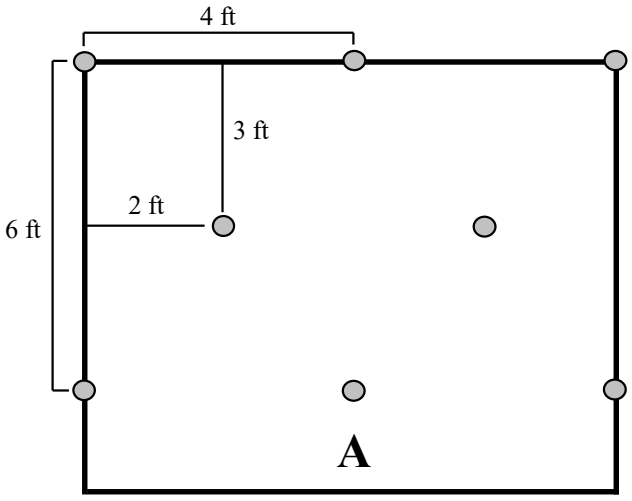
American Excelsior Company®
Earth Science Division

Proud Participant in NTPEP and Proud Member of:

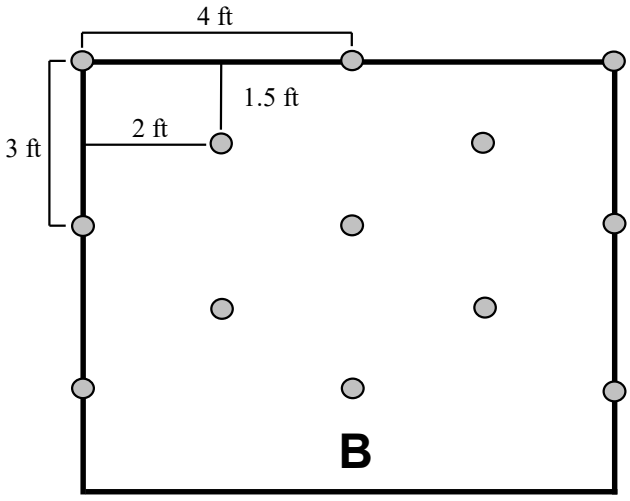
Curlex® NetFree™ Staple Pattern Guide

Application	Slope		Channel
	≤ 4H:1V	≤ 3H:1V	≤ 1.0 lb/ft^2 (48 Pa) Shear Stress ≤ 3.0 ft/sec (0.9 m/sec) Velocity
Staple Pattern	A	B	C

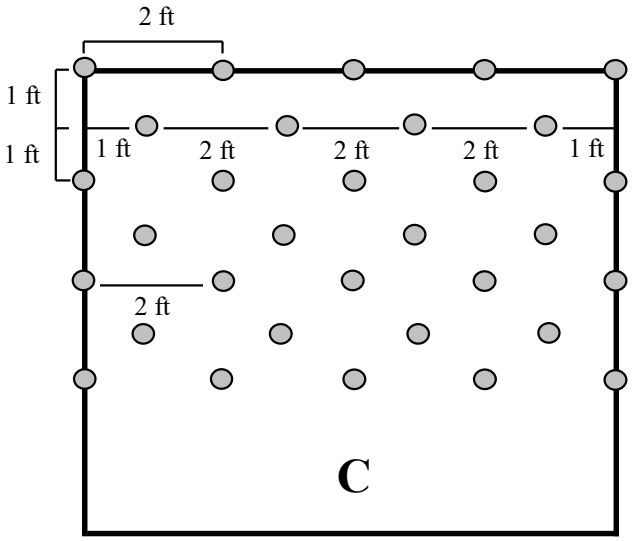
= Staple Placement



0.9 Staples/yd^2



1.9 Staples/yd^2

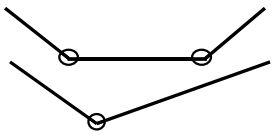


4.8 Staples/yd^2

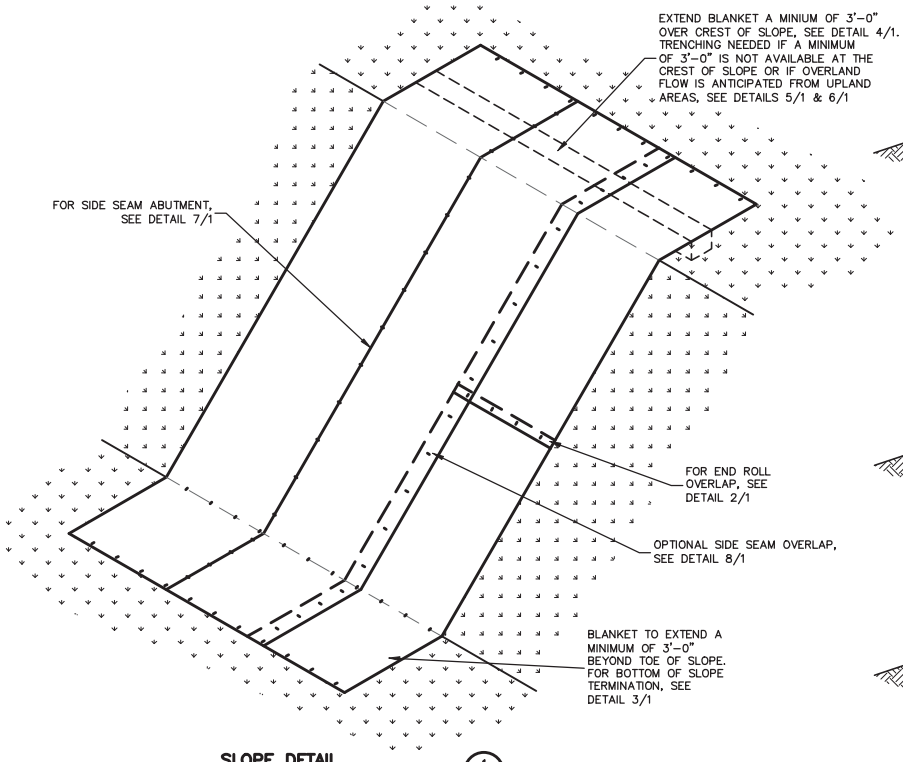
Notes:

1. Recommended staples are a minimum 4 in long 100% biodegradable E-Staple®, as provided by American Excelsior Company, for cohesive soils and 6 in long 100% biodegradable E-Staple®, as provided by American Excelsior Company, for non-cohesive soils.
2. Staples shall be placed on a stitch line and for best results insert staples so heads are parallel to the flow of water.
3. Adjust staple pattern so staples are placed in critical channel points (e.g. slope interface, channel bottom) as illustrated below:

Critical channel points are circled.



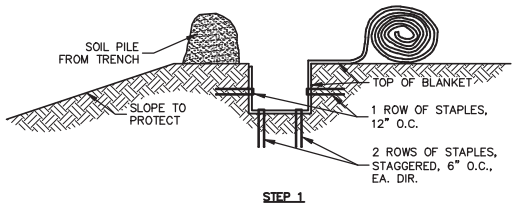
850 Avenue H East | Arlington, Texas 76011
Phone 1-800-777-SOIL | Fax 817-385-3585 | www.Curlex.com



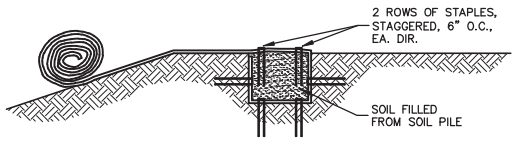
SLOPE DETAIL (1/1)
NO SCALE

OVER SLOPE CREST METHOD (4/1)
NO SCALE

DO NOT NEED TO TRENCH BLANKET IN IF IT CAN BE EXTENDED A MINIMUM OF 3'–0" OVER THE CREST OF THE SLOPE.

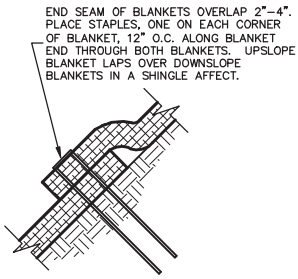


STEP 1

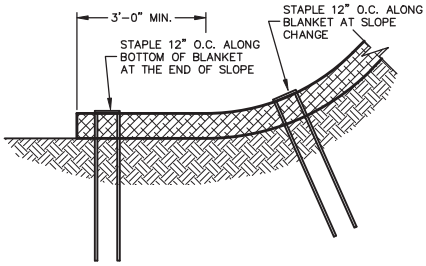


STEP 2

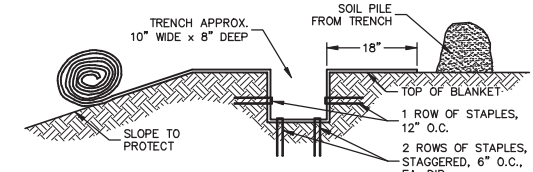
SLOPE TRENCHING METHOD "A" (5/1)
NO SCALE



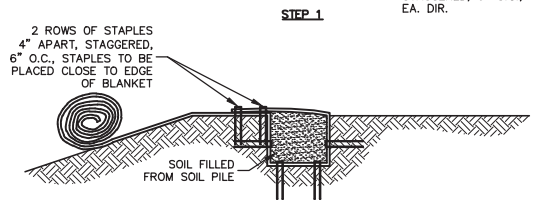
END ROLL OVERLAP (2/1)
NO SCALE



BOTTOM OF SLOPE TERMINATION (3/1)
NO SCALE



STEP 1



STEP 2

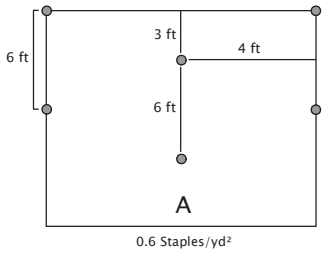
SLOPE TRENCHING METHOD "B" (6/1)
NO SCALE

Curlex® Staple Pattern Guide

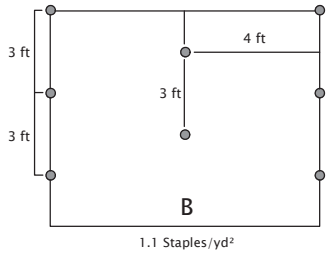
For 8 ft wide Curlex Erosion Control Blankets
Adjust horizontal staple spacing for 4 ft and 16 ft wide Curlex Erosion Control Blankets

Application	Slope		
	≤ 4H:1V	≤ 3H:1V	≤ .5H:1V
Staple Pattern	A	B	C

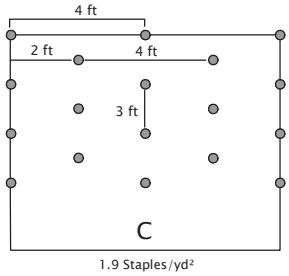
● = Staple Placement



0.6 Staples/yd²



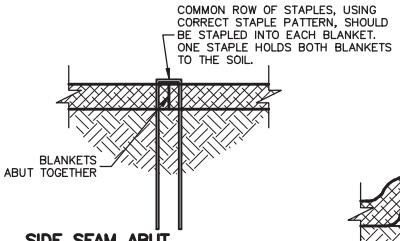
1.1 Staples/yd²



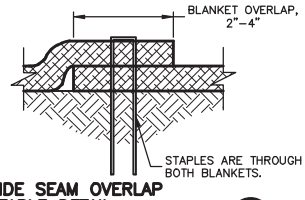
1.9 Staples/yd²

Notes:

1. Recommended staples are minimum 4 in biodegradable E-Staple®, as provided by American Excelsior Company, or 6 in wire for cohesive soils and 6 in biodegradable E-staple®, as provided by American Excelsior Company, or 8 in wire for non-cohesive soils.
2. For best results insert staples so heads are parallel to the flow of water.



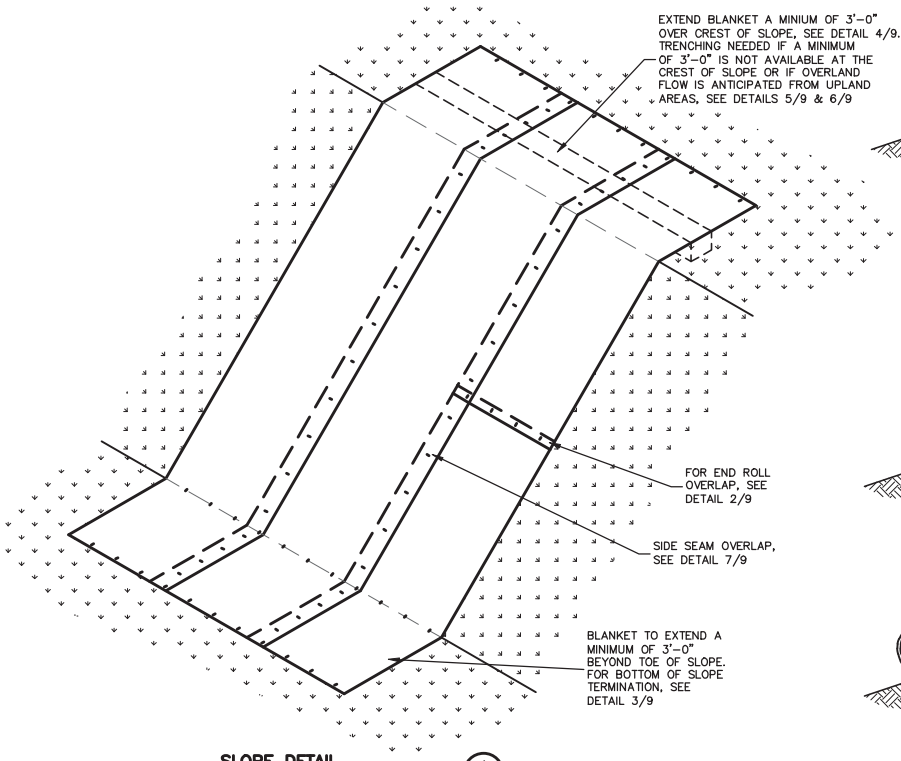
SIDE SEAM ABUT STAPLE DETAIL (7/1)
NO SCALE



SIDE SEAM OVERLAP STAPLE DETAIL (8/1)
NO SCALE

American Excelsior Company®
Earth Science Division

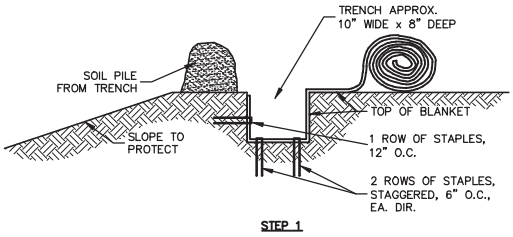
AMERICAN EXCELSIOR COMPANY ARLINGTON, TEXAS	SHEET DESCRIPTION CURLEX® SLOPE APPLICATION DETAIL	DATE 03/01/18	DRAWN BY
		SCALE NONE	PROJECT NO.
			SHEET NO. 1



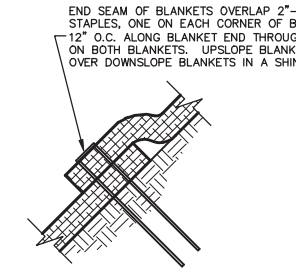
SLOPE DETAIL 1/9
NO SCALE

OVER SLOPE CREST METHOD 4/9
NO SCALE

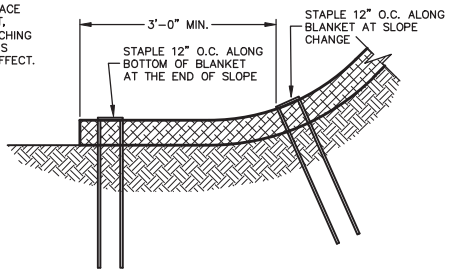
DO NOT NEED TO TRENCH BLANKET IN IF IT CAN BE EXTENDED A MINIMUM OF 3'-0" OVER THE CREST OF THE SLOPE.



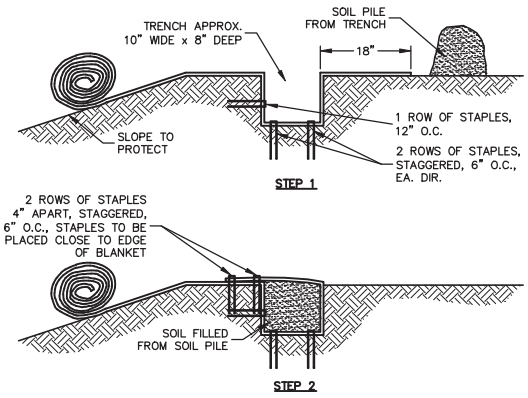
SLOPE TRENCHING METHOD "A" 5/9
NO SCALE



END ROLL OVERLAP 2/9
NO SCALE



BOTTOM OF SLOPE TERMINATION 3/9
NO SCALE

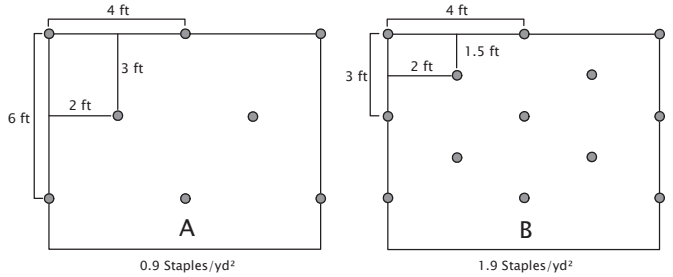


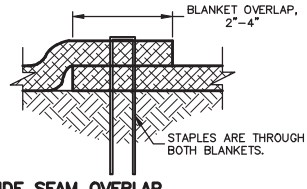
SLOPE TRENCHING METHOD "B" 6/9
NO SCALE

Curlex® NetFree™ Staple Pattern Guide

Application	Slope	
	≤ 4H:1V	≤ 3H:1V
Staple Pattern	A	B

● = Staple Placement





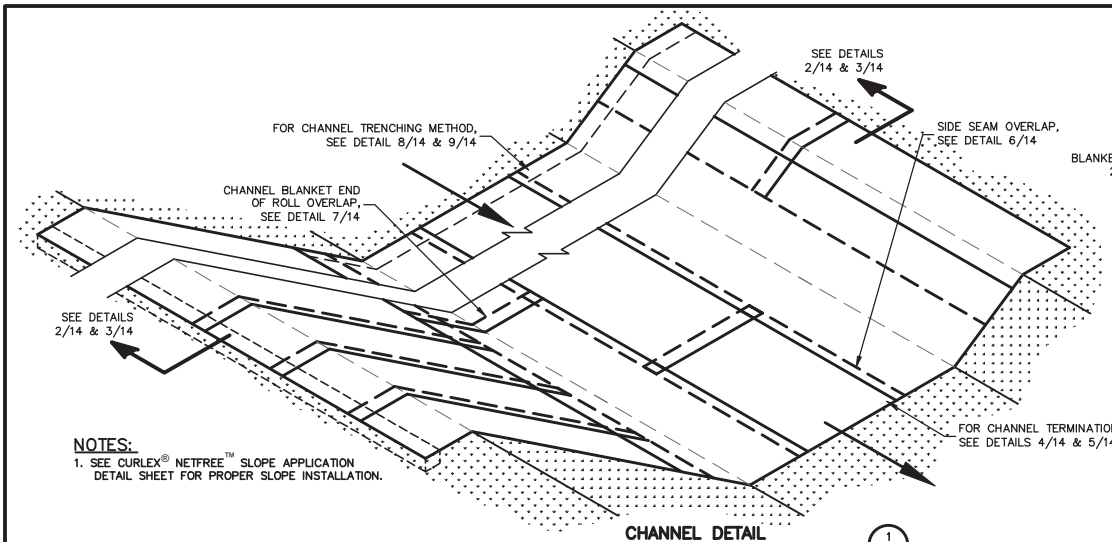
SIDE SEAM OVERLAP STAPLE DETAIL 7/9
NO SCALE

Notes:

1. Recommended staples are minimum 4 in long 100% biodegradable E-Staple®, as provided by American Excelsior Company, for cohesive soils and 6 in long 100% biodegradable E-staple®, as provided by American Excelsior Company, for non-cohesive soils.
2. Staples shall be placed on a stitch line and for best results insert staples so heads are parallel to the flow of water.

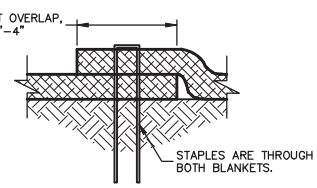
American Excelsior Company®
Earth Science Division

AMERICAN EXCELSIOR COMPANY ARLINGTON, TEXAS	SHEET DESCRIPTION CURLEX® NETFREE™ SLOPE APPLICATION DETAIL	DATE 03/01/18	DRAWN BY	
		SCALE NONE	PROJECT NO.	SHEET NO. 9

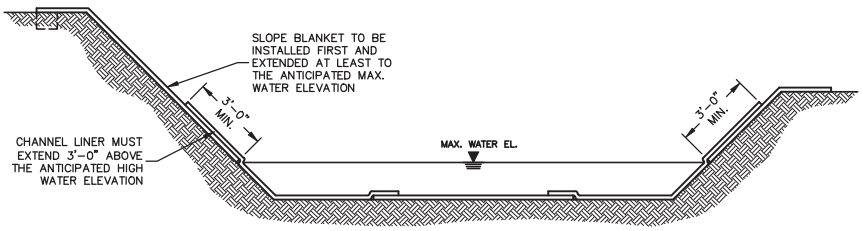


NOTES:
1. SEE CURLEX® NETFREE™ SLOPE APPLICATION DETAIL SHEET FOR PROPER SLOPE INSTALLATION.

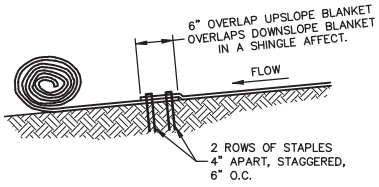
CHANNEL DETAIL — NO SCALE — 1/14



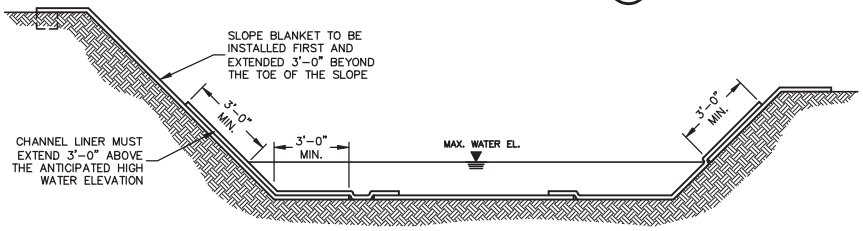
SIDE SEAM OVERLAP STAPLE DETAIL — NO SCALE — 6/14



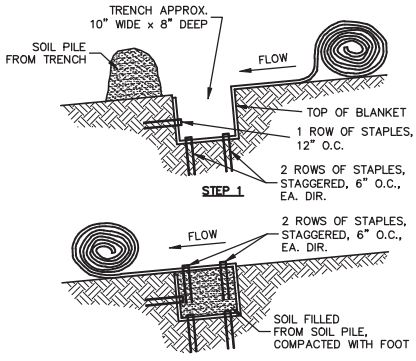
CHANNEL INSTALLATION METHOD "A" — NO SCALE — 2/14



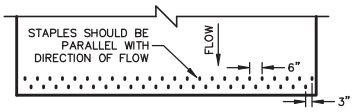
CHANNEL BLANKET END OF ROLL OVERLAP — NO SCALE — 7/14



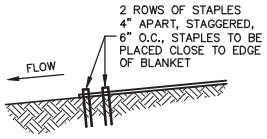
CHANNEL INSTALLATION METHOD "B" — NO SCALE — 3/14



CHANNEL TRENCHING METHOD "A" — NO SCALE — 8/14



CHANNEL TERMINATION PLAN — NO SCALE — 4/14

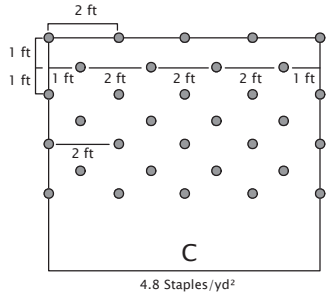


CHANNEL TERMINATION — NO SCALE — 5/14

Curlex® NetFree™ Staple Pattern Guide

	Channel
Application	≤ 1.0 lb/ft² (48 Pa) Shear Stress ≤ 3.0 ft/sec (0.9 m/sec) Velocity
Staple Pattern	B

● = Staple Placement

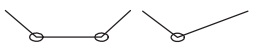


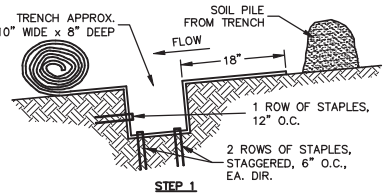
4.8 Staples/yd²

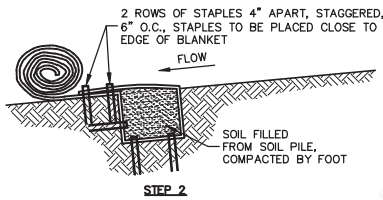
Notes:

1. Recommended staples are minimum 4 in long 100% biodegradable E-Staple®, as provided by American Excelsior Company, for cohesive soils and 6 in long 100% biodegradable E-staple®, as provided by American Excelsior Company, for non-cohesive soils.
2. Staples shall be placed on a stitch line and for best results insert staples so heads are parallel to the flow of water.
3. Adjust staple pattern so staples are placed in critical channel points (e.g. slope interface, channel bottom) as illustrated below:

Critical channel points are circled.







CHANNEL TRENCHING METHOD "B" — NO SCALE — 9/14

American Excelsior Company®
Earth Science Division

AMERICAN EXCELSIOR COMPANY ARLINGTON, TEXAS	SHEET DESCRIPTION CURLEX® NETFREE™ CHANNEL APPLICATION DETAIL	DATE 03/01/18 SCALE NONE	DRAWN BY PROJECT NO. SHEET NO. 14

PLANTING ACORNS

1. TOOLS & MATERIALS:
- STAPLER – FOR ASSEMBLING SINGLE–SHEET TUBE TYPE SHELTERS BEFORE PLANTING DAY
- HOLE PUNCH – FOR ASSEMBLING TWO–PART SLEEVE TYPE SHELTERS BEFORE PLANTING DAY (TAKE OUT INTO FIELD ON PLANTING DAY IN CASE HOLE LOCATIONS NEED TO BE ADJUSTED)
- FLAGS
- ROUND–NOSED SHOVELS
- DIGGING BARS
- ACORNS (USE ACORNS LOCAL TO THE AREA TO BE PLANTED)
- BLUE–X SHELTERS (ONE PART OR TWO PARTS)
- STAKES – SHOULD BE SEVERAL INCHES LONGER THAN SHELTER, STURDY BUT NOT TOO WIDE AS THEY WILL EITHER BE INSERTED INTO THE OVERLAP OF THE SINGLE–SHEET TUBE TYPE SHELTER OR ON THE INSIDE OF THE TWO–PART SLEEVE TYPE SHELTER.
- TIES OR BINDER CLIPS DEPENDING ON BLUE–X DESIGN
- PERMANENT MARKERS TO MARK ACORN NAME ON EACH SHELTER
- MALLETS TO DRIVE IN STAKES
- MULCH (WOOD CHIP OR NATIVE DUFF)
- WHEELBARROWS TO MOVE MULCH
- BUCKETS TO MOVE MULCH

2. BLUE–X SHELTERS SHOULD BE ASSEMBLED BEFORE PLANTING DAY. FOLLOW MANUFACTURES INSTRUCTIONS. DEPENDING ON THE DESIGN, THE ASSEMBLY CONSISTS OF THE FOLLOWING:
- SINGLE SHEETS PRINTED WITH "BLUE–X" – ROLL THE SHEET, OVERLAP AND STAPLE PER THE DIRECTIONS. FIVE OF THESE ROLLED TUBES CAN BE SLIPPED INTO EACH OTHER FOR EASY STORAGE AND CARRIED OUT TO THE FIELD IN A BOX. THE PERSON DISPENSING THE ACORNS ON THE PLANTING DAY CAN PULL OUT THE SHELTERS, SLIP A STAKE INTO THE OVERLAP IN EACH SHELTER, ATTACH A BINDER CLIP, AND MARK THE SHELTER WITH THE COMMON NAME OF THE OAK SPECIES TO BE PLANTED.
- TWO–PART SHELTERS – ROLL CLEAR BLUE SHEET, SLIP INTO LIGHT BLUE SLEEVE, PINCH SIDES OF SHELTER AND PUNCH 2 HOLES NEAR THE TOP AND 2 HOLES MIDWAY DOWN. MAKE SURE THE HOLES ARE PLACED PROPERLY TO ALLOW ATTACHING A STAKE ON THE INSIDE OF THE SHELTER; REMEMBER THE BOTTOM OF THE SHELTER WILL BE BURIED APPROXIMATELY 2".

3. ON PLANTING DAY:
- FIND FLAGS MARKING ACORN SITE.
- LOOSEN SOIL ONE SHOVEL DEEP AND ONE SHOVEL WIDE. REPLACE LOOSE SOIL INTO HOLE.
- HOLLOW OUT PLANTING HOLE FIST DEEP AND WIDE IN LOOSE SOIL.
- GET 2 ACORNS ACCORDING TO FLAG TYPE (INDICATING SPECIES OR GROUP), BLUE–X, STAKE, AND TIE/BINDER CLIP. PLACE THE ACORNS HORIZONTALLY. IF ANY OF THE ACORNS HAVE GERMINATED AVOID BREAKING THE ROOT TIP AND POSITION THE ROOT TIP FACING DOWN.
- COVER THE ACORNS WITH FINE SOIL UP TO GROUND LEVEL AND GENTLY HAND TAMP DOWN.
- IF FOLLOW UP WATERING IS PLANNED BUILD UP A SOIL BERM 4" ABOVE THE SOIL GRADE TO FORM A 2 FOOT DIAMETER WATERING BASIN.
- IF NOT USING BLUE–X SKIP NUMBER 8.
- CENTER AND SINK BLUE–X SHELTER, POUND IN AND CLIP STAKE. DEPENDING ON THE BLUE–X DESIGN, THE STAKE WILL EITHER BE SLIPPED INTO THE SLEEVE OF THE OVERLAPPED ENDS OF THE BLUE–X SHEET, OR SHOULD BE POUNDED ON THE INSIDE OF THE TUBE (TO PREVENT LIZARDS AND MICE FROM CLIMBING UP FROM THE OUTSIDE AND GETTING STUCK ON THE INSIDE) AND ATTACHED TO THE SHELTER WITH TIES THROUGH HOLES ALREADY PUNCHED NEAR THE TOP AND THE BOTTOM OF THE SHELTER.
- MULCH A TWO FOOT DIAMETER CIRCLE AROUND THE BLUE–X OR PLANTING SITE TO A DEPTH OF 1 TO 2 INCHES.

4. WE USUALLY DON'T WATER ACORNS AT THE TIME OF PLANTING . WE LET THE RAINS STIMULATE THEM TO GERMINATE.

REGIONAL OPEN SPACE

PLANTING ACORNS SPECIFICATION

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\1A planting acorns.dwg

PLANTING CONTAINER STOCK

1. PLANTS SHOULD BE NATIVE TO THE LOCAL AREA AND COME FROM REGIONAL STOCK. SPECIES AND SUPPLIER SHOULD BE APPROVED BY THE SENIOR RESOURCE MANAGEMENT SPECIALIST OR DESIGNEE.

2. SOIL IN PLANT CONTAINERS SHOULD BE WATERED AND REMAIN MOIST PRIOR TO THE INSTALLATION OF PLANTS.

3. AUGER OR DIG A HOLE AT LEAST 12" WIDE BY 12" DEEP FOR CONTAINERS UP TO 1 GALLON AND 12" WIDE BY 16" DEEP FOR CONTAINERS OVER A GALLON. IN ALL CASES THE HOLE SHOULD BE DEEP ENOUGH TO ACCEPT THE ROOT BALL AND ALSO PROVIDE A LOOSENED AREA OF SOIL AROUND THE ROOTS. SCARIFY THE SIDES AND BOTTOM OF THE HOLE PRIOR TO INSERTING THE PLANT.

4. REMOVE THE PLANT FROM THE CONTAINER WITH THE ROOT BALL INTACT. INSERT THE ROOT BALL IN THE HOLE WITHOUT BENDING OR DAMAGING THE ROOTS. POSITION THE PLANT UPRIGHT AND SO THE ROOT CROWN IS AT THE FINISHED GRADE.

5. BACK FILL THE PLANTING HOLE WITH MOIST, PULVERIZED NATIVE SOIL, MAKING GOOD SOIL CONTACT WITH THE ROOT BALL. COMPLETE BACKFILLING AT FINISHED GRADE, JUST COVERING THE ROOT CROWN.

6. CONSTRUCT A 36" DIAMETER, CIRCULAR, HAND COMPACTED, SOIL BERM AROUND SINGLE PLANTS AND A 48" DIAMETER BERM AROUND GROUPINGS OF 2 OR MORE PLANTS. THE BASIN LIP SHOULD BE 6" WIDE AT THE TOP AND 4" ABOVE THE BASIN GRADE. ON SLOPES THE BOTTOM OF THE BERM WILL NEED TO BE BUILT UP AND THE UPSLOPE SIDE OF THE BERM MAY NOT BE NEEDED.

7. IRRIGATE THE NEWLY INSTALLED PLANTS WITH 2 TO 3 GALLONS OF WATER TO SETTLE THE SOIL. IF THE ROOTS BECOME EXPOSED ADD MORE SOIL.

8. MULCH THE INSIDE OF THE BASINS WITH WOOD CHIPS OR LOCAL DUFF. USE STRAW MULCH OUTSIDE THE BASINS.

REGIONAL OPEN SPACE

PLANTING CONTAINER STOCK SPECIFICATION

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\1A planting container stock.dwg

PLANTING SEED

1. ON COMPACTED SOIL USE A RAKE OR MECHANICAL MEANS (SUCH AS RIPPERS, A DISC OR DRAG) TO BREAK UP THE SURFACE OF THE SOIL. ALL FURROWS CREATED SHOULD RUN ACROSS (PERPENDICULAR TO) THE GRADE. THIS REDUCES EROSION AND PREVENTS SEED FROM WASHING AWAY. IF LINEAR SWATHS ARE USED FOR EROSION CONTROL THEY SHOULD BE A MINIMUM OF 3 FEET WIDE AND BE SPACED A MAXIMUM OF 10 FEET APART. LOOSE SOIL NEED NOT BE DISTURBED.

2. TO CHOOSE SEED SEE SPECIFICATION EROSION CONTROL OPTIONS. SEED TYPE AND PROVIDER SHOULD BE APPROVED BY THE SENIOR RESOURCE SPECIALIST OR DESIGNEE. USE ONLY NATIVE SEED OR STERILE SEED.

3. SEED CAN BE SPREAD BY HAND OR BY A SEED SPREADER ON FOOT OR WITH AN ATV. NATIVE SEED SHOULD BE SOWN AT THE RATE OF 40 LBS. PER ACRE. THIS EQUATES TO APPROXIMATELY ONE HAND FULL OF SEED FOR EVERY 10 FOOT BY 3 FOOT WIDE SWATH.

4. AFTER SEEDING LIGHTLY RAKE OR DRAG THE SEEDED AREA. SEED SHOULD BE COVERED BY NO MORE THAN ¼" OF SOIL.

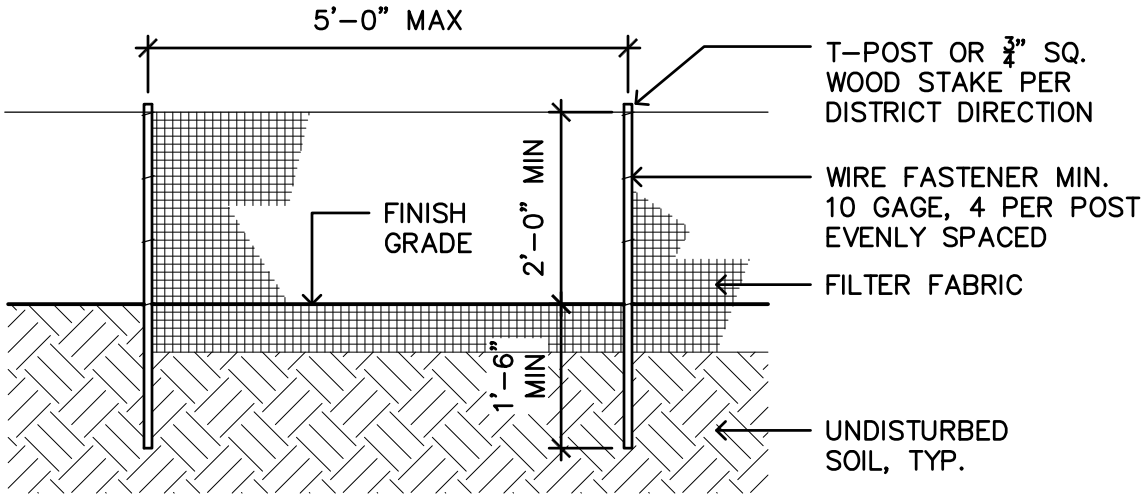
5. COVER WITH APPROXIMATELY 2" OF WEED FREE STRAW. CRIMP STRAW INTO SOIL WITH THE TIP OF A SHOVEL TO SECURE OR TRACK WALK IN WITH EQUIPMENT.

REGIONAL OPEN SPACE

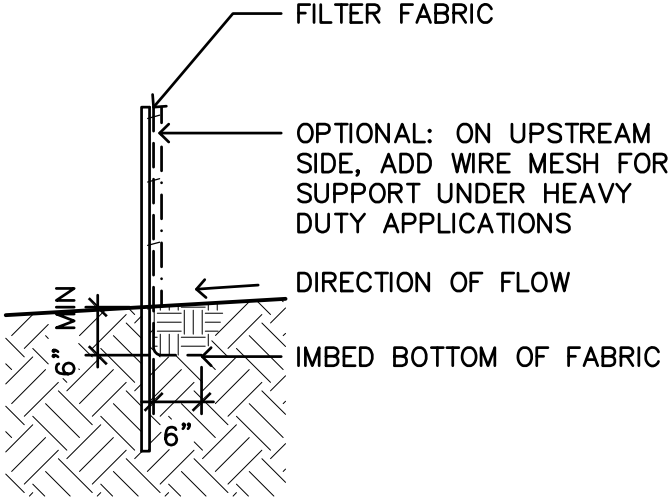
PLANTING SEED SPECIFICATION

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\1A planting seed.dwg

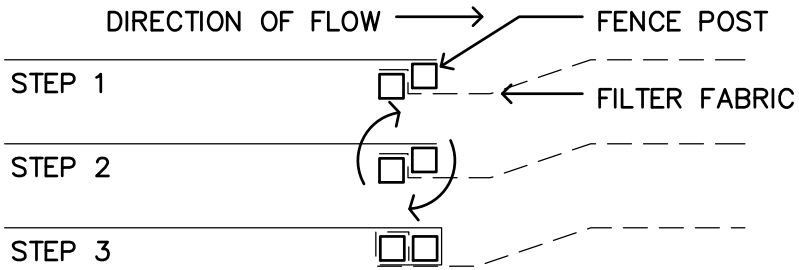


SECTION ELEVATION



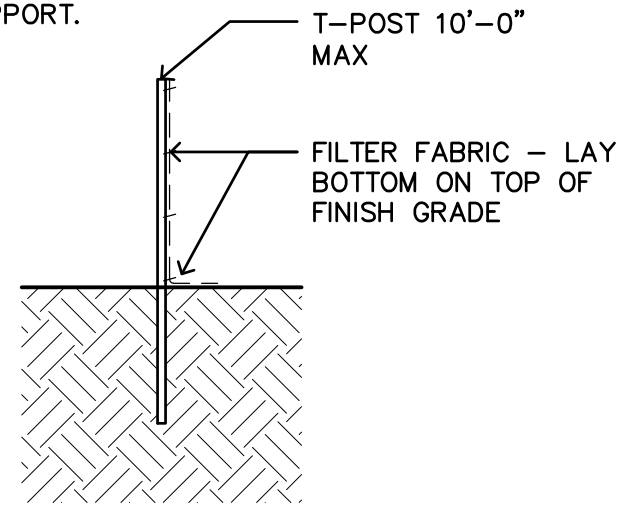
FABRIC ANCHOR DETAIL

NOTES:
1. 5' MAX. BETWEEN STAKES.
2. FABRIC TO FOLLOW CONTOURS OR TO BE INSTALLED IN "SMILES" (SEE SMILES DETAIL).
3. ALTERNATE MATERIAL: COMMERCIALLY AVAILABLE INTEGRATED FABRIC AND POST SYSTEM.
4. HEAVY DUTY APPLICATIONS: ADD WIRE MESH UPSTREAM SIDE OF FABRIC FOR SUPPORT.



ENLARGEMENT: ATTACHING TWO SILT FENCES TOGETHER (NOT TO SCALE)

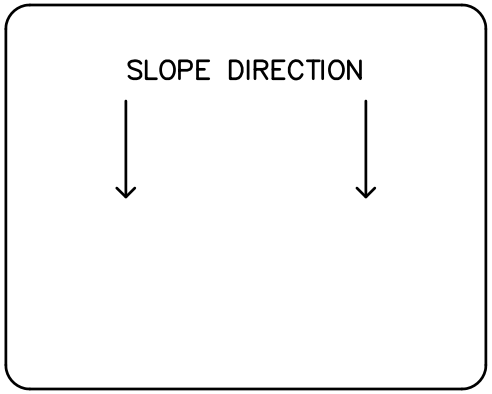
NOTES:
1. PLACE END POST OF SECOND FENCE INSIDE END POST OF FIRST FENCE.
2. ROTATE BOTH POSTS AT LEAST 180° CLOCKWISE TO CREATE TIGHT SEAL WITH FABRIC MATERIAL OVERLAP.
3. USE APPROVED FILTER FABRIC FOR SILT FENCE.

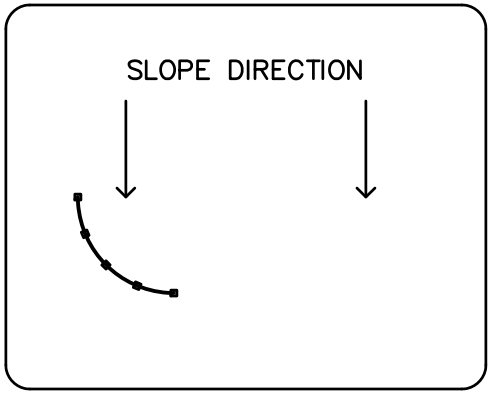


BOUNDARY FENCE ALTERNATE
(USED TO DEFINE PROJECT AREA)

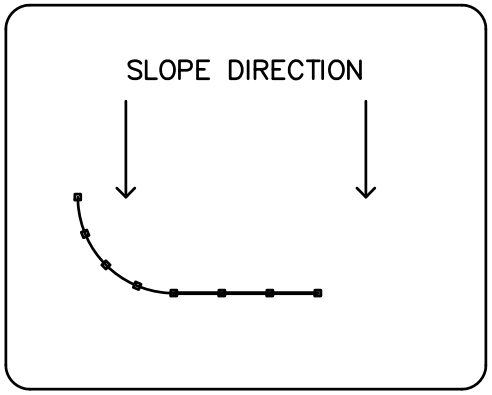
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		SILT FENCE & BOUNDARY FENCE ALTERNATIVE
SCALE: 1/2" = 1'-0"	DATE: 04/16/2015	

\\fileserv\shareall\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\1B Fence-Silt_Or_Boundary.dwg

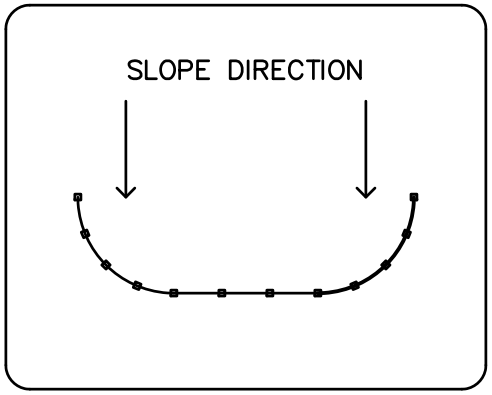




STEP 1 – CONSTRUCT LEG 1



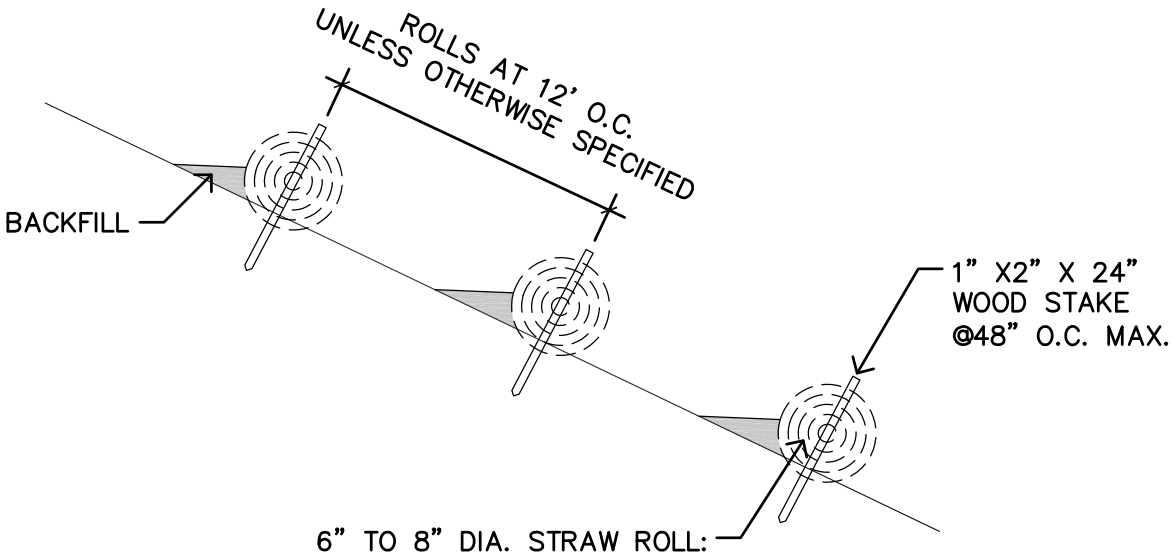
STEP 2 – CONSTRUCT DAM



STEP 3 – CONSTRUCT LEG 2

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		SILT FENCE TYPICAL PLACEMENT ON SLOPE "SMILES"
SCALE: 1/2" = 1'-0"	DATE: 10/2019	

\\fileserv\shareall\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\1B Fence-Silt_SlopePlacementSmiles.dwg



6" TO 8" DIA. STRAW ROLL:

- STRAW ROLLS SHALL BE MANUFACTURED FROM RICE STRAW AND WRAPPED IN BURLAP
- BIO-12 STRAW WATTLES BY CALIFORNIA STRAW WORKS OR EQUIVALENT;
- INSTALL PER MANUFACTURES RECOMMENDATIONS.

NOTES:

- LOCATION
  1) INSTALL AT BASE OF DISTURBED AREAS AND AT OUTLETS OF NEW OR RECONSTRUCTED REVERSE GRADES/ROLLING DIPS UNLESS OTHERWISE SPECIFIC;
  2) ROLLS TO EXTEND ACROSS ENTIRE WIDTH OF DISTURBED AREA UNLESS OTHERWISE SPECIFIED OR DIRECTED.
- PLACEMENT
  1) INSTALL PER MANUFACTURES RECOMMENDATIONS.
  2) ROLLS TO BE PLACED ON SLOPE CONTOUR;
  3) ADJACENT ROLLS TO OVERLAP; TURN ENDS OF ROLLS UP;
  4) RUNOFF MUST NOT BE ALLOWED TO RUN UNDER OR AROUND THE ROLL.

STRAW ROLL PLACEMENT

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\1B Straw roll placement.dwg

©TIMOTHY C. BEST, CEG

DETAILS AND SPECIFICATIONS GUIDELINES

SECTION 2

VEGETATION MANAGEMENT

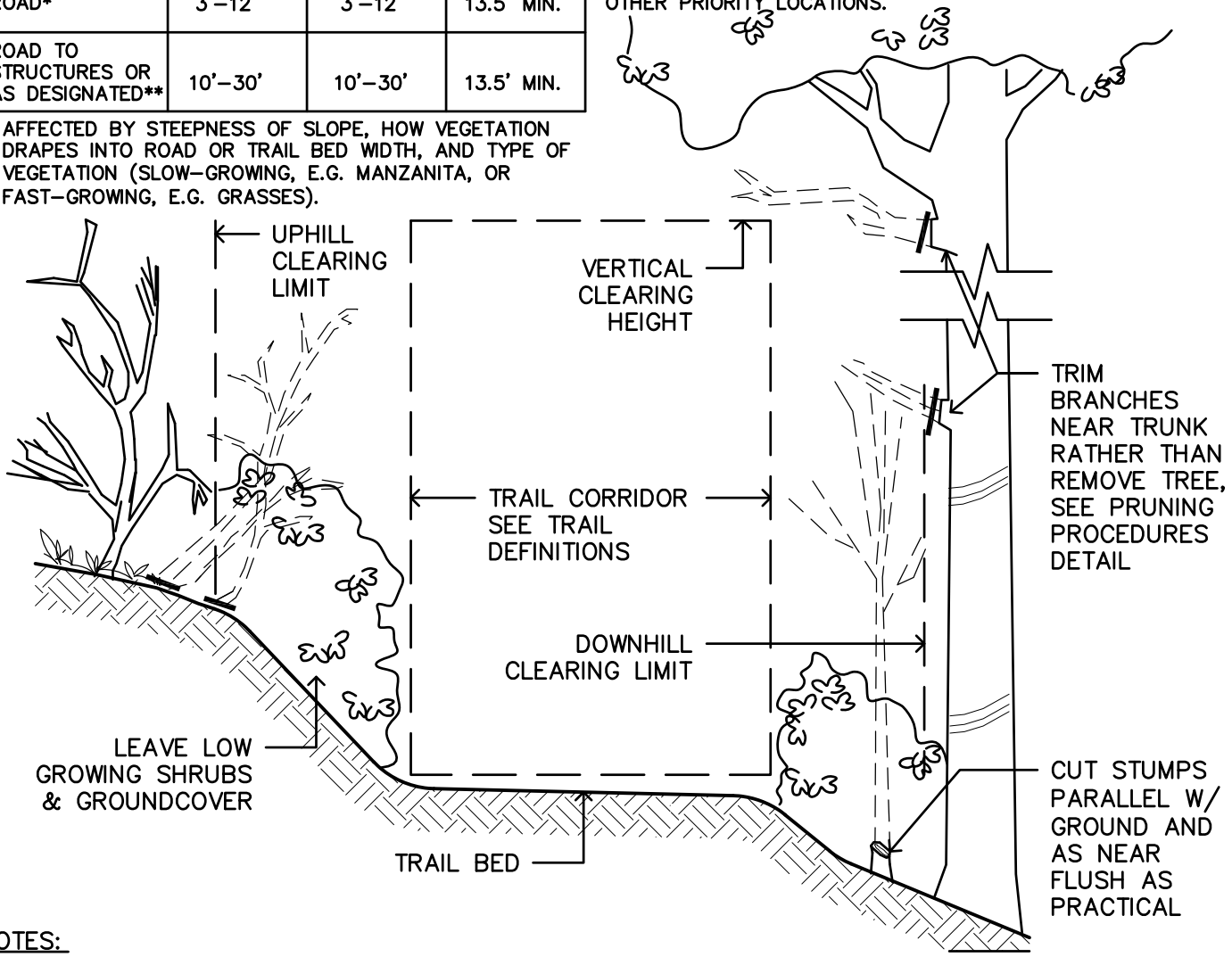
TABLE A: TYPICAL BRUSHING GUIDELINES

LOCATION/ TYPE OF TRAIL	UPHILL*	DOWNHILL*	HEIGHT OVER TRAIL AND ROAD BED
TYP., MULTI-USE, U.O.N.*	2'-4'	2'	10'
HIKING ONLY*	2'-4'	2'	8'
ROAD*	3'-12'	3'-12'	13.5' MIN.
ROAD TO STRUCTURES OR AS DESIGNATED**	10'-30'	10'-30'	13.5' MIN.

*AFFECTED BY STEEPNESS OF SLOPE, HOW VEGETATION DRAPES INTO ROAD OR TRAIL BED WIDTH, AND TYPE OF VEGETATION (SLOW-GROWING, E.G. MANZANITA, OR FAST-GROWING, E.G. GRASSES).

** IN AREAS WHERE FLAMES FROM VEGETATION WILL BE LESS THAN 8' HIGH (TYPICALLY GRASS, OAK WOODLANDS, OR FOREST LITTER), CLEAR 10' FROM ROAD SO FLAMES WILL BE LESS THAN 2' HIGH.

IN AREAS WHERE FLAMES FROM VEGETATION WILL BE MORE THAN 8' HIGH (TYPICALLY BRUSH OR THICK UNDERSTORY), CLEAR 30' FROM ROAD SO FLAMES WILL BE LESS THAN 2' HIGH. SPECIFIC PRESCRIPTIONS CAN BE MADE FOR STEEPER SLOPES, FIRE CHIMNEY'S, OR OTHER PRIORITY LOCATIONS.



NOTES:

1. CLEARING LIMIT SHALL BE AS SHOWN IN TABLE A. DISPOSE OF CLEARED MATERIAL PER PERMIT GUIDELINES AND SPECIAL CONDITIONS.
2. FOR PROPER PRUNING PROCEDURE, SEE DISTRICT STANDARD PRUNING PROCEDURES DETAIL.
3. CUT AND REMOVE FALLEN LOGS AS NEEDED WITHIN CLEARING LIMITS.
4. DO NOT REMOVE TREES OR LOGS OUTSIDE THE TRAIL CORRIDOR. REMOVE ALL TREES 6" DBH OR LESS WITHIN THE CLEARING LIMITS. TREES 6" DBH OR GREATER WITHIN THE TRAIL CLEARING LIMITS SHALL BE PRUNED SO AS NOT TO INTRUDE INTO VERTICAL SPACE ABOVE THE TRAIL BED UP TO THE CLEARING LIMIT HEIGHT.
5. IN GRASSLANDS CUT BACK GRASS FAR ENOUGH FROM EDGE OF TRAIL SO THAT THE TRAIL TREAD IS NOT IMPACTED WHEN GRASS LAYS FLAT.
6. ALL CLEARING DISTANCES ARE MEASURED FROM THE TRAIL BED.
7. LOW LYING SHRUBS, FLOWERS, AND GROUNDCOVER OUTSIDE THE TRAIL BED SHOULD RETAINED ONLY IF THERE IS NO POTENTIAL FOR THEM TO GROW INTO THE TRAIL BED. WILL DEPEND ON TYPE OF VEGETATION AND RATE OF GROWTH.
8. GROUND LEVEL ON SLOPES TO BE MEASURED ON HIGH SIDE OF TREE.

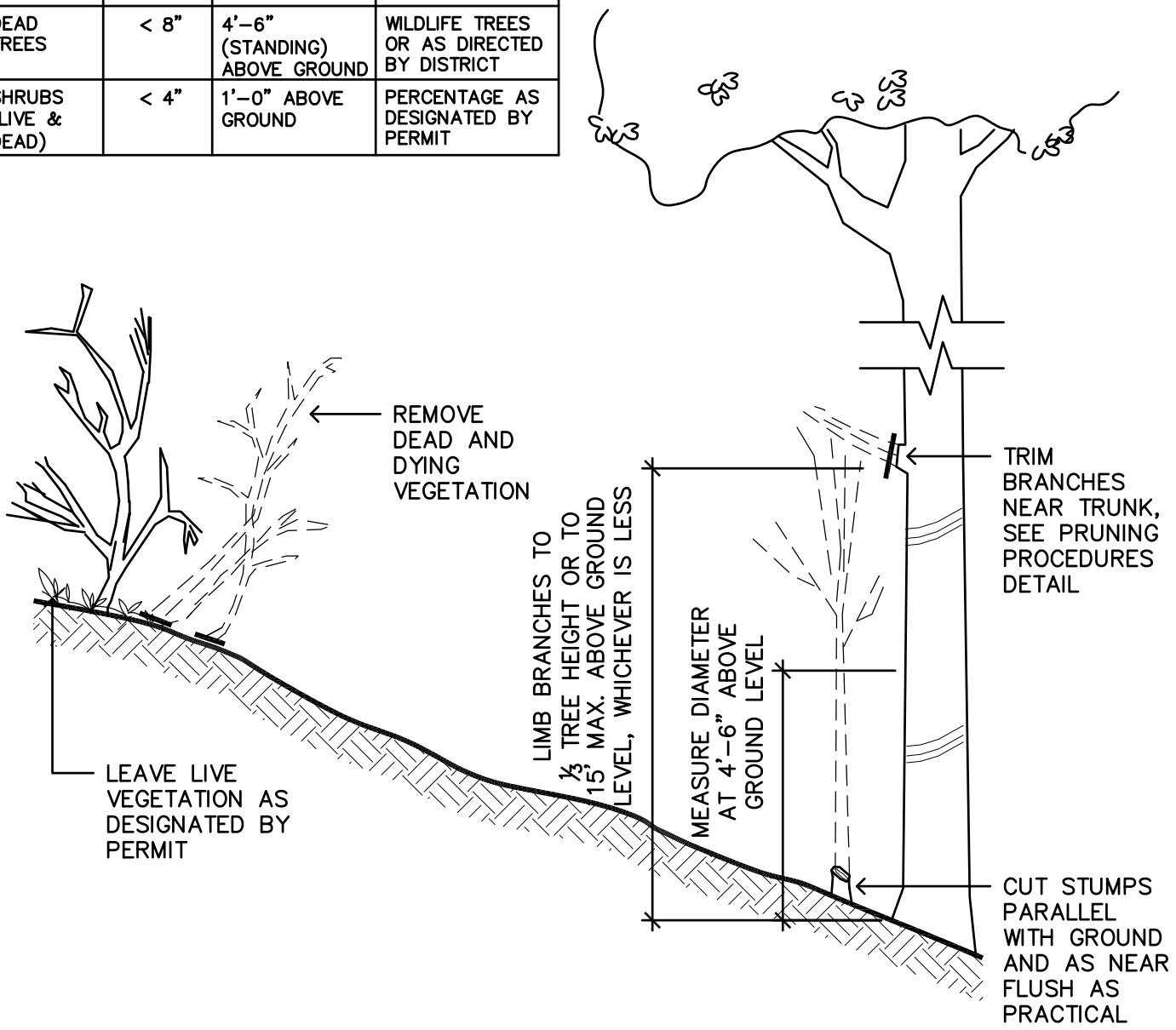
VEGETATION - MANAGEMENT
TYPICAL BRUSHING GUIDELINES

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1/2" = 1'-0"	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\2A VegMgmt-BrushingLimits.dwg

TABLE A: DEFENSIBLE SPACE CLEARING GUIDELINES

TYPE	DIAMETER	MEASURED AT	AMT OF VEGETATION TO BE RETAINED
LIVE TREES	< 6"	4'–6" ABOVE GROUND	PERCENTAGE AS DESIGNATED BY PERMIT
DEAD TREES	< 8"	4'–6" (STANDING) ABOVE GROUND	WILDLIFE TREES OR AS DIRECTED BY DISTRICT
SHRUBS (LIVE & DEAD)	< 4"	1'–0" ABOVE GROUND	PERCENTAGE AS DESIGNATED BY PERMIT



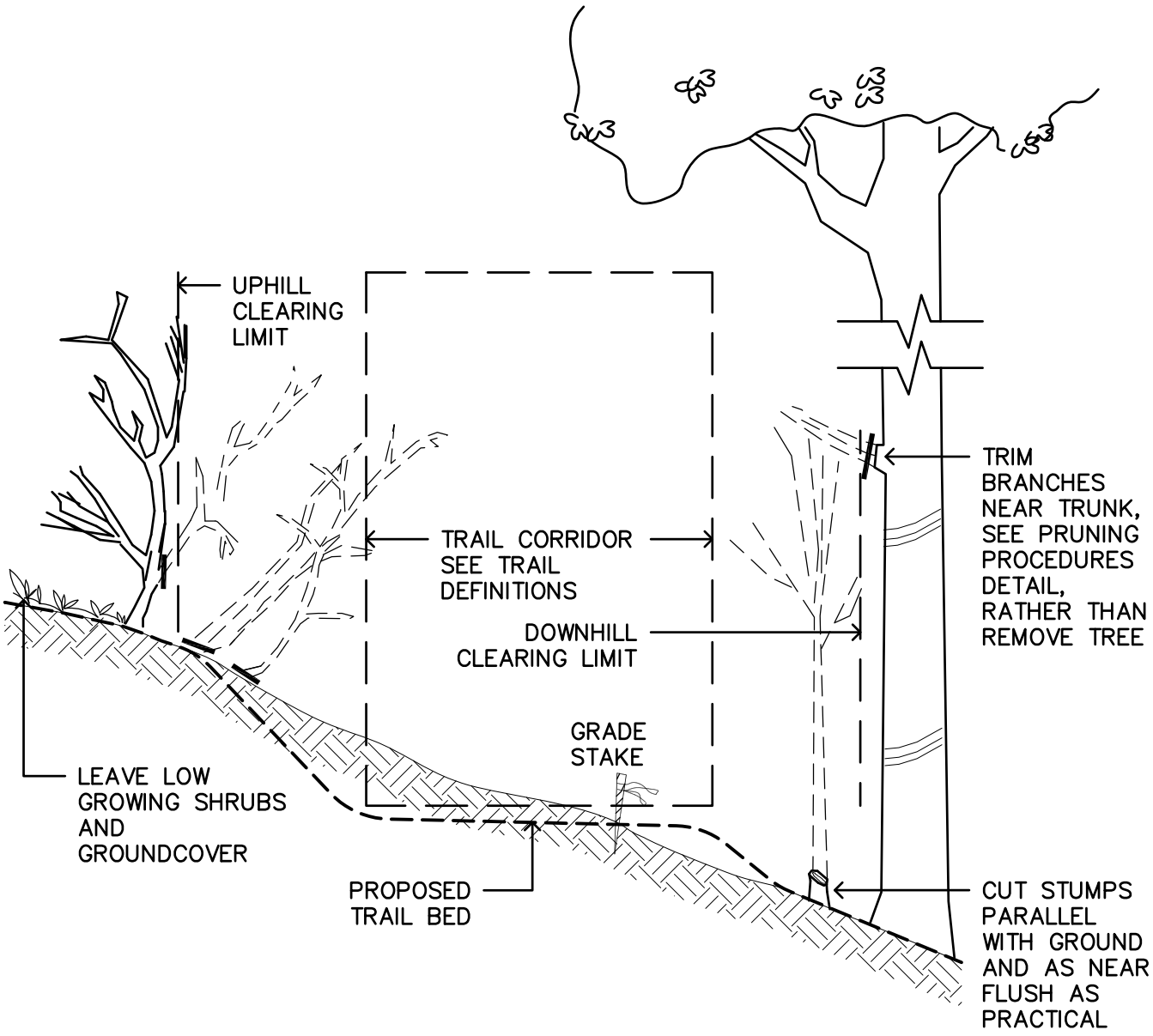
NOTES:

1. PERMICLEARING LIMIT SHALL BE AS SHOWN IN TABLE A. DISPOSE OF CLEARED MATERIAL PER PERMIT GUIDELINES AND SPECIAL CONDITIONS.
2. FOR PROPER PRUNING PROCEDURE, SEE DISTRICT STANDARD PRUNING PROCEDURES DETAIL.
3. CUT AND REMOVE FALLEN LOGS AS NEEDED WITHIN CLEARING LIMITS.
4. LIVE TREES 6" DBH OR GREATER WITHIN THE PROJECT SITE SHALL BE REMOVED ONLY IF INDICATED FOR REMOVAL ON PLANS AND WITH WRITTEN AUTHORIZATION OF THE DISTRICT.
5. GROUND LEVEL ON SLOPES TO BE MEASURED ON HIGH SIDE OF TREE.

VEGETATION - MANAGEMENT
DEFENSIBLE SPACE CLEARING GUIDELINES

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1/2" = 1'-0"	DATE: 11/23/2011

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\2A VegMgmt-DefensibleSpace.dwg



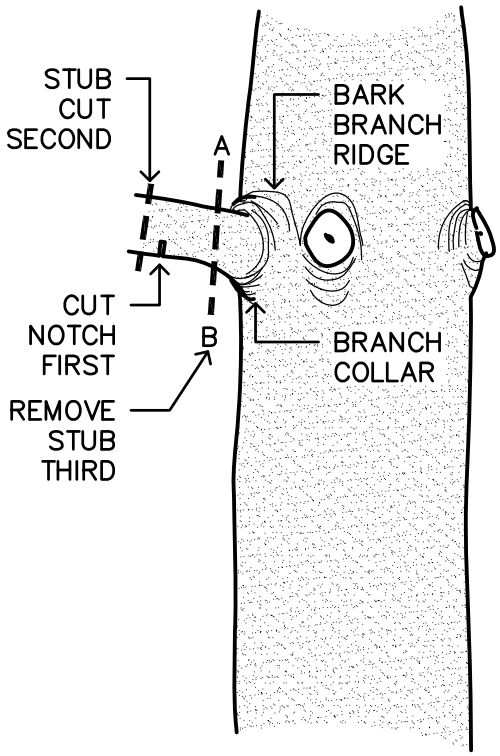
NOTES:

1. ALL VEGETATION WITHIN TRAIL CORRIDOR SHALL BE REMOVED. IN ADDITION, REFER TYPICAL BRUSHING DETAIL TO DETERMINE IF PRUNING SHOULD EXTEND OUTSIDE CORRIDOR.
2. FOR PROPER PRUNING PROCEDURE, SEE DISTRICT STANDARD PRUNING PROCEDURES DETAIL.
3. CUT AND REMOVE FALLEN LOGS AS NEEDED WITHIN CLEARING LIMITS.
4. DO NOT REMOVE TREES OR LOGS OUTSIDE THE TRAIL CORRIDOR. REMOVE ALL TREES 6" DBH OR LESS WITHIN THE DESIGNATED TRAIL CORRIDOR.
5. TREES 6" DBH OR GREATER WITHIN THE TRAIL CLEARING LIMITS SHALL BE PRUNED SO AS NOT TO INTRUDE INTO VERTICAL SPACE ABOVE THE TRAIL BED UP TO THE CLEARING LIMIT HEIGHT. THEY SHALL BE REMOVED ONLY IF INDICATED FOR REMOVAL ON PLANS OR IF AUTHORIZED BY DISTRICT REPRESENTATIVE.
6. TREE PROTECTION SHALL BE IN PLACE PRIOR TO START OF WORK IF REQUIRED BY DISTRICT REPRESENTATIVE.
7. ALL ROOTS EXPOSED DURING CONSTRUCTION SHALL BE CLEAN CUT TO AVOID TREE DAMAGE.

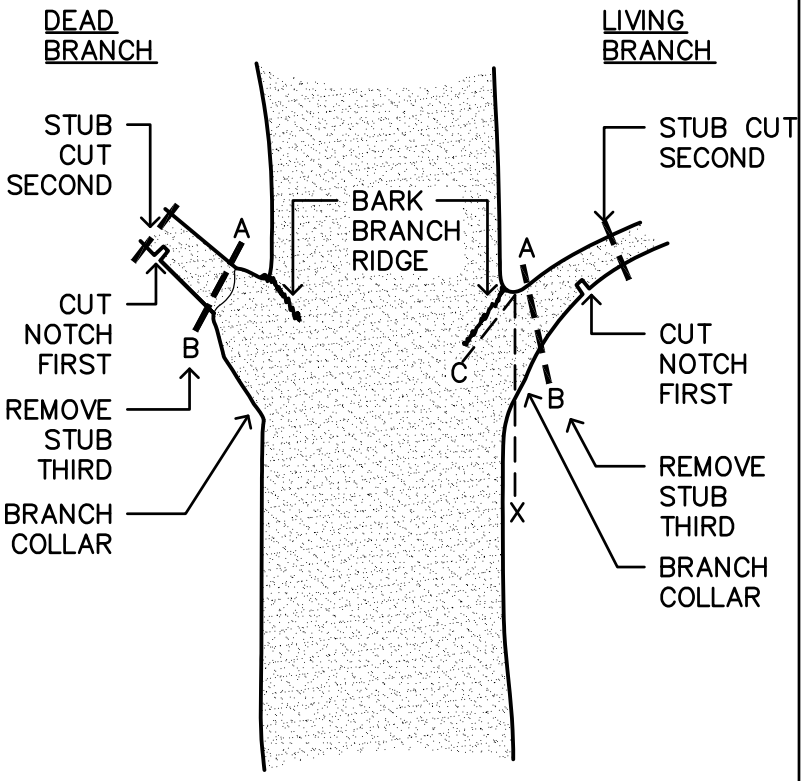
VEGETATION - NEW CONSTRUCTION CLEARING LIMIT DETAIL

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1/2" = 1'-0"	DATE: 11/23/2011

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\2B VegNewConst-ClearingLimits.dwg



CONIFERS
(LIVING OR DEAD BRANCHES)



DECIDUOUS AND
EVERGREENS

NOTES:

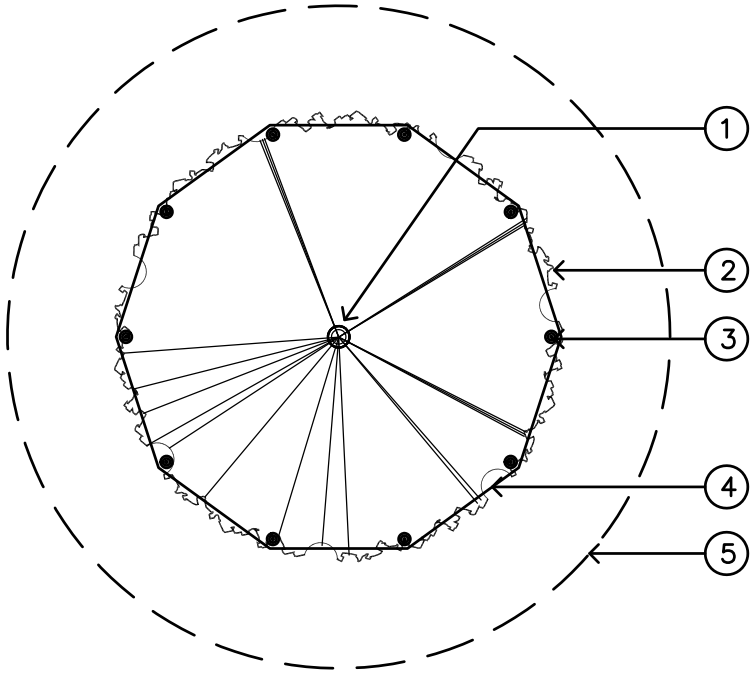
USE A THREE–STEP PRUNING METHOD ON LARGE LIMBS:

1. UNDERCUT NOTCH ON LARGE BRANCHES ABOUT ¼ TO 1/3 THROUGH TO PREVENT BARK–STRIPPING WHEN THE BRANCH FALLS.
2. REMOVE MOST OF THE BRANCH WEIGHT WITH A STUB CUT OUTSIDE OF THE UNDERCUT.
3. MAKE A THIRD CUT OUTSIDE OF THE BRANCH BARK RIDGE AND COLLAR TO REMOVE THE STUB:
   - LOCATE THE BRANCH BARK RIDGE (BBR)
   - FIND TARGET A –– OUTSIDE BBR
   - FIND TARGET B –– WHERE BRANCH MEETS COLLAR
   - IF B CANNOT BE FOUND, DROP AN IMAGINARY LINE AT AX. ANGLE XAC EQUALS XAB.
   - STUB CUT THE BRANCH.
   - MAKE FINAL CUT AT LINE AB (WITH POWERSAWS MAKE FINAL CUT ON UPSTROKE.)

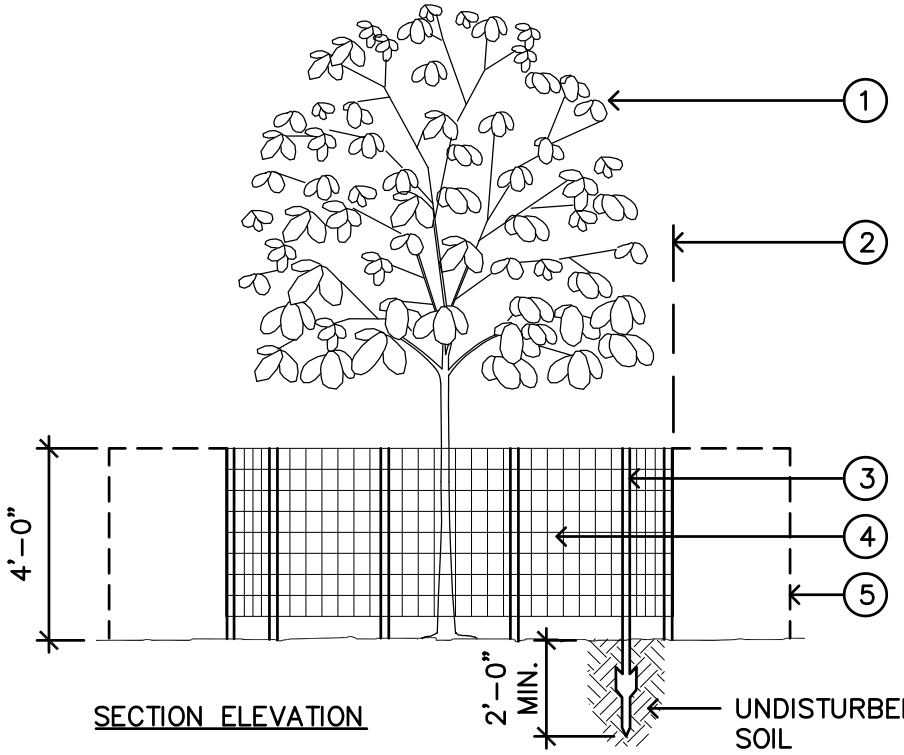
VEGETATION
PRUNING PROCEDURES

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1/2" = 1'-0"	DATE: 11/23/2011

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\2B VegNewConst-PruningProcedures.dwg



PLAN



SECTION ELEVATION

NOTES/LEGEND:

1. EXISTING TREE TO REMAIN, AS DESIGNATED ON PLANS OR BY DISTRICT REPRESENTATIVE.
2. TREE DRIP LINE.
3. STEEL T–POST, 6' O.C. MAX. DRIVE POST INTO UNDISTURBED SOIL, AVOIDING MAJOR ROOTS AS MUCH AS POSSIBLE.
4. ORANGE "HI–VIS" BARRIER FENCING, 48" TALL.
5. EXTEND FENCING 50% BEYOND DRIPLINE OF SIGNIFICANT MATURE SPECIMEN TREES WHERE POSSIBLE, OR AS OTHERWISE SHOWN ON PLANS.
6. ALL EXCEPTIONS SHALL BE APPROVED IN THE FIELD BY DISTRICT REPRESENTATIVE, PRIOR TO START OF WORK.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		PROTECTIVE TREE FENCING
SCALE: 1/4" = 1'-0"	DATE: 11/23/2011	

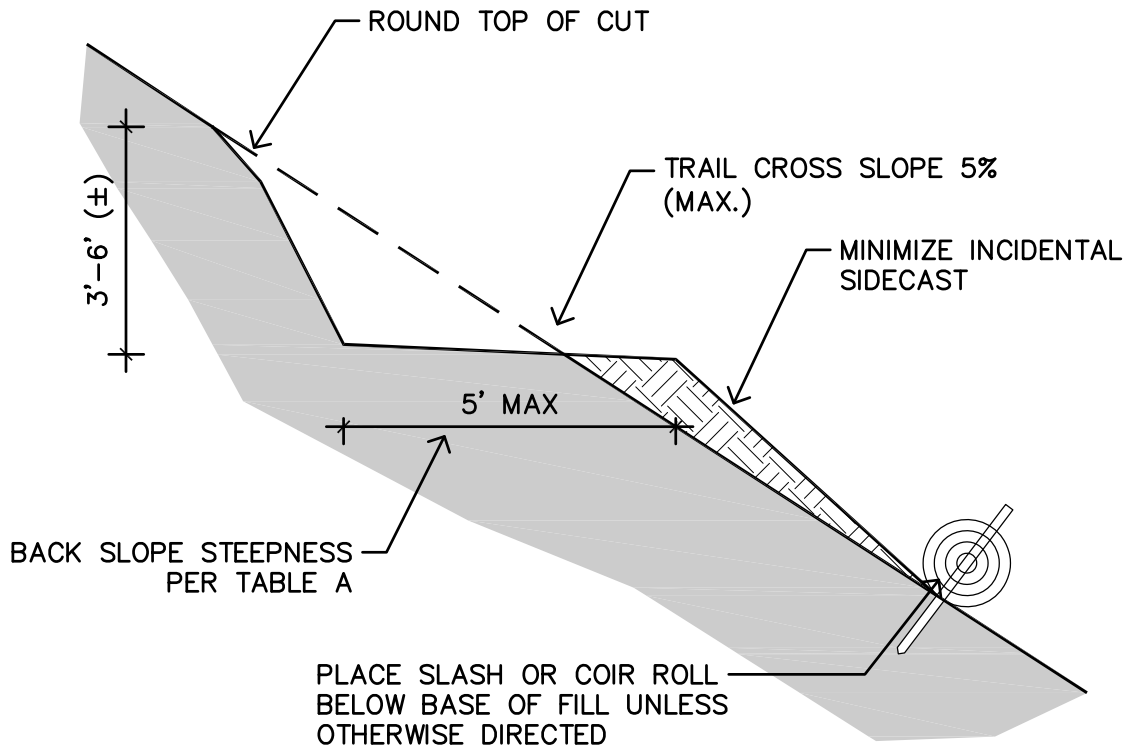
\\fileserv\shareall\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\2B VegNewConst-ProtTreeFencing.dwg

DETAILS AND SPECIFICATIONS GUIDELINES

SECTION 3

ROADS AND TRAILS

TRAIL CUT BENCH (>60% SLOPE)



NOTES:

- TRAIL SHALL BE CONSTRUCTED AT 5 FOOT MAXIMUM WIDTH.
- TRAIL SHALL BE CONSTRUCTED ON A FULL BENCH.
- SPOILS SHALL BE EITHER ENDHAULED TO A STABLE LOCATION OR "SCATTERED CASTED" BELOW THE TRAIL. INCIDENTAL SIDECAST SHALL NOT EXCEED 8 INCHES IN THICKNESS NOR EXTEND DOWNSLOPE MORE THAN 15 FEET.
- WITHIN 50 FEET OF A DESIGNATED WATERCOURSE SPOILS SHALL BE ENDHAULED TO AN APPROVED LOCATION.
- CUTBANK BACKSLOPE SHALL BE INCLINED AT SIMILAR STEEPNESS TO ADJACENT UNFAILED CUTS IN SIMILAR SOILS AND HEIGHT. REFER TO TABLE A FOR GENERAL GUIDELINE. WHERE CUTS ARE STEEPER THAN 6 FEET OF WHERE SEEPAGE OF WATER OF UNSUITABLE EARTH MATERIALS ARE ENCOUNTERED, THE BACKSLOPE SHALL BE SELECTED BY THE PROJECT GEOTECHNICAL CONSULTANT.
- ALL DISTURBED AREAS SHALL BE TREATED TO CONTROL EROSION PER SPECIFICATIONS.
- SPECIFICATIONS ARE INDENTED ONLY AS GUIDELINE, MODIFICATIONS MAY BE MADE IN THE FIELD BY GEOTECHNICAL CONSULTANT OR DESIGNEE.
- THIS IS NOT A DETAIL FOR EASY ACCESS TRAIL. REFER TO DISTRICT STANDARD EASY ACCESS TRAIL SPEC FOR APPLICABLE CODE.

TABLE A

MATERIAL	ASTM CLASSIFICATION	BACK SLOPE (H:V)
COMPETENT ROCK	–	0.5 : 1
DENSE SOIL – WEATHERED BEDROCK (SAND/ GRAVEL WITH FINES)	SM, SC, GM, GC	0.75–1 : 1
SOFT SOIL (SANDY CLAY AND COHESIONLESS SANDS)	CL, ML, SW, SP, GW, SP	1–1.5 : 1

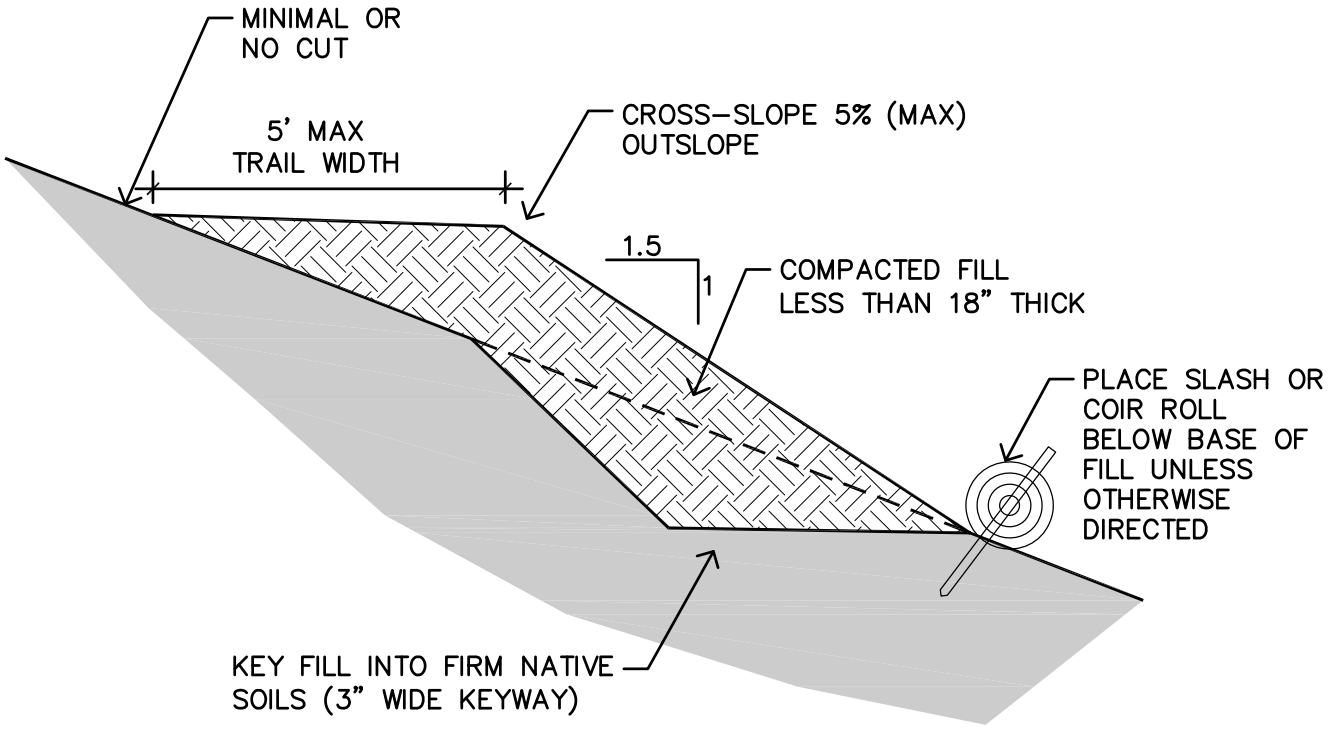
CUT BENCH TRAIL

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\3A cut bench trail.dwg

©TIMOTHY C. BEST, CEG

TRAIL FULL BENCH



NOTES:

- TRAIL SHALL BE CONSTRUCTED AT 5 FOOT MAXIMUM WIDTH.
- AREAS TO RECEIVE FILL SHALL BE STRIPPED TO REMOVE VEGETATION, NEAR SURFACE ROOTS, BRUSH, HIGHLY ORGANIC SOILS AND OTHER UNSUITABLE FILL MATERIAL. DEPTH OF STRIPPING IS ASSUMED TO BE 6 INCHES.
- FILL SHALL BE KEYED AND BENCH INTO FIRM NATIVE SOILS. KEYWAYS SHALL BE MINIMUM 3 FEET WIDE AND INCLINED 5% INTO SLOPE.
- ONSITE SOILS MAY BE REUSED AS FILL. FILL SHALL BE ADEQUATELY MOISTURE CONDITION AND COMPACTED TO A LEVEL EQUAL OR GREATER THAN THE SURROUND MATERIALS (ABOUT 85 PERCENT RELATIVE COMPACTION PER ASTM D 1557); DURING PLACEMENT AND COMPACTION OF FILL, THE MOISTURE CONTENT OF THE MATERIALS BEING PLACED SHALL BE MAINTAINED AS NECESSARY.
- FILL EMBANKMENT SHALL BE INCLINED NO STEEPER THAN 1.5:1 UNLESS OTHERWISE SPECIFIED OR DIRECTED.
- ALL DISTURBED AREAS SHALL BE TREATED TO CONTROL EROSION PER SPECIFICATIONS.
- SPECIFICATIONS ARE INTENDED ONLY AS GUIDELINE, MODIFICATIONS MAY BE MADE IN THE FIELD BY GEOTECHNICAL CONSULTANT OR DESIGNEE.
- THIS IS NOT A DETAIL FOR EASY ACCESS TRAIL. REFER TO DISTRICT STANDARD EASY ACCESS TRAIL SPEC FOR APPLICABLE CODE.

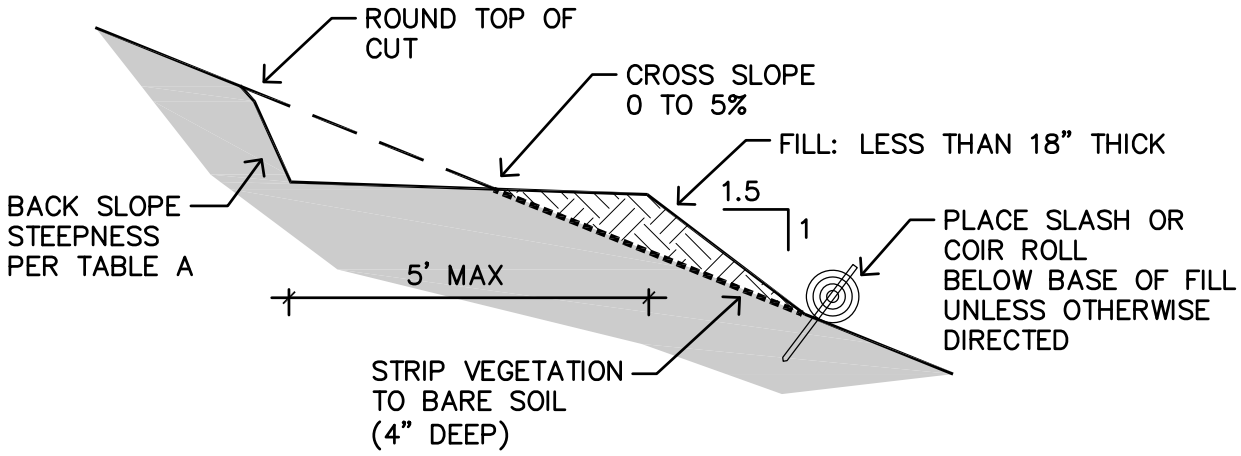
FULL BENCH TRAIL

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\3A full bench trail.dwg

©TIMOTHY C. BEST, CEG

TRAIL PARTIAL BENCH (<60% SLOPE)



NOTES:

- TRAIL SHALL BE CONSTRUCTED AT 5 FOOT MAXIMUM WIDTH.
- TRAIL SHALL BE CONSTRUCTED ON BALANCED CUT AND FILL.
- AREAS TO RECEIVE FILL SHALL BE STRIPPED OF VEGETATION AND HIGHLY ORGANIC SOIL (4" DEPTH).
- ONSITE SOILS MAY BE REUSED AS FILL. FILL SHALL COMPACTED TO A LEVEL EQUAL OR GREATER THAN THE SURROUNDING MATERIALS (APPROXIMATELY 85 PERCENT RELATIVE COMPACTION PER ASTM D 1557); DURING PLACEMENT AND COMPACTION OF FILL, THE MOISTURE CONTENT OF THE MATERIALS BEING PLACED SHALL BE MAINTAINED AS NECESSARY.
- FILL SHALL BE A MAXIMUM OF 18 INCHES THICK UNLESS OTHERWISE SPECIFIED.
- FILL EMBANKMENT SHALL BE INCLINED AT SIMILAR STEEPNESS TO ADJACENT UNFAILED CUTS IN SIMILAR SOILS AND HEIGHT. REFER TO TABLE A FOR GENERAL GUIDELINE. WHERE CUTS ARE STEEPER THAN 6 FEET OF WHERE SEEPAGE OF WATER OF UNSUITABLE EARTH MATERIALS ARE ENCOUNTERED, THE BACKSLOPE SHALL BE SELECTED BY THE PROJECT GEOTECHNICAL CONSULTANT.
- ALL DISTURBED AREAS SHALL BE TREATED TO CONTROL EROSION PER SPECIFICATIONS.
- SPECIFICATIONS ARE INTENDED ONLY AS GUIDELINE, MODIFICATIONS MAY BE MADE IN THE FIELD BY GEOTECHNICAL CONSULTANT OR DESIGNEE.
- THIS IS NOT A DETAIL FOR EASY ACCESS TRAIL. REFER TO DISTRICT STANDARD EASY ACCESS TRAIL SPEC FOR APPLICABLE CODE.

TABLE A

MATERIAL	ASTM CLASSIFICATION	BACK SLOPE (H:V)
COMPETENT ROCK	–	0.5 : 1
DENSE SOIL – WEATHERED BEDROCK (SAND/ GRAVEL WITH FINES)	SM, SC, GM, GC	0.75–1 : 1
SOFT SOIL (SANDY CLAY AND COHESIONLESS SANDS)	CL, ML, SW, SP, GW, SP	1–1.5 : 1

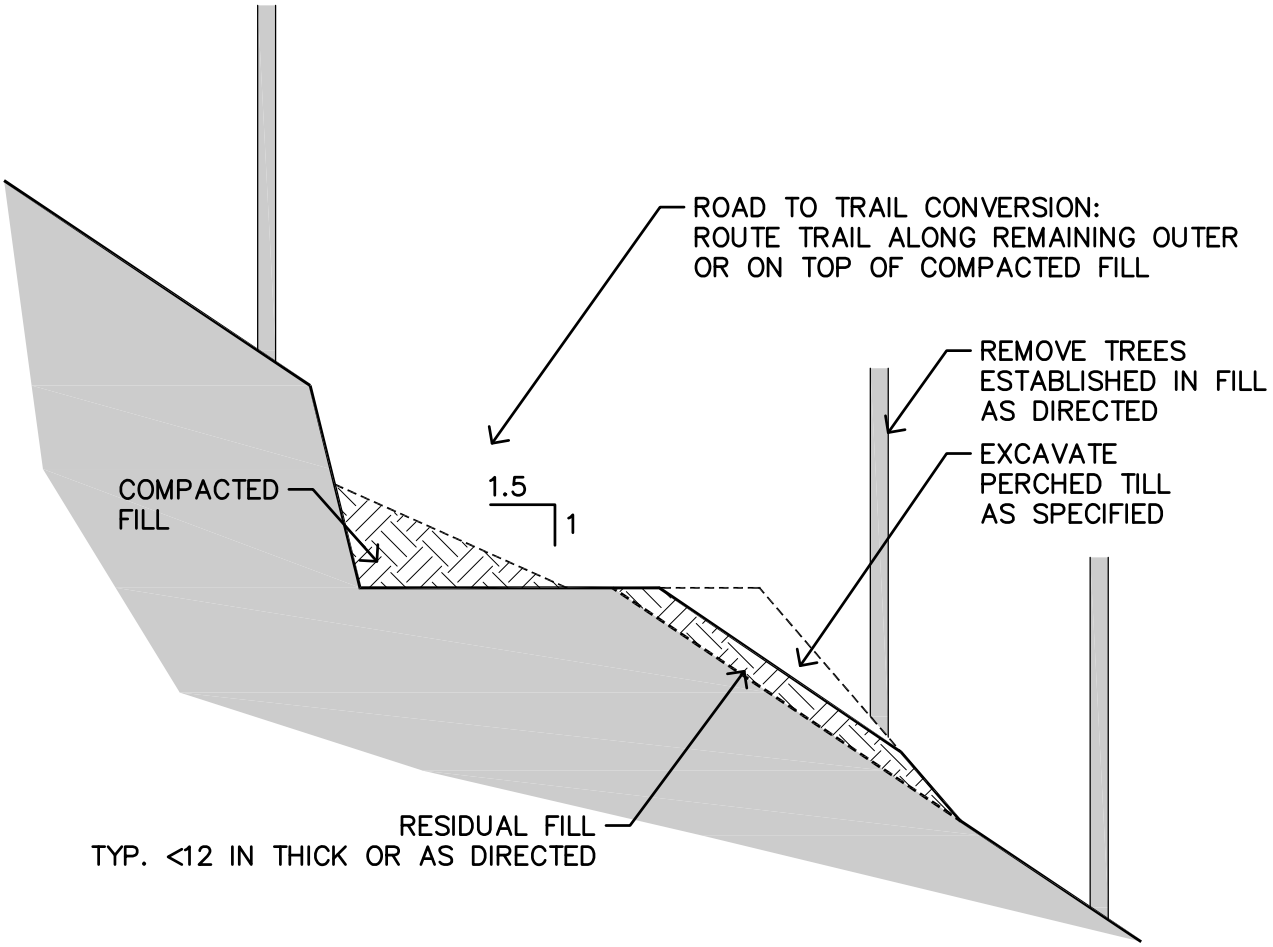
PARTIAL BENCH TRAIL

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT | SCALE: NTS | DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\3A partial bench trail.dwg

©TIMOTHY C. BEST, CEG

ROAD TO TRAIL CONVERSION



NOTES:

- THIS IS NOT A DETAIL FOR EASY ACCESS TRAIL. REFER TO DISTRICT STANDARD EASY ACCESS TRAIL SPEC FOR APPLICABLE CODE.
- REMOVE TREES ESTABLISHED IN ROADWAY AND IN FILL AS DIRECTED
  - TREES GREATER THAN 6 IN DIAMETER SHALL BE MARKED BY DISTRICT PRIOR TO REMOVAL.
- EXCAVATE PERCHED FILL AS SPECIFIED AND DIRECTED
  - LIMITS OF FILL REMOVAL TO BE IDENTIFIED IN THE FIELD BY PROJECT GEOLOGIST OR DESIGNEE.
- SPOILS SHALL BE COMPACTED ALONG INBOARD EDGE OF ROAD.
  - SPOILS SHALL NOT BE PLACED IN ANY AREAS WHERE SEASONAL BANK SEEPS OR WET AREAS ARE PRESENT.
  - AREAS TO RECEIVE FILL SHALL BE CLEARED OF VEGETATION.
  - SPOILS SHALL BE PLACED IN THIN LIFTS NOT TO EXCEED 8 INCHES IN MAXIMUM THICKNESS AND COMPACTED (MINIMUM 85 PERCENT RELATIVE COMPACTION). COMPACTING MAY INCLUDE TRACK WALKING WITH A DOZER, BUCKET OF THE EXCAVATOR, ROLLER OR HAND TAMPER. SPOILS MAY NEED TO BE MOISTURE CONDITIONED TO ACHIEVE A SUITABLE LEVEL OF COMPACTION.
  - SPOILS SHALL BE PLACED A MAXIMUM OF 5 FEET DEEP WITH AN EMBANKMENT FACE INCLINED NO STEEPER THAN 1.5"1 (65%) UNLESS OTHERWISE DIRECTED OR SPECIFIED.
  - PROJECT GEOTECHNICAL CONSULTANT OR DESIGNEE SHALL APPROVE ALL SPOIL SITES PRIOR TO FILL PLACEMENT.
- SPECIFICATIONS ARE INTENDED ONLY AS GUIDELINE. MODIFICATIONS MAY BE MADE IN THE FIELD BY PROJECT GEOTECHNICAL CONSULTANT OR DESIGNEE.

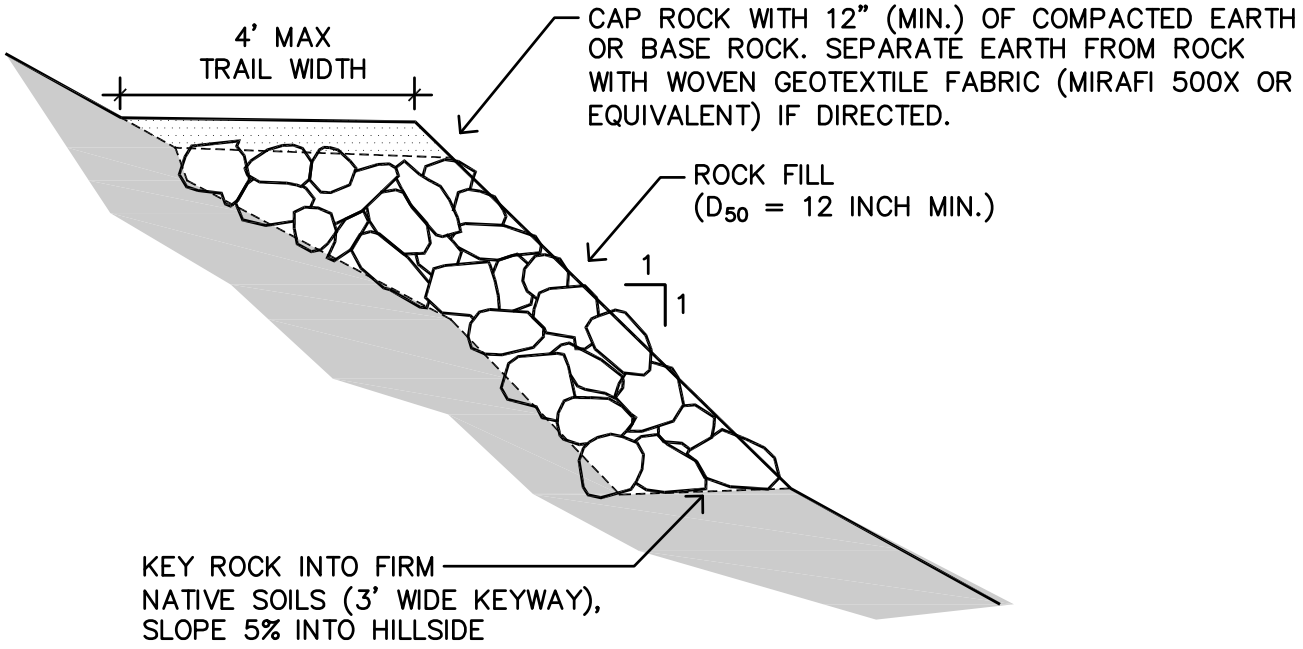
ROAD TO TRAIL CONVERSION

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\3A road to trail conversion.dwg

©TIMOTHY C. BEST, CEG

TRAIL ROCK FILL BENCH (<60% SLOPES)



NOTES:

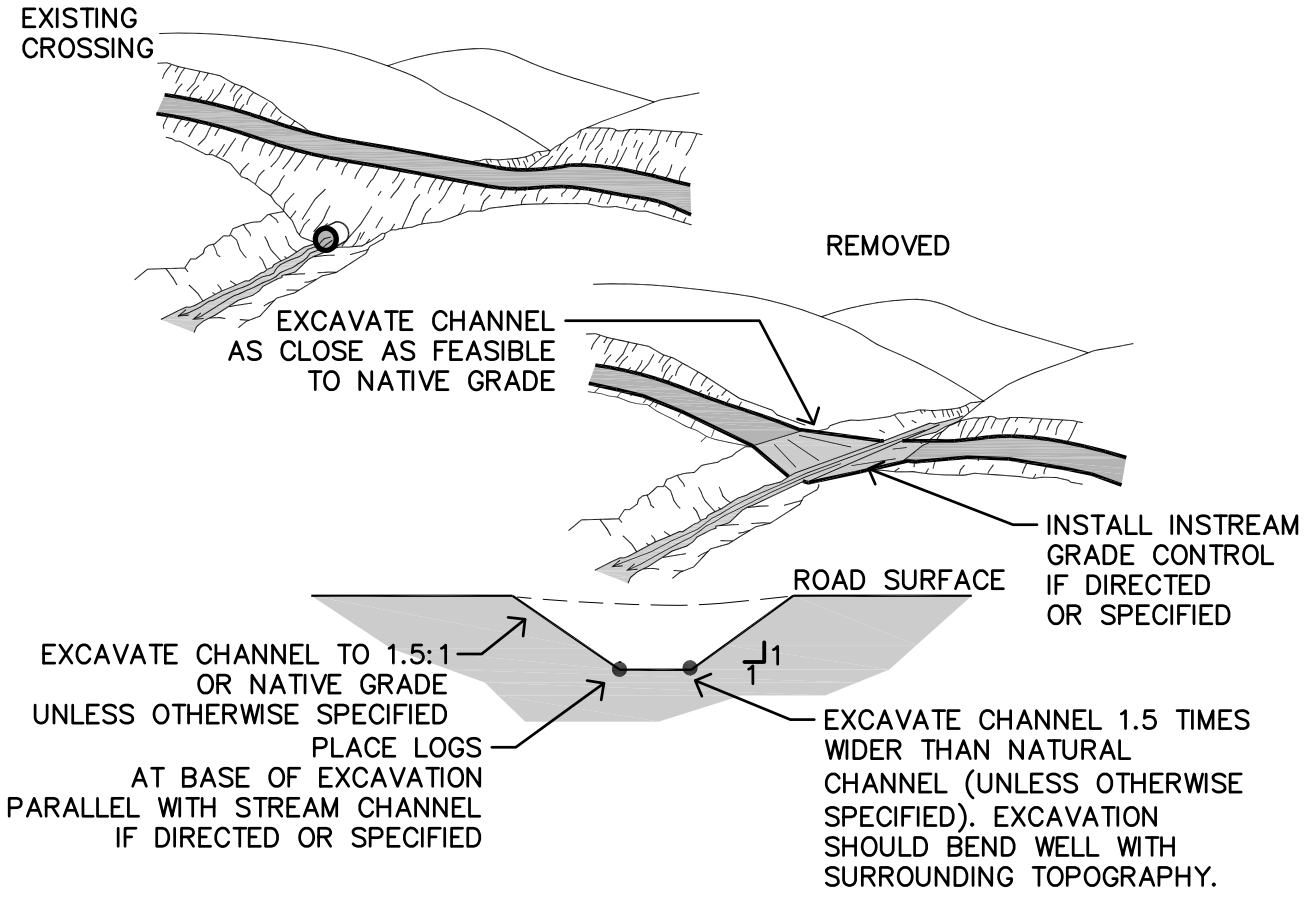
- TRAIL SHALL BE CONSTRUCTED AT 4–FOOT MAXIMUM WIDTH UNLESS OTHERWISE SPECIFIED.
- AREAS TO RECEIVE FILL SHALL BE STRIPPED OF VEGETATION AND HIGHLY ORGANIC SOIL (±4" DEPTH).
- FILL SHALL BE KEYED AND BENCH INTO FIRM NATIVE SOILS. KEYWAYS SHALL BE MINIMUM 3 FEET WIDE AND INCLINED 5% INTO SLOPE.
- ROCK FILL SHALL CONSIST OF SOUND DURABLE ROCK WITH 50% EQUAL OR GREATER THAN 12 IN DIAMETER. ROCK SHALL BE PLACED FOR MAXIMUM STABILITY.
- ROCK SHALL BE BROUGHT UP TO WITHIN 1 FOOT OF FINAL TRAIL GRADE AT 1:1 SLOPE.
- ROCK EMBANKMENT SHALL BE CAPPED BY 12 INCHES OF COMPACTED FILL OR BASEROCK. FILL/BASEROCK SHALL BE ADEQUATELY MOISTURE CONDITIONED AND COMPACTED TO A LEVEL EQUAL OR GREATER THAN THE SURROUND MATERIALS.
- SEPARATE FILL FROM ROCK WITH WOVEN GEOTEXTILE FABRIC (MIRAFI 500X OR EQUIVALENT) UNLESS OTHERWISE SPECIFIED.
- SPECIFICATIONS ARE INTENDED ONLY AS GUIDELINE. MODIFICATIONS MAY BE MADE IN THE FIELD BY GEOTECHNICAL CONSULTANT OR DESIGNEE.
- THIS IS NOT A DETAIL FOR EASY ACCESS TRAIL. REFER TO DISTRICT STANDARD EASY ACCESS TRAIL SPEC FOR APPLICABLE CODE.

ROCK FILL BENCH

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\3A rock fill bench.dwg

©TIMOTHY C. BEST, CEG



NOTES:

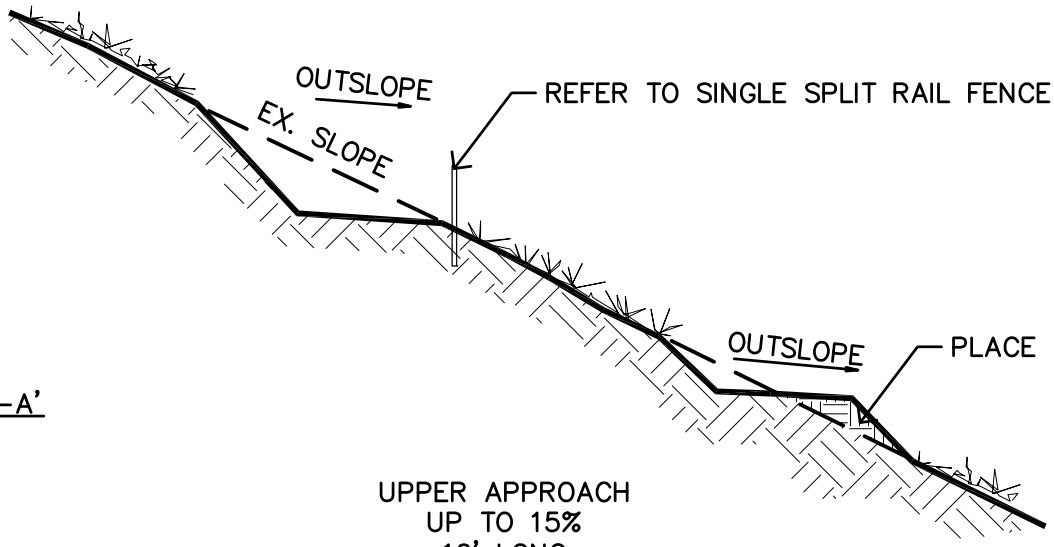
- EXCAVATE A CHANNEL THAT IS 1.5 TIMES WIDER THAN THE NATURAL CHANNEL (UNLESS OTHERWISE SPECIFIED).
  - EXCAVATED CHANNEL SHALL BE AS CLOSE AS FEASIBLE TO THE GRADE AND ORIENTATION OF THE NATURAL CHANNEL.
  - CHANNEL BANKS SHALL BE EXCAVATED TO A 1.5:1 SLOPE OR NATIVE GRADE (WHICHEVER IS STEEPEST) UNLESS OTHERWISE SPECIFIED IN THE PLAN OR DIRECTED.
  - EXCAVATION SHOULD BLEND WELL WITH SURROUNDING NATURAL TOPOGRAPHY.
  - SPOILS SHALL BE PLACED AND COMPACTED ALONG A STABLE PORTION OF THE INBOARD EDGE OF THE ROAD, UNLESS OTHERWISE SPECIFIED. FILL SHALL BE PLACED IN A MANNER TO PREVENT FUTURE EROSION. FILL SHALL BE COMPACTED TO 85% RELATIVE COMPACTION UNLESS OTHERWISE SPECIFIED OR DIRECTED.
- INSTALL INSTREAM GRADE CONTROL IF SPECIFIED IN THE PLAN OR DIRECTED. GRADE CONTROL SHALL CONSIST OF LARGE WOOD OR ROCK AND IS INTENDED TO PREVENT STREAM DOWN CUTTING. SEE GENERAL SPECIFICATIONS.
- PLACE LOGS AT BASE OF EXCAVATED CHANNEL IF DIRECTED. LOGS TO BE PLACED PARALLEL WITH STREAM WITH UPSTREAM LOG OVERLAPPING DOWNSTREAM LOG. LOGS TO BE EMBEDDED INTO CHANNEL BANK TO MINIMIZE STREAM BANK EROSION. LOG DIAMETER TO BE DETERMINED BY PROJECT GEOTECHNICAL CONSULTANT OR DESIGNEE.
- MULCH DISTURBED GROUND
  - IF AVAILABLE AND DIRECTED BY PROJECT GEOTECHNICAL CONSULTANT, THE EXCAVATED CHANNEL BANKS AND SPOIL SITES MAY BE SLASH MULCHED USING 6–INCH MINUS WOODY DEBRIS WITH 90% COVERAGE. SLASH SHOULD BE PACKED USING A DOZER OR THE BUCKET OF THE EXCAVATOR.
- INSTALL A STRAW ROLL AT BASE OF DISTURBED AREAS AS DIRECTED BY GEOTECHNICAL CONSULTANT AND/OR DISTRICT REPRESENTATIVE.
- CONFORM TO REQUIREMENTS DEPARTMENT OF FISH AND GAME 1600 AGREEMENTS WHERE APPLICABLE.
- SPECIFICATIONS ARE INDENTED ONLY AS GUIDELINE, MODIFICATIONS MAY BE MADE IN THE FIELD BY GEOTECHNICAL CONSULTANT OR DESIGNEE.

STREAM CROSSING REMOVAL

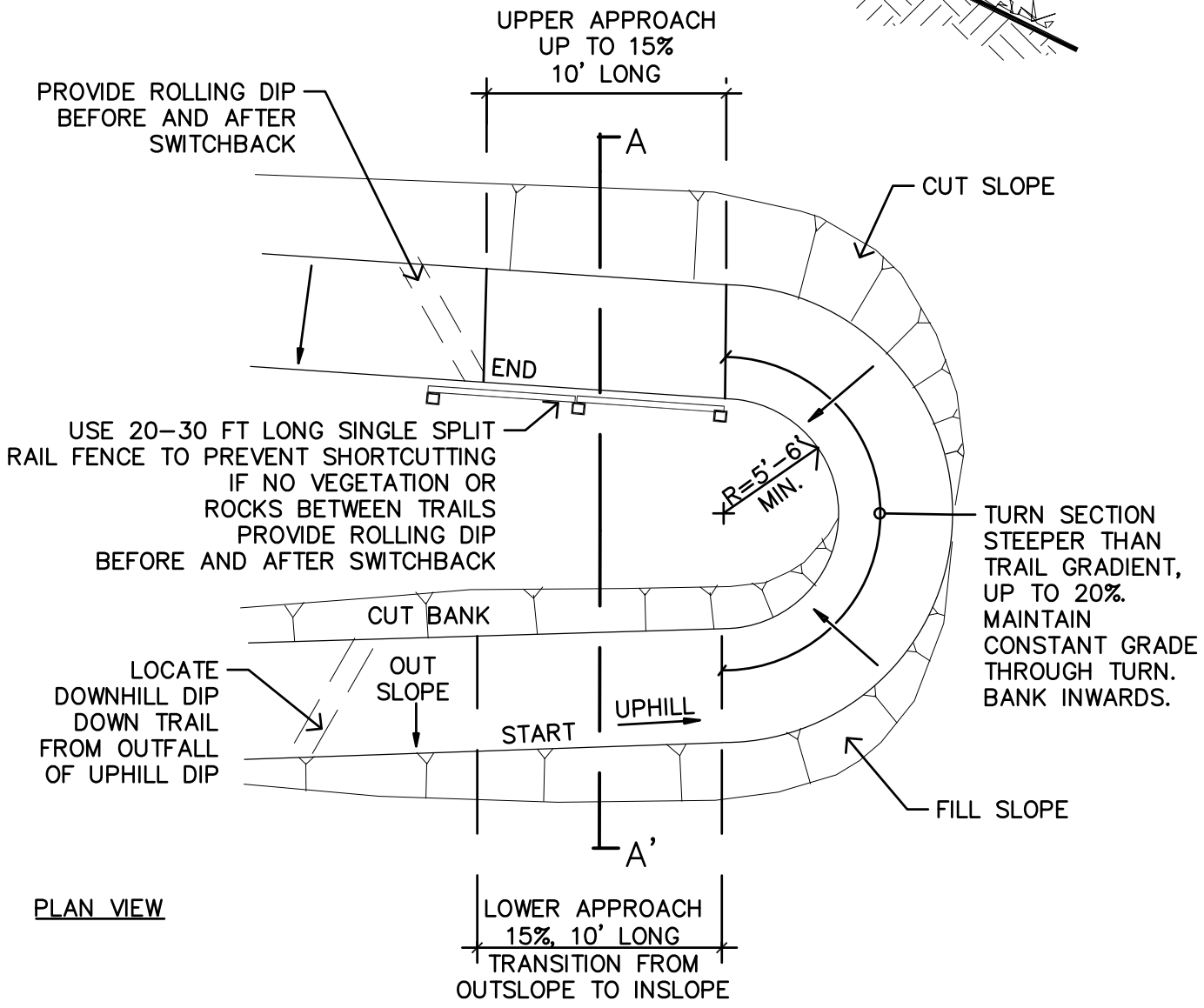
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\3A stream crossing removal.dwg

©TIMOTHY C. BEST, CEG



SECTION A–A'



PLAN VIEW

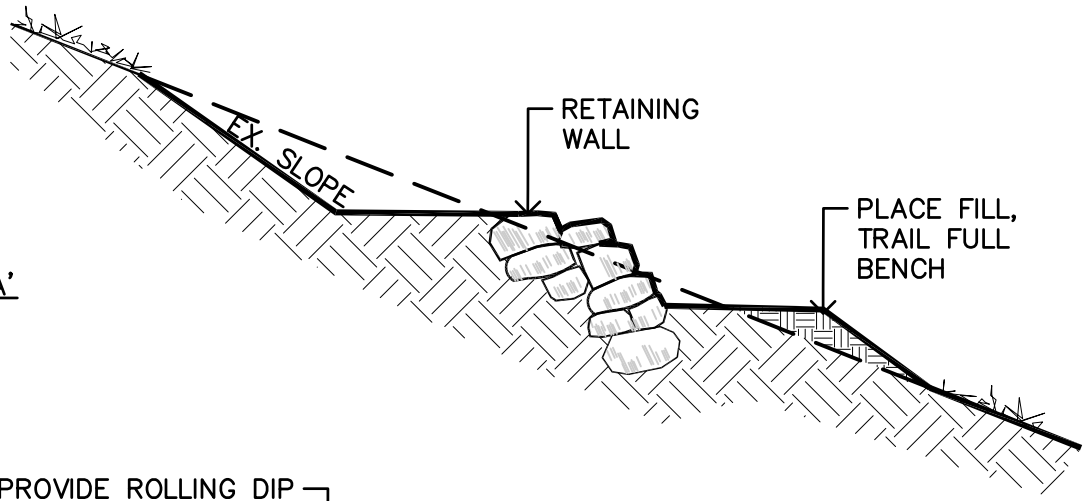
NOTES:

1. LOCATE TURN AT NATURAL GRADE BREAKS OR LESS STEEP AREAS IF CROSSING STEEP SIDE SLOPE. AVOID USING THIS TURN TYPE ON SIDE SLOPES OVER 40%.
2. RADIUS OF TURN WILL BE STAKED AT EACH SITE. TRAIL WIDTH TO BE PER PLANS.
3. USE MATERIAL EXCAVATED FROM THE TOP LEG TO BUILD UP THE BOTTOM LEG.
4. REFER TO TRAIL PRISM DESIGN.

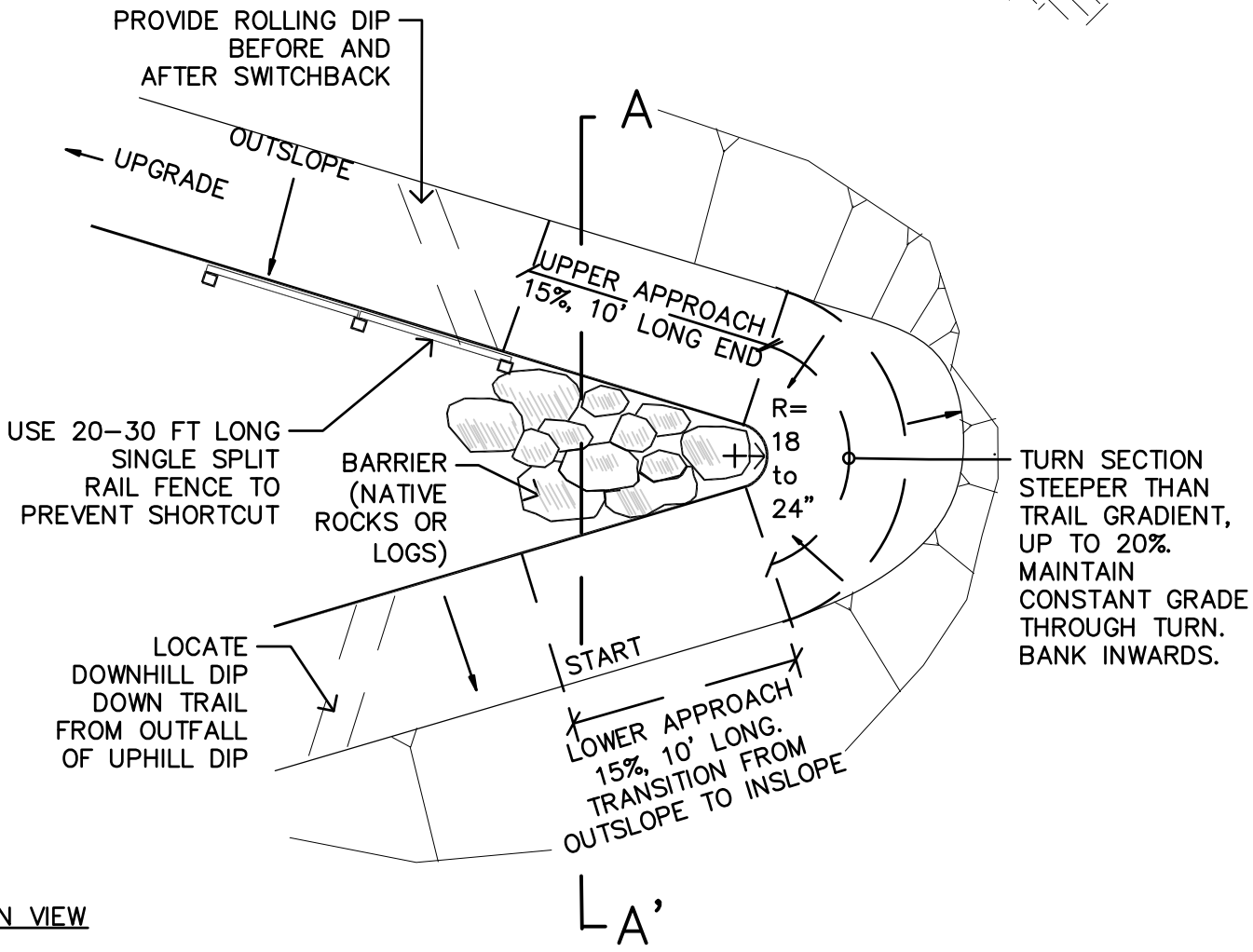
SWITCHBACK# 1
CLIMBING TURN

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1/8" = 1'-0"	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\3B switchback#1 climbing turn.dwg



SECTION A–A'



PLAN VIEW

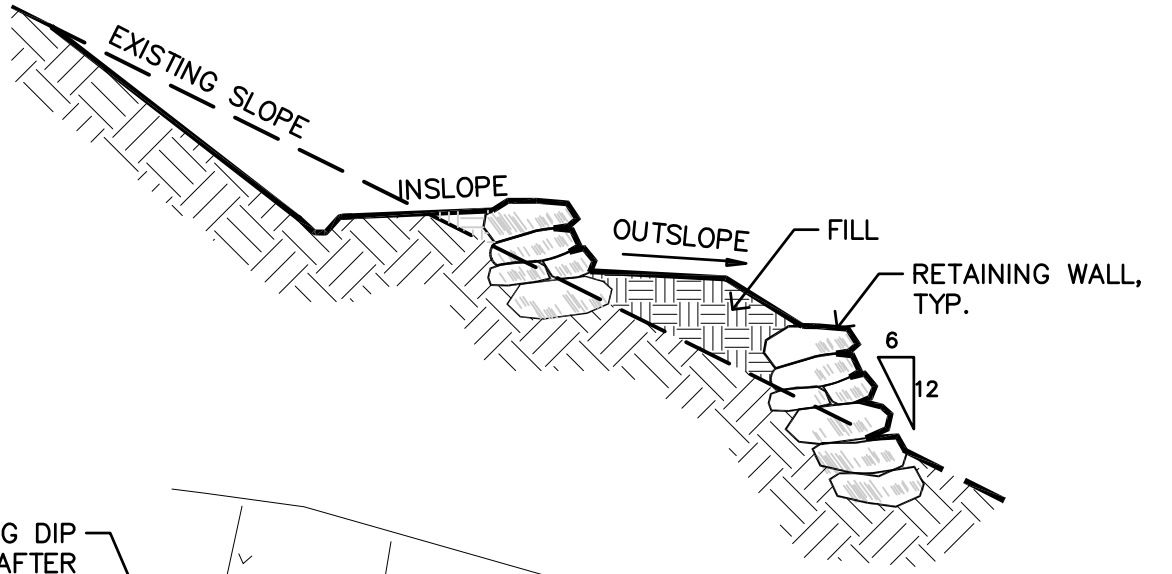
NOTES:

1. LOCATE TURN AT NATURAL GRADE BREAKS OR LESS STEEP AREAS IF CROSSING STEEP SIDE SLOPE. AVOID USING THIS TURN TYPE ON SIDE SLOPES OVER 40%.
2. RADIUS OF TURN WILL BE STAKED AT EACH SITE. TRAIL WIDTH TO BE PER PLANS.
3. USE MATERIAL EXCAVATED FROM THE TOP LEG TO BUILD UP THE BOTTOM LEG.
4. REFER TO TRAIL PRISM DESIGN.

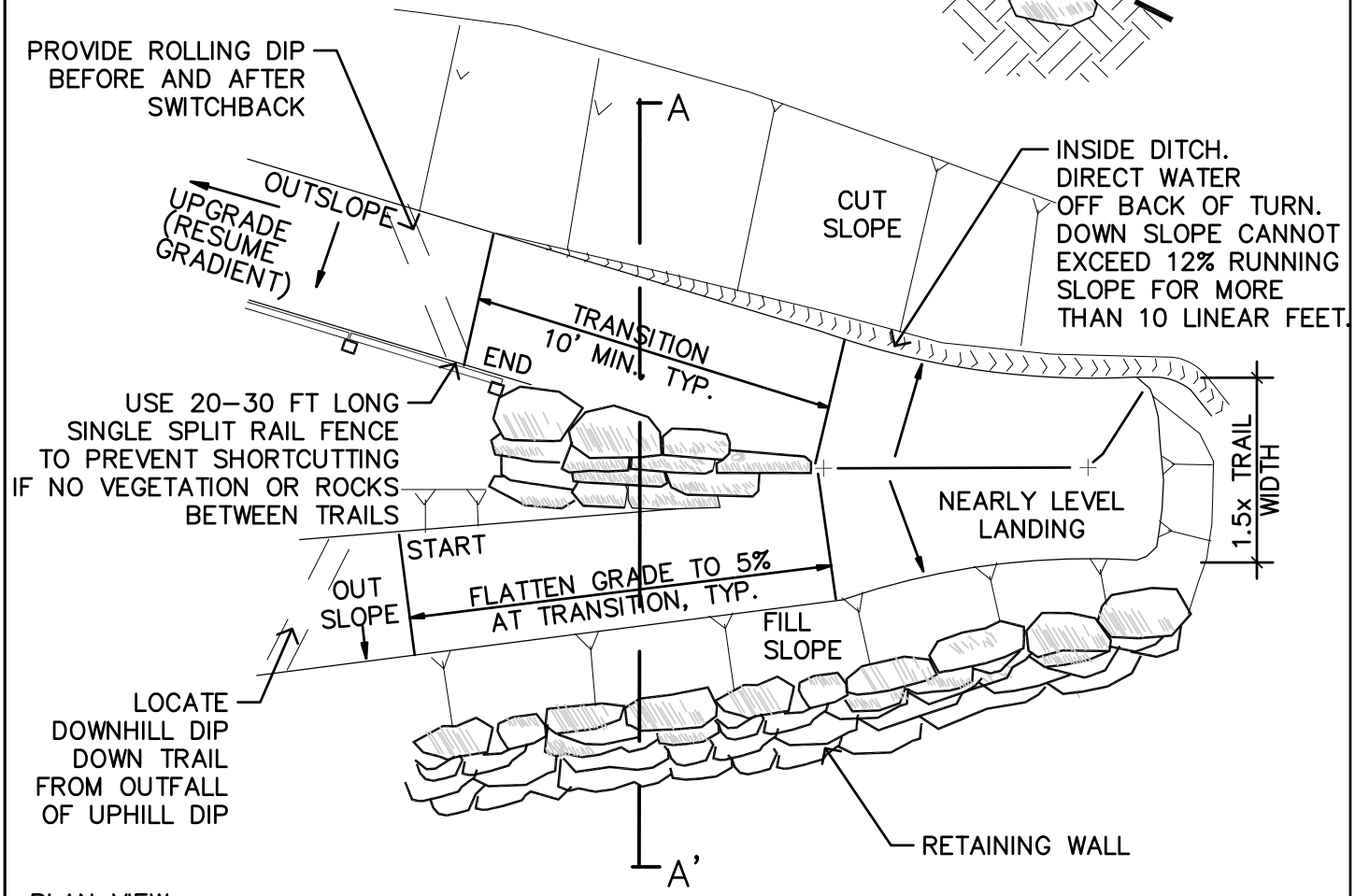
SWITCHBACK# 2 HYBRID

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1/8" = 1'-0"	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\3B switchback#2 hybrid.dwg



SECTION A–A'



PLAN VIEW

NOTES:

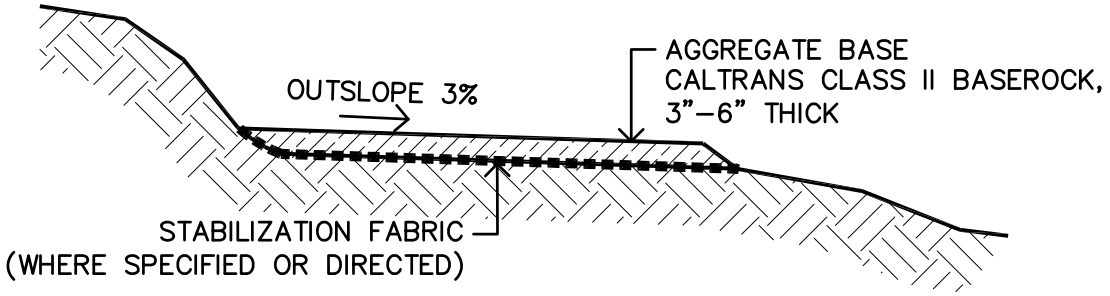
1. LOCATE TURN AT NATURAL GRADE BREAKS OR LESS STEEP AREAS IF CROSSING STEEP SIDE SLOPE. AVOID USING THIS TURN TYPE ON SIDE SLOPES OVER 40%.
2. RADIUS OF TURN WILL BE STAKED AT EACH SITE. TRAIL WIDTH TO BE PER PLANS.
3. USE MATERIAL EXCAVATED FROM THE TOP LEG TO BUILD UP THE BOTTOM LEG.
4. REFER TO TRAIL PRISM DESIGN.
5. FOR EASY ACCESS TRAILS, PROVIDE A 60"X60" MIN. LEVEL LANDING AREA AT SWITCHBACK TURN. THE LEVEL LANDING TO BE NO MORE THAN 2% IN ANY DIRECTION, EXCEPT FOR SURFACES OTHER THAN CONCRETE, ASPHALT, OR BOARDWALK, THAT MAY BE UP TO 5%.

SWITCHBACK# 3

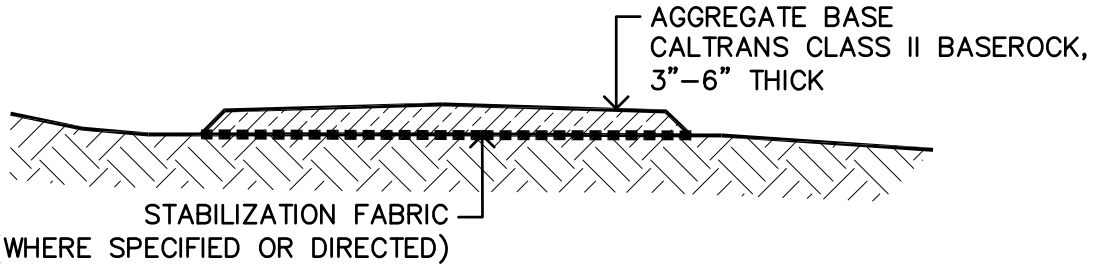
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1/8" = 1'-0"	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\3B switchback#3.dwg

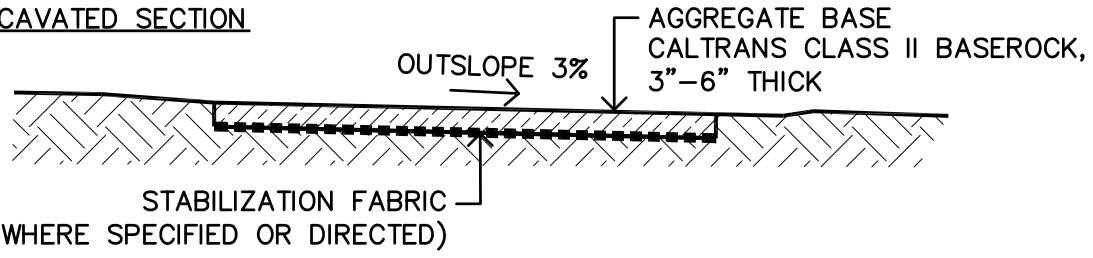
OUTSLOPE SECTION



CROWN SECTION



EXCAVATED SECTION



NOTES:

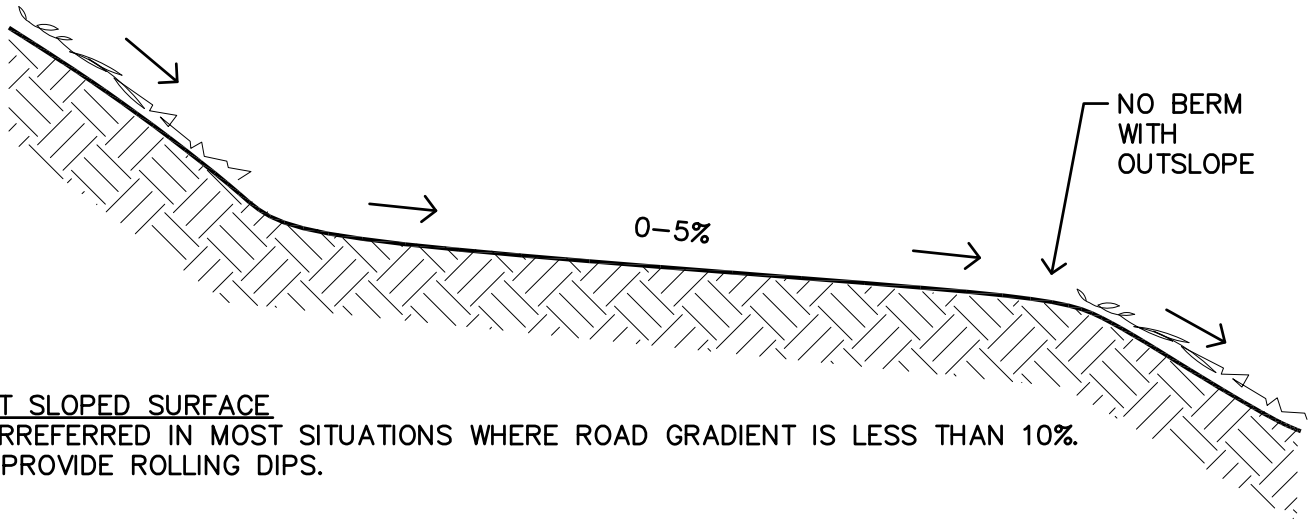
- OVER–EXCAVATION MAY BE REQUIRED IN LIMITED AREAS TO OBTAIN THE REQUIRED COMPACTION. IN ADDITION, THE USE OF STABILIZATION FABRIC (MIRAFI 500X OR EQUIVALENT) MAY BE USED TO STABILIZE LOCALIZED AREAS.
- AGGREGATE BASEROCK SHOULD CONSIST OF CLASS II BASEROCK CONFORMING TO THE LATEST CALTRANS STANDARDS. AGGREGATE BASEROCK SHOULD BE COMPACTED TO THE EXTENT FEASIBLE AND APPROVED BY DISTRICT REPRESENTATIVE.

TRAIL AGGREGATE SURFACING

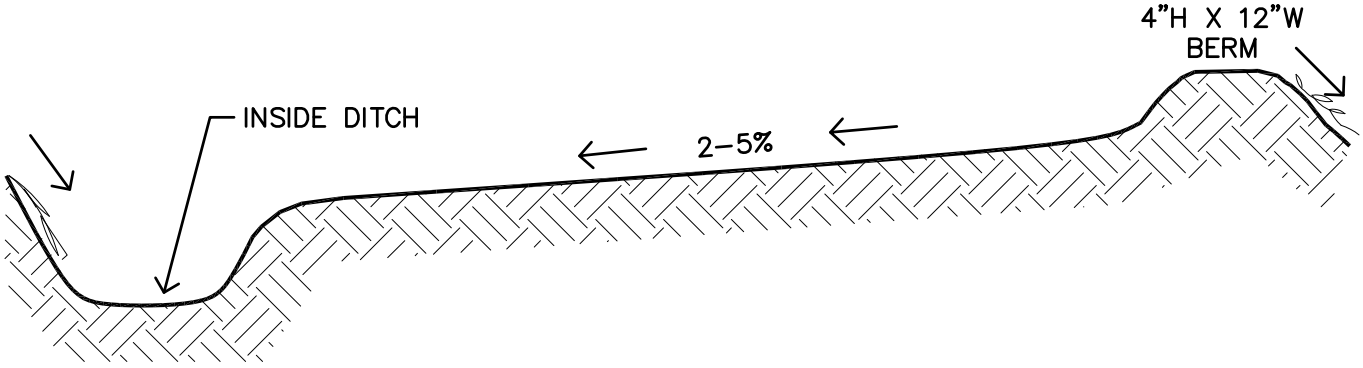
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\3B trail aggregate surfacing.dwg

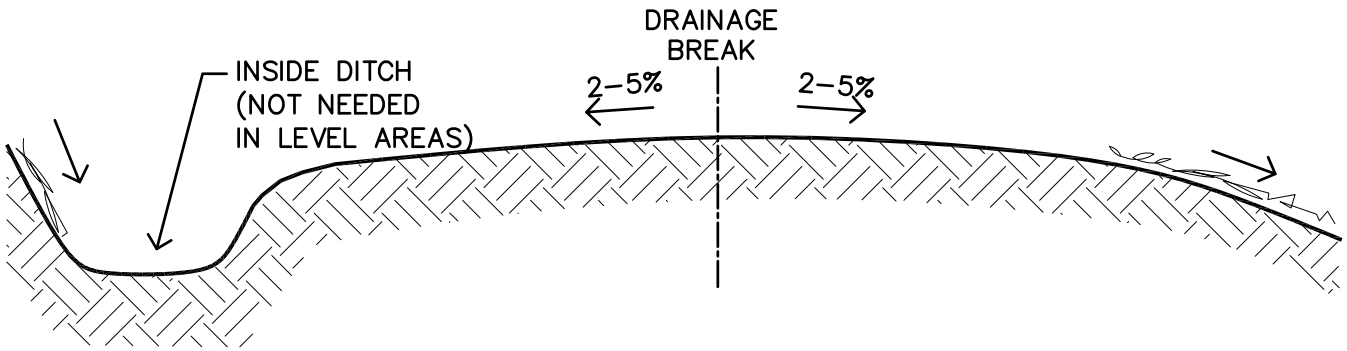
©TIMOTHY C. BEST, CEG



OUT SLOPED SURFACE
1. RREFERRED IN MOST SITUATIONS WHERE ROAD GRADIENT IS LESS THAN 10%.
2. PROVIDE ROLLING DIPS.



IN SLOPED SURFACE
1. TYPICAL DESIGN AT LOCAL WET AREAS & SPRINGS OR IN AREAS OF ERODIBLE FILL SOILS.



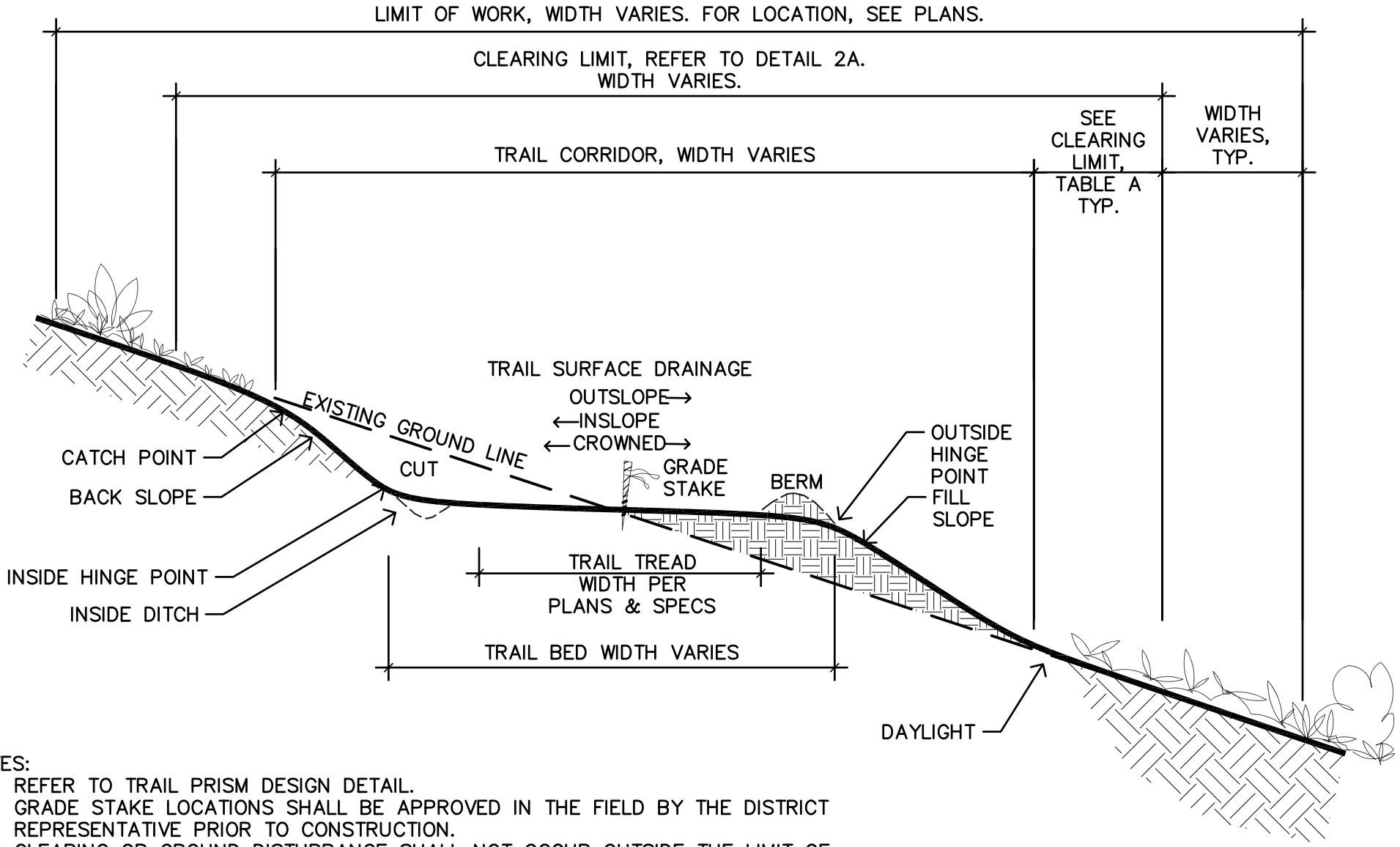
CROWNED SURFACE
1. TYPICAL DESIGN FOR LEVEL AREAS. MAY ALSO BE USEFUL ON STEEPER TRAIL GRADES (OVER 10%) WHERE CONCENTRATION OF ENTIRE RUNOFF QUANTITY INTO DITCH IS NOT DESIRED.

NOTES:
1. AVOID LESS THAN 3% CROSS SLOPE IN WET AREAS DUE TO LACK OF POSITIVE DRAINAGE OFF TRAIL SURFACE.
2. FOR TRAILS WITH CONCRETE, ASPHALT OR BOARD SURFACES THAT MAY BE USED AS EASY ACCESS TRAILS, SPECIFY 2% MAX. CROSS SLOPE. WHERE SURFACE IS OTHER THAN CONCRETE, ASPHALT, OR BOARDWALK, SPECIFY 5% MAX. CROSS SLOPE.

TRAIL CROSS SLOPE

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1"=1'-0"	DATE: 08/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\3B trail cross slope.dwg

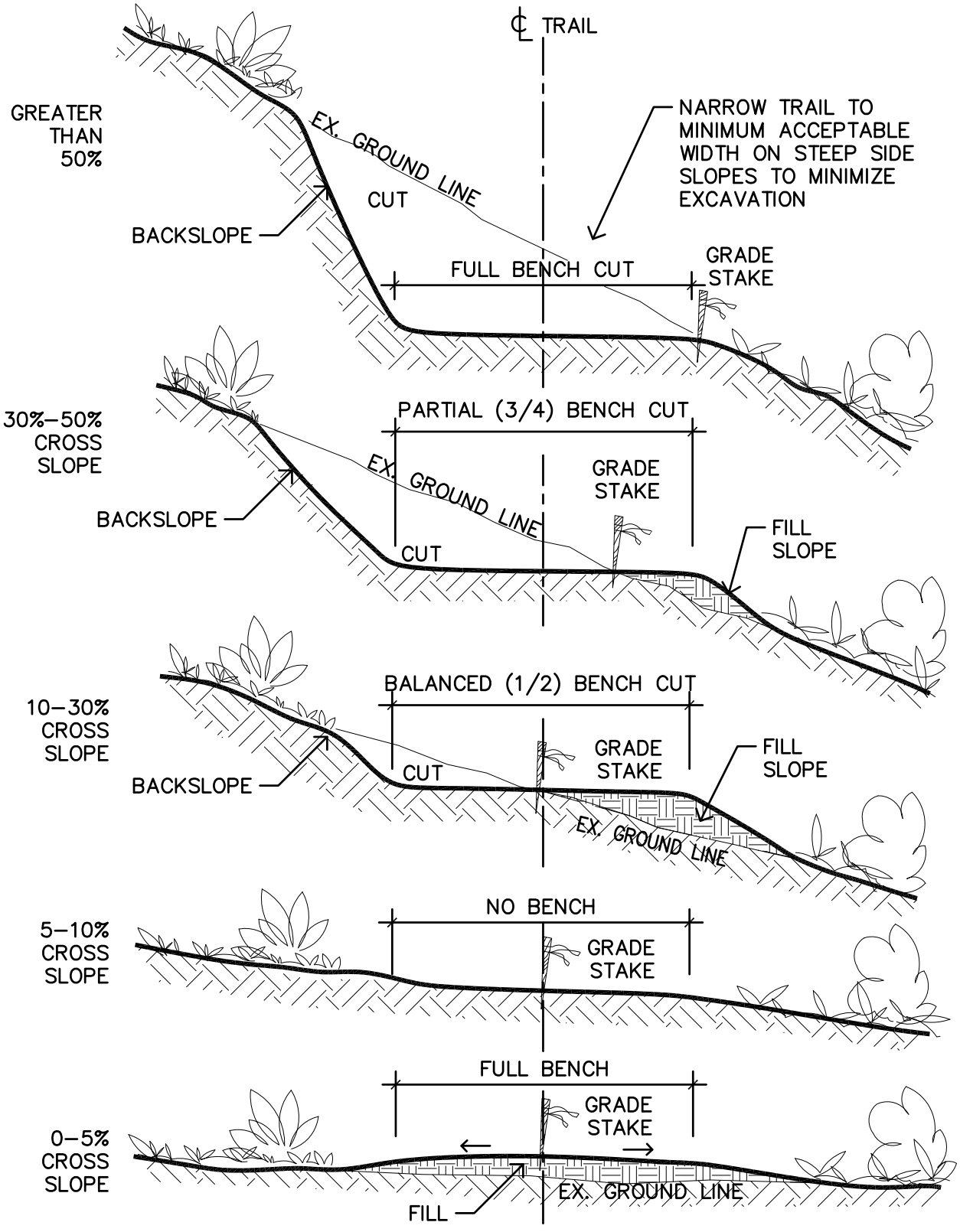


NOTES:

1. REFER TO TRAIL PRISM DESIGN DETAIL.
2. GRADE STAKE LOCATIONS SHALL BE APPROVED IN THE FIELD BY THE DISTRICT REPRESENTATIVE PRIOR TO CONSTRUCTION.
3. CLEARING OR GROUND DISTURBANCE SHALL NOT OCCUR OUTSIDE THE LIMIT OF WORK.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		TRAIL DEFINITIONS
SCALE: 1/2" = 1'-0"	DATE: 10/2019	

\\fileserv\shareall\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\3B trail definitions.dwg



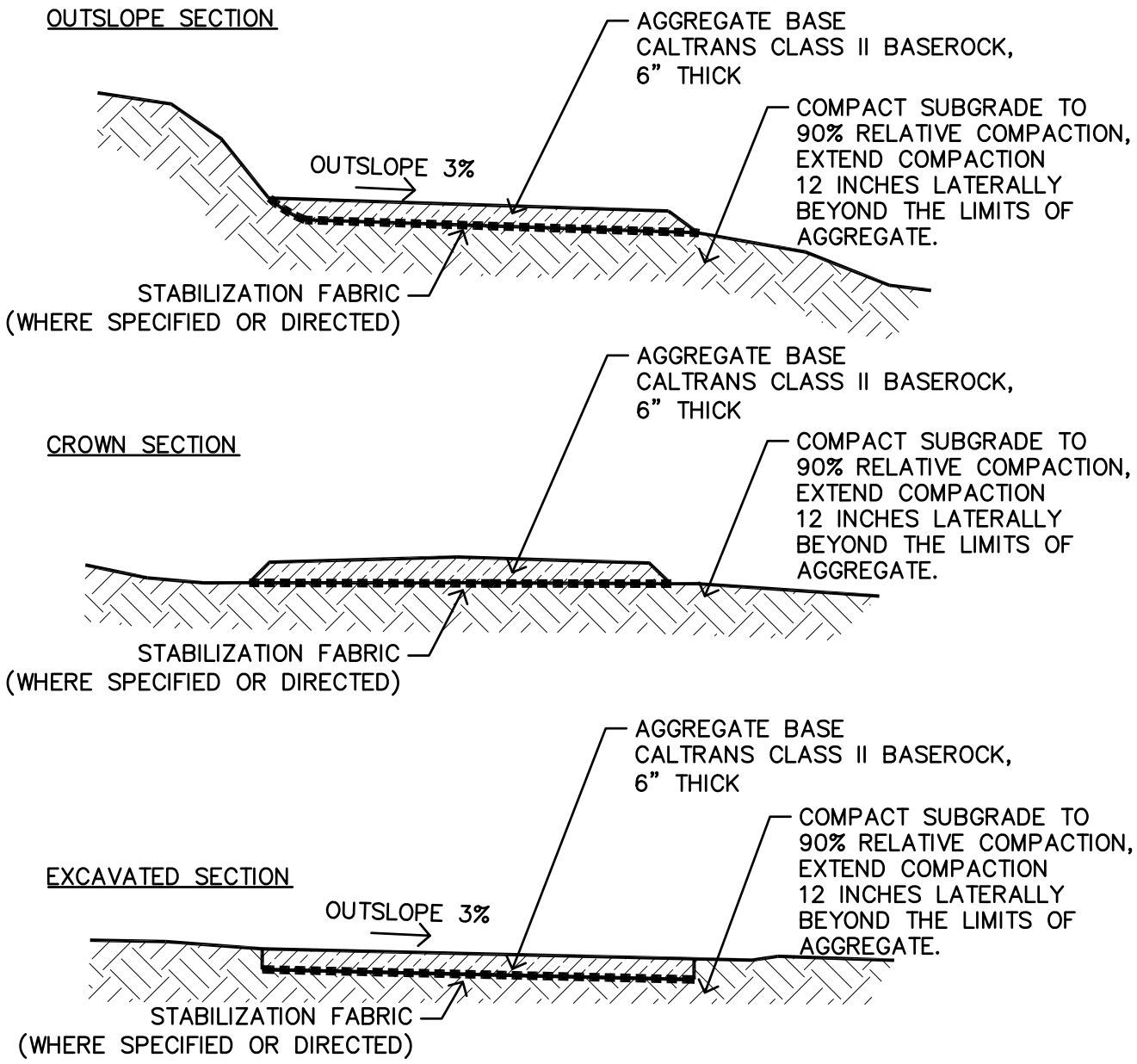
NOTES:

1. USE FULL BENCH IN WATERCOURSE PROTECTION ZONES (PER PLANS) OR WHERE STREAM WATER QUALITY COULD BE IMPACTED BY TRAIL WORK.
2. REFER TO TRAIL SURFACE DRAINAGE DETAILS.

TRAIL PRISM

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1/2" = 1'-0"	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\3B trail prism design.dwg



NOTES:

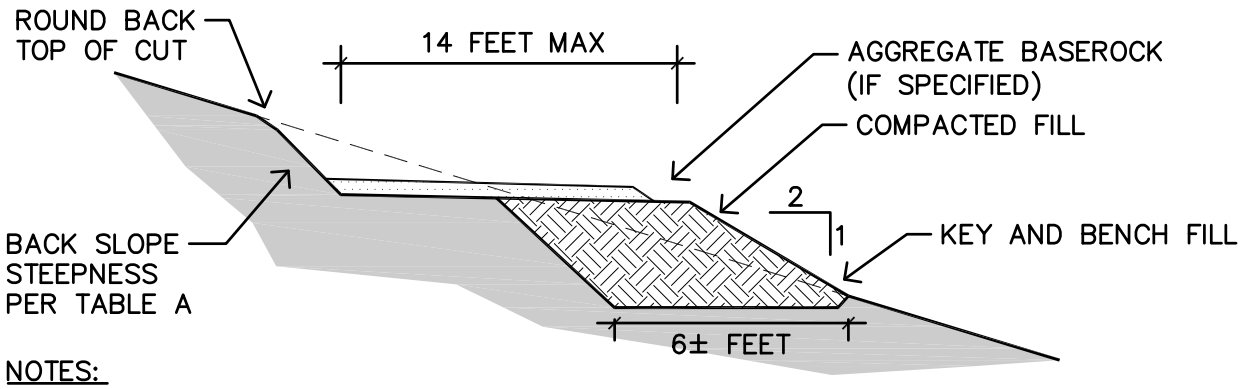
- THE SUBGRADE FOR THE ROAD TRAIL SHOULD BE SCARIFIED TO A DEPTH OF 6 INCHES, MOISTURE CONDITIONED AND COMPACTED TO A MINIMUM OF 90 PERCENT RELATIVE COMPACTION. THE SUBGRADE SHOULD BE COMPACTED TO A MINIMUM OF 12 INCHES BEYOND (LATERALLY) THE EDGE OF THE BASE ROCKED SURFACE.
- IN AREAS WHERE EXPANSIVE SUBGRADE IS ENCOUNTERED, THE SUBGRADE SHOULD BE MOISTURE CONDITIONED TO BETWEEN 2 AND 4 PERCENT OVER OPTIMUM MOISTURE. THESE AREAS WILL BE LOCATED IN THE FIELD BY THE GEOTECHNICAL ENGINEER.
- OVER-EXCAVATION MAY BE REQUIRED IN LIMITED AREAS TO OBTAIN THE REQUIRED COMPACTION. IN ADDITION, THE USE OF STABILIZATION FABRIC (MIRAFI 500X OR EQUIVALENT) MAY BE USED TO STABILIZE LOCALIZED AREAS. THE DEPTH OF OVER-EXCAVATION AND PLACEMENT OF STABILIZATION FABRIC SHOULD BE REVIEWED BY THE GEOTECHNICAL ENGINEER DURING GRADING.
- AGGREGATE BASEROCK SHOULD CONSIST OF CLASS II BASEROCK CONFORMING TO THE LATEST CALTRANS STANDARDS. AGGREGATE BASEROCK SHOULD BE COMPACTED TO A MINIMUM OF 95 PERCENT RELATIVE COMPACTION.

ROAD AGGREGATE SURFACING

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

©TIMOTHY C. BEST, CEG

ROAD WIDTH TRAIL (PARTIAL BENCH CONSTRUCTION):



NOTES:

- ROAD SHALL BE CONSTRUCTED AT A MAXIMUM WIDTH LESS THAN 14 FEET.
- AREAS TO RECEIVE FILL SHALL BE STRIPPED TO REMOVE ALL VEGETATION, ROOTS, BRUSH, HIGHLY ORGANIC SOILS AND OTHER UNSUITABLE FILL MATERIAL. DEPTH OF STRIPPING IS ASSUMED TO BE 6 TO 12 INCHES.
- FILL SHALL BE KEYED AND BENCHED INTO FIRM NATIVE SOILS. KEYWAYS SHALL BE MINIMUM 6 FEET WIDE AND INCLINED 5% INTO SLOPE.
- IN AREAS WHERE EXPANSIVE SUBGRADE IS ENCOUNTERED, THE SUBGRADE SHOULD BE MOISTURE CONDITIONED TO BETWEEN 2 AND 4% OVER OPTIMUM MOISTURE. THESE AREAS WILL BE LOCATED IN THE FIELD BY THE GEOTECHNICAL CONSULTANT.
- OVER-EXCAVATION MAY BE REQUIRED IN LIMITED AREAS TO OBTAIN THE REQUIRED COMPACTION. IN ADDITION, THE USE OF STABILIZATION FABRIC (MIRAFI 500X OR EQUIVALENT) MAY BE USED TO STABILIZE LOCALIZED AREAS. THE DEPTH OF OVER-EXCAVATION AND PLACEMENT OF STABILIZATION FABRIC SHOULD BE REVIEWED BY THE GEOTECHNICAL CONSULTANT DURING GRADING.
- ONSITE SOILS MAY BE REUSEDS AS ENGINEERED FILL. BACKFILL SHOULD CONSIST OF SELECT STRUCTURAL BACK FILL CONSISTING OF 50% OF THE MATERIAL BEING RETAINED ON THE #200 SIEVE, THE FINES PORTION BEING NON-EXPANSIVE, NO ROCK OR COBBLES GREATER THAN 3 INCHES IN SIZE, AND FREE OF ORGANIC MATERIAL. ANY IMPORTED FILL SHOULD CONSIST OF NON-EXPANSIVE SOIL, ALL FILL SHALL BE REVIEWED BY THE GEOTECHNICAL CONSULTANT 48 HOURS PRIOR TO PLACEMENT.
- FILL SHALL BE PLACED IN MAXIMUM 8 INCH THICK HORIZONTAL LIFTS AND COMPACTED TO A MINIMUM OF 90% PER ASTM D 1557. DURING PLACEMENT AND COMPACTION OF FILL, THE MOISTURE CONTENT OF THE MATERIALS BEING PLACED SHALL BE MAINTAINED.
- FILL SHALL BE BROUGHT UP TO GRADE AT A 2:1 SLOPE UNLESS OTHERWISE SPECIFIED.
- CUTBANK BACKSLOPE SHALL BE INCLINED AT SIMILAR STEEPNESS TO ADJACENT UNFAILED CUTS IN SIMILAR SOILS AND HEIGHT. REFER TO TABLE B FOR GENERAL GUIDELINE. WHERE CUTS ARE STEEPER THAN 6 FEET OF WHERE SEEPAGE OF WATER OF UNSUITABLE EARTH MATERIALS ARE ENCOUNTERED, THE BACKSLOPE SHALL BE SELECTED BY THE PROJECT GEOTECHNICAL CONSULTANT.
- WHERE SPECIFIED AGGREGATE BASEROCK SHOULD CONSIST OF CLASS II BASEROCK CONFORMING TO THE LATEST CALTRANS STANDARDS. AGGREGATE BASEROCK SHOULD BE MINIMUM 6 INCH THICK AND COMPACTED TO A MINIMUM OF 95% RELATIVE COMPACTION.
- ALL DISTURBED AREAS SHALL BE TREATED TO CONTROL EROSION PER SPECIFICATIONS.
- SPECIFICATIONS ARE INDENTED ONLY AS GUIDELINE, MODIFICATIONS MAY BE MADE IN THE FIELD BY GEOTECHNICAL CONSULTANT OR DESIGNEE.
- THIS IS NOT A DETAIL FOR EASY ACCESS TRAIL. REFER TO DISTRICT STANDARD EASY ACCESS TRAIL SPEC FOR APPLICABLE CODE.

TABLE B

MATERIAL	ASTM CLASSIFICATION	BACK SLOPE (H:V)
COMPETENT ROCK	–	0.75 : 1
DENSE SOIL – WEATHERED BEDROCK (SAND/ GRAVEL WITH FINES)	SM, SC, GM, GC	1 : 1
SOFT SOIL (SANDY CLAY AND COHESIONLESS SANDS)	CL, ML, SW, SP, GW, SP	1.5 : 1

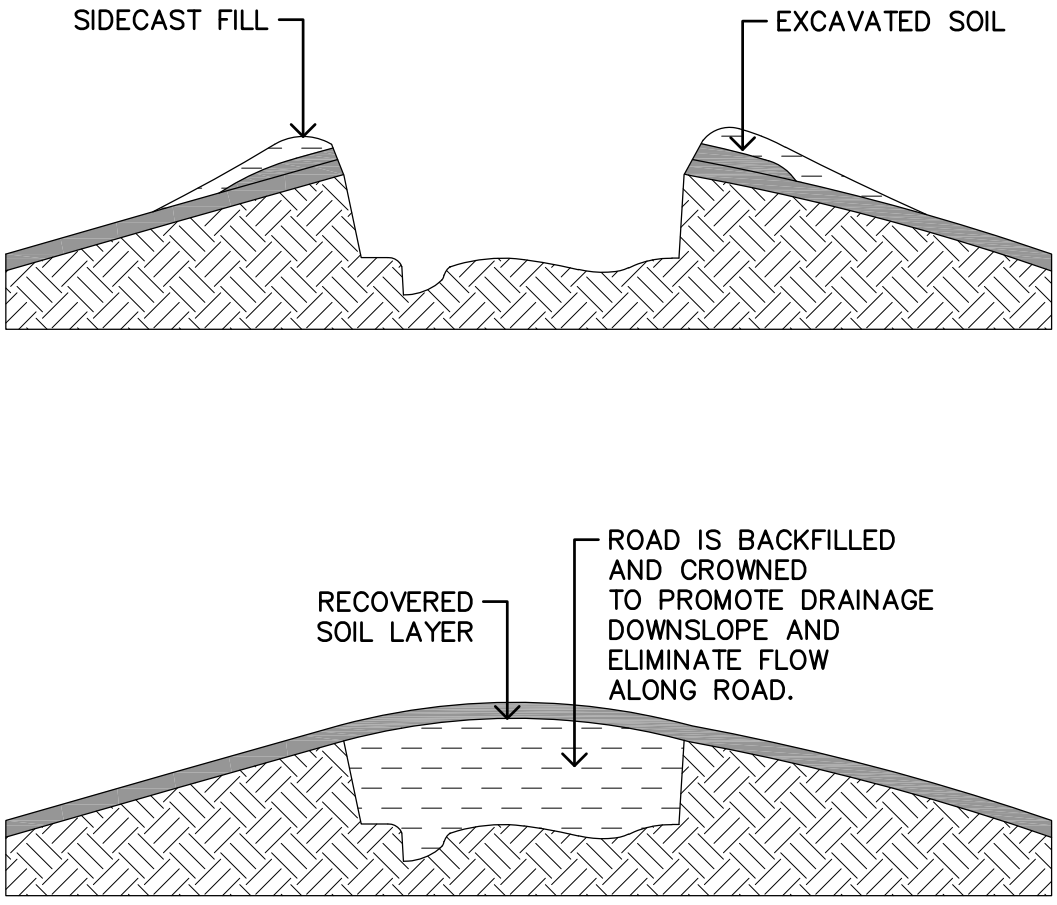
ROAD WIDTH TRAIL
PARTIAL BENCH CONSTRUCTION

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\3C road width trail partial bench.dwg

©TIMOTHY C. BEST, CEG

CROSS SECTION CUTAWAY
TYPICAL DIAGRAM



AFTER TREATMENT
FILL AND SOIL ARE RECOVERED FROM THE EDGES OF THE ROAD AND USED TO RECONTOUR THE RIDGE. LARGE WOODY DEBRIS IS SPREAD EVENLY ON THE WORK AREA.

LEGEND

BEDROCK

EXCAVATED ROCK

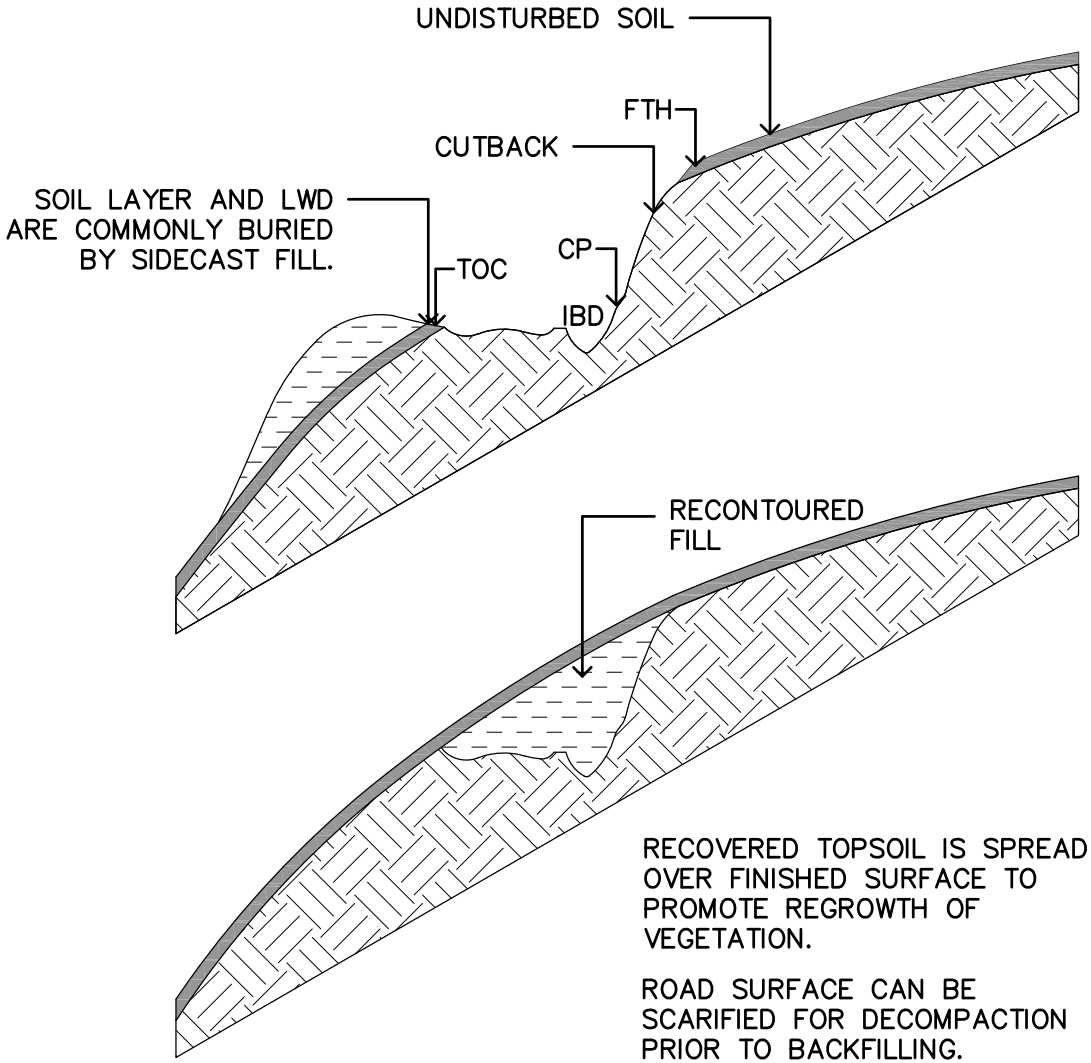
ORGANIC SOIL

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		ROAD RESTORATION RIDGE TOP
SCALE: NTS	DATE: 10/2019	

\\fileserv\shareall\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\3C road restoration ridge top.DWG

©CALIFORNIA STATE PARK

CROSS SECTION CUTAWAY
TYPICAL DIAGRAM



RECOVERED TOPSOIL IS SPREAD OVER FINISHED SURFACE TO PROMOTE REGROWTH OF VEGETATION.

ROAD SURFACE CAN BE SCARIFIED FOR DECOMPACTION PRIOR TO BACKFILLING.

AFTER TREATMENT
ROAD FILL IS RECOVERED FROM THE OUTBOARD FILL AND REPLACED INTO THE CUT BENCH. TOPSOIL IS PRESERVED AND SHOULD E REDISTRIBUTED ON FINISHED SURFACES. TAKE APPROPRIATE EROSION CONTROL MEASURES.

LEGEND

- BEDROCK
- EXCAVATED ROCK
- ORGANIC SOIL

CP	CONTROL POINT
CTH	CUT TO HERE
FTH	FILL TO HERE
TOC	TOP OF CUT
IBD	INBOARD DITCH

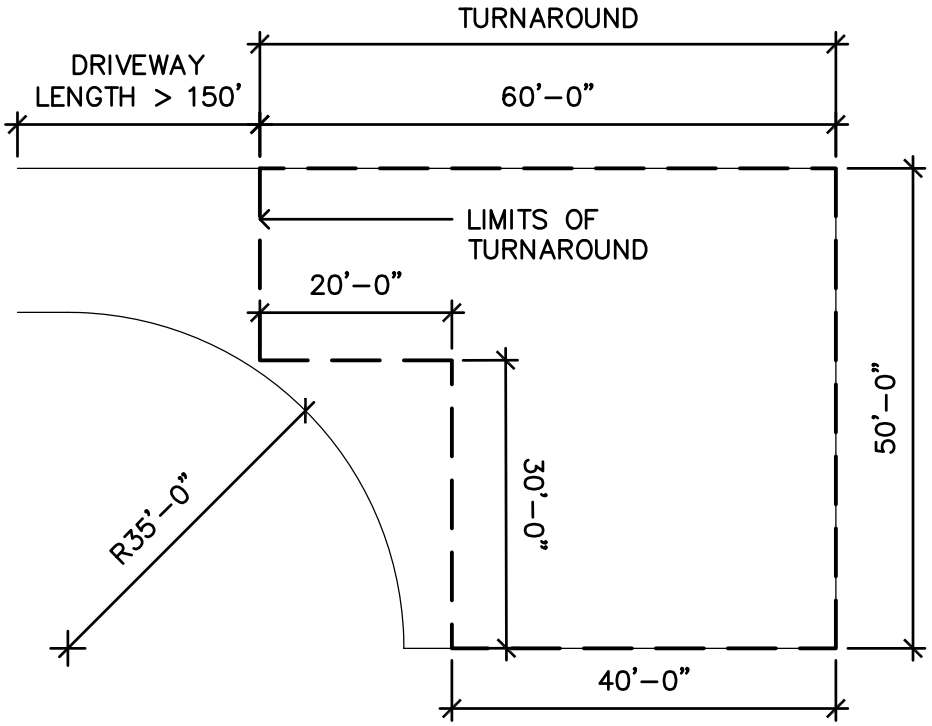
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT

ROAD RESTORATION SIDE SLOPE

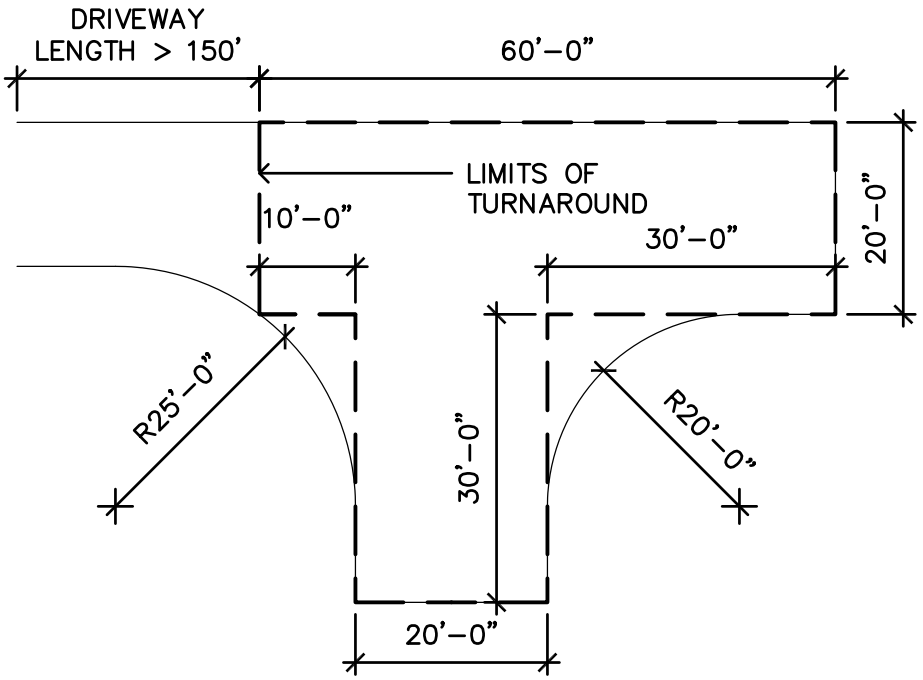
SCALE: NTS | DATE: 10/2019

\\fileserv\shareall\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\3C road restoration side slope.DWG

©CALIFORNIA STATE PARK



PLAN ALTERNATE 1



PLAN ALTERNATE 2

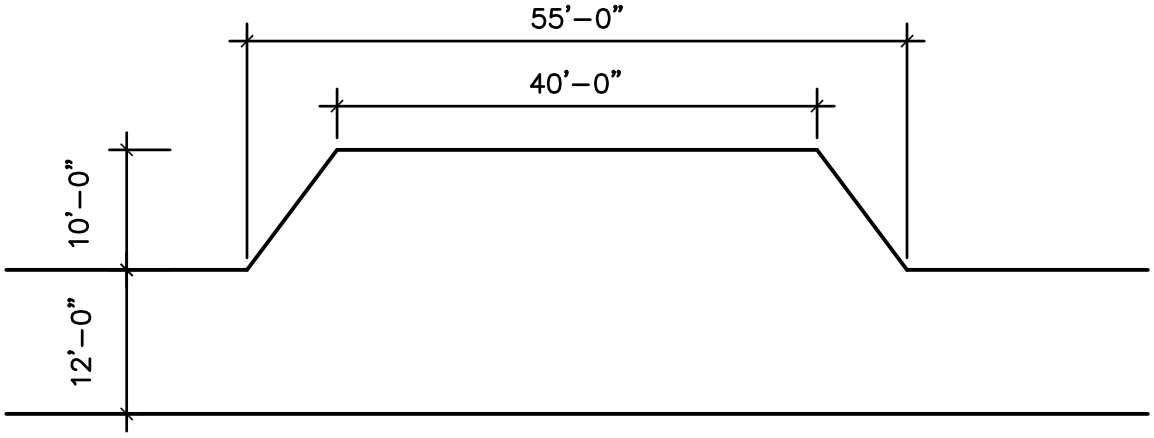
NOTES:
1. TURNAROUNDS ARE REQUIRED FOR ALL DRIVEWAYS IN EXCESS OF 150' IN LENGTH.
2. IF FEASIBLE, TURNAROUNDS SHOULD BE PROVIDED AT THE END OF PATROL ROUTES W/ DEAD ENDS LONGER THAN 500'.
3. ACTUAL TURNAROUND CONFIGURATION MAY VARY AS LONG AS MINIMUM TURNAROUND DIMENSIONS (SHOW W/ DASHED LINES) ARE MAINTAINED.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		TYPICAL FIRE TRUCK TURNAROUND
SCALE: 1"=20'-0"	DATE: 11/17/2011	

\\fileserv\shareall\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\3C Turnaround_FireTruck.dwg

TURNOUTS

1. TURNOUTS SHOULD BE PLACED ON ALL ACCESS ROADS TO STRUCTURES WHICH ARE UNDER 20' WIDE AND OVER 500' LONG AT INTERVALS OF EVERY 500'. THE DRIVEWAY SHOULD BE A MINIMUM OF 12 FEET WIDE. THE PULLOUT SHOULD ADD AN ADDITIONAL 10' OF WIDTH FOR A LENGTH OF 55'.
2. TURNOUTS SHOULD BE PLACED ON DESIGNATED PATROL ROUTES WHERE FEASIBLE. IF POSSIBLE EVERY 1/4 MILE.



TURNOUT

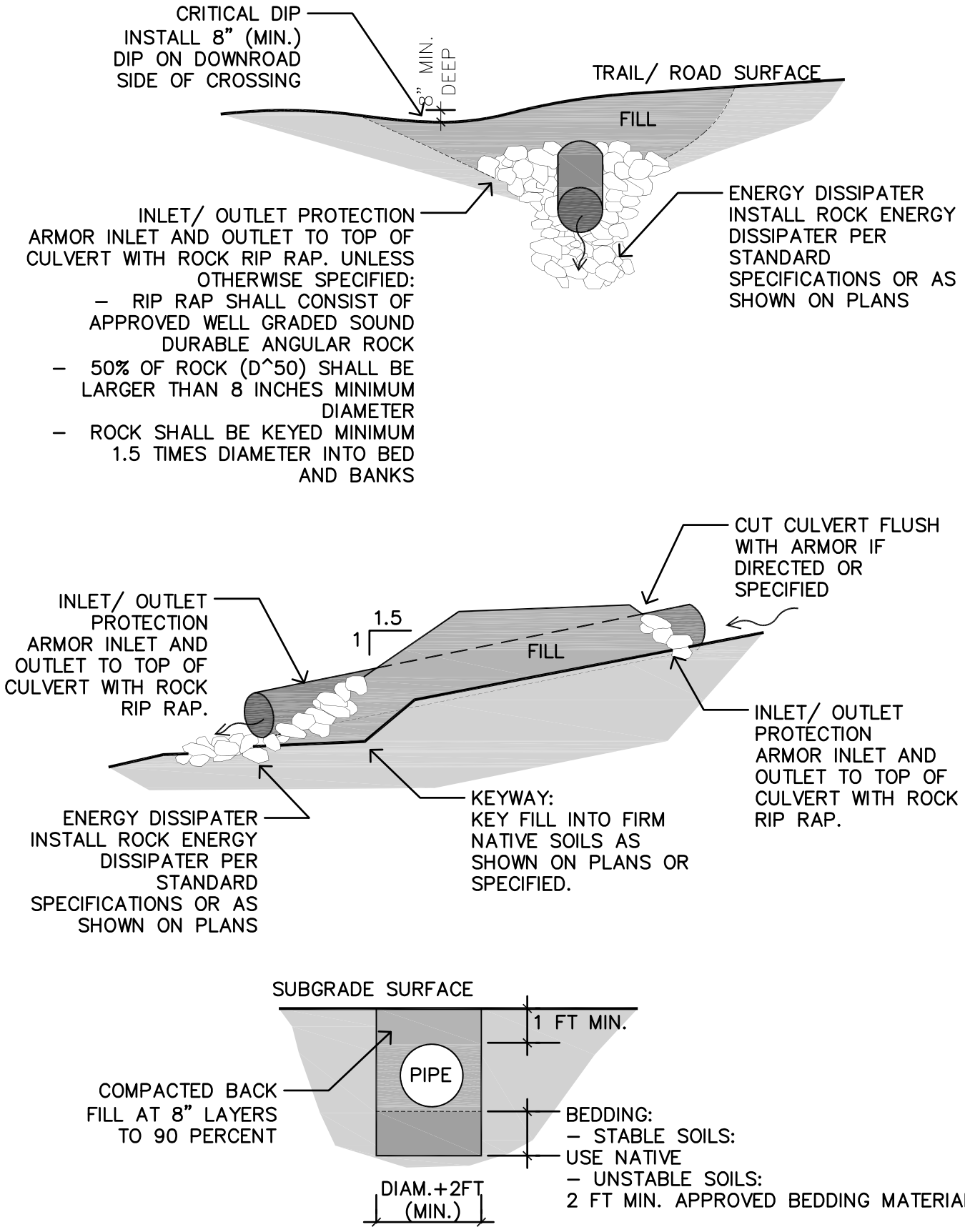
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1/16" = 1'-0"	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\3C turnout.dwg

DETAILS AND SPECIFICATIONS GUIDELINES

SECTION 4

DRAINAGE



PERMANENT CULVERT - RURAL ROAD

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 permanent culvert.dwg

©TIMOTHY C. BEST, CEG

NOTES

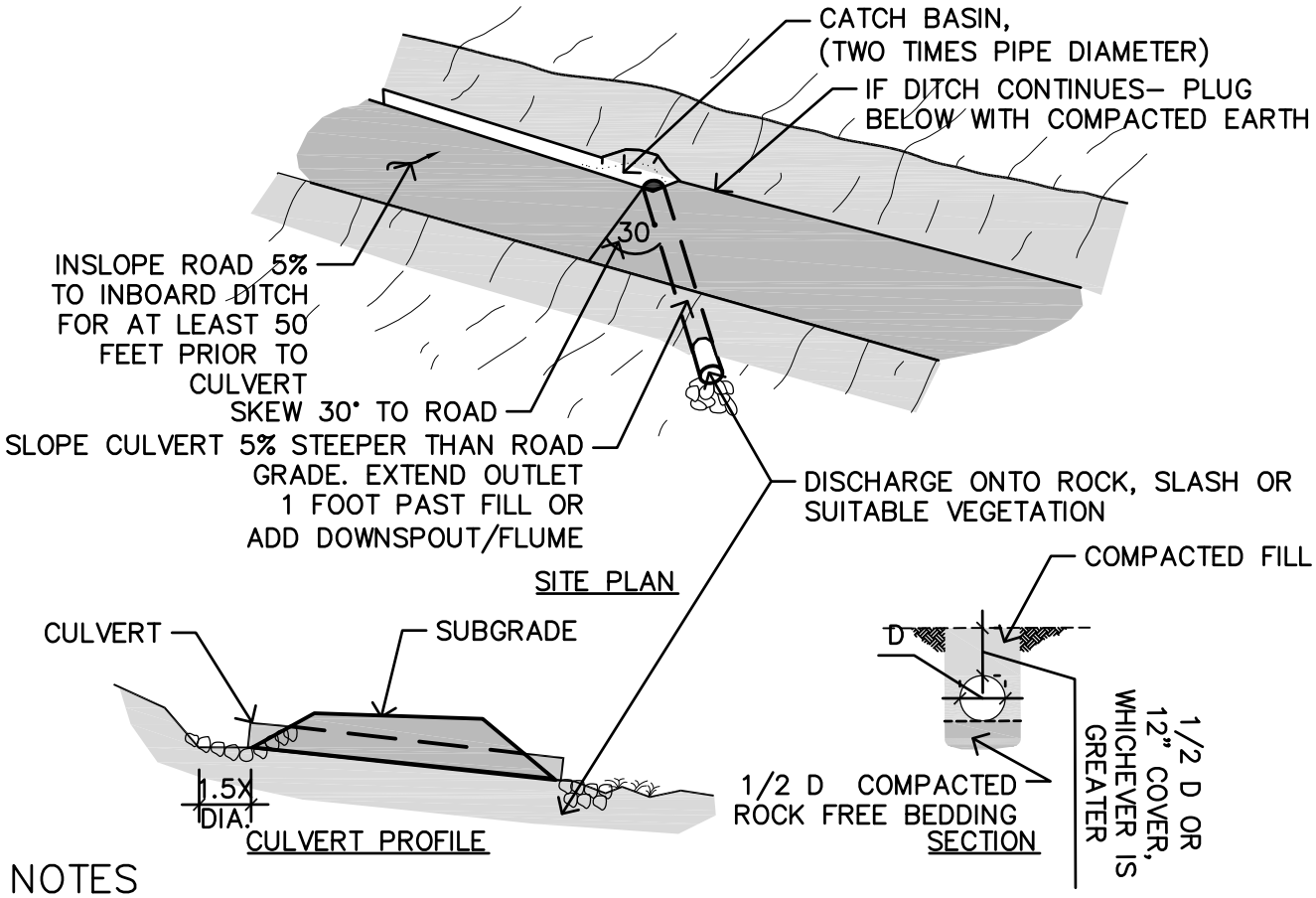
- CULVERT ORIENTATION
  - CULVERT SHOULD BE INSTALLED AT THE NATURAL STREAM LEVEL, GRADE AND ORIENTATION
- CULVERT BED
  - THE WIDTH OF TRENCHES SHALL PERMIT SATISFACTORY JOINING AND THROUGH TAMPING OF THE BACKFILL MATERIAL.
  - THE CULVERT BED SHALL BE CLEAN AND FREE OF LARGE WOODY DEBRIS AND LARGE ROCKS. UNSUITABLE MATERIAL SHALL BE REPLACED WITH SELECTED GRANULAR FOUNDATION MATERIAL AND COMPACTED TO OBTAIN UNIFORM BED.
  - WHERE ROCK, HARDPAN, OR OTHER UNYIELDING MATERIAL IS ENCOUNTERED, IT SHALL BE REMOVED BELOW THE FOUNDATION GRADE FOR A DEPTH OF AT LEAST 1 FOOT AND A WIDTH OF AT LEAST 2 FEET PLUS THE CULVERT DIAMETER. THIS MATERIAL SHALL BE REPLACED WITH SELECTED ENGINEER FILL.
  - THE INLET TO THE CULVERT SHOULD BE A COUNTERSUNK 10% OF THE PIPE DIAMETER BELOW STREAM GRADE SO THAT THE WATER FALLS INTO THE CULVERT INLET.
- LAYING PIPE
  - CULVERT SHALL BE LAID IN CENTER OF TRENCH ON UNIFORM GRADE LINE TO CONFORM TO THE FLOW LINE OF THE STREAM. THE ENTIRE LENGTH OF PIPE SHALL BE IN CONTACT WITH THE CULVERT BEDDING.
  - UNLESS OTHERWISE SPECIFIED, THE CULVERT SHALL HAVE A MINIMUM GRADE OF 2%.
  - CULVERT SHALL BE JOINED AND ANCHORED PER MANUFACTURES GUIDELINES.
- BACKFILL
  - FILL SHALL BE KEYED AND BENCH INTO FIRM NATIVE SOILS. AREAS TO RECEIVE FILL SHALL BE STRIPPED TO REMOVE VEGETATION, NEAR SURFACE ROOTS, BRUSH, HIGHLY ORGANIC SOILS AND OTHER UNSUITABLE FILL MATERIAL.
  - SELECT MINERAL SOIL SHALL BE USED FOR CULVERT BACK FILL. THE BACK FILL SHALL HAVE NO ROCKS GREATER THAN 3 INCHES IN ANY DIMENSIONS PLACED CLOSER THAN 1 FOOT TO THE CULVERT.
  - BACKFILL SHALL BE ADEQUATELY COMPACTED THROUGHOUT THE ENTIRE PROCESS TO A DEGREE GREATER THAN THE SURROUNDING MATERIALS (APPROXIMATELY 85 PERCENT RELATIVE COMPACTION). DURING PLACEMENT AND COMPACTION OF ILL, THE MOISTURE CONTENT OF THE MATERIALS BEING PLACED SHALL BE MAINTAINED.
  - FILL SHALL BE BROUGHT UP TO GRADE AT A 1.5:1 SLOPE UNLESS OTHERWISE SPECIFIED.
- CULVERTS
  - CULVERTS SHALL BE SMOOTH BORE, DOUBLE WALL (ASTM D3350 AND AASHTO M294, TYPE S)
  - CULVERTS SHALL BE CUT FLUSH WITH ARMORED EMBANKMENT/HEADWALL IF DIRECTED OR SPECIFIED.
- INLET/OUTLET PROTECTION
  - ARMOR INLET AND OUTLET TO TOP OF CULVERT WITH ROCK RIP RAP.
  - RIPRAP SHALL CONSIST OF APPROVED WELL GRADED SOUND DURABLE ANGULAR ROCK UNLESS OTHERWISE SPECIFIED.
  - 50% OF ROCK (D_{50}) SHALL BE LARGER THAN 8 INCHES MINIMUM DIAMETER UNLESS OTHERWISE SPECIFIED.
  - ROCK SHALL BE KEYED MINIMUM 1.5 TIMES DIAMETER INTO BED AND BANKS UNLESS OTHERWISE SPECIFIED.
- ENERGY DISSIPATER
  - CULVERT SHALL DISCHARGE ONTO ROCK APRON PER GENERAL SPECIFICATIONS.
- EROSION CONTROL
  - ON RUNNING STREAMS, WATER WILL BE PUMPED OR DIVERTED PAST THE CROSSING AND INTO THE DOWNSTREAM CHANNEL DURING THE CONSTRUCTION PROCESS.
  - CRITICAL DIP (8" MIN) SHALL BE INSTALLED ON THE DOWN ROAD SIDE OF CROSSING.
  - EXPOSED SOILS SHALL BE MULCHED PER STANDARD SPECIFICATION. INSTALL COIR ROLL AT BASE OF EXPOSED SOILS.
- DEPARTMENT OF FISH AND GAME AGREEMENT
  - CONFORM TO DEPARTMENT OF FISH AND GAME 1600 AGREEMENT WHERE APPLICABLE.

PERMANENT CULVERT SPECIFICATION

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 permanent culvert notes.dwg

©TIMOTHY C. BEST, CEG



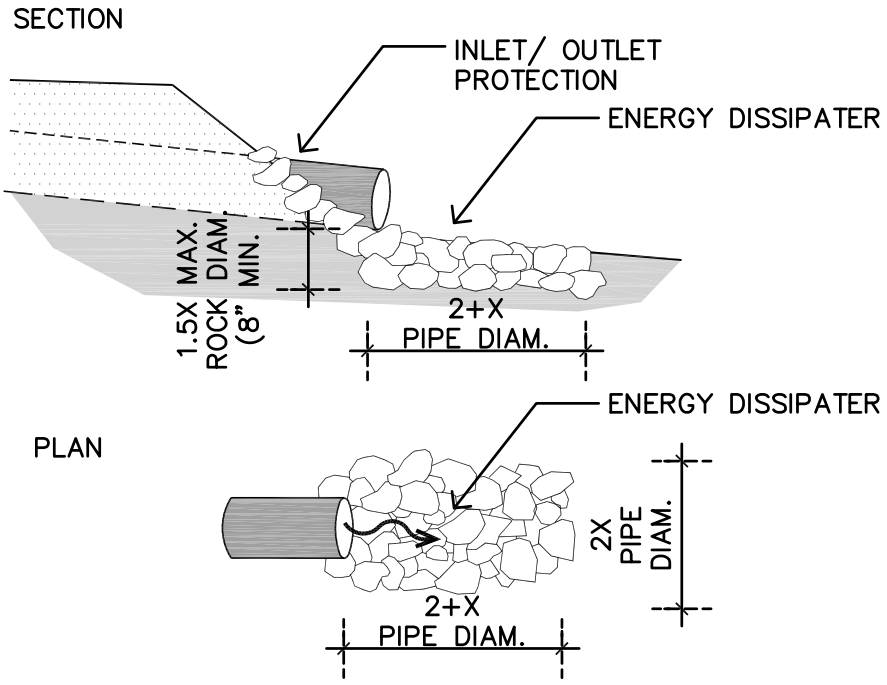
NOTES

1. INSTALL DITCH RELIEF CULVERTS AT FLAGGED LOCATIONS OR AS IDENTIFIED ON PLANS. THE MAXIMUM SPACING OF CULVERTS SHALL BE 150 FEET UNLESS OTHERWISE SPECIFIED OR DIRECTED.
2. CULVERTS SHALL BE 12–INCH DIAMETER SMOOTH BORE, DOUBLE WALL HDPE (ASTM D3350 AND AASHTO M294, TYPE S) UNLESS OTHERWISE SPECIFIED.
3. PLACE CULVERTS AT A 30 DEGREE SKEW ANGLE DOWN GRADE (WHERE ALLOWABLE) WITH A GRADIENT 5% STEEPER THAN THAT OF THE ROAD. CULVERTS SHOULD EXTEND A MINIMUM OF 1' BEYOUND BASE OF ROAD FILL.
4. WHERE NECESSARY, OUTLET DITCH SHALL BE CONSTRUCTED AT A STEEPER GRADIENT THAN THE CULVERT, AT LEAST ONE PIPE DIAMETER IN WIDTH, AND WITH BANK TAPERED BACK TO A 1:1 SLOPE.
5. THE CULVERT BEDDING SHALL BE PLACED TO A DEPTH OF ½ DIAMETER OF THE CULVERT, AND BE CLEAN AND FREE OF LARGE WOODY DEBRIS AND LARGE ROCKS. TRENCH SHALL BE ADEQUATE WIDTH TO FACILITATE COMPACTION.
6. THE BACKFILL SHALL CONSIST OF APPROVED MINERAL SOIL, WITH NO ROCKS GREATER THAN 3 INCHES IN ANY DIMENSION PLACED CLOSER THAN 1 FOOT TO THE CULVERT. BACKFILL SHALL BE ADEQUATELY COMPACTED THROUGHOUT THE ENTIRE PROCESS TO 95 PERCENT ASTM 1557 UNLESS OTHERWISE SPECIFIED. DURING PLACEMENT AND COMPACTION OF FILL, THE MOISTURE CONTENT OF THE MATERIALS BEING PLACED SHALL BE MAINTAINED AS DIRECTED BY THE ENGINEER.
7. COMPACTED FILL MINIMUM COVER SHALL BE THE GREATER OF 12" OR HALF THE PIPE DIAMETER.
8. ROCK, SLASH OR SUITABLE VEGETATION SHOULD BE USED AT DISCHARGE POINT AS DIRECTED OR SPECIFIED.
9. PLACE A DITCH BLOCK IMMEDIATELY DOWNSLOPE OF THE CULVERT INTAKE TO PREVENT DITCH FLOW FROM BYPASSING THE PIPE INLET.
10. SPECIFICATIONS ARE INTENDED ONLY AS GUIDELINES; MODIFICATIONS MAY BE MADE IN FE FIELD BY GEOTECHNICAL CONSULTANT OR DESIGNEE.

DITCH RELIEF CULVERT

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

©TIMOTHY C. BEST, CEG



NOTES:

– INLET/ OUTLET PROTECTION

1. ARMOR INLET AND OUTLET TO THE TOP OF THE CULVERT WITH ROCK RIPRAP, AS SHOWN.
2. RIPRAP SHALL CONSIST OF APPROVED WELL GRADED SOUND DURABLE ANGULAR ROCK UNLESS OTHERWISE SPECIFIED.
3. 50% OF ROCK (D_{50}) SHALL BE LARGER THAN 8 INCHES MINIMUM DIAMETER UNLESS OTHERWISE SPECIFIED.
4. ROCK SHALL BE KEYED MINIMUM 1.5 TIMES DIAMETER INTO BED AND BANKS UNLESS OTHERWISE SPECIFIED.

– ENERGY DISSIPATER

1. CULVERT SHALL DISCHARGE ONTO ROCK ENERGY DISSIPATER/ APRON ALIGNED WITH NATIVE CHANNEL AS SHOWN ON PLANS OR DIRECTED.
2. UNLESS OTHERWISE SPECIFIED IN PLANS OR DIRECTED BY GEOTECHNICAL CONSULTANT, ARMOR SHALL CONSIST OF APPROVED SOUND DURABLE ANGULAR ROCK ADEQUATELY SIZED FOR DESIGN FLOW. PRELIMINARY ROCK SIZE IS SPECIFIED IN TABLE C.
3. ROCK APRON SHALL EXTEND A MINIMUM OF 2 TIME PIPE DIAMETER DOWNSTREAM OF OUTLET AND BE A MINIMUM OF 2 TIMES PIPE DIAMETER WIDE. APRON MAY TAPER DOWNSTREAM ON STEEPER GRADIENT CHANNELS.
4. ROCK SHALL BE EMBEDDED INTO CHANNEL A MINIMUM OF 1.5 TIMES MAXIMUM ROCK DIAMETER. SUBEXCAVATE CHANNEL BED AND BANKS IN AREAS TO RECEIVE ROCK. ROCK SHALL BE PLACED TO FORM A UNIFORM GRADE AT THE PIPE OUTLET IN A MANNER TO PREVENT FLOW FROM ERODING AROUND THE EDGE OF THE APRON.
5. SEPARATE ROCK FROM NATIVE SOILS WITH APPROVED GEOTEXTILE FABRIC IF SPECIFIED ON PLANS OR DIRECTED.
6. COMPACT LOOSE SOILS ADJACENT TO ROCK RIP RAP.

TABLE C

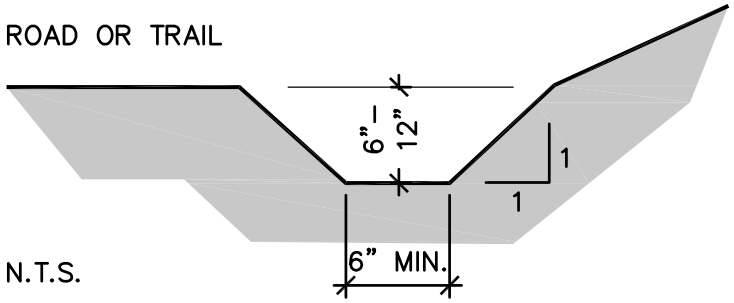
PIPE DIAMETER	D_{50} ROCK SIZE (50% OF ROCK LARGER THAN SPECIFIED)	
	DIAMETER	WEIGHT
<18"	8"	GABION +
24"	12"	0.25 T
36"	24"	0.5 T
48"	36"	1.5 T

ENERGY DISSIPATER

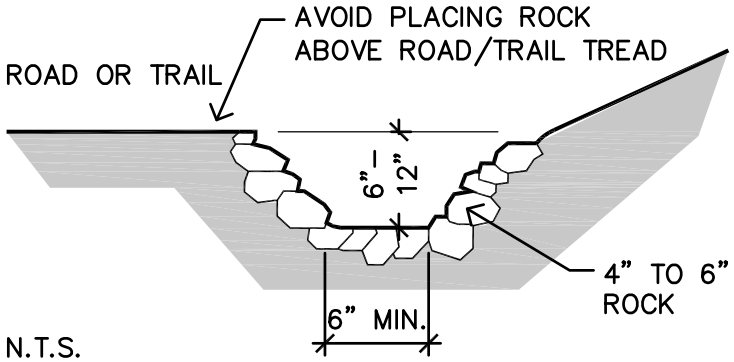
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT | SCALE: NTS | DATE: 10/2019

©TIMOTHY C. BEST, CEG

INSIDE DITCH (NATIVE)



INSIDE DITCH (ROCK LINED)



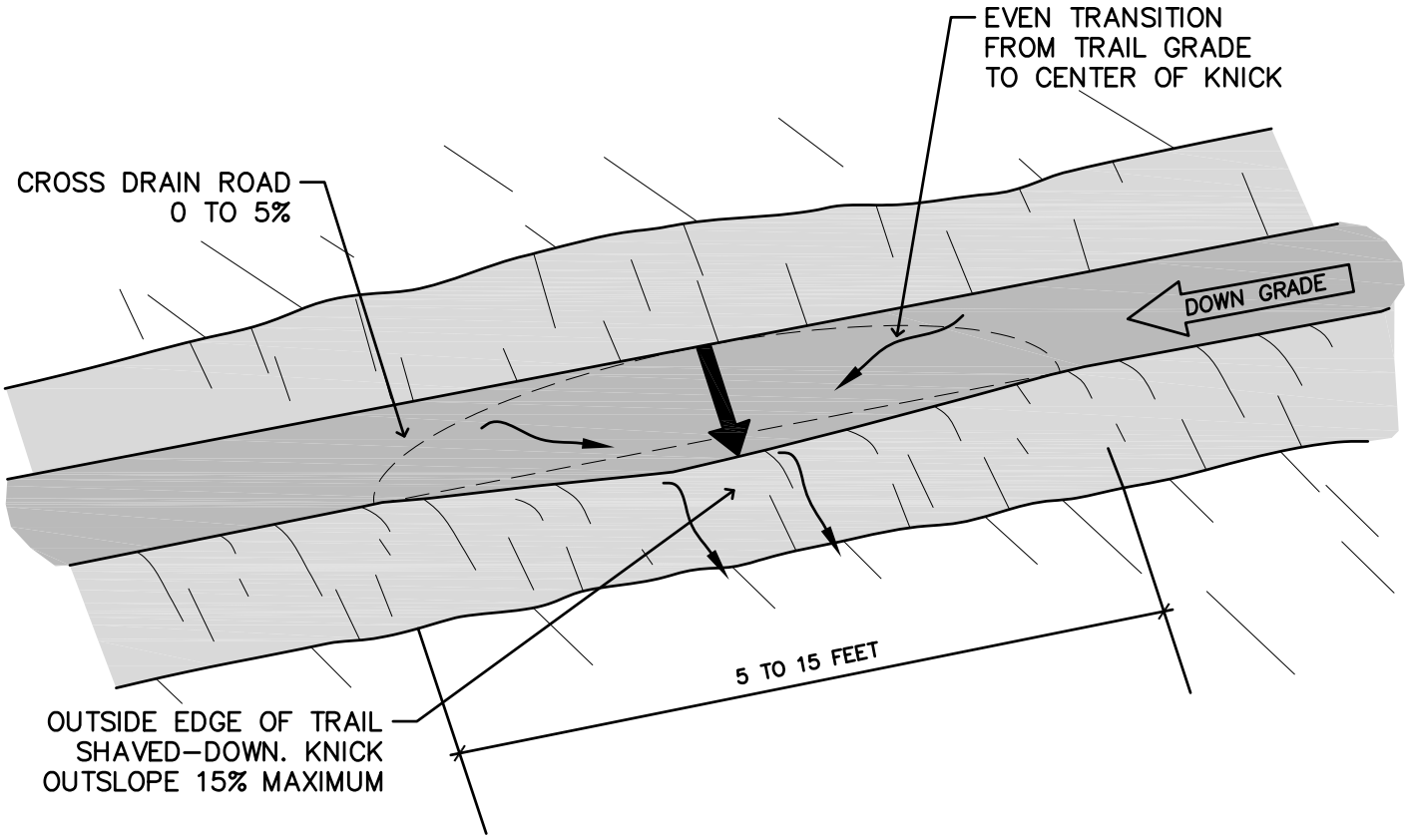
NOTES:
1. SLOPE DITCH TO DRAIN 3% MIN.
2. ARMOR DITCH WHERE SPECIFIED.
3. DRAIN DITCH TO DITCH RELIEF CULVERT INLET AS SPECIFIED.

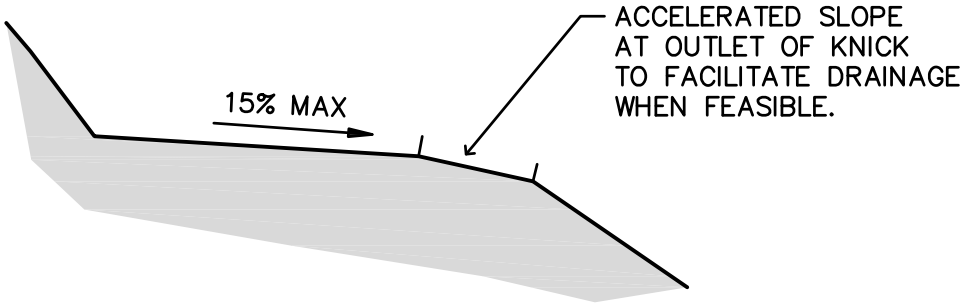
INSIDE ROAD DITCH

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 inside road ditch.dwg

©TIMOTHY C. BEST, CEG





NOTES

1. A KNICK IS A SEMI-CIRCULAR, SHAVED-DOWN SECTION OF THE OUTSIDE EDGE OF THE TRAIL.
2. THE CENTER OF THE NICK IS OUTSLOPED 15% MAX. WHICH DRAWS WATER OFF OF THE TRAIL.
3. DIP OUTLETS SHOULD BE LOCATED TO DRAIN INTO AREAS WITH ADEQUATE SEDIMENT FILTER QUALITY AND NON-ERODIBLE MATERIAL SUCH AS ROCK, SLASH, BRUSH, ETC.

KNICK

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 knick.dwg

©TIMOTHY C. BEST, CEG

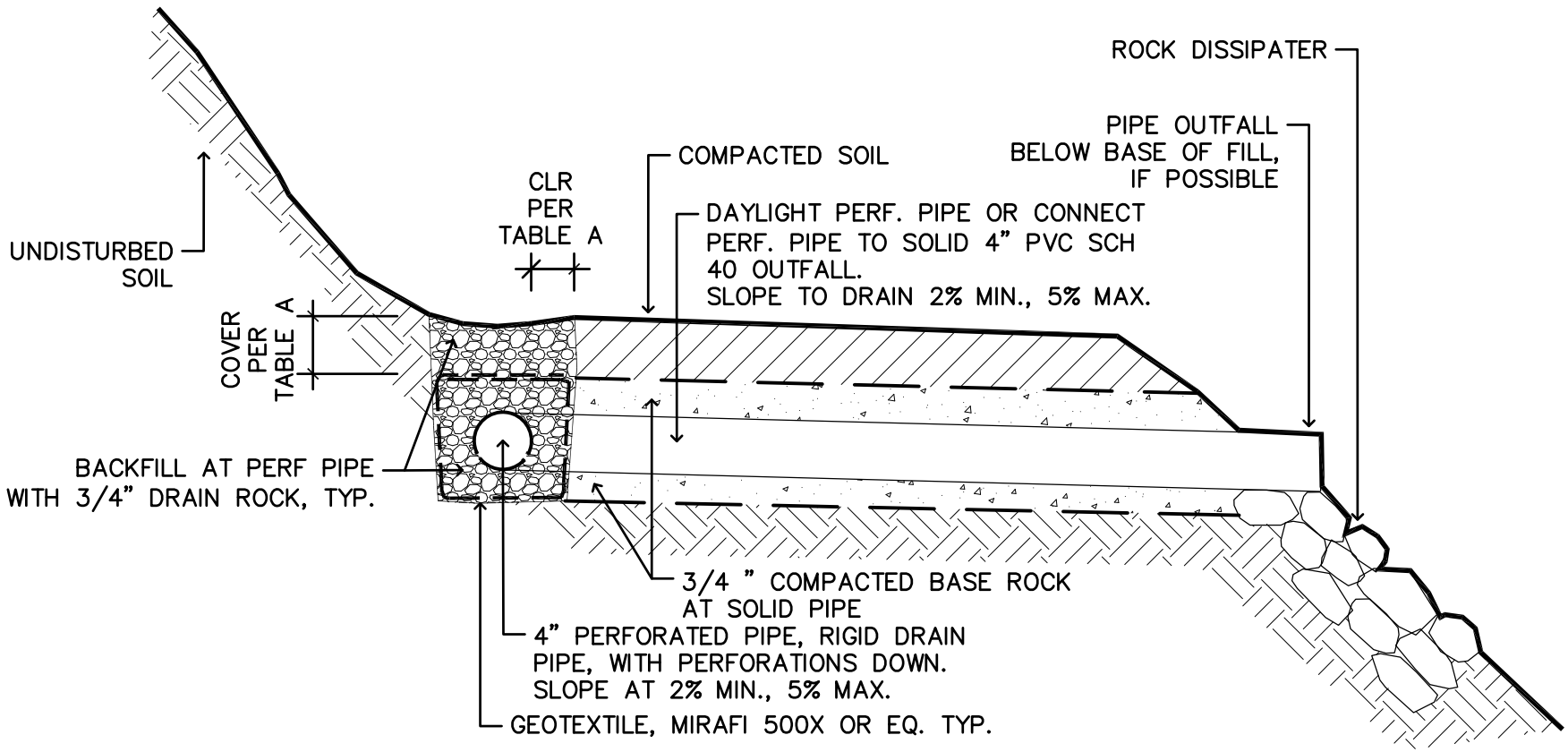


TABLE A: CLEARANCES AT PIPE

DIMENSION	ROAD (10'–12')	TRAIL (4'–6')
COVER FROM SURFACE TO GEOTEXTILE	6'	4'
CLEARANCE B/W PIPE & GEOTEXTILE, ALL SIDES	4'	2'

NOTES:
1. DAYLIGHT PERF. PIPE, OR PROVIDE SOLID OUTFALL PIPE AT 100' O.C. MAX.
2. SEAL OR CAP UPHILL END OF PERF. PIPE.

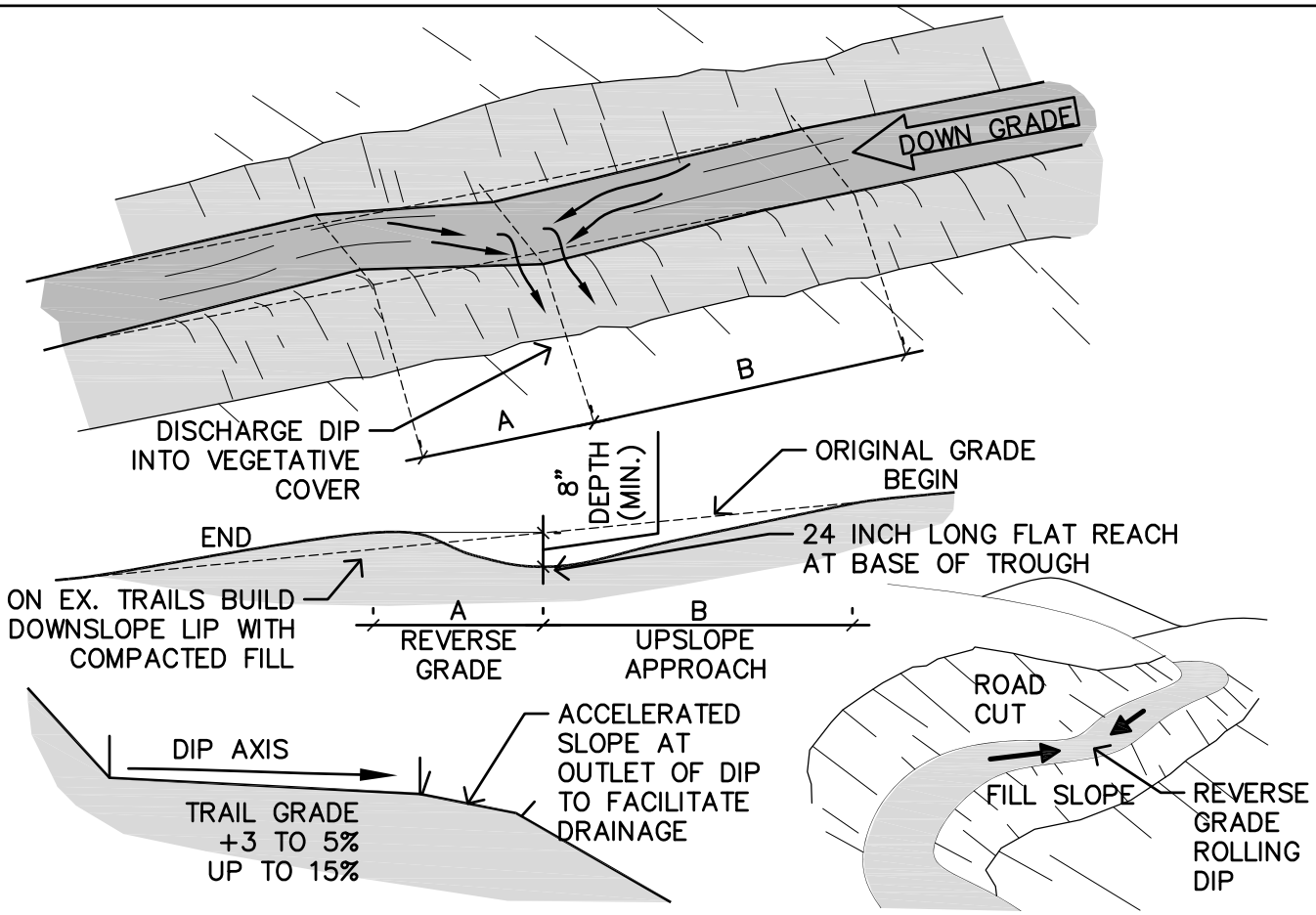
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT

PERFORATED PIPE

SCALE: 1" = 1'-0"

DATE: 10/2019

\\fileserv\shareall\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 perforated pipe.dwg



EX. TRAIL ROAD GRADE (%)	TROUGH	A: REVERSE GRADE		B: UPSLOPE APPROACH	
	MIN. DEPTH BELOW DOWNSLOPE CREST	DISTANCE FROM TROUGH AXIS TO DOWNROAD CREST (FT)	GRADE (%)	DISTANCE FROM UP-ROAD START OF ROLLING DIP TO TROUGH AXIS (FT)	GRADE (%)
<5%	8"	7 MIN, 15 PREFERRED	-5 TO 10%	30	10%
10%	8"	7 MIN, 15 PREFERRED	-5 TO 10%	45	15%
15%	8"	7 MIN, 15 PREFERRED	-5 TO 10%	60	20%
>15%	8"	10	-10%	60	25%

NOTES

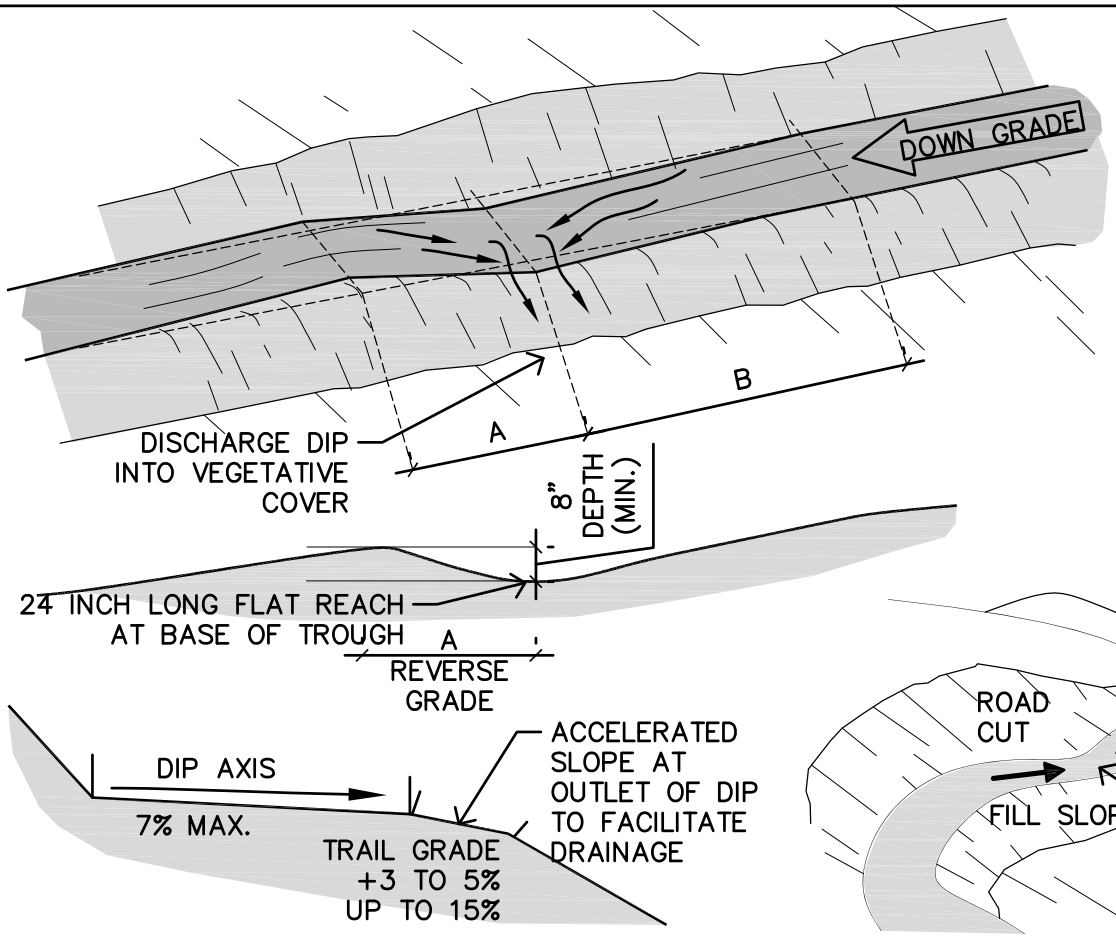
1. A REVERSE GRADE DIP (OR ROLLING DIP) IS A BROAD LONG PERMANENT DIP CONSTRUCTED INTO NATIVE SOILS. IT IS INTENDED TO DRAIN THE TRAIL/ ROAD WHILE NOT SIGNIFICANTLY IMPEDING TRAFFIC.
2. ON EXISTING TRAILS/ ROADS THE DIP IS CUT INTO THE EXISTING TRAIL WITH THE DOWN ROAD DIP BUILT UP ON COMPACTED FILL.
3. THE DOWN ROAD REVERSE GRADE OF THE DIP SHALL BE 5-10%, FOR A MIN. OF 7 FEET (AT 10%) OR MIN. OF 15 FEET (AT 5%), TO FORM A MIN. 8 INCH DEEP DIP AND INCORPORATE A 2-FOOT LONG FLAT REACH AT THE BASE OF THE TROUGH (UNLESS OTHERWISE DIRECTED). THE DIP AXIS SHOULD BE OUTSLOPED THE TRAIL GRADE PLUS 3-5% UP TO 15%.
4. DIP OUTLETS SHOULD BE LOCATED TO DRAIN INTO AREAS WITH ADEQUATE SEDIMENT FILTER QUALITY AND NON-ERODIBLE MATERIAL SUCH AS ROCK, SLASH, BRUSH, ETC. WHERE SPECIFIED, THE BOTTOM OF THE OUTFALL OF THE DIP WILL BE SURFACE ROCKED.
5. WHERE NATURAL SLOPES EXCEED 50%, FILL SHALL NOT BE PUSHED OVER THE DIP OUTLET. A BACKHOE OR EXCAVATOR MAY BE REQUIRED TO PULL BACK FILL AT OUTLET OF EXISTING DIPS.
6. DIPS SHALL BE PLACED AS SPECIFIED IN THE PLANS. IF NOT SPECIFIED THEN DIPS SHALL BE PLACED AT MAX. 75 FOOT SPACINGS.

REVERSE GRADE DIP EXISTING TRAIL, TYP.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT | SCALE: NTS | DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 reverse grade dip existing trail.dwg

©TIMOTHY C. BEST, CEG



NEW CONSTRUCTION GRADE (%)	TROUGH	A: REVERSE GRADE		B: UPSLOPE APPROACH	
	MIN. DEPTH BELOW DOWNSLOPE CREST	DISTANCE FROM TROUGH AXIS TO DOWNROAD CREST (FT)	GRADE (%)	DISTANCE FROM UP-ROAD START OF ROLLING DIP TO TROUGH AXIS (FT)	GRADE (%)
<5%	8"	7 MIN, 15 PREFERRED	-5 TO 10%	N/A. SHOULD BE CONSISTENT GRADE	
10%	8"	7 MIN, 15 PREFERRED	-5 TO 10%	N/A. SHOULD BE CONSISTENT GRADE	
15%	8"	7 MIN, 15 PREFERRED	-5 TO 10%	N/A. SHOULD BE CONSISTENT GRADE	
>15%	8"	10	-10%	N/A. SHOULD BE CONSISTENT GRADE	

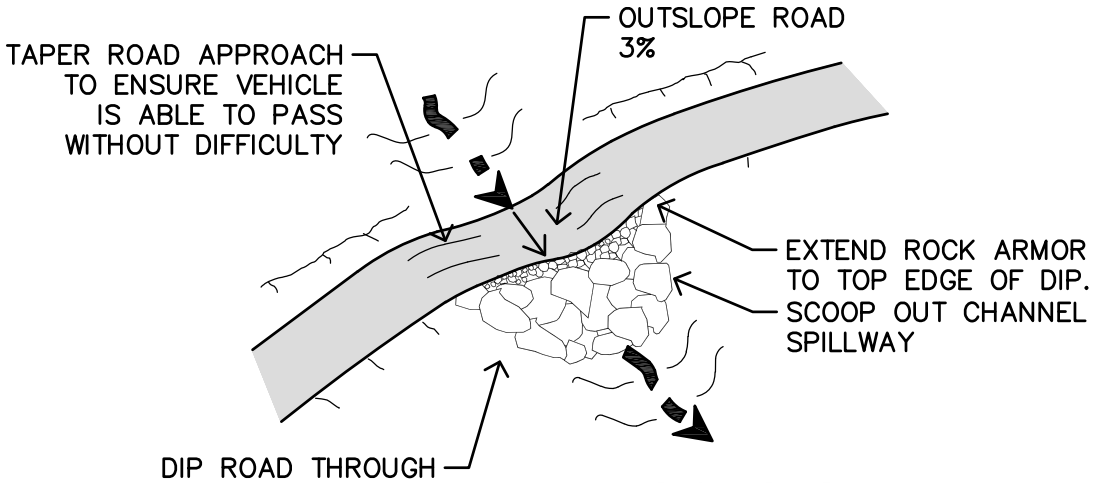
NOTES

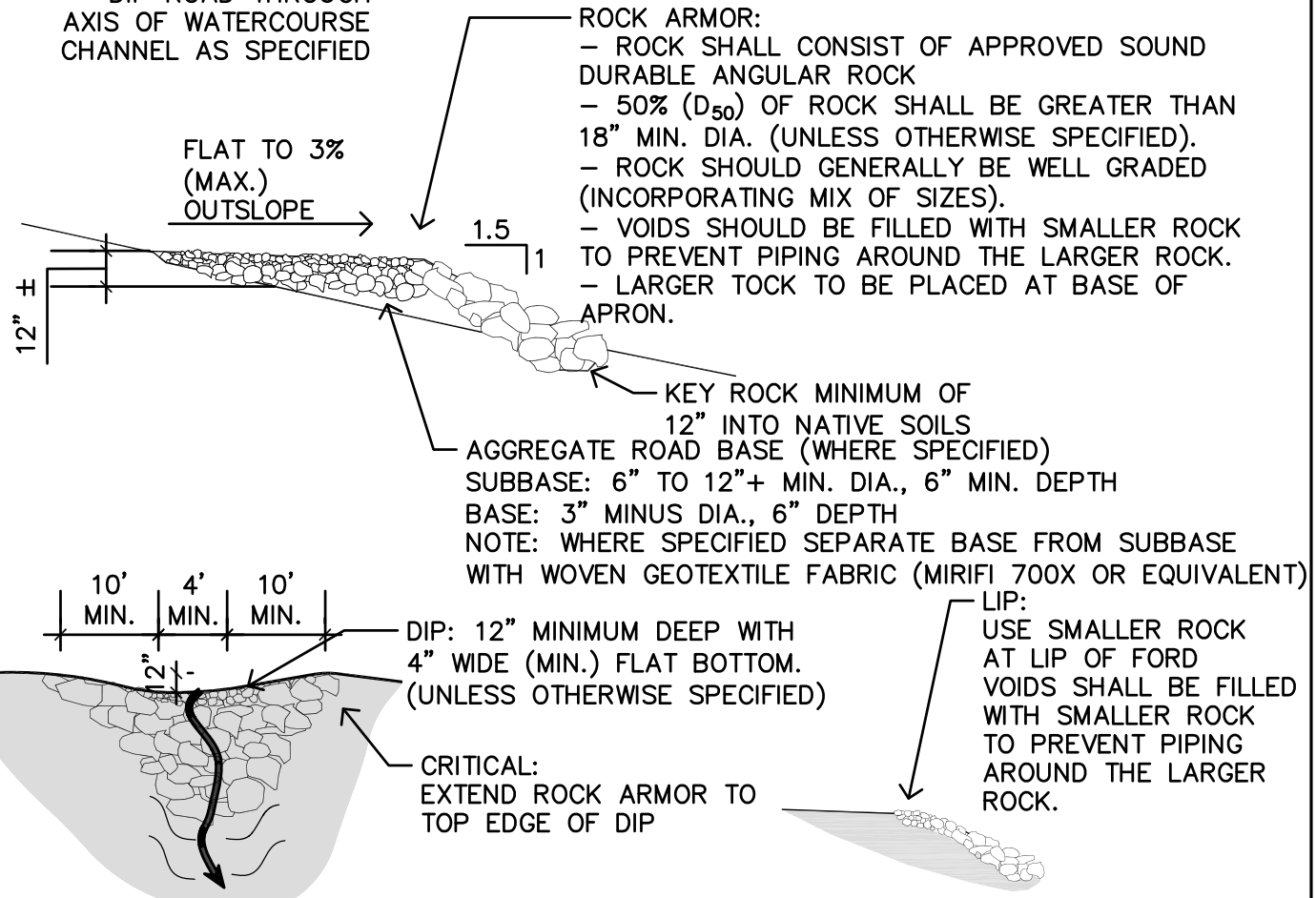
1. A REVERSE GRADE DIP (OR ROLLING DIP) IS A BROAD LONG PERMANENT DIP CONSTRUCTED INTO NATIVE SOILS. IT IS INTENDED TO DRAIN THE TRAIL/ ROAD WHILE NOT SIGNIFICANTLY IMPEDING TRAFFIC.
2. ON NEW TRAILS AND ROADS THE DIP IS INCORPORATED INTO THE TRAIL/ROAD DESIGN.
3. THE DOWN ROAD REVERSE GRADE OF THE DIP SHALL BE 5-10%, FOR A MIN. OF 7 FEET (AT 10%) OR MIN. OF 15 FEET (AT 5%), TO FORM A MIN. 8 INCH DEEP DIP AND INCORPORATE A 2-FOOT LONG FLAT REACH AT THE BASE OF THE TROUGH (UNLESS OTHERWISE DIRECTED). THE DIP AXIS SHOULD BE OUTSLOPED THE TRAIL GRADE PLUS 3-5% UP TO 15%.
4. DIP OUTLETS SHOULD BE LOCATED TO DRAIN INTO AREAS WITH ADEQUATE SEDIMENT FILTER QUALITY AND THE TRAIL GRADE PLUS 3 TO 5% UP TO 15%. WHERE SPECIFIED, THE BOTTOM OF THE OUTFALL OF THE DIP WILL BE SURFACE ROCKED.
5. WHERE NATURAL SLOPES EXCEED 50%, FILL SHALL NOT BE PUSHED OVER THE DIP OUTLET. A BACKHOE OR EXCAVATOR MAY BE REQUIRED TO PULL BACK FILL AT OUTLET OF EXISTING DIPS.

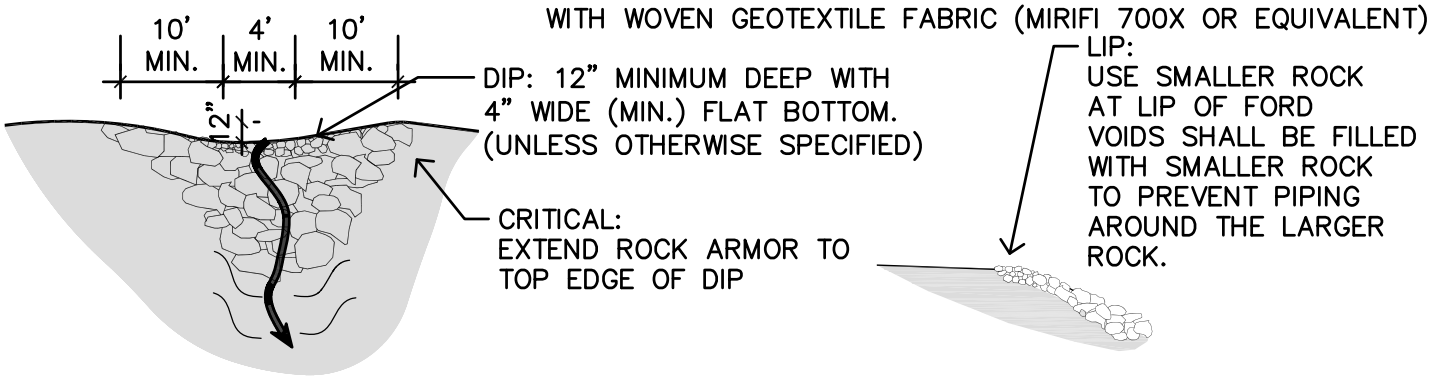
REVERSE GRADE DIP NEW CONSTRUCTION, TYP.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT | SCALE: NTS | DATE: 10/2019

©TIMOTHY C. BEST, CEG







NOTES:

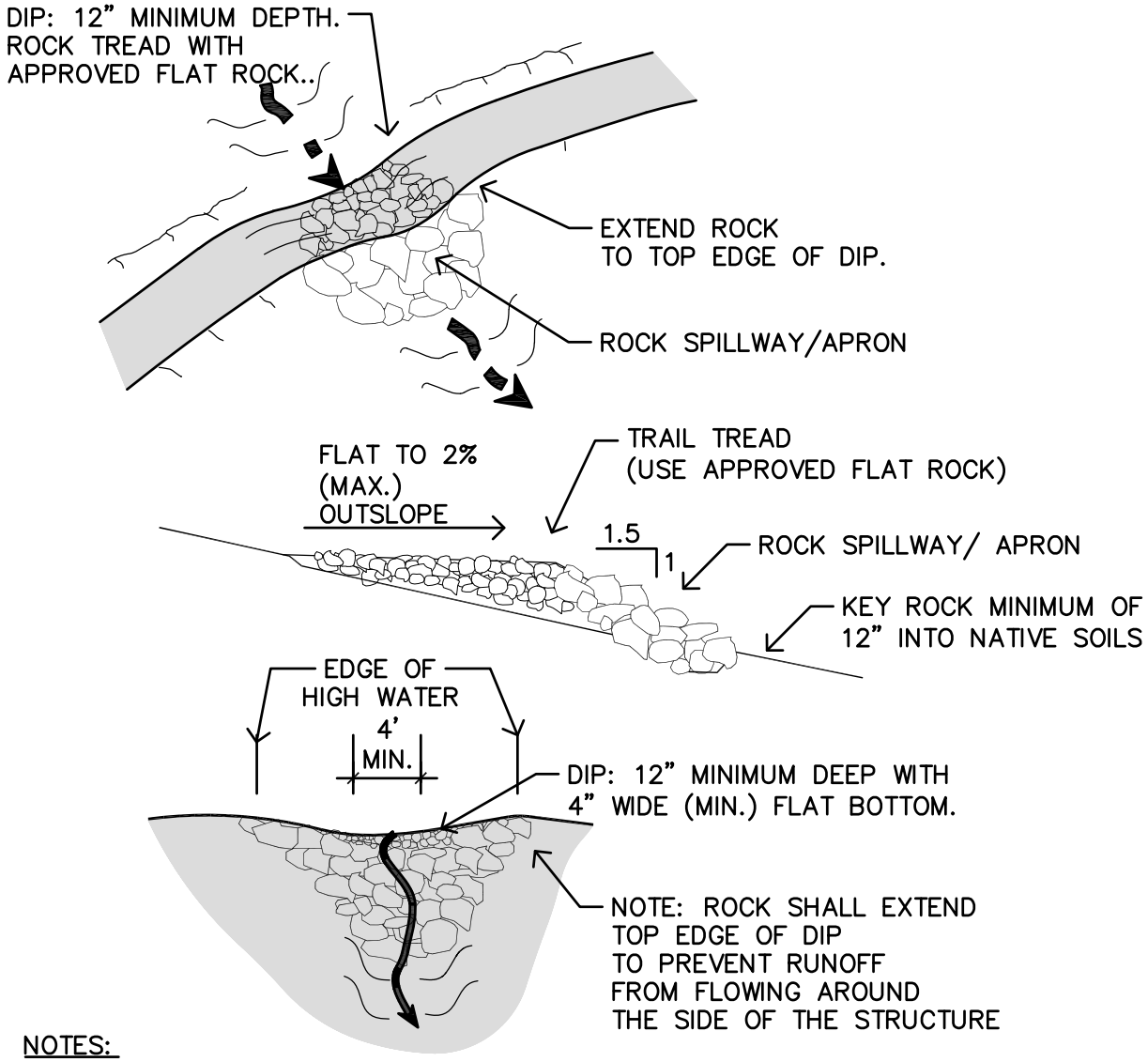
- DETAILS ARE TYPICAL AND INTENDED FOR USE AS A GUIDELINE. ADJUSTMENTS TO THE ACTUAL DESIGN MAY NEED TO OCCUR IN FIELD DURING TIME OF CONSTRUCTION DUE TO LOCAL SITE CONDITIONS. REFER TO SITE DETAILS FOR SPECIFIC DESIGN CRITERIA WHERE APPLICABLE.

ROCK FORD - RURAL ROAD

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 rock ford - road.dwg

©TIMOTHY C. BEST, CEG



NOTES:

- CONSTRUCT TRAIL TO DIP THROUGH WATERCOURSE.
  - BOTTOM OF DIP TO BE A MINIMUM OF 4 FEET WIDE AND 12 INCHES DEEP UNLESS OTHERWISE SPECIFIED OR DIRECTED.
  - ESTABLISH WELL DEFINED SPILLWAY AT DIP OUTLET.
- ARMOR OUTSIDE TRAIL EDGE WITH ROCK TO FORM APRON IN THE SPILLWAY
  - ROCK SHALL CONSIST OF APPROVED SOUND DURABLE ANGULAR ROCK.
  - 50% (D_{50}) OF ROCK SHALL BE GREATER THAN 18 INCHES MINIMUM DIAMETER (UNLESS OTHERWISE SPECIFIED).
  - ROCK SHOULD GENERALLY BE WELL GRADED (INCORPORATING MIX OF SIZES).
  - VOIDS SHALL BE FILLED WITH SMALLER ROCK TO PREVENT PIPING AROUND THE LARGER ROCK.
  - LARGER ROCK TO BE PLACED AT BASE OF APRON.
  - EXTEND ROCK TO TOP EDGE OF DIP. ROCK MUST BE PLACED HIGH ENOUGH TO FORM A WELL DEFINED SPILLWAY TO PREVENT HIGH FLOWS FROM ERODING AROUND THE EDGE OF THE ROCK.
  - ROCK TO BE PLACED NO STEEPER THAN 1.5:1.
- ARMOR TRAIL TREAD WITH ROCK
  - USE 6" OR LARGER DIAMETER SOUND DURABLE ROCK (UNLESS OTHERWISE SPECIFIED)
  - ROCK SHALL BE FLAT AND PLACED TO CREATE EVEN TRAIL TREAD.
  - BACKFILL LARGER ROCKS WITH SMALLER ROCKS, SOIL OR BASE ROCK.
- SPECIFICATIONS ARE INTENDED ONLY AS GUIDELINES. MODIFICATIONS MAY BE MADE IN THE FIELD BY GEOTECHNICAL CONSULTANT OR DESIGNEE.

ROCK FORD - TRAIL

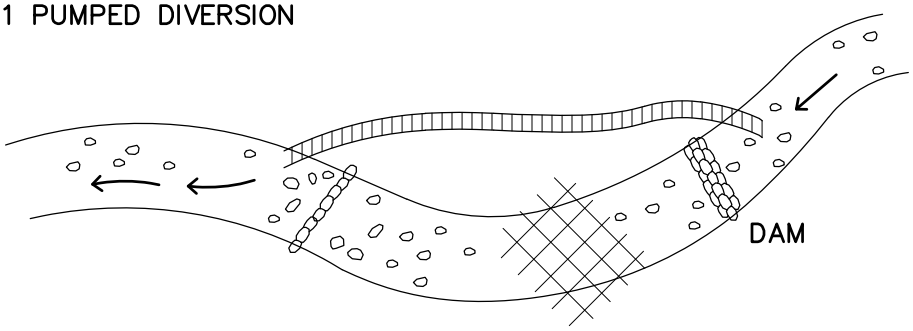
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 rock ford - trail.dwg

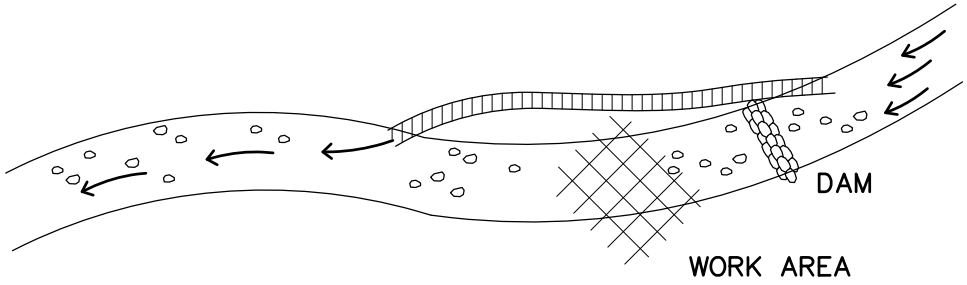
©TIMOTHY C. BEST, CEG

TYPICAL STREAM DIVERSIONTECHNIQUES

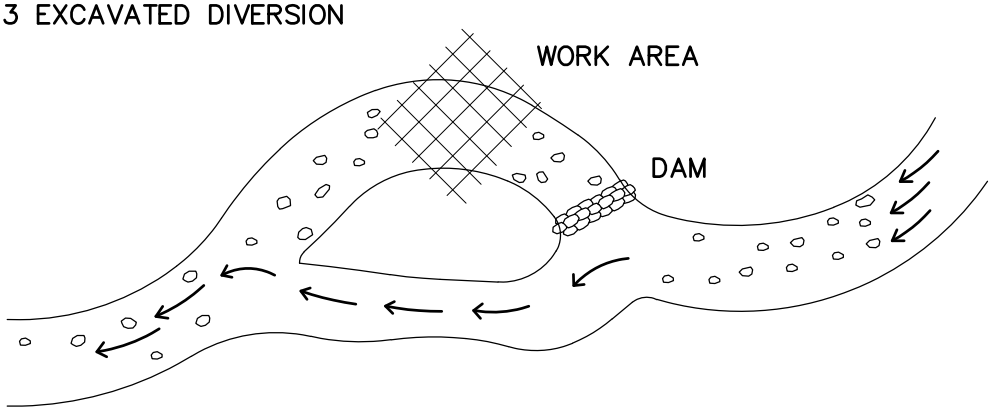
1 PUMPED DIVERSION



2 PUMP/FLUME DIVERSION



3 EXCAVATED DIVERSION



STREAM DIVERSION TECHNIQUES TYP.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 stream diversion.dwg

©CALTRAIN

TEMPORARY STREAM DIVERSIONS

PURPOSE: TO ISOLATE WORK FROM ACTIVE STREAM FLOW TO PROTECT WATER QUALITY AND TO PROVIDE A DRY WORKING ENVIRONMENT FOR CONSTRUCTION ACTIVITIES.

METHODS:

- UTILIZE DURING DRY SEASON ONLY DURING PERIODS OF LOW STREAM FLOW.
- TEMPORARY STREAM DIVERSIONS SHALL BE QUICKLY AND CAREFULLY INSTALLED TO MINIMIZE DURATION OF DISTURBANCE. ALL MATERIALS NEEDED FOR DIVERSION SHALL BE ONSITE PRIOR TO INSTALLING DIVERSION.
- MONITOR DIVERSION OFTEN DURING THE WORK DAY. MONITOR WEATHER REPORTS. IN CASE OF UNSEASONABLE INCLEMENT WEATHER, ALTER WORK PLANS AND/OR INSTALL ADDITIONAL PLASTIC SHEETING, PIPE, SANDBAGS AND STRAW WATTLES AS NECESSARY TO CONTROL EROSION.
- LOCATE TEMPORARY DIVERSIONS TO MINIMIZE STREAM DISTURBANCE. USE NATURAL FEATURES SUCH AS STREAM CONSTRICTIONS, BEDROCK, BOULDERS, OR UNIFORM CHANNEL, WHERE HELPFUL.
- REMOVE ROCK, STICKS, AND OTHER DEBRIS AT THE DIVERSION LOCATION SO THAT THE STREAM BED AND BANKS ARE RELATIVELY SMOOTH SO THAT SHEETING, FABRIC, SANDBAGS WILL REST FLUSH WHEN PLACED.
- EXCAVATED MATERIALS SHALL BE STOCKPILED OUTSIDE OF STREAM CHANNEL IF NOT RE-USED IN THE DIVERSION STRUCTURE.
- KEY DIVERSION STRUCTURE AT LEAST 12" INTO STREAM BANKS AND STREAM BED TO PREVENT SEEPAGE. IN COARSE BEDDED CHANNELS (LARGER COBBLE/ BOULDER), KEYS SHALL BE EXCAVATED A MINIMUM OF 24" INTO THE STREAM BED.
- BACKFILLING OF KEYWAYS SHALL BE DONE CAREFULLY TO AVOID TEARING OR BUNCHING THE DIVERSION MATERIALS.
- STREAM DIVERSION MATERIALS MAY INCLUDE: PLASTIC SHEETING, GEOTEXTILE FABRIC, SAND OR GRAVEL BAGS, SUPPORT POSTS, FLEXIBLE OR RIGID PLASTIC PIPE, FIRE HOSE, AND NATIVE STREAM SUBSTRATE. SIZE DIVERSION PIPE, HOSE, AND/OR PUMPS ADEQUATELY TO CARRY ALL STREAM FLOW WELL PAST THE WORK AREA.
- PLASTIC SHEETING, IF USED, SHALL BE ONE CONTINUOUS PIECE ACROSS THE WIDTH OF THE CHANNEL, AND SHALL HAVE A MINIMUM THICKNESS OF 6 MIL. SHEETING SHALL BE OVERLAPPED A MINIMUM OF 18" WITH THE UPSTREAM PORTION COVERING THE DOWNSTREAM PORTION.
- IN ADDITION TO THE UPSTREAM DIVERSION DAM, A DOWNSTREAM SETTLING DAM OR FILTER BERM SHALL BE CONSTRUCTED WHERE SUBSURFACE AND/OR BANK SEEPAGE EXISTS, THAT MAY OTHERWISE TRANSPORT SEDIMENT DOWNSTREAM. A SETTLING DAM SHOULD BE OF SUFFICIENT SIZE TO ALLOW SEDIMENT TO DROP FROM THE WATER COLUMN BEFORE RELEASE. FILTER BERMS SHALL BE CONSTRUCTED WITH CLEAN WASHED GRAVELS, GEOTEXTILE FABRIC, STRAW WATTLES, OR DENSE SLASH THAT EFFECTIVELY ENTRAINS SEDIMENT.
- UPON COMPLETION, RESTORE CHANNEL DIMENSIONS TO PRE-EXISTING CONDITIONS TO PREVENT EROSION.

TEMPORARY STREAM DIVERSION SPECIFICATION

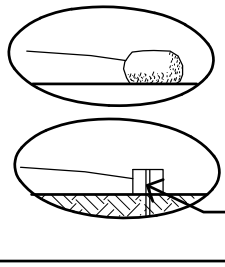
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 temporary stream diversion notes.dwg

TABLE A:
DRAIN ROCK SIZING

WIDTH	MATERIAL SIZE	MIN. DEPTH
TRAIL, 4–6 FT	3/4 IN	3 IN
ROAD, 8–12 FT	1 1/2 IN	6 IN

OTHER RETAINER TYPES, NTS

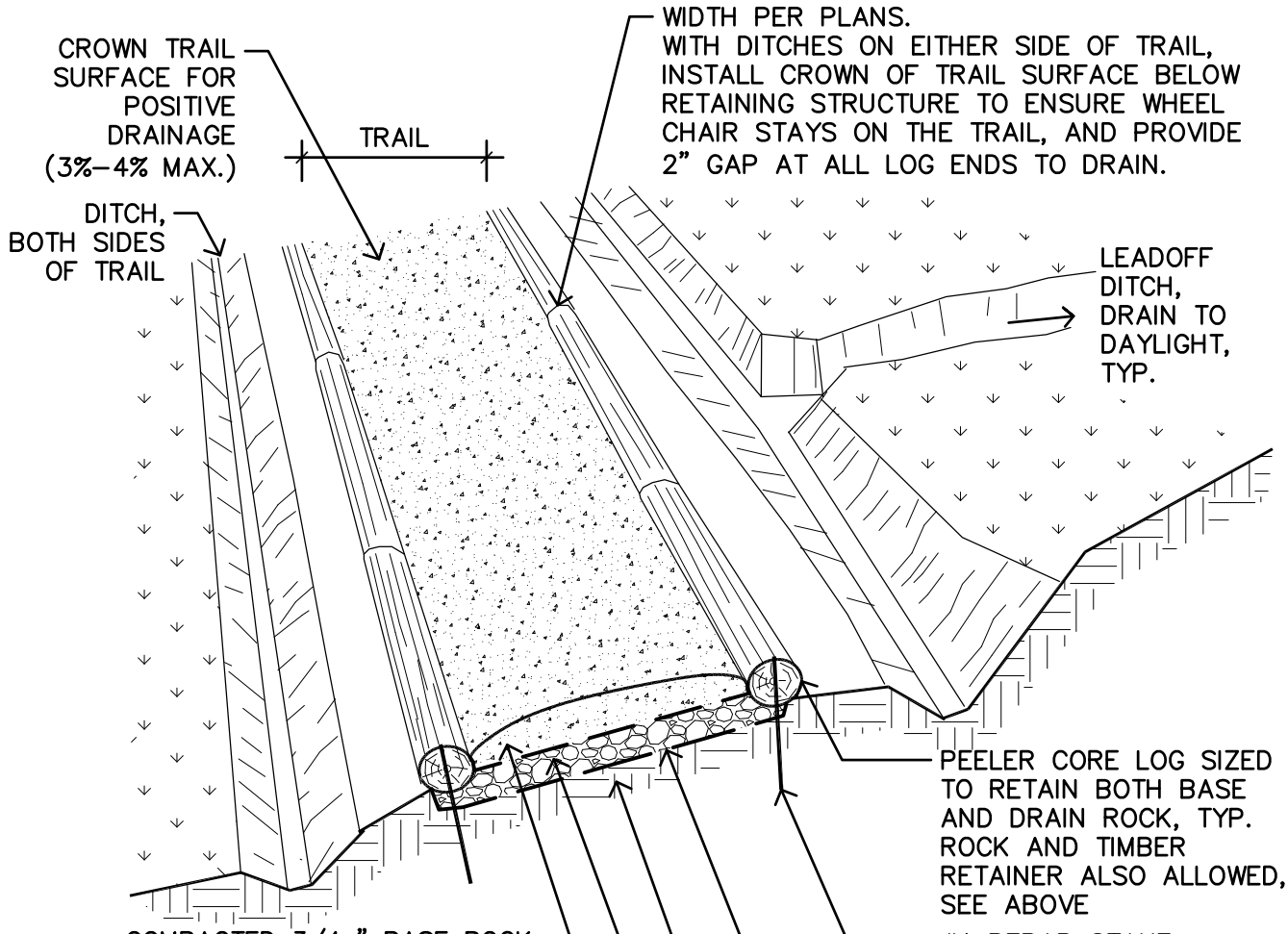


ROCK RETAINER
MIN. ROCK SIZE:
100LBS

SAWN TIMBER
RETAINER 6X6

REBAR STAKE,
SEE BELOW

NOTE: TURNPIKE MAY BUILT WITHOUT A RETAINING STRUCTURE AT DISTRICT OPTION.



NOTE:
REFER TO EASY ACCESS TRAIL SPECIFICATIONS FOR ADDITIONAL TRAIL DESIGN REQUIREMENTS.

TRAIL TURNPIKE AT MARSHY AREA

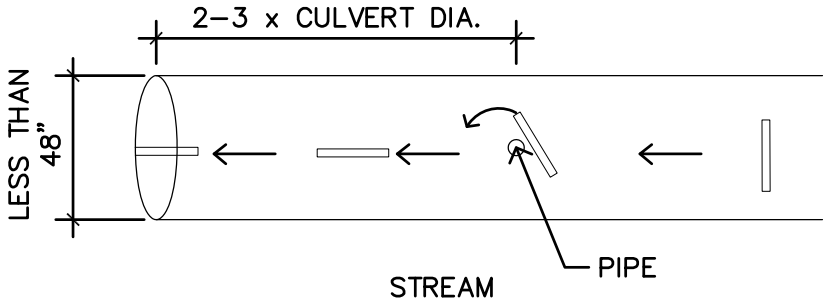
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1/4" = 1'-0"	DATE: 04/2020

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 trail turnpike at marshy area.dwg

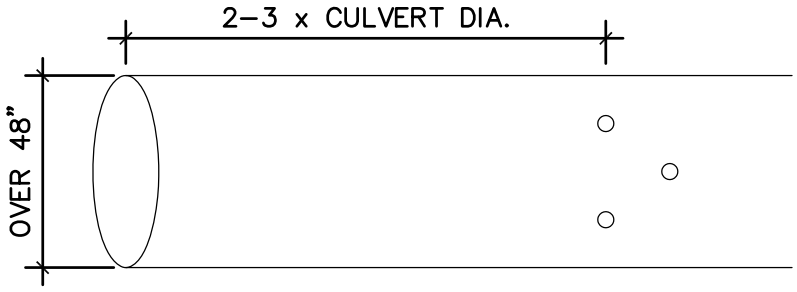
TRASH RACKS

INSTALL TRASH RACK (ONLY IN NON FISH BEARING STREAMS) UPSTREAM FROM THE CULVERT INLET WHERE THERE IS A HIGH HAZARD OF FLOATING DEBRIS PLUGGING THE CULVERT.

- ON STREAMS WITH CULVERTS UNDER 48" DIAMETER SET A SINGLE POST VERTICALLY IN THE CENTER OF THE STREAM BED, DIRECTLY UPSTREAM FROM THE CULVERT INLET, AND LOCATED 2–3 TIMES CULVERT DIAMETER DISTANCE UPSTREAM FROM THE INLET. SIZE THE POST AND SET DEEP INTO THE STREAM BED TO WITHSTAND THE SIZE OF WOODY DEBRIS TRANSPORTED BY THE STREAM DURING EXTREME RUNOFF EVENTS.



- ON STREAMS WITH CULVERTS OVER 48" DIAMETER SET THREE POSTS VERTICALLY IN THE STREAM BED, DIRECTLY UPSTREAM FROM THE CULVERT INLET, AND LOCATED 2–3 TIMES CULVERT DIAMETER DISTANCE UPSTREAM FROM THE INLET. SIZE THE POST AND SET DEEP INTO THE STREAM BED TO WITHSTAND THE SIZE OF WOODY DEBRIS TRANSPORTED BY THE STREAM DURING EXTREME RUNOFF EVENTS.



  - SET THE TWO BASE POSTS 1/3 WIDTH OF STREAM BED AND TOP POST AT MIDDLE OF STREAM BED.

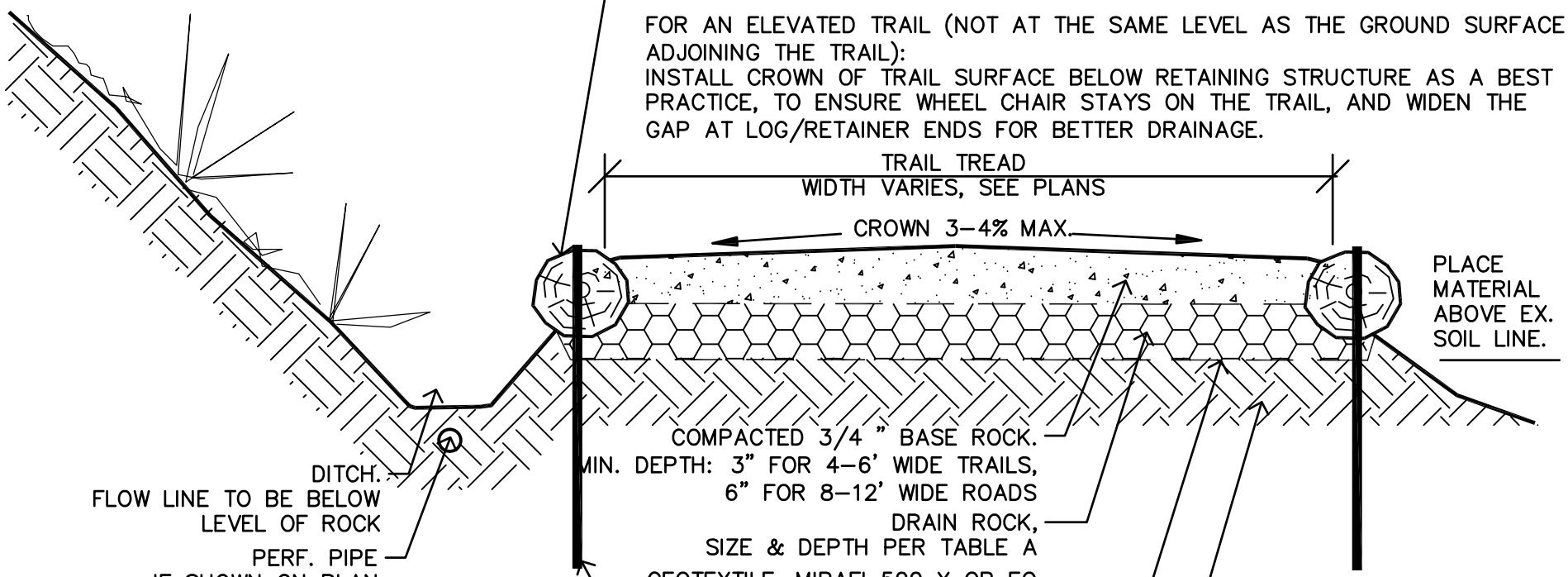
TRASH RACK

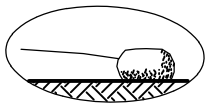
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

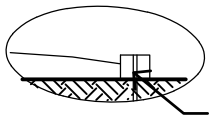
S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 trash rack.dwg

PEELER CORE OR LOG EDGING TO CONTAIN MATERIAL, BOTH SIDES.
PROVIDE 1/2" GAP AT LOG ENDS TO DRAIN.
ROCK OR TIMBER RETAINER ALSO ALLOWED, SEE BELOW.

FOR AN ELEVATED TRAIL (NOT AT THE SAME LEVEL AS THE GROUND SURFACE ADJOINING THE TRAIL):
INSTALL CROWN OF TRAIL SURFACE BELOW RETAINING STRUCTURE AS A BEST PRACTICE, TO ENSURE WHEEL CHAIR STAYS ON THE TRAIL, AND WIDEN THE GAP AT LOG/RETAINER ENDS FOR BETTER DRAINAGE.




ROCK RETAINER
MIN. ROCK SIZE:
100 LBS


SAWN TIMBER RETAINER
6X6

REBAR STAKE,
SEE ABOVE

OTHER RETAINER TYPES, NTS

TABLE A:
ROCK SIZING

WIDTH	MAT'L SIZE	MIN. DEPTH
TRAIL, 4–6 FT.	3/4 IN.	3 IN.
ROAD, 8–12 FT.	1 1/2 IN.	6 IN.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT

WET AREA TRAIL TREATMENT

SCALE: 1" = 1'-0"

DATE: 04/2020

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 wet area trail treatment.dwg

DETAILS AND SPECIFICATIONS GUIDELINES

SECTION 5

BANK STABILIZATION

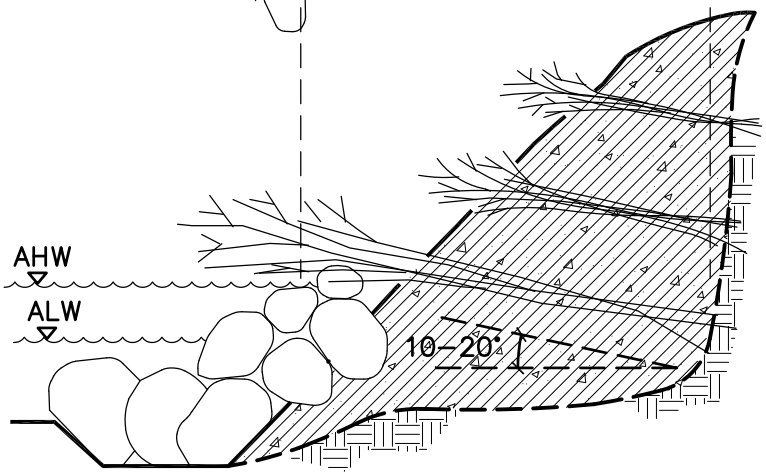
PLAN VIEW

FRONT OF SLOPE

BACK OF SLOPE

CRISSCROSS BRANCHES
5–8 BRANCHES/FT. MIN.
(20/ LINEAR METER)
PLACED AT RANDOM WITH
REGARD TO SIZE AND AGE.

SECTION



NOTES:

1. USE LIVE WILLOW BRANCHES AT LEAST 6' LONG AND ¾" IN DIAMETER, AND MIN. 1/4 TON RIP RAP.
2. KEY RIP RAP 1.5 TIMES LARGEST BOULDER SIZE. EXTEND ROCK UPSLOPE ABOVE EXPECTED HIGH WATER.
3. CONSTRUCT BY EXCAVATING OR FILLING TERRACES, SLOPED 10–20 DEGREES BACK INTO SLOPE.
4. PLACE BRANCHES AND CRISCROSS AT RANDOM (5–8 PER LINEAR FOOT) WITH 8–18" PROTRUDING.
5. COVER AND COMPACT WITH 6–18" OF SOIL. REPEAT UNTIL AT TOP OF SLOPE.

BRUSHLAYERING WITH ROCK TOE PROTECTION

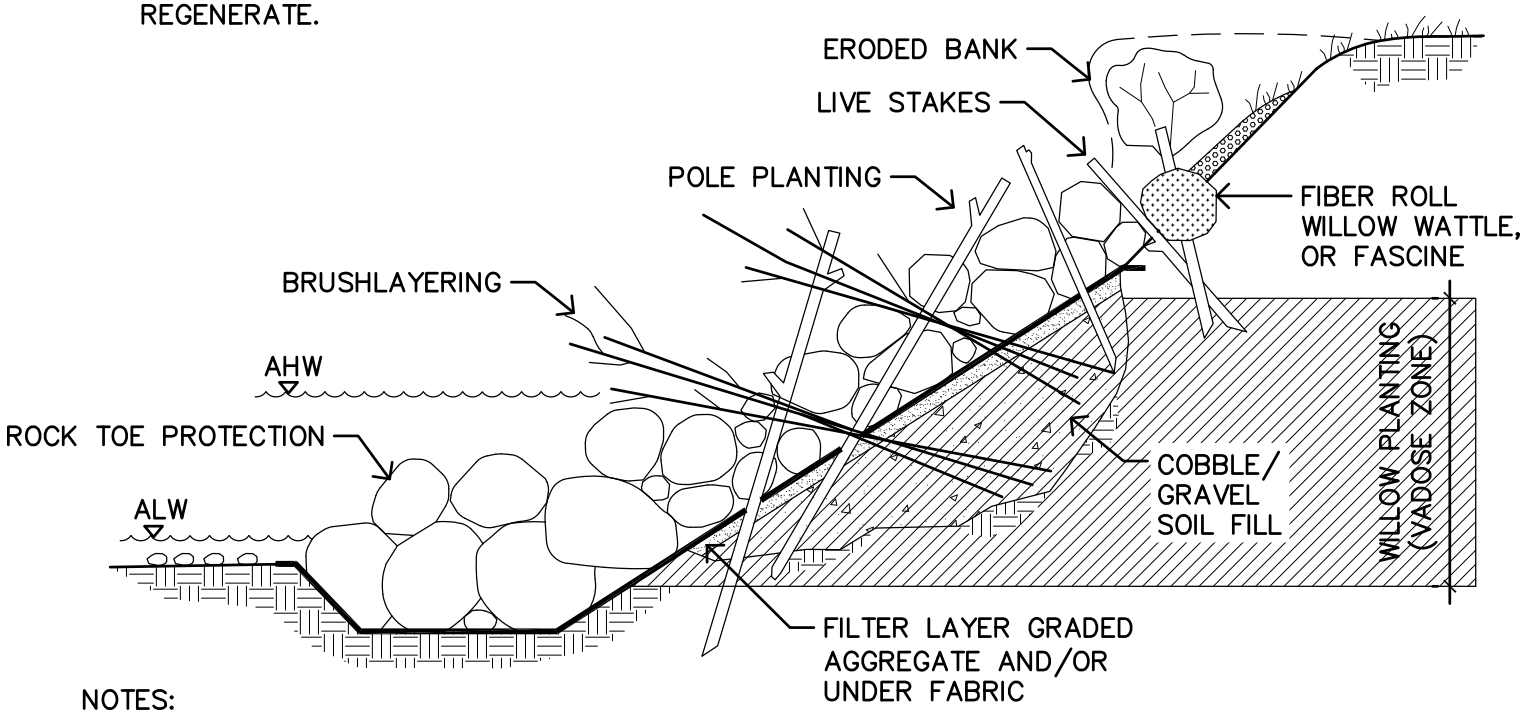
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\5 brushlayering with rock toe protection.dwg

©1994 JOHN MCCULLAH

NOTES:

1. INSTALL WILLOW POLE PLANTING AND BRUSHLAYERING DURING BANK GRADING AND RIPRAP PLACEMENT TO ENSURE GOOD CONTACT WITH 'NATIVE GROUND' AND/OR SOIL FILL.
2. WILLOW POLES AND BRUSH LAYERS SHOULD EXTEND DOWN INTO EXPECTED SOIL MOISTURE ZONES (VADOSE).
3. CUT SMALL HOLES OR SLITS IN FILTER FABRIC AS NECESSARY.
4. PLACE SOIL FILL (COBBLES, GRAVEL, SOIL) AROUND CUTTINGS.
5. PLACE RIPRAP CAREFULLY, DO NOT END DUMP. SOME DAMAGE TO BRUSH LAYERS AND WILLOW POLES IS UNAVOIDABLE AND ACCEPTABLE. DEEPLY PLANTED WILLOW MATERIAL WILL REGENERATE.

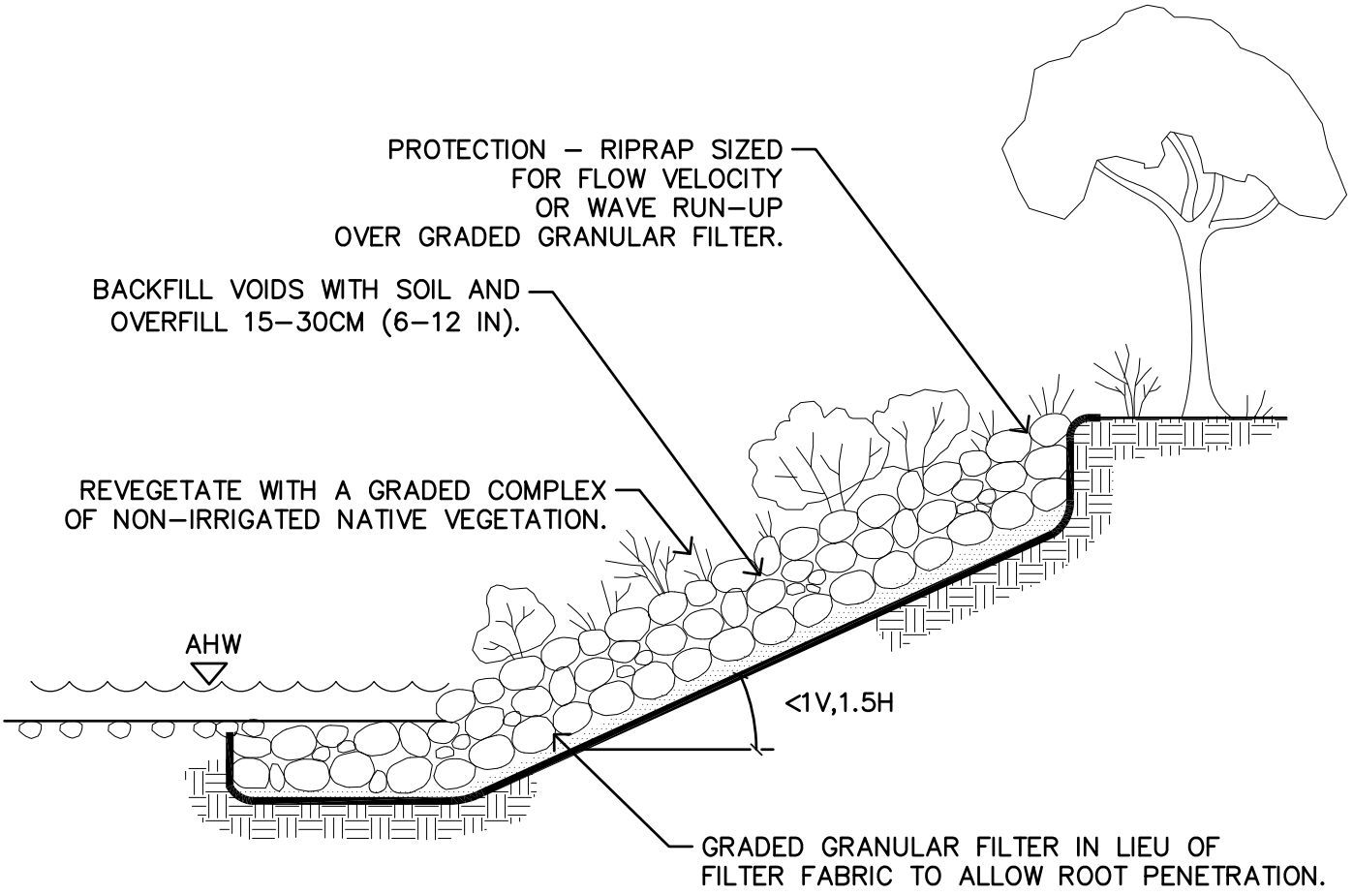


NOTES:

1. PREPARE SUBGRADE, COMPACT TO DENSITY OF SURROUNDING NATIVE SOIL. REMOVE BRUSH, TREES AND STUMPS. KEY TOE OF RIP RAP 1.5 TIMES THE DESIRED THICKNESS OF FINISHED RIP RAP. USE LARGEST ROCK AT KEY. PLACE BRUSH AND POLES AS ROCK PLACEMENT MOVES UPSLOPE.
2. FILL VOIDS BY HAND WITH SMALLER ROCKS TO END UP WITH RELATIVELY SMOOTH SURFACE AT FINISHED GRADE.
3. MINIMUM BOULDER SIZE 1/4 TON, OR SIZED ACCORDING TO LARGEST ROCK IN NATIVE CHANNEL.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	VEGETATED RIPRAP WITH BRUSHLAYERING & POLE PLANTING
SCALE: NTS	DATE: 10/2019

©2004 SALIX



NOTES: CLASS 2 PERMEABLE MATERIAL

PERMEABLE MATERIAL FOR BLANKETS OR OTHER SUBDRAINAGE PURPOSES SHALL CONSIST OF HAND, DURABLE, CLEAN SAND, GRAVEL OR CRUSHED STONE AND SHALL BE FREE FROM ORGANIC MATERIAL, CLAY BALLS, OR OTHER DELETERIOUS SUBSTANCES.

NOTES:

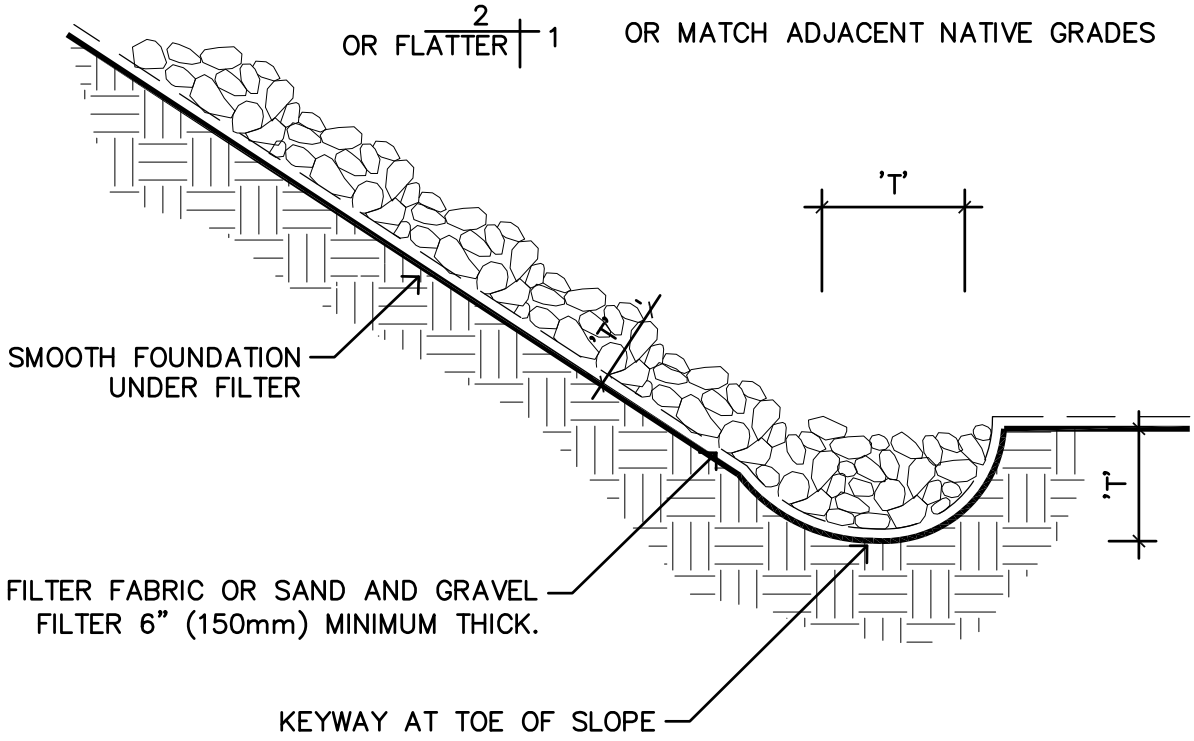
1. PREPARE SUBGRADE, COMPACT TO DENSITY OF SURROUNDING NATIVE SOILS. REMOVE BRUSH, TREES, STUMPS.
2. CUT SUBGRADE SO FINISHED GRADE OF RIP–RAP WILL MATCH NATIVE GRADE.
3. KEY TOE OF RIP–RAP AT LEAST 1.5 TIMES THICKNESS OF RIP RAP.
4. HAND PLACE SMALLER ROCK TO ACHIEVE SMOOTH UNIFORM SURFACE.

RIPRAP WITH SOIL AND GRASS OR GROUNDCOVER

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\5 riprap with soil & grass or groundcover.dwg

©2004 SALIX



TYPICAL SECTION

NOTES:

1. T=MINIMUM THICKNESS SHALL BE 1.5x THE MINIMUM STONE DIAMETER, NEVER LESS THAN 6"(150mm).
2. MIN. $\frac{1}{4}$ TON RIP–RAP OR SIZED LARGER THAN THE LARGEST BOULDERS IN STREAM.

RIPRAP PROTECTION

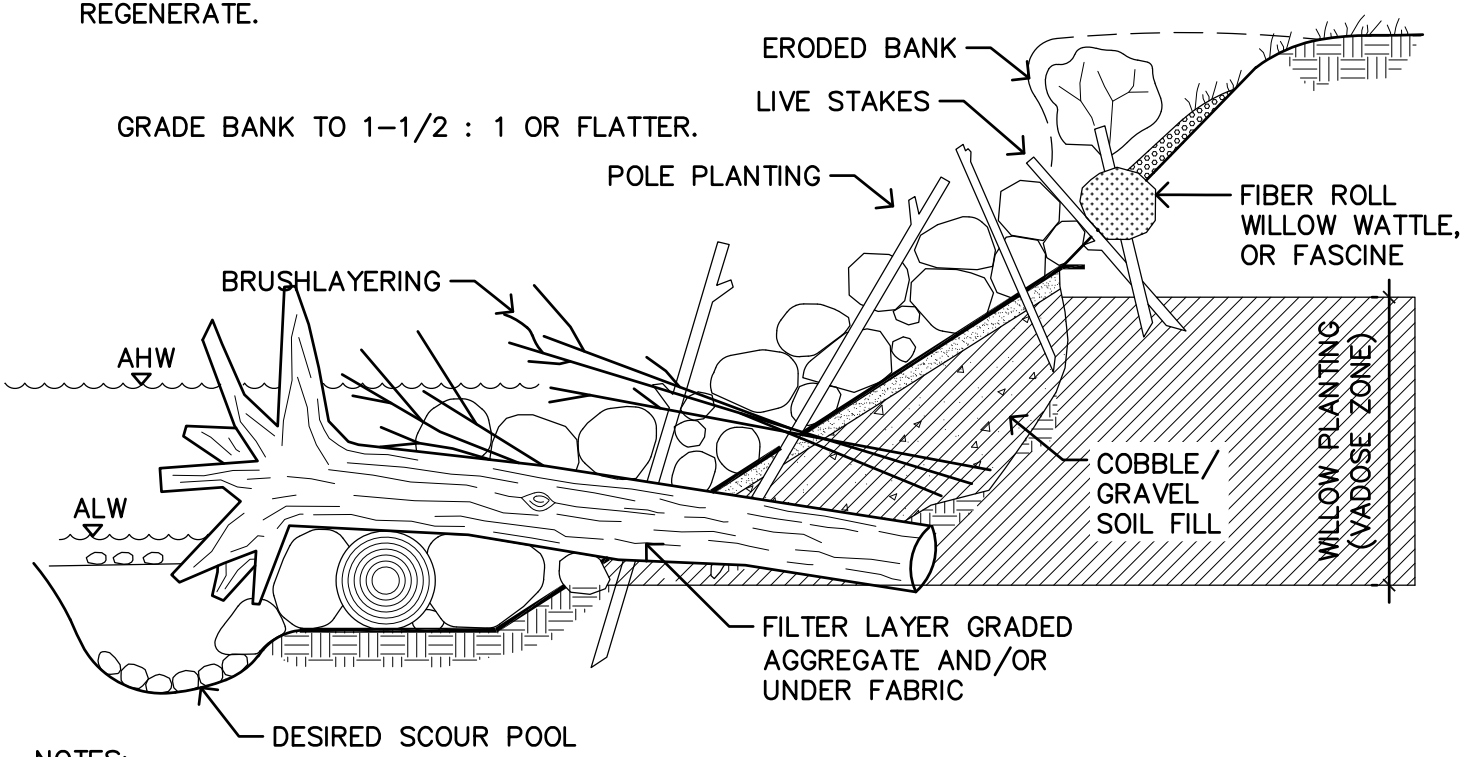
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 11/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\5 riprap protection.dwg

©1994 JOHN MCCULLAH

NOTES:

1. WILLOW POLE PLANTING AND BRUSHLAYERING SHALL BE INSTALLED DURING BANK GRADING AND RIPRAP PLACEMENT TO ENSURE GOOD CONTACT WITH 'NATIVE GROUND' AND SOIL FILL.
2. WILLOW POLES AND BRUSH LAYERS SHALL EXTEND DOWN INTO EXPECTED SOIL MOISTURE ZONES (VADOSE).
3. CUT SMALL HOLES OR SLITS IN FILTER FABRIC AS NECESSARY.
4. PLACE SOIL FILL (COBBLES, GRAVEL, SOIL) AROUND CUTTINGS.
5. PLACE RIPRAP CAREFULLY, DO NOT END DUMP. SOME DAMAGE TO BRUSH LAYERS AND WILLOW POLES IS UNAVOIDABLE AND ACCEPTABLE. DEEPLY PLANTED WILLOW MATERIAL WILL REGENERATE.

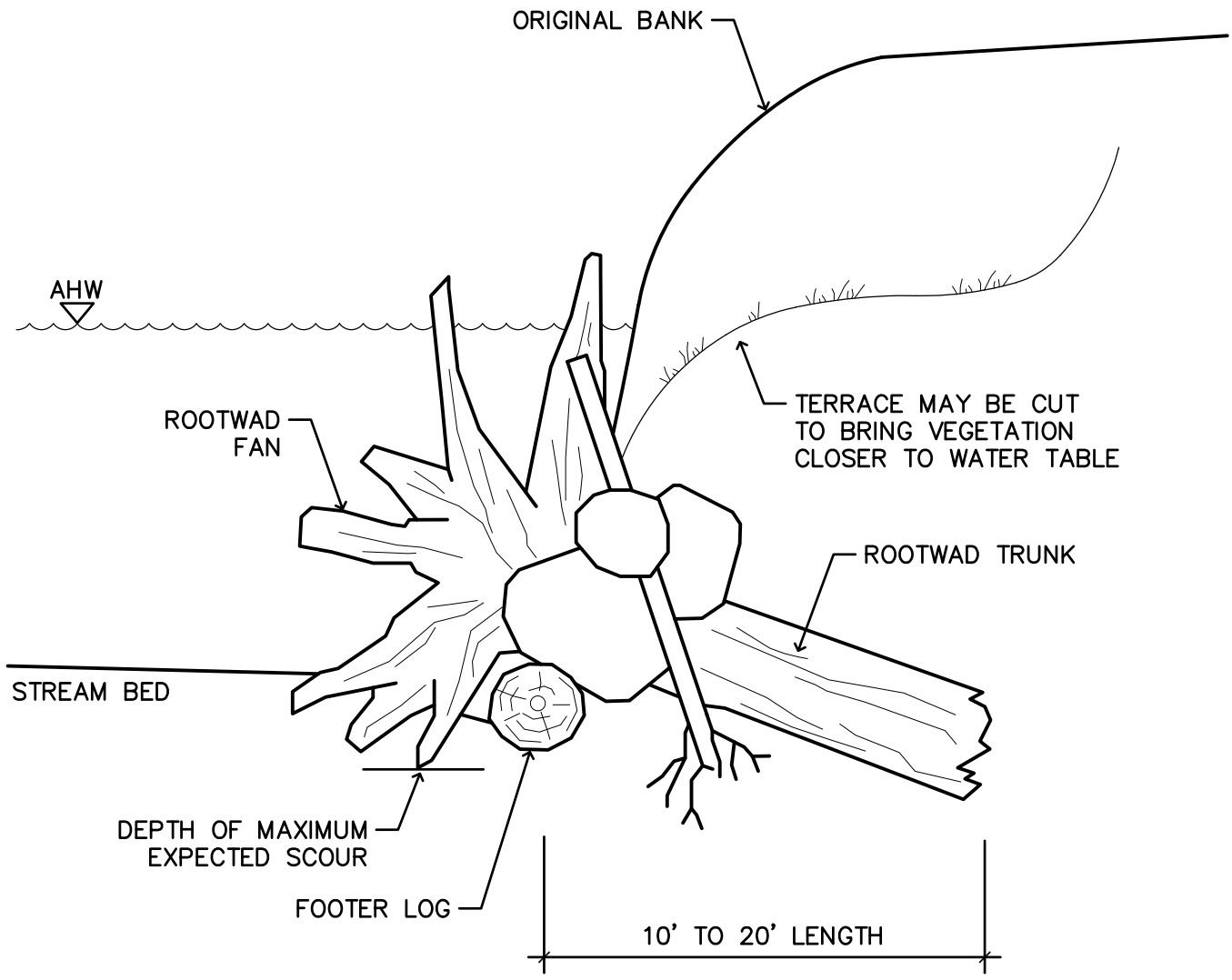


NOTES:

1. EXCAVATE TRENCH BELOW LOWEST STREAM BED GRADE, PARALLEL WITH BANK TO SET FOOTER LOG.
2. SET ROOT WAD WITH MIN. OF 6' OF BOLE ON TOP OF FOOTER LOG DIAGONALLY FORMING AN 'X'.
3. ROOTWAD PIECE SHOULD BE ANGLED UPSTREAM AT 45–60 DEGREE ANGLE, WITH BOLE SET INTO TRENCH IN BANK.
4. PLACE WILLOW POLES AND BOULDERS TO SECURE, ESPECIALLY AT APEX AND IN TRENCHES.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		ROOTWAD REVETMENT WITH VEGETATED RIPRAP
SCALE: NTS	DATE: 11/2019	

©JOHN MCCHULLAH



ROOTWAD REVETMENT CROSS SECTION

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

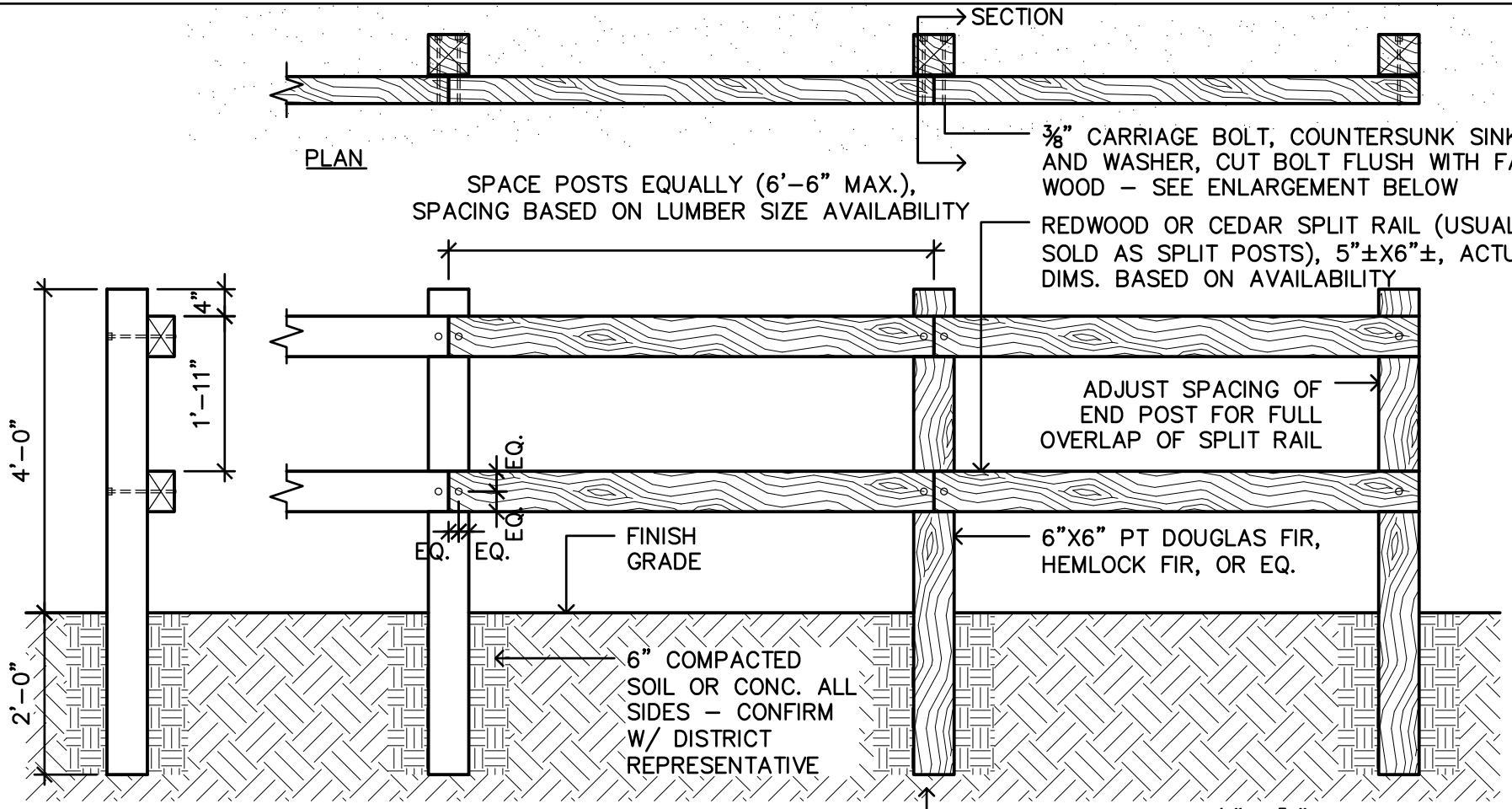
S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\5 rootwad revetment cross section.dwg

©2004 SALIX

DETAILS AND SPECIFICATIONS GUIDELINES

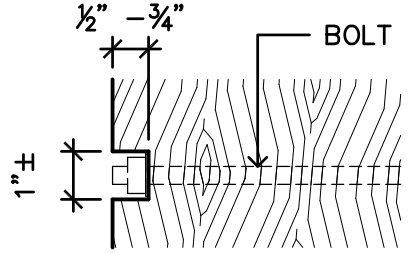
SECTION 6

STRUCTURES



NOTES:

1. LUMBER AVAILABLE FROM BIG CREEK LUMBER (831–457–5042) OR EQ.
2. INSTALL ALL POSTS PLUMB. LOCATE ANY ADJACENT UNDERGROUND UTILITIES PRIOR TO EXCAVATING POST HOLES TO AVOID DAMAGE.
3. SPLICE RAILS ON CENTERLINE OF POST ONLY. FACE RAILS OUTWARDS (TOWARDS ROAD OR TRAIL).
4. POST MATERIAL TO BE CONSISTENT THROUGHOUT PROJECT.
5. IF W/IN 50' OF ORDINARY HIGH WATER LEVEL (AS DETERMINED BY DISTRICT REPRESENTATIVE), POSTS SHALL BE REDWOOD OR EQUIVALENT NON–PT MATERIAL.
6. PT LEVEL AS APPROPRIATE FOR UNDERGROUND APPLICATION.



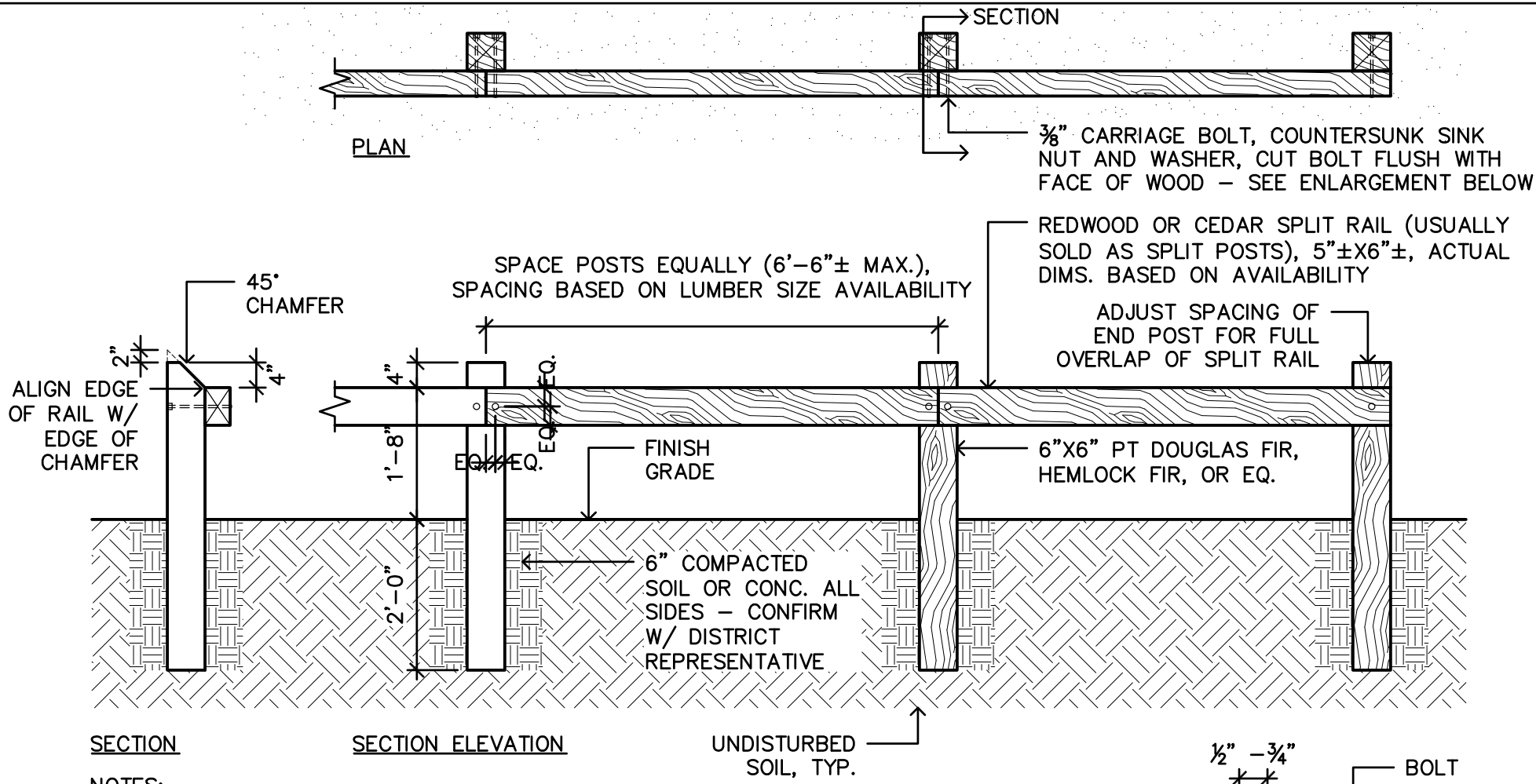
SECTION ENLARGEMENT
SCALE: 3" = 1'–0"

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT

FENCE - DOUBLE SPLIT RAIL FENCE

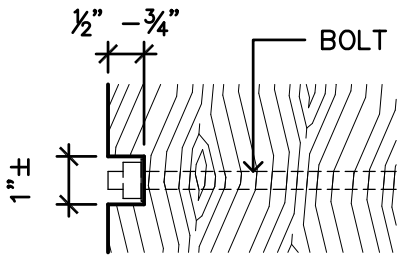
SCALE: 1/2" = 1'-0"

DATE: 11/17/2011



NOTES:

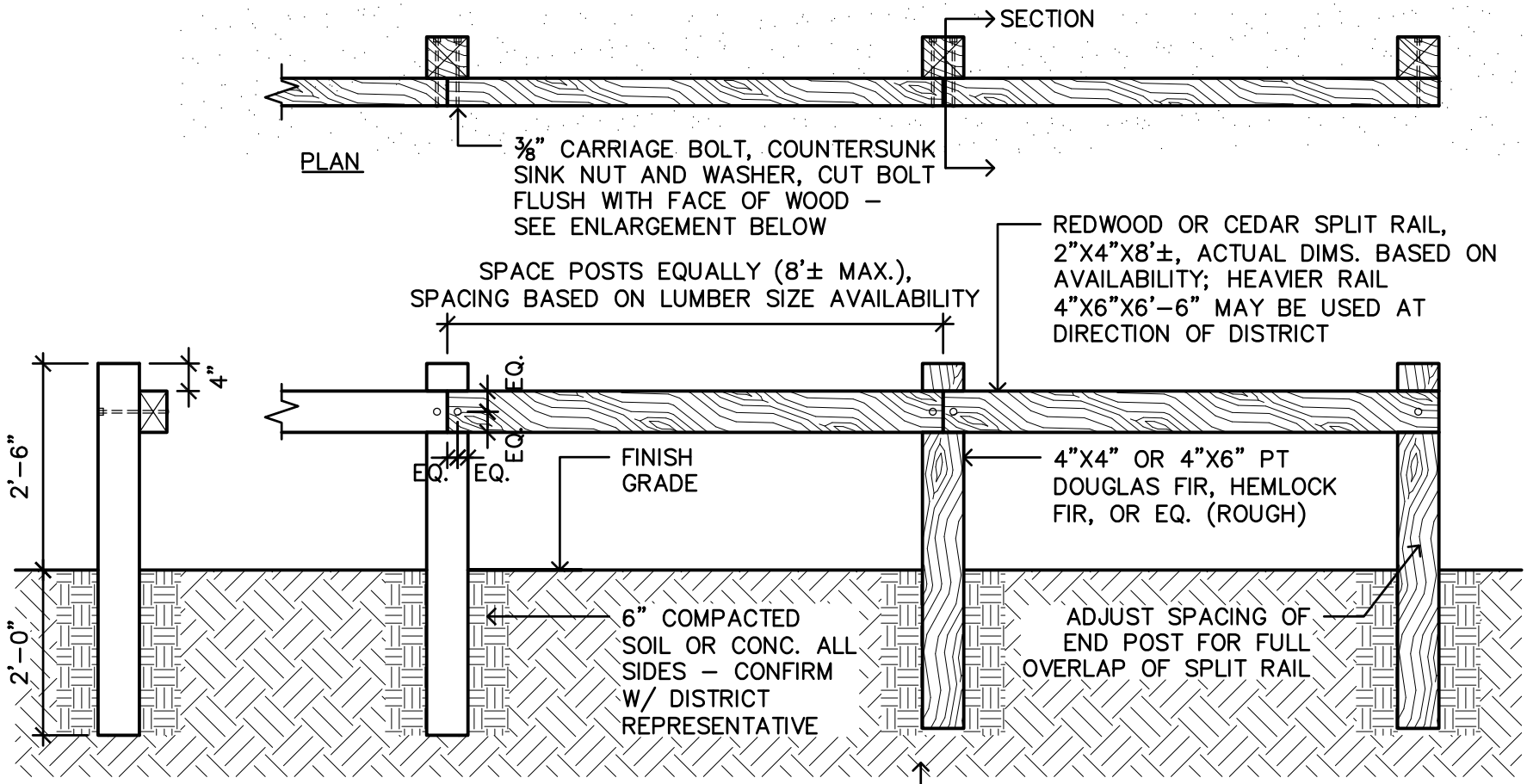
1. LUMBER AVAILABLE FROM BIG CREEK LUMBER (831–457–5042) OR EQ.
2. INSTALL ALL POSTS PLUMB. LOCATE ANY ADJACENT UNDERGROUND UTILITIES PRIOR TO EXCAVATING POST HOLES TO AVOID DAMAGE.
3. SPLICE RAILS ON CENTERLINE OF POST ONLY. FACE RAILS OUTWARDS (TOWARDS ROAD OR TRAIL).
4. POST MATERIAL TO BE CONSISTENT THROUGHOUT PROJECT.
5. IF W/IN 50' OF ORDINARY HIGH WATER LEVEL (AS DETERMINED BY DISTRICT REPRESENTATIVE), POSTS SHALL BE REDWOOD OR EQUIVALENT NON–PT MATERIAL.
6. PT LEVEL AS APPROPRIATE FOR UNDERGROUND APPLICATION.

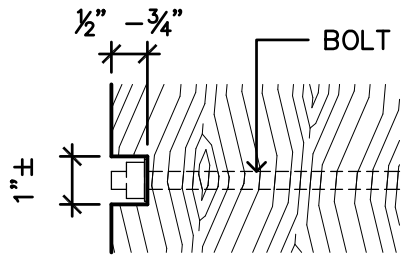


SECTION ENLARGEMENT
SCALE: 3" = 1'–0"

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		FENCE- SINGLE SPLIT RAIL FENCE
SCALE: 1/2" = 1'-0"	DATE: 11/17/2011	

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6A Fence-Split-Single.dwg





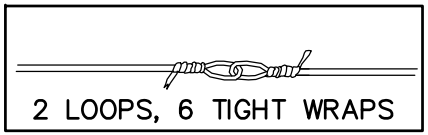
SECTION ENLARGEMENT
SCALE: 3" = 1'–0"

NOTES:

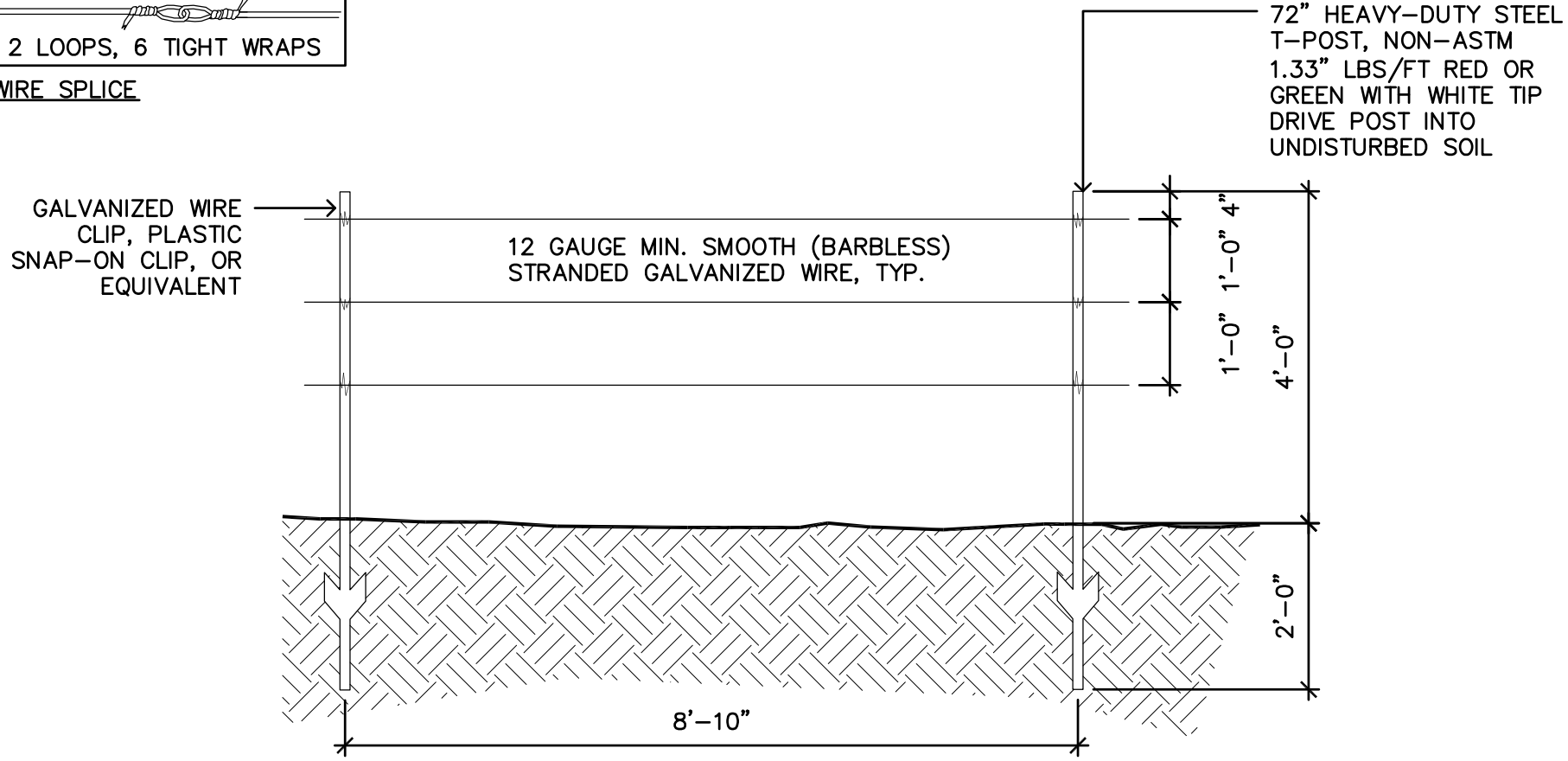
1. LUMBER AVAILABLE FROM BIG CREEK LUMBER (831–457–5042) OR EQ.
2. INSTALL ALL POSTS PLUMB. SLOPE RAILS W/GRADE. LOCATE ANY ADJACENT UNDERGROUND UTILITIES PRIOR TO EXCAVATING POST HOLES TO AVOID DAMAGE.
3. SPLICE RAILS ON CENTERLINE OF POST ONLY. FACE RAILS OUTWARDS (TOWARDS ROAD OR TRAIL).
4. POST MATERIAL TO BE CONSISTENT THROUGHOUT PROJECT.
5. IF W/IN 50' OF ORDINARY HIGH WATER LEVEL (AS DETERMINED BY DISTRICT REPRESENTATIVE), POSTS SHALL BE REDWOOD OR EQUIVALENT NON–PT MATERIAL.
6. PT LEVEL AS APPROPRIATE FOR UNDERGROUND APPLICATION.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		# FENCE - SWITCHBACK BARRIER FENCE
SCALE: 1/2" = 1'-0"	DATE: 11/17/2011	

\\fileserv\shareall\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6A Fence-Switchback-Barrier.dwg



WIRE SPLICE

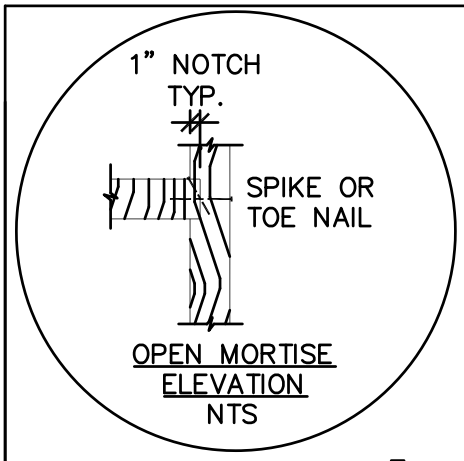


NOTES:

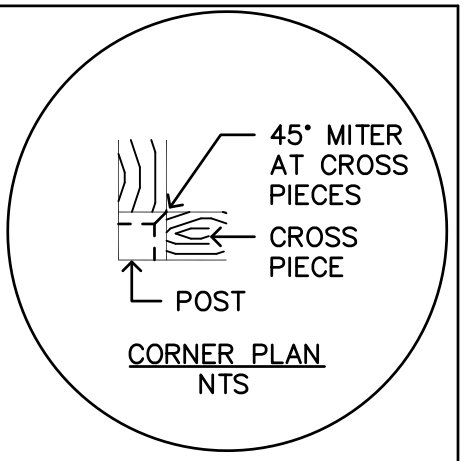
1. THIS DETAIL IS NOT FOR USE IN CATTLE AREAS.
2. SET ALL POSTS PLUMB.
3. STRING WIRE TAUT. STRING WIRE FROM BOTTOM.
4. FOR AREAS WHERE SLOPE IS >45%, USE 84" STEEL T-POST AND DRIVE 6" INTO SOIL.
5. WITH SPECIAL PERMISSION, USE 72"L 6"X6" PT DOUGLAS FIR, HEMLOCK FIR, OR EQ. (ROUGH) INSTEAD OF T-POST WHERE MINOR GRADE CHANGES ARE CLOSE TOGETHER, WHERE MORE SUPPORT IS NEEDED TO STRING WIRE TAUT, OR AT LONG STRAIGHT RUNS. LOOP WIRE AT POST OR STAPLE.
6. USE H-BRACE PANEL AT SIGNIFICANT GRADE CHANGES, OR CHANGES OF 135° OR LESS. SEE H-BRACE, END, AND CORNER DETAIL.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		WIRE BARRIER FENCE
SCALE: 1/2" = 1'-0"	DATE: 10/2019	

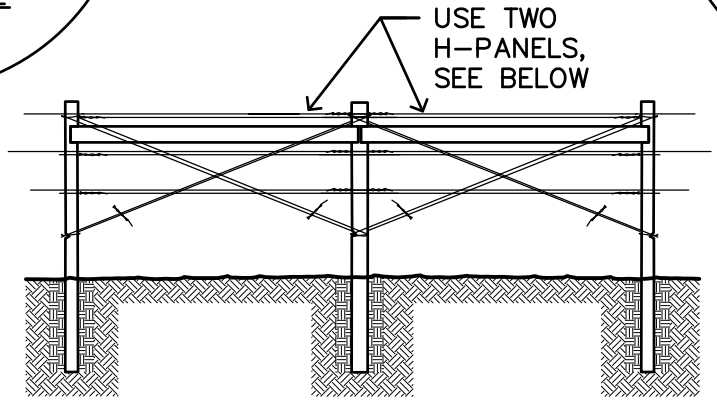
\\fileserv\shareall\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6A Fence-WireBarrier.dwg



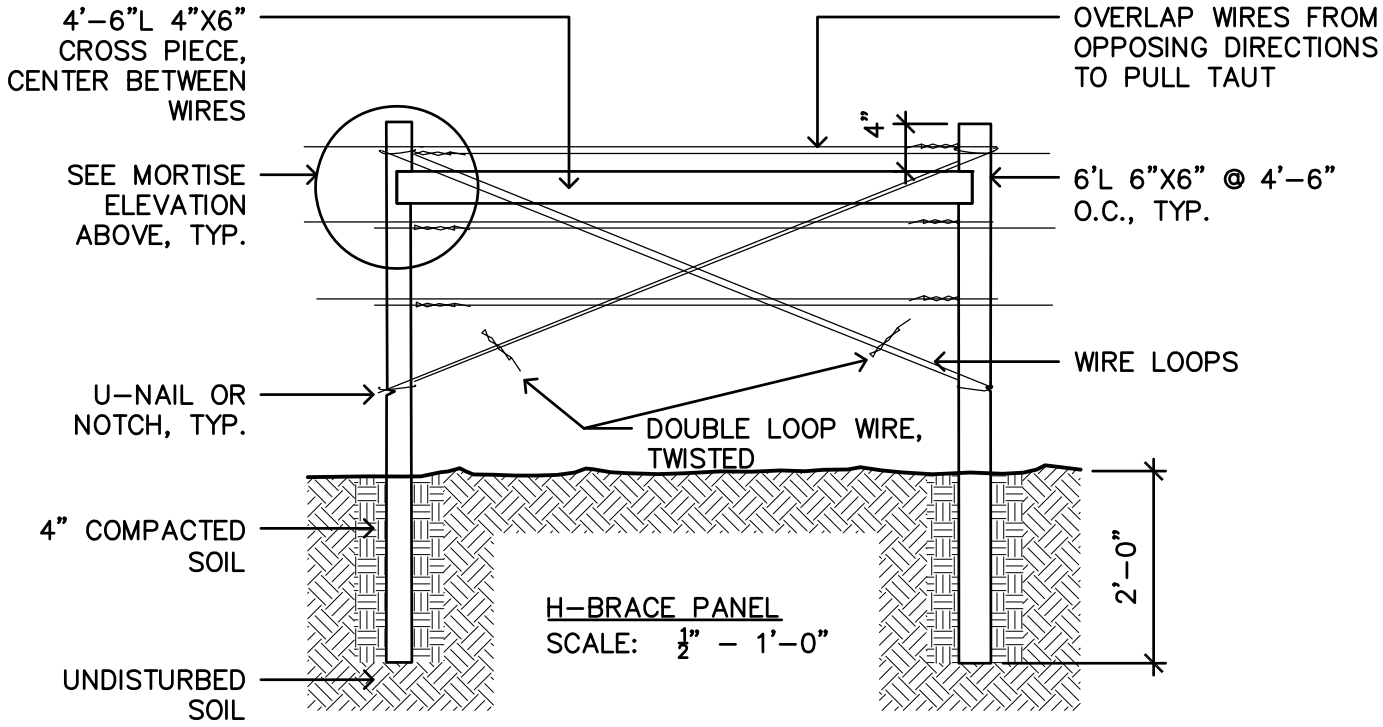
OPEN MORTISE
ELEVATION
NTS



CORNER PLAN
NTS



END PANEL
SCALE: $\frac{1}{4}$" = 1'-0"



H-BRACE PANEL
SCALE: $\frac{1}{2}$" - 1'-0"

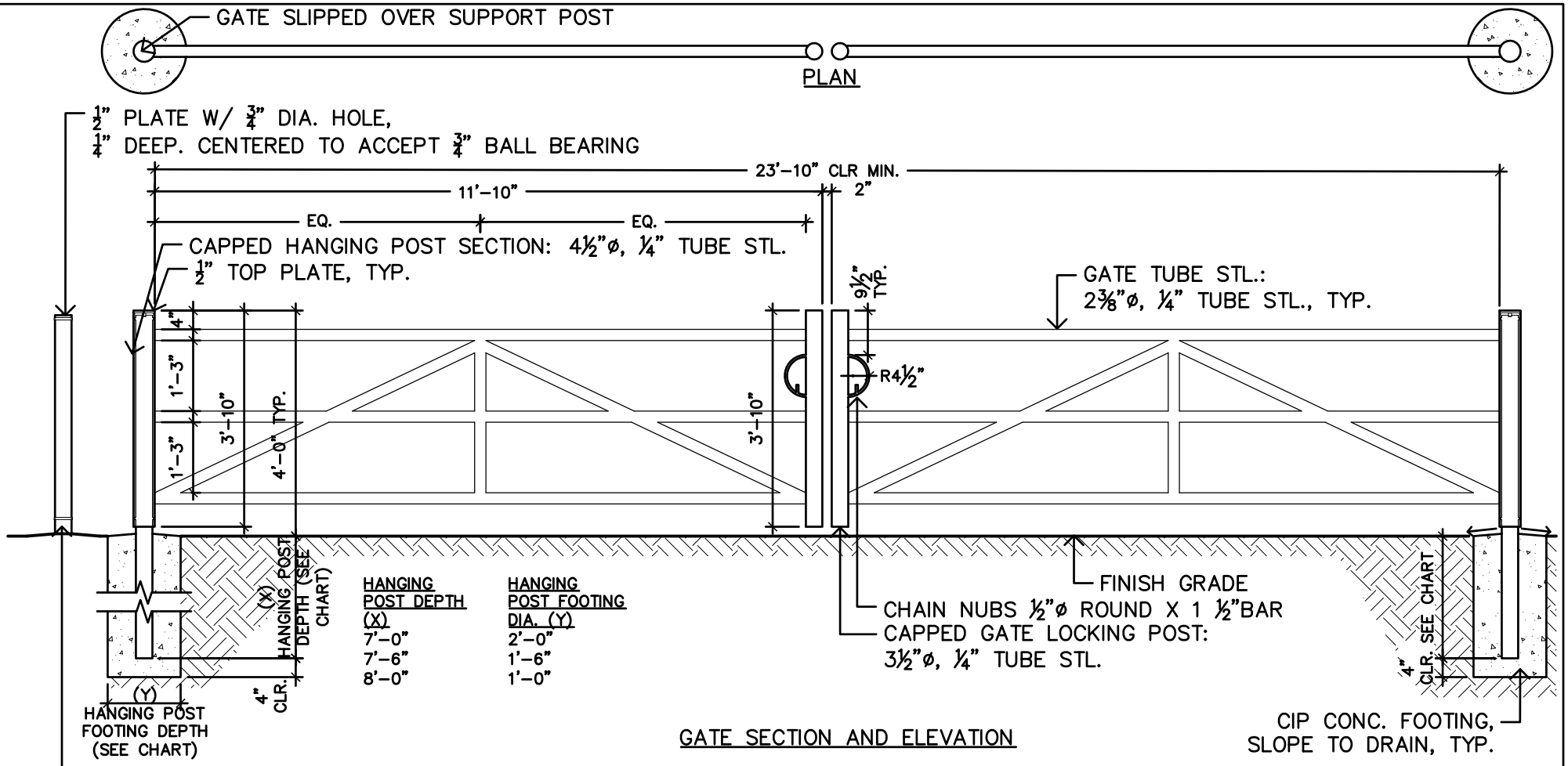
NOTES:

1. ALL LUMBER TO BE PT DOUGLAS FIR, HEMLOCK FIR, OR EQ. (ROUGH). IN CATTLE AREAS, USE METAL POSTS & H-BRACES INSTEAD.
2. SEE WIRE BARRIER DETAIL FOR POST TYPE, WIRE TYPE AND SPACING, AND SPLICE DETAIL..
3. AT CORNERS 135° OR LESS, INSTALL TWO (2) H-BRACE PANELS, SIMILAR TO END PANEL SHOWN ABOVE. MITER CROSS PIECE AS SHOWN IN PLAN, ABOVE.

WIRE BARRIER FENCE BRACING, END, & CORNER

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: AS NOTED	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6A Fence-WireBarrier-BracingEndCorner.dwg



GATE SECTION AND ELEVATION

SUPPORT POST ELEVATION

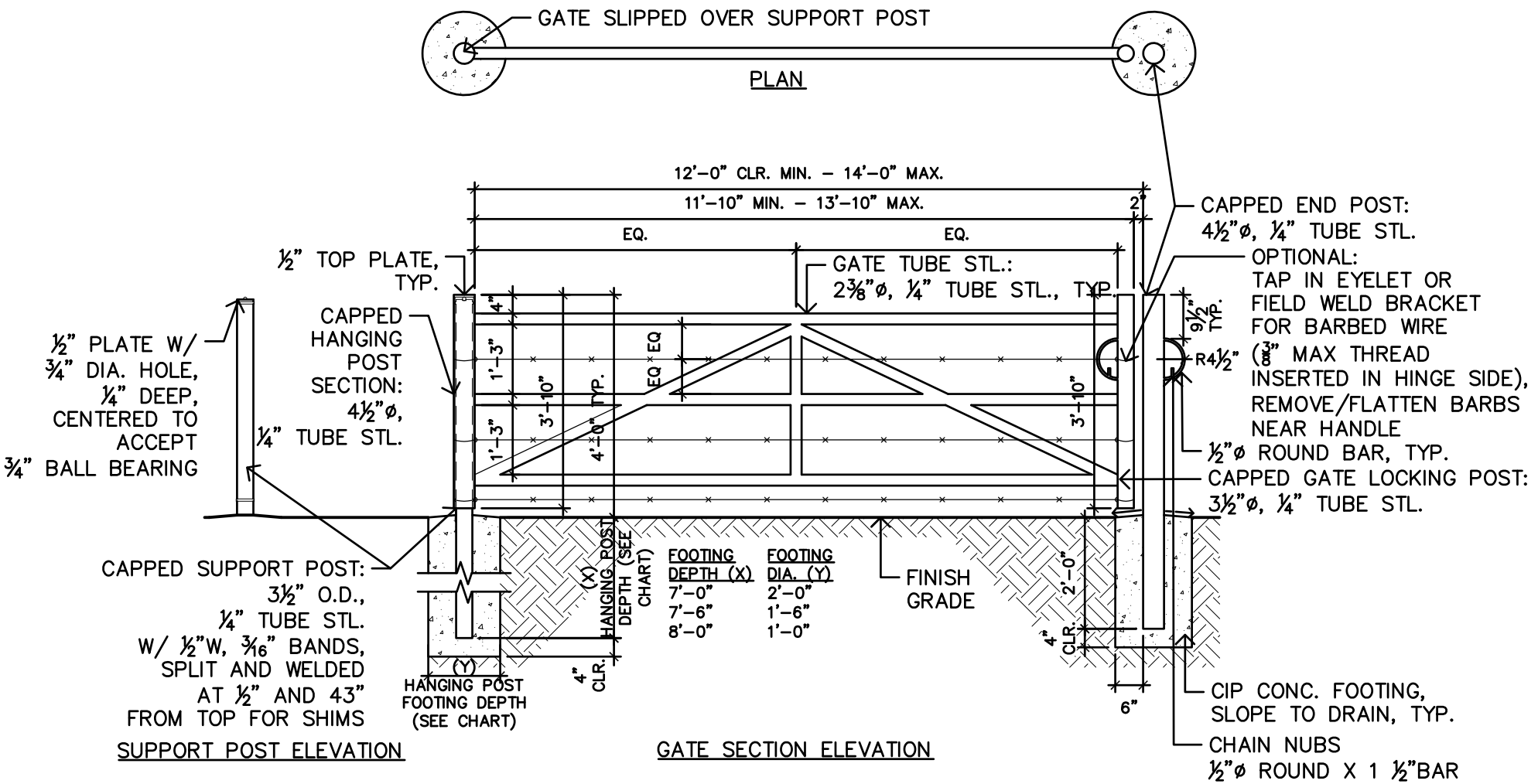
CAPPED SUPPORT POST: 3½" O.D., ¼" TUBE STL. W/ ½"W, 3⁄16" BANDS, SPLIT AND WELDED AT ½" AND 43" FROM TOP FOR SHIMS

NOTES:

1. TUBE STL. DIMENSIONS SHOWN ARE O.D.
2. ALL PIPE TO BE WELDED ALL AROUND W/ ¼" FILLET WELD.
3. PLACE HINGE POST ON UPHILL SIDE OF ROADWAY OR AS SHOWN ON DRAWINGS. INSTALL HINGE POST WITH ENOUGH CAMBER (1–2%) TO COMPENSATE FOR BENDING WHEN GATE IS HUNG.
4. PRIME ALL EXPOSED SURFACES WITH RUST INHIBITIVE PAINT. COLOR: OLYMPIC OXFORD BROWN. FINISH: PAINT ALL EXPOSED SURFACES WITH WEATHER RESISTANT OUTDOOR PAINT.
5. FOR CATTLE AREAS, USE MORE SECURE GATES FOR COW–CALF OPERATIONS. CONSIDER A LIGHT–DUTY CATTLE GATE.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		ENTRY GATE DOUBLE LEAF STEEL PIPE
SCALE: 3/8"=1'-0"	DATE: 10/2019	

\\fileserv\shareall\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6B Gate-Entry-Stl-Double.dwg

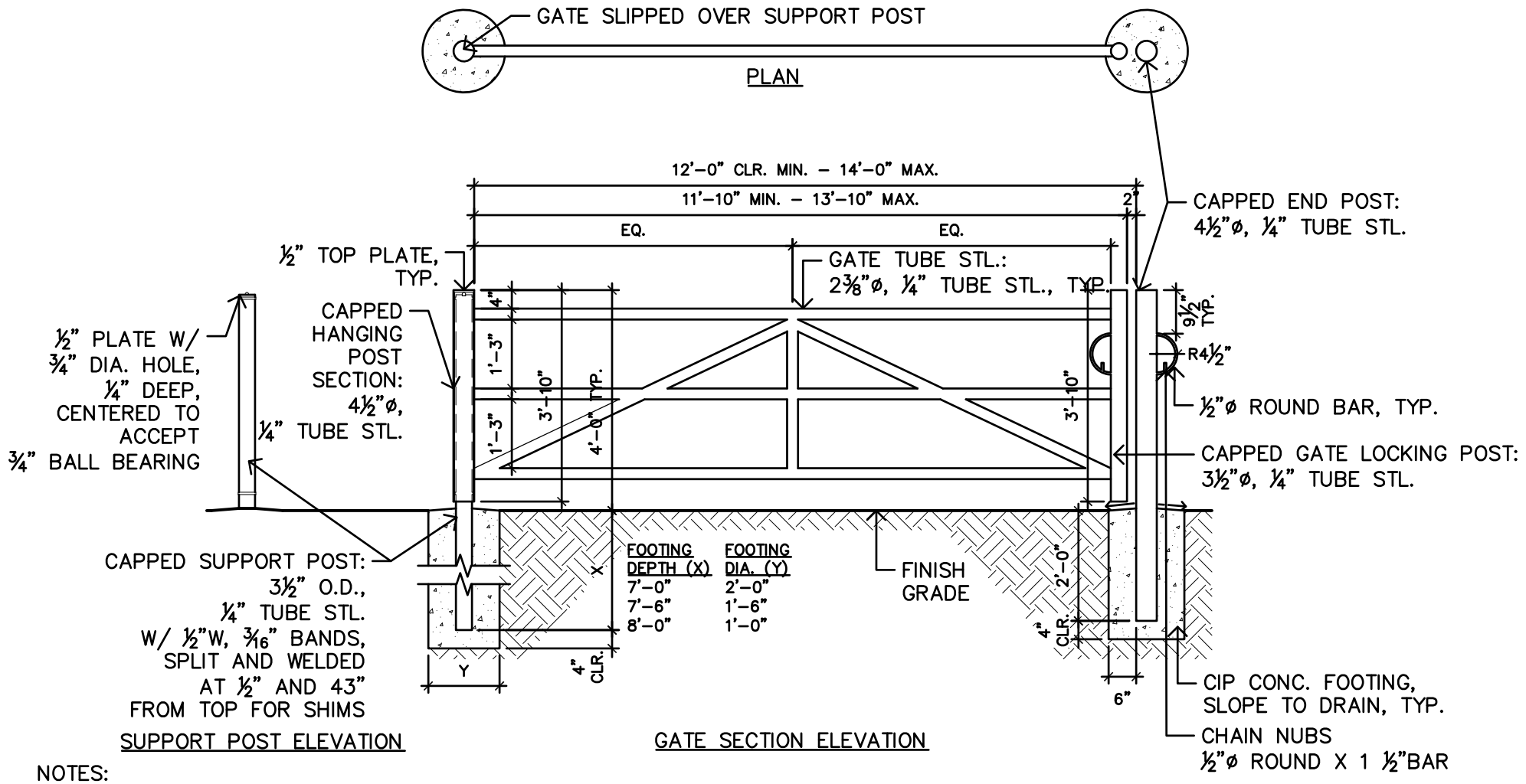


NOTES:

1. BETTER IN CATTLE AREAS. (CONFIRM WITH PROPERTY MANAGEMENT TEAM)
2. TUBE STL. DIMENSIONS SHOWN ARE O.D.
3. ALL PIPE TO BE WELDED ALL AROUND W/ ¼" FILLET WELD.
4. PLACE HINGE POST ON UPHILL SIDE OF ROADWAY OR AS SHOWN ON DRAWINGS. INSTALL HINGE POST WITH ENOUGH CAMBER (1–2%) TO COMPENSATE FOR BENDING WHEN GATE IS HUNG.
5. PRIME ALL EXPOSED SURFACES WITH RUST INHIBITIVE PAINT. COLOR: OLYMPIC OXFORD BROWN. FINISH: GLOSS ENAMEL. .

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		ENTRY GATE SINGLE LEAF STEEL PIPE W/ BARBED WIRE
SCALE: 3/8"=1'-0"	DATE: 10/2019	

\\fileserv\shareall\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6B Gate-Entry-Stl-Single-Barbed.dwg



NOTES:

1. NOT FOR CATTLE AREAS. WITH SPECIAL PERMISSION, A WIDER WIDTH IS ACCEPTABLE (I.E. 16' WIDE ALUMINUM GATE FOR EMERGENCY SERVICE). REVIEW FOOTING DESIGN ACCORDINGLY.
2. TUBE STL. DIMENSIONS SHOWN ARE O.D.
3. ALL PIPE TO BE WELDED ALL AROUND W/ ¼" FILLET WELD.
4. PLACE HINGE POST ON UPHILL SIDE OF ROADWAY OR AS SHOWN ON DRAWINGS. INSTALL HINGE POST WITH ENOUGH CAMBER (1–2%) TO COMPENSATE FOR BENDING WHEN GATE IS HUNG.
5. PRIME ALL EXPOSED SURFACES WITH RUST INHIBITIVE PAINT. COLOR: OLYMPIC OXFORD BROWN. FINISH: PAINT ALL EXPOSED SURFACES WITH WEATHER RESISTANT OUTDOOR PAINT.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		ENTRY GATE SINGLE LEAF STEEL PIPE - NO BARBED WIRE
SCALE: 3/8" = 1'-0"	DATE: 10/2019	

\\fileserv\shareall\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6B Gate-Entry-Stl-Single-NotBarbed.dwg

LIGHT DUTY GATE

1. THE SPECIFICATION FOR DISTRICT LIGHT DUTY GATES IS:

MANUFACTURER:
POWDER RIVER LIVESTOCK HANDLING EQUIPMENT COMPANY
485 E 1130 S
PROVO, UT 84606
800-453-5318
INFO@POWDERRIVER.COM

MODEL:
1600 TUBE GATE IN POWDER RIVER GREEN

SIZE:
12' OR 14' WITH CHAIN LATCH ON ROADS.
4' WITH CHAIN LATCH ON TRAILS
(6' WIDE WHERE UTV ACCESS IS REQUIRED FOR EMERGENCY SERVICE OR MAINTENANCE).

INSTALLATION:
HUNG ON 3"X3" APPROXIMATELY 104" SQUARE STEEL POST SET 4' IN GROUND WITH CONCRETE.
4" CLEARANCE BETWEEN GROUND AND GATE.
POST SHALL BE CAPPED AND PAINTED GREEN TO MATCH GATE.

2. NOTES:

ALTERNATE EQUIVALENT GATE MAY BE APPROVED BY DISTRICT REPRESENTATIVE.
CONSIDER WIRE MESH GATES FOR CATTLE AREAS.

LIGHT DUTY GATE

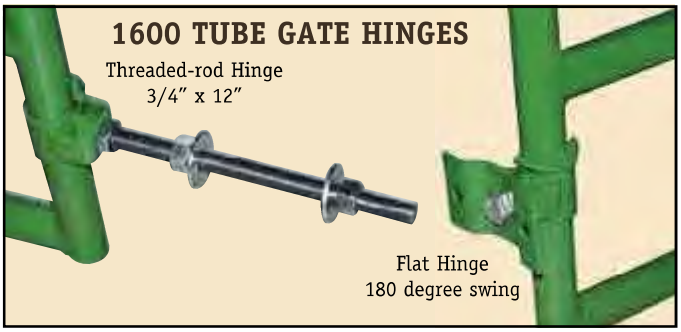
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT | SCALE: NTS | DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6B Gate-light duty.dwg

1600 Tube Gates

1600 Tube Gates

The 1600 Series Tube Gates are built to the same tough specifications as the 1600 Tube Panels. Powder River's 1600 Tube Gates come with a choice of our 180 degree steel hinges or our 12" long threaded bolt hinges. These gates are perfect for pasture, lanes, driveways and limited crowding.



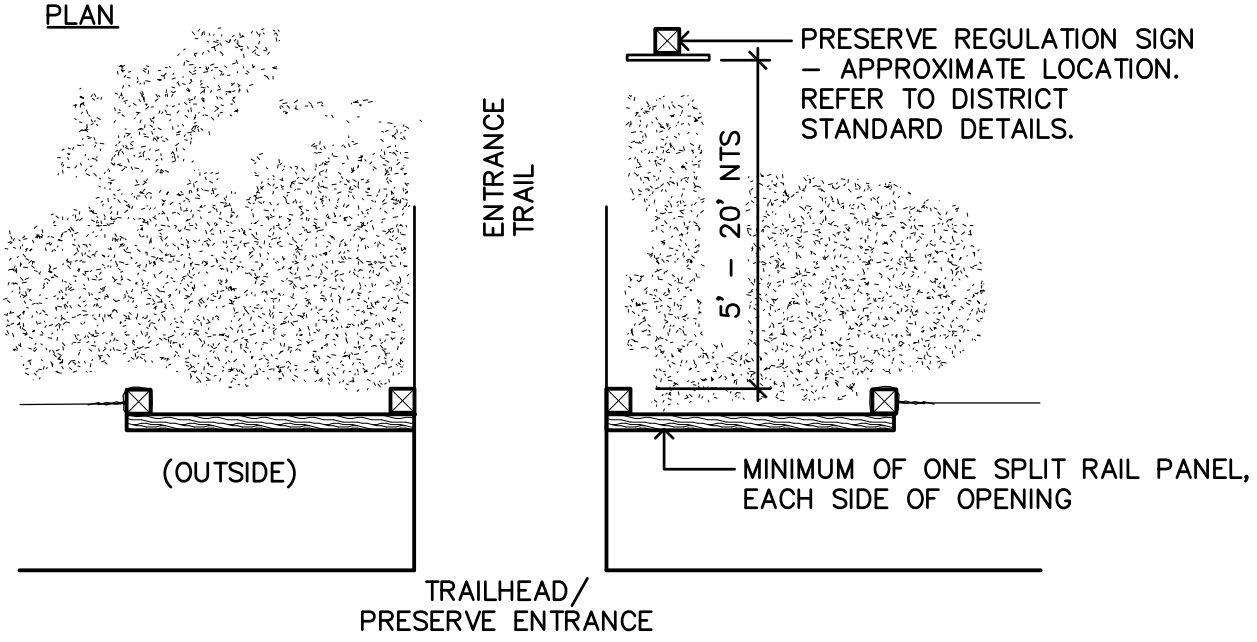
1600 TUBE GATE SPECIFICATIONS

Height Overall . . . . . 52"
Horizontal Rails (6) . . . . . 1.66" O.D., 16-gauge Tube
Hinges . . . . . 3/4" x 12" Threaded-rod or 180° Flat
Latch . . . . . .33" Chain w/Keeper

Order No.	Description	No. Stays	Weight*
Threaded-rod Hinge			
033-16004	4' Tube Gate	0	34 lbs.
033-16006	6' Tube Gate	0	46 lbs.
033-16008	8' Tube Gate	1	62 lbs.
033-16010	10' Tube Gate	1	75 lbs.
033-16012	12' Tube Gate	1	89 lbs.
033-16014	14' Tube Gate	2	103 lbs.
033-16016	16' Tube Gate	2	115 lbs.
180 Degree Hinge			
033-18004	4' Tube Gate	0	34 lbs.
033-18006	6' Tube Gate	0	46 lbs.
033-18008	8' Tube Gate	1	62 lbs.
033-18010	10' Tube Gate	1	75 lbs.
033-18012	12' Tube Gate	1	89 lbs.
033-18014	14' Tube Gate	2	103 lbs.
033-18016	16' Tube Gate	2	115 lbs.

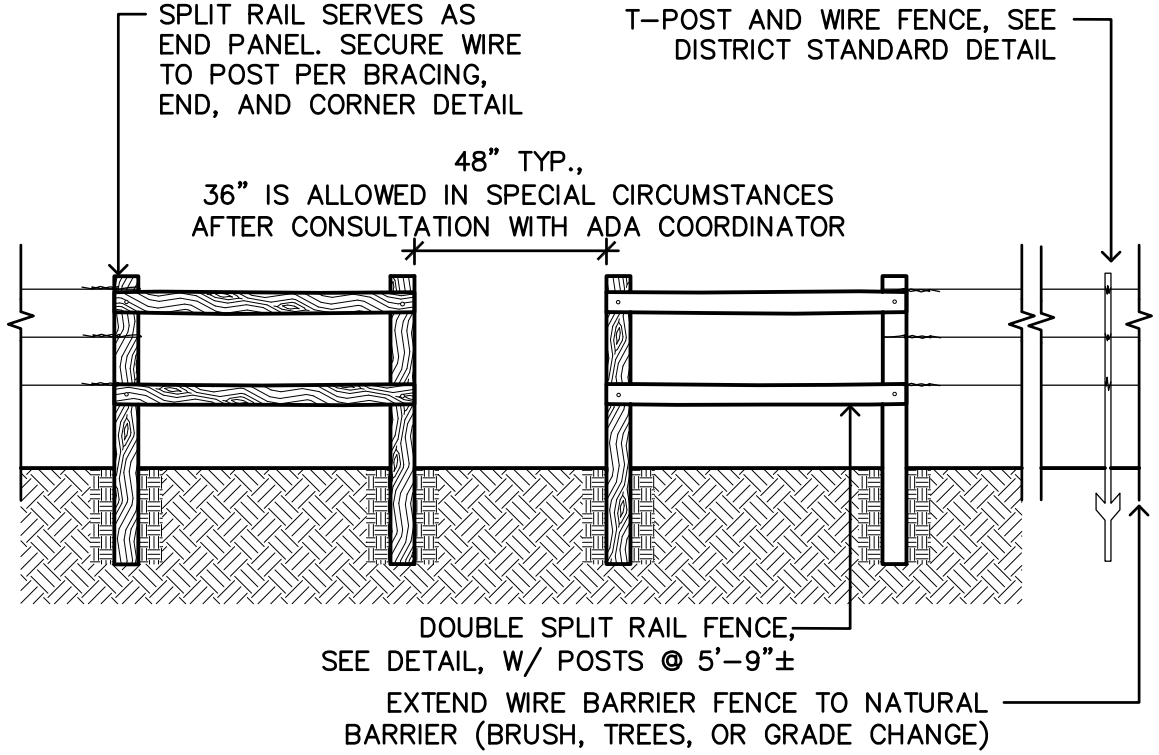
NOTES:
1. REFER TO DISTRICT STANDARD DETAILS FOR DOUBLE SPLIT RAIL FENCE, WIRE BARRIER FENCE, AND REGULATION SIGNS.
2. PROVIDE ENTRANCE MANEUVERING CLEARANCE THAT DOES NOT EXCEED 5% IN ANY DIRECTION (48" IN LENGTH ON EITHER SIDE OF STILE BY FULL WIDTH OF TRAIL).

PLAN



TRAILHEAD/
PRESERVE ENTRANCE

ELEVATION



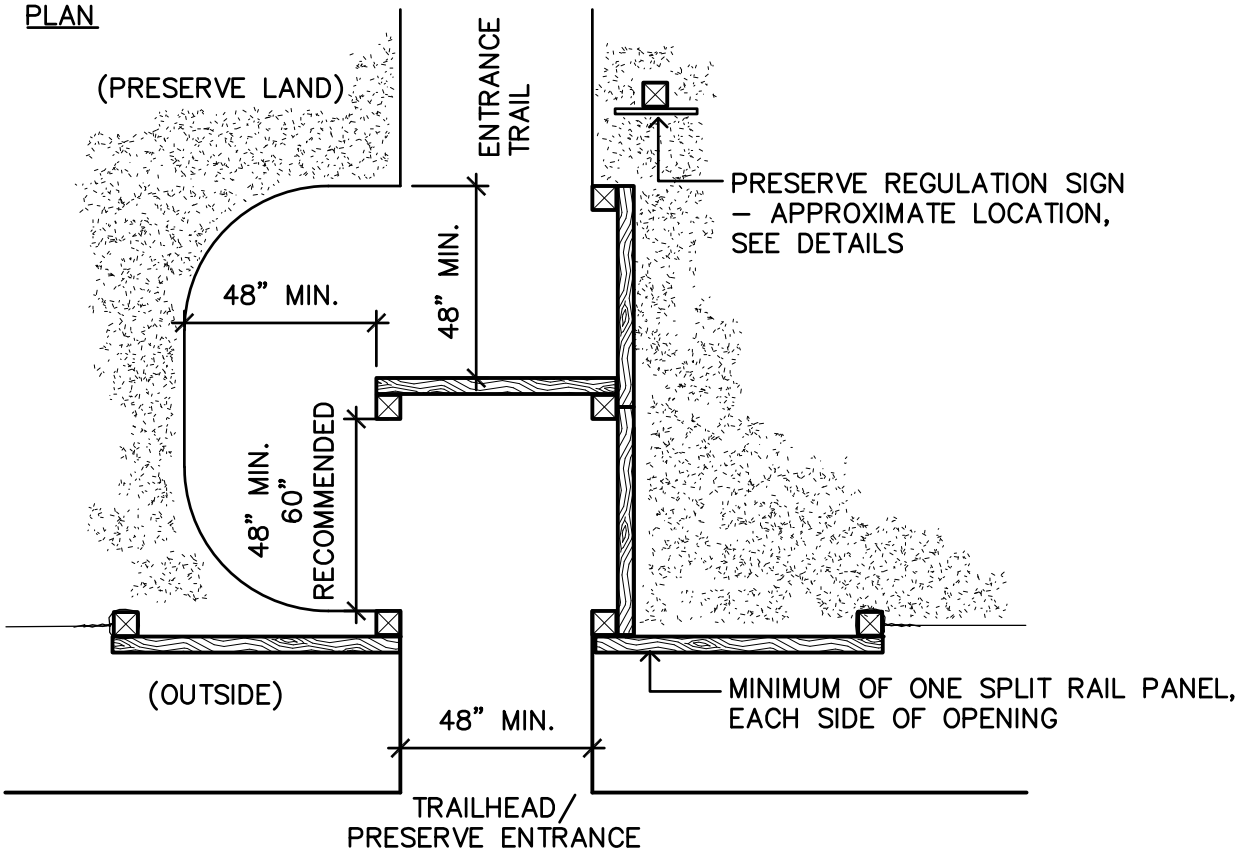
TRAILHEAD/PRESERVE ENTRANCE TYPE 1

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1/4" = 1'-0"	DATE: 02/2020

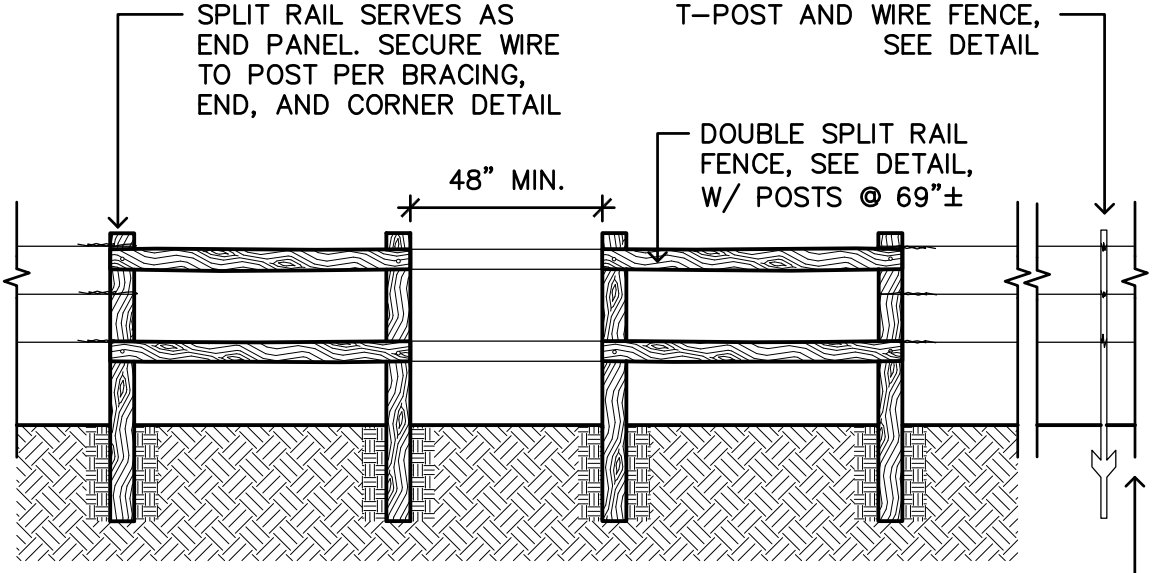
S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6C Trailhead-PreserveEntranceAlt1.dwg

NOTES:
1. REFER TO DISTRICT STANDARD DETAILS FOR DOUBLE SPLIT RAIL FENCE, WIRE BARRIER FENCE, AND REGULATION SIGNS.
2. PROVIDE MANEUVERING CLEARANCE THROUGHOUT AND ADJACENT TO ENTRANCE THAT DOES NOT EXCEED 5% IN ANY DIRECTION (48" IN LENGTH ON EITHER SIDE OF ENTRANCE BY FULL WIDTH OF TRAIL) .

PLAN



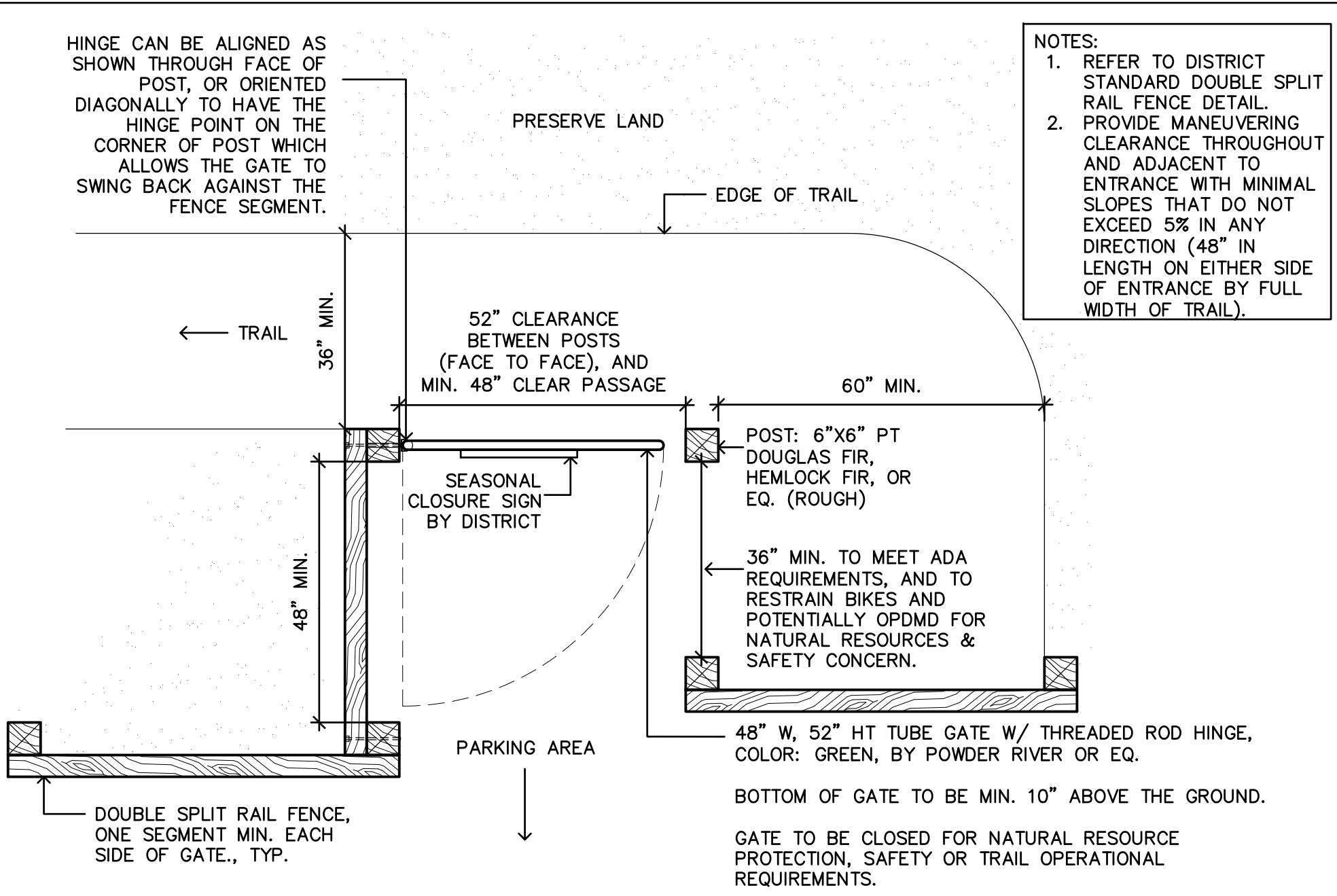
ELEVATION



TRAILHEAD/PRESERVE ENTRANCE TYPE 2

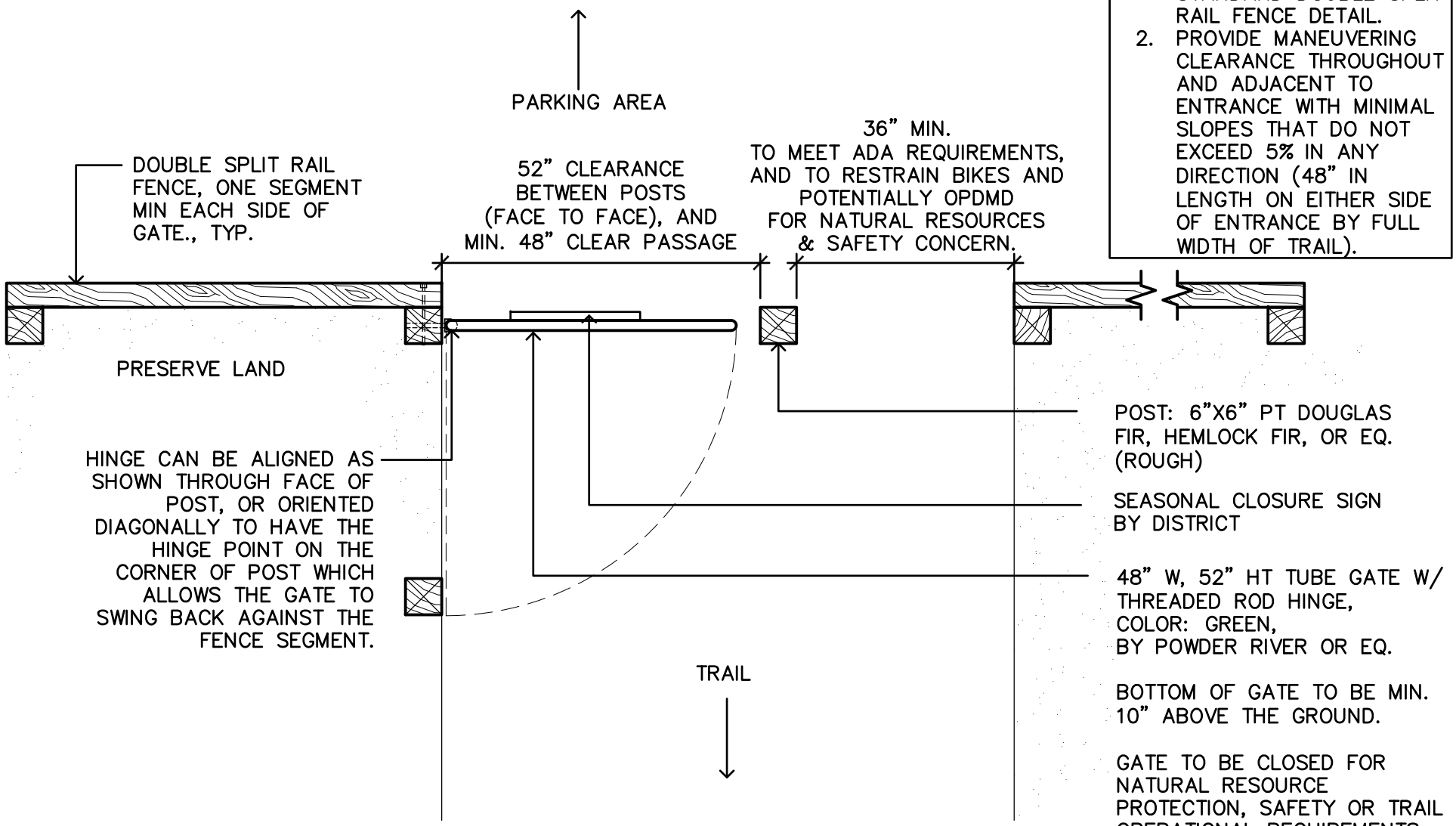
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1/4" = 1'-0"	DATE: 02/2020

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6C Trailhead-PreserveEntranceAlt2.dwg



MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		TRAIL GATE PLAN SEASONAL CLOSURE, TYPE 1
SCALE: 1/2"=1'-0"	DATE: 02/2020	

\\fileserv\shareall\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6C Gate-Trail-Seasonal-Alt1.dwg

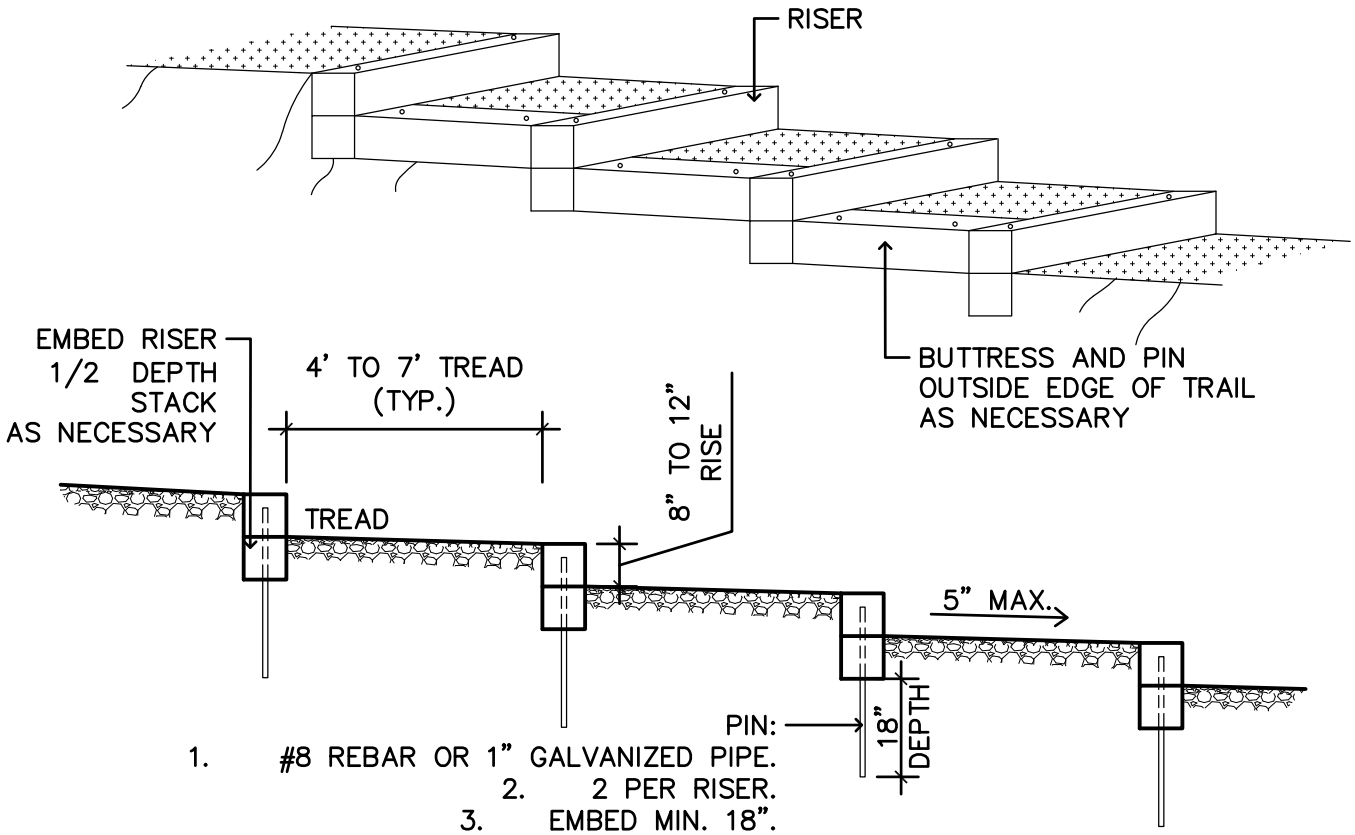


NOTES:
1. REFER TO DISTRICT STANDARD DOUBLE SPLIT RAIL FENCE DETAIL.
2. PROVIDE MANEUVERING CLEARANCE THROUGHOUT AND ADJACENT TO ENTRANCE WITH MINIMAL SLOPES THAT DO NOT EXCEED 5% IN ANY DIRECTION (48" IN LENGTH ON EITHER SIDE OF ENTRANCE BY FULL WIDTH OF TRAIL).

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	
SCALE: 1/2"=1'-0"	DATE: 02/2020

TRAIL GATE PLAN
SEASONAL CLOSURE, TYPE 2

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6C Gate-Trail-Seasonal-Alt2.dwg



1. #8 REBAR OR 1" GALVANIZED PIPE.
2. 2 PER RISER.
3. EMBED MIN. 18".
4. COUNTER SINK HEAD 2" BELOW TOP.

GRAVEL BACKFILL

	ROCK	DEPTH
CAP	3/4"CLASS II AGGREGATE BASE	1"
BASE	3" MINUS DRAIN ROCK	4"

NOTES:

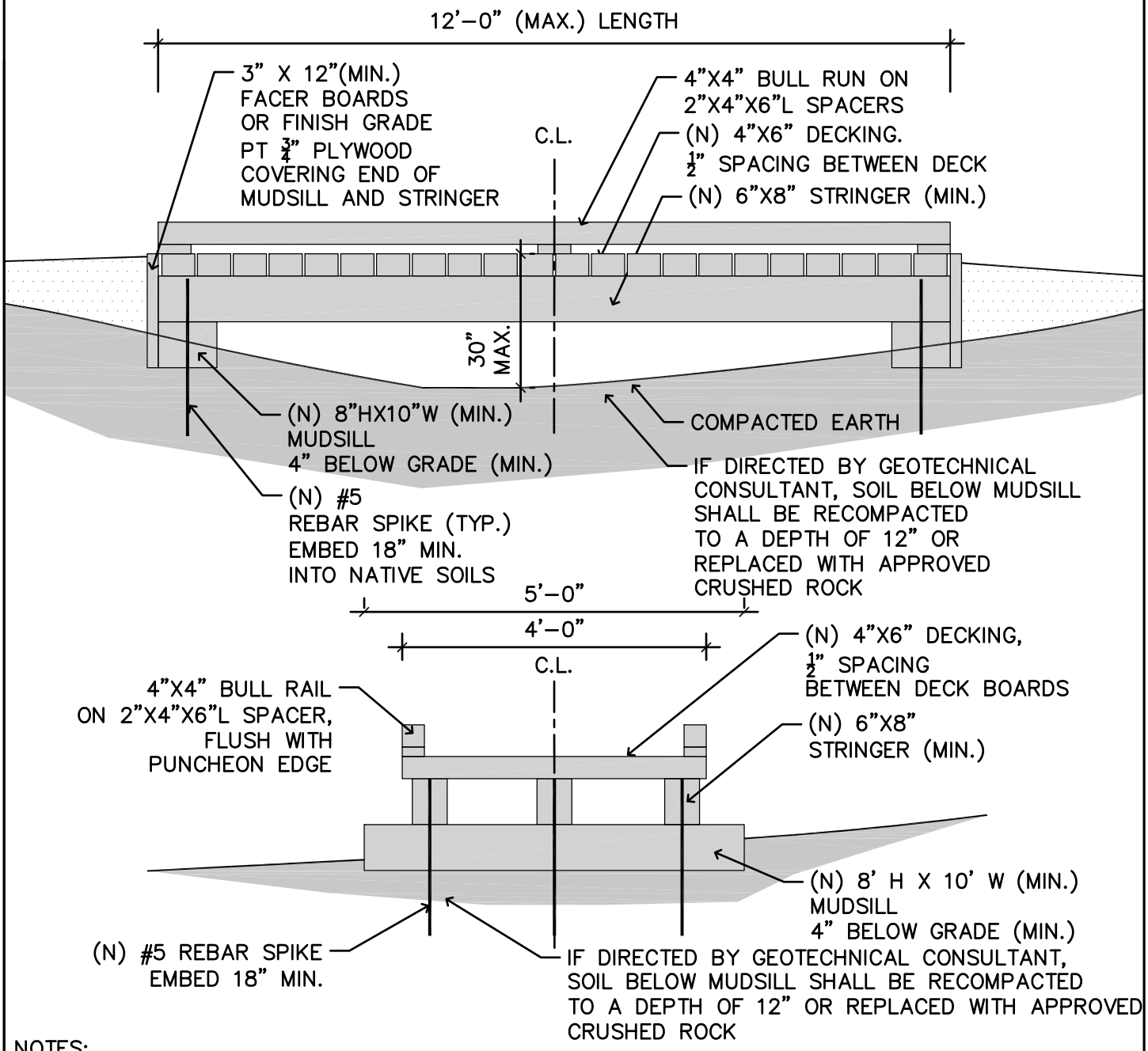
1. RISER TO CONSIST OF APPROVED DURABLE MATERIAL INCLUDING BUT NOT LIMITED TO PRESSURE TREATED WOOD, CONCRETE BLOCKS, OR ROCK.
2. RISER TO BE MAXIMUM 12" HIGH WITH MINIMUM 4 FOOT TREAD UNLESS OTHERWISE DIRECTED BY DISTRICT REPRESENTATIVE OR EXISTING CONDITION PRECLUDE.
3. BUTTRESS OUTSIDE EDGE OF TRAIL. USE SIMILAR MATERIALS AND CONSTRUCTION METHOD AS RISER.
4. EMBED RISER 1/2 DEPTH. STACK RISERS AS NECESSARY.
5. PIN EACH RISER USING REBAR (#8 MIN.) OR 1" GALVANIZED PIPE. MINIMUM TWO PER STEP.
6. COUNTER SINK PINS A MINIMUM OF TWO INCHES BELOW THE TOP OF THE RISER TREAD. TOPS OF PINS MUST BE COVERED AND NO PART OF THE PIN SHALL BE VISIBLE.
7. OUTSLOPE TRAIL 5%.
8. BUTTRESS OUTSIDE EDGE OF TRAIL. USE SIMILAR MATERIALS AND CONSTRUCTION METHOD AS RISER.
9. STEP LAYOUT TO BE MADE UNDER DIRECT SUPERVISION OF DISTRICT REPRESENTATIVE.
10. SPECIFICATIONS ARE ONLY AS GUIDELINE, MODIFICATIONS MAY BE MADE IN THE FIELD BY GEOTECHNICAL CONSULTANT OR DESIGNEE.
11. MAINTAIN A CONSISTENT STEP HEIGHT WHEN FEASIBLE.
12. THIS DETAIL SHOULD NOT BE USED AS PART OF AN ACCESSIBLE ROUTE OR TRAIL.

TRAIL STEPS

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6D wood trail steps.dwg

©TIMOTHY C. BEST, CEG



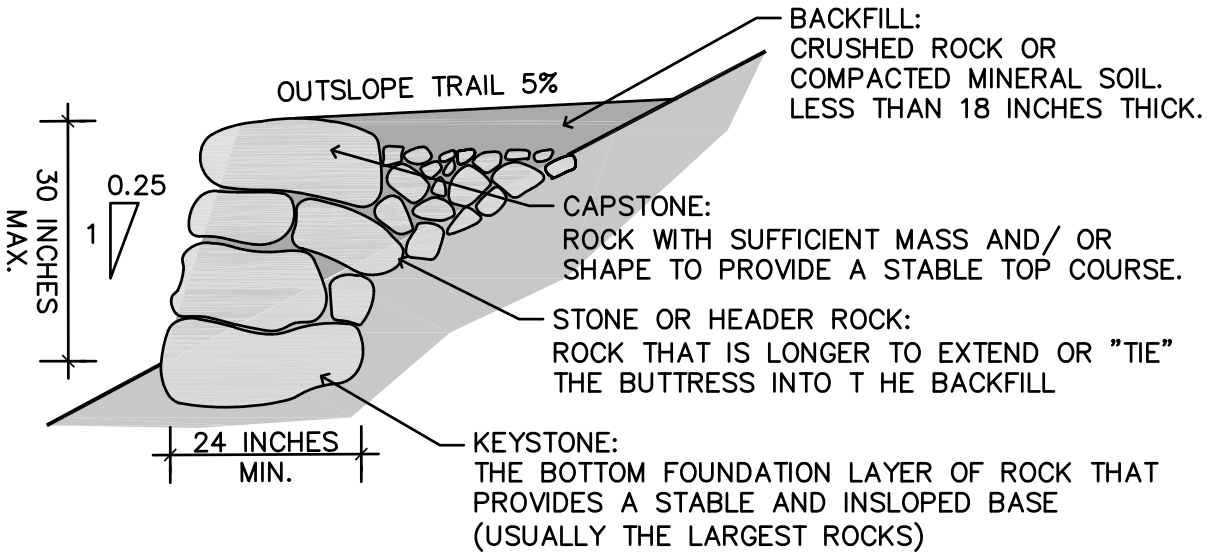
NOTES:

1. STANDARD PUNCHEON WIDTH SHALL BE 4 FEET. REFER TO SITE PLAN IF NARROWER PUNCHEON IS PROPOSED.
2. ALL DECKING, BEAMS, MUDSILLS AND WOOD IN CONTACT WITH EARTH OR WITHIN 1 FOOT OF EARTH SHALL BE CONSTRUCTION HEART REDWOOD OR APPROVED PLASTIC.
3. IF DIRECTED BY GEOTECHNICAL CONSULTANT, SOIL BELOW MUDSILL SHALL BE RECOMPACTED TO A DEPTH OF 12" OR REPLACED WITH APPROVED CRUSHED ROCK.
4. ALL HARDWARE SHALL BE GALVANIZED.
5. ANCHOR DECKING WITH (2) 3/8"X 8" GALVANIZED WIRE SPIKES (TYP.); PREDRILL HOLES FOR SPIKES.
6. ANCHOR BULL RAIL WITH (2) 3X8"X 10" GALVANZIED WIRE SPIKES (TYP.); PREDRILL HOLES FOR SPIKES.
7. MAINTAIN 2% MAXIMUM SLOPE ON PUNCHEON.
8. THIS DETAIL IS TYPICAL AND INTENDED FOR USE AS A GUIDELINE. ADJUSTMENTS TO THE ACTUAL DESIGN MAY NEED TO OCCUR IN FIELD DURING TIME OF CONSTRUCTION DUE TO LOCAL SITE CONDITIONS, AS DIRECTED BY AN ENGINEER OR OTHERWISE QUALIFIED PERSON.

LOW PUNCHEON (BOARDWALK)

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 03/2020

©TIMOTHY C. BEST, CEG



NOTES:

1. EXCAVATE A KEYWAY FOOTING TO FIRM, STABLE DIRT OR TO SOLID ROCK. SLOPE THE FOOTING SLIGHTLY INTO THE HILLSIDE (BATTER) SO THE ROCK BUTTRESS WILL LEAN INTO THE HILL AND DIG FOOTING DEEP ENOUGH TO SUPPORT THE FOUNDATION TIER OF ROCKS (THESE ARE USUALLY THE LARGEST ROCKS IN THE BUTTRESS). THE FOOTING IS DUG SO THAT THE FOUNDATION TIER IS EMBEDDED FOR THE FULL THICKNESS OF THE FIRST LAYER OF ROCKS.
2. CONSTRUCT BUTTRESS USING SOUND DURABLE ROCK. A MIN. OF 50% OF THE ROCK SHALL BE LARGER THAN 18 INCHES (130 LB MIN.) IDEALLY, THE BIGGER THE ROCK. THE BETTER, SINCE BIG ROCKS ARE LESS LIKELY TO SHIFT OR BECOME DISLODGED. THE BEST ROCK IS RECTANGULAR WITH FLAT SURFACES ON ALL SIDES. ROUND RIVER ROCK IS THE WORST.
3. THE KEYSTONE IS LAID INTO THE FOOTING AND SUCCESSIVE TIERS ARE LAID. FOR EACH TIER, OVERLAP THE GAPS BETWEEN ROCKS IN THE NEXT LOWER TIER, CALLED BREAKING THE JOINTS. EACH TIER SHOULD BE STAGGERED SLIGHTLY INTO THE HILL TO CREATE THE DESIRED AMOUNT OF BATTER. HEADER ROCKS ARE LONG ROCKS TURNED AND PLACED SO THAT THEY EXTEND DEEP INTO THE HILLSIDE. USING HEADER ROCKS IS PARTICULARLY IMPORTANT IF THE BUTTRESS'S CROSS SECTION WIDENS AS THE BUTTRESS GETS HIGHER. THE CAPSTONE IS THE TOP ROCK LAYER WITH SUFFICIENT MASS TO PROVIDE A STABLE TRAIL TREAD.
4. ROCKS IN EACH SUCCESSIVE TIER SHOULD BE SET SO THEY HAVE AT LEAST THREE POINTS OF GOOD CONTACT WITH THE ROCKS BELOW. GOOD CONTACT IS DEFINED AS NO WOBBLE OR SHIFTING UNDER A LOAD, WITHOUT RELYING ON SHIMS (OR CHINKING) TO ELIMINATE MOVEMENT. SHIMS ARE PRONE TO SHIFTING AND SHOULD NOT BE USED TO ESTABLISH CONTACT, ESPECIALLY ON THE FACE OF THE BUTTRESS, WHERE THEY CAN FALL OUT. ADD BACKFILL AND TAMP CRUSHED ROCKS INTO THE CRACKS AS YOU BUILD.
5. PROJECT ENGINEERING GEOLOGIST OR DISTRICT DESIGNEE SHOULD FLAG THE LOCATION OF THE ROCK BUTTRESS PRIOR TO CONSTRUCTION.
6. SPECIFICATIONS MODIFIED FROM U.S. FOREST SERVICE TRAIL CONSTRUCTION OF MAINTENANCE NOTEBOOK, 2007 EDITION (HESSELBARTH ET AL., 2007)

NOTES:

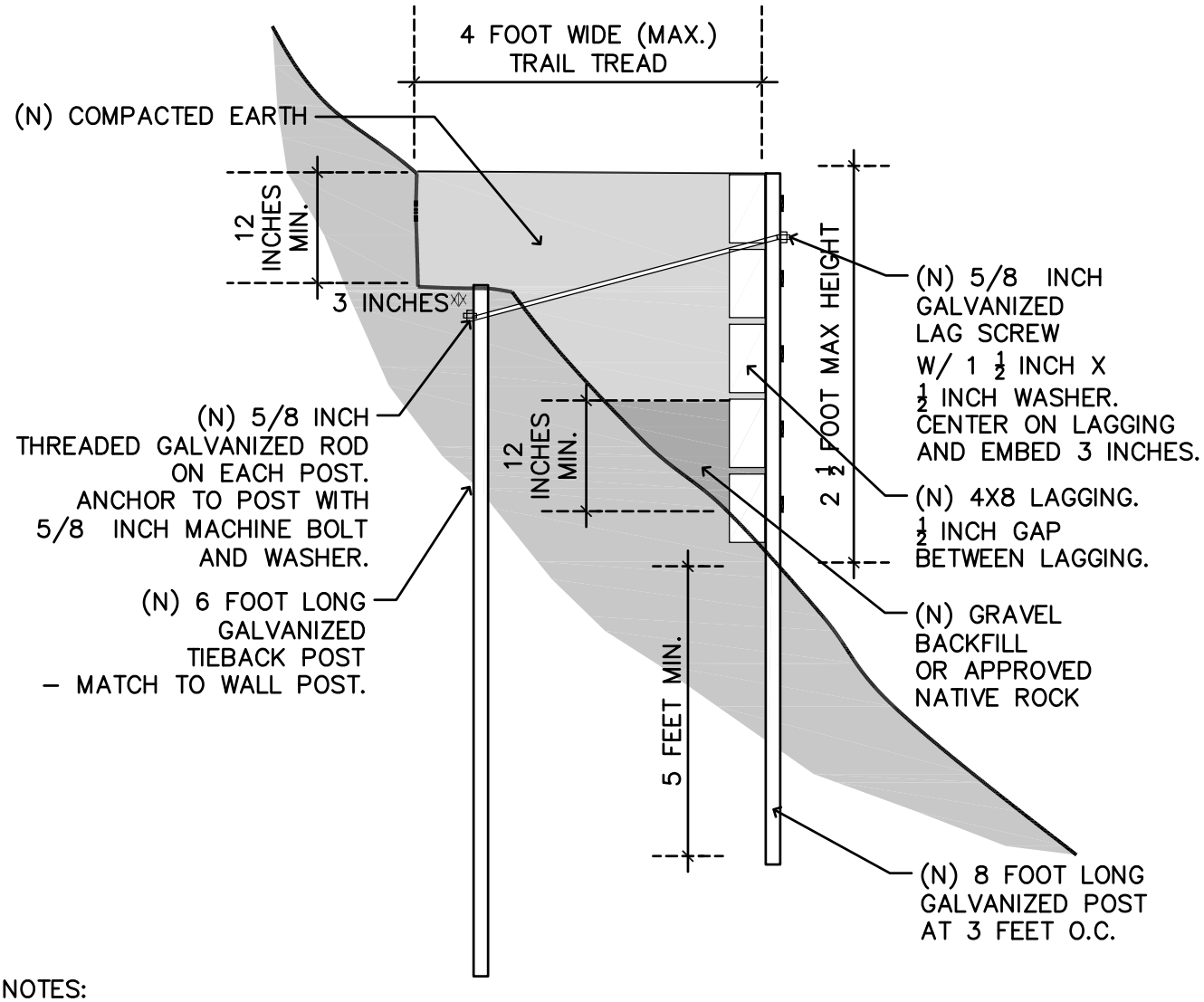
1. THIS DETAIL IS TYPICAL AND INTENDED FOR USE AS A GUIDELINE. ADJUSTMENTS TO THE ACTUAL DESIGN MAY NEED TO OCCUR IN FIELD DURING TIME OF CONSTRUCTION DUE TO LOCAL SITE CONDITIONS, AS DIRECTED BY AN ENGINEER OR OTHERWISE QUALIFIED PERSON.

ROCK RETAINING WALL - TRAIL (TYPICAL)

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 03/2020

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6D Retaining Wall-Rock.dwg

©TIMOTHY C. BEST, CEG



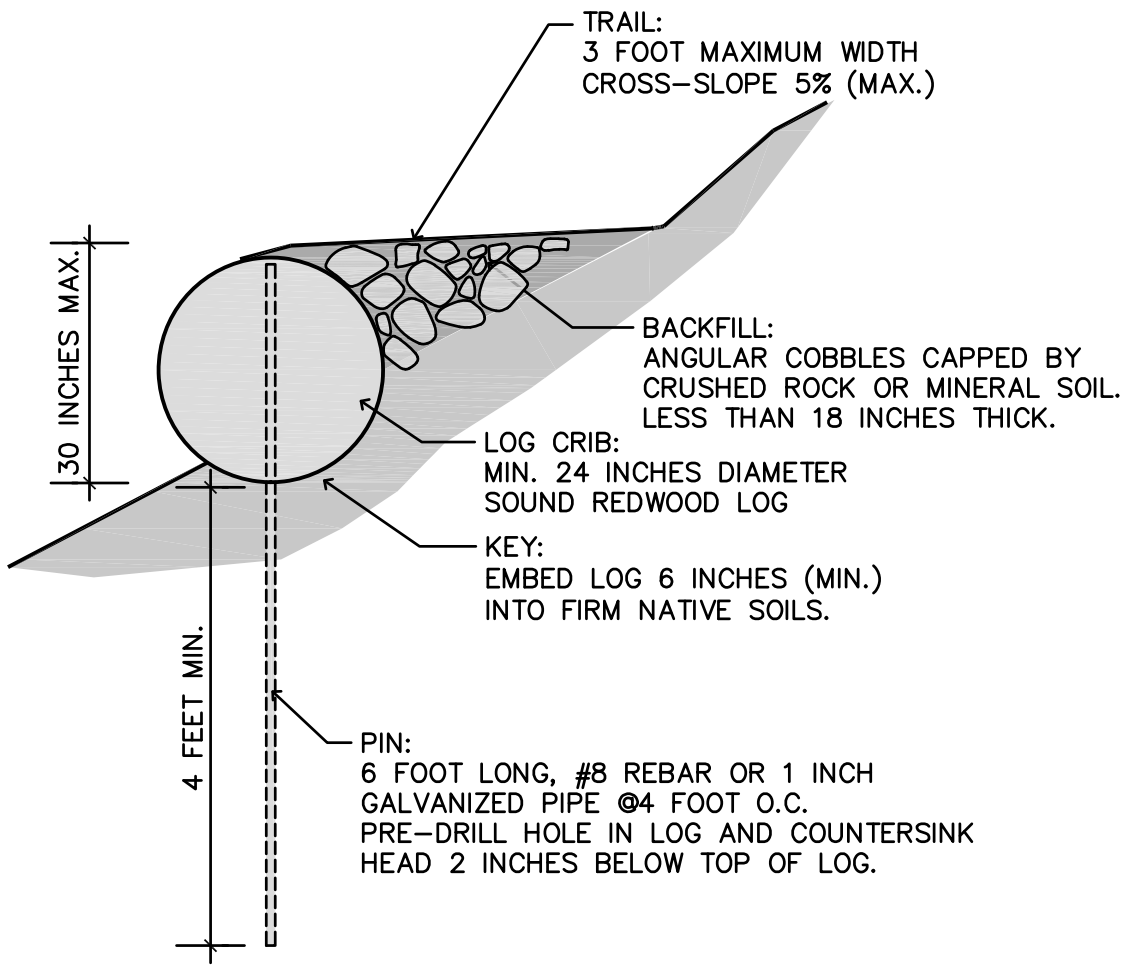
NOTES:

1. POST SHALL BE 8 FOOT X 2.0 LBS/FT GALVANIZED U–CHANNEL CONFORMING TO ASTM A4999, GRADE 60.
2. FINAL DEPTH OF POST EMBEDMENT TO BE DETERMINED IN FIELD BY PROJECT ENGINEERING GEOLOGIST BASED ON ON–SITE SOIL CONDITIONS.
3. ALL WOOD SHALL BE PRESSURE–TREATED DOUGLAS–FIR OR CLEAR HEART REDWOOD UNLESS OTHERWISE SPECIFIED OR APPROVED.
4. THIS DETAIL IS TYPICAL AND INTENDED FOR USE AS A GUIDELINE. ADJUSTMENTS TO THE ACTUAL DESIGN MAY NEED TO OCCUR IN FIELD DURING TIME OF CONSTRUCTION DUE TO LOCAL SITE CONDITIONS, AS DIRECTED BY AN ENGINEER OR OTHERWISE QUALIFIED PERSON.

WOOD RETAINING WALL - TRAIL (TYPICAL)

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 03/2020

©TIMOTHY C. BEST, CEG



NOTES:

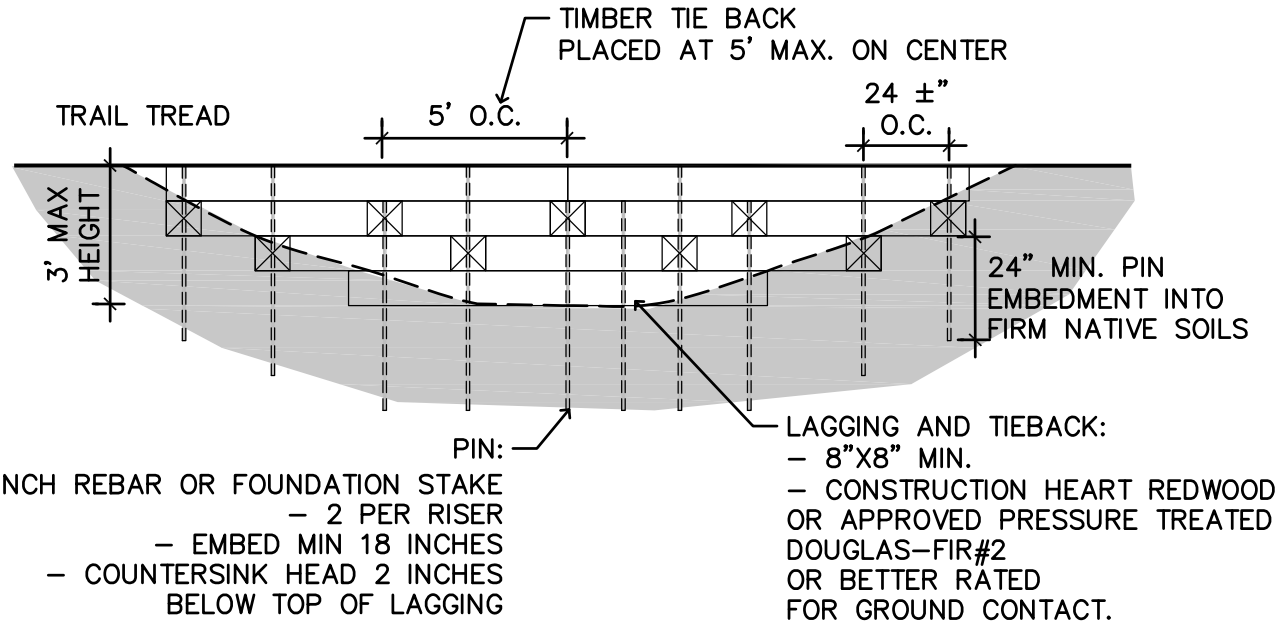
1. LOG SHALL BE A 24 INCH (MIN.) DIAMETER SOUND DURABLE REDWOOD LOG. ON-SITE LOGS USED FOR THE BUTTRESS SHALL BE APPROVED BY DISTRICT REPRESENTATIVE AND THE PROJECT GEOTECHNICAL CONSULTANT PRIOR TO CONSTRUCTION.
2. LOG SHALL BE PLACED IN A MINIMUM 6 INCH DEEP KEYWAY. WHERE POSSIBLE KEY THE LOG UPSLOPE AND AGAINST EXISTING TREES.
3. BACKFILL BEHIND LOG WITH CRUSHED ANGULAR COBBLES AND CAP TRAIL TREAD WITH CRUSHED AGGREGATE OR COMPACTED MINERAL SOIL
4. PIN LOG USING 6 FOOT LONG #8 REBAR OR 1 INCH GALVANIZED PIPE. PREDRILL HOLE IN LOG AND COUNTERSINK HEAD 2 INCHES BELOW TOP OF LOG. PINS TO BE INSTALLED AT 4 FEET O.C. UNLESS OTHERWISE SPECIFIED OR DIRECTED.
5. PROJECT ENGINEERING GEOLOGIST OR DESIGNEE SHALL FLAG THE LOCATION OF THE LOG BUTTRESS PRIOR TO CONSTRUCTION.
6. THIS DETAIL IS TYPICAL AND INTENDED FOR USE AS A GUIDELINE. ADJUSTMENTS TO THE ACTUAL DESIGN MAY NEED TO OCCUR IN FIELD DURING TIME OF CONSTRUCTION DUE TO LOCAL SITE CONDITIONS, AS DIRECTED BY AN ENGINEER OR OTHERWISE QUALIFIED PERSON.

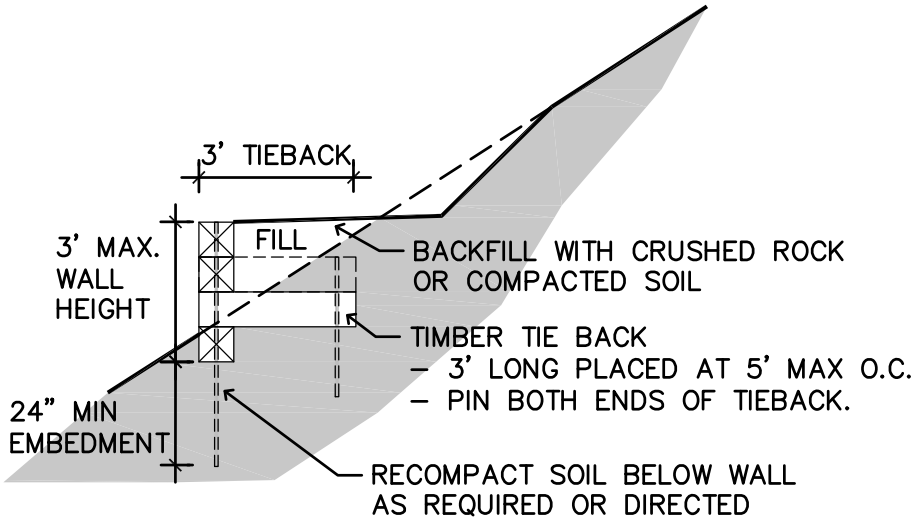
SINGLE LOG RETAINING WALL - TRAIL (TYPICAL)

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 03/2020

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6D Retaining Wall-Single Log.dwg

©TIMOTHY C. BEST, CEG





NOTES:

THIS DETAIL IS TYPICAL AND INTENDED FOR USE AS A GUIDELINE. ADJUSTMENTS TO THE ACTUAL DESIGN MAY NEED TO OCCUR IN FIELD DURING TIME OF CONSTRUCTION DUE TO LOCAL SITE CONDITIONS, AS DIRECTED BY AN ENGINEER OR OTHERWISE QUALIFIED PERSON.

TIMBER TIE BACK RETAINING WALL - TRAIL (TYPICAL)

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 03/2020

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6D Retaining Wall-Timber Tie-back.dwg

©TIMOTHY C. BEST, CEG

BENCH

1. STANDARD DISTRICT BENCHES ARE MADE FROM RECYCLED PLASTIC, AND ORDERED FROM ROSS RECREATION, LOCATED IN SANTA ROSA, CA: HTTP://WWW.ROSSREC.COM/

THE SPECIFICATION FOR DISTRICT BENCHES IS:

MANUFACTURER:
DUMOR
PO BOX 142
MIFFLINTON, PA 17059

MODEL:
BACKED BENCH:
DUMOR – BENCH 88, RECYCLED PLASTIC SLATES (COLOR: CEDAR OR REDWOOD),
STEEL LEG SUPPORTS (COLOR: BLACK)
6' OR 8' LENGTHS
HTTP://DUMOR.COM/PRODUCTS/BENCHES/BENCH-88

BACKLESS BENCH:
DUMOR – BENCH 103, RECYCLED PLASTIC SLATES (COLOR: CEDAR OR REDWOOD),
STEEL LEG SUPPORTS (COLOR: BLACK)
103-40PL 4' LONG, 2 SUPPORTS
103-50PL 5' LONG, 2 SUPPORTS
103-60PL 6' LONG, 3 SUPPORTS
103-80PL 8' LONG, 3 SUPPORTS
HTTP://DUMOR.COM/PRODUCTS/BENCHES/BENCH-103

INSTALLATION:
FOLLOW MANUFACTURES INSTRUCTIONS.
TYPICALLY EMBEDMENT 2' IN CONCRETE, BUT SURFACE MOUNTS AVAILABLE AS WELL.

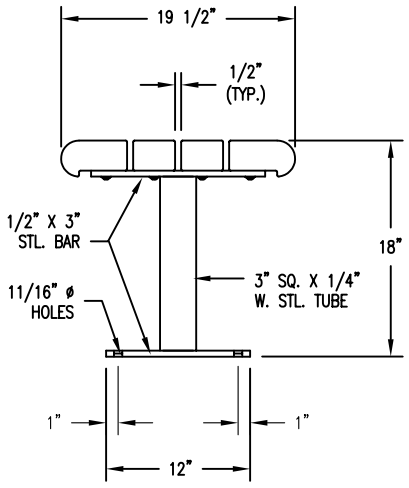
NOTES:
- DISTRICT REPRESENTATIVE MAY ALSO SPECIFY REDWOOD OR DOUG FIR SLATS.
- MEMORIAL PLAQUES AVAILABLE.
- DISTRICT BOARD MAY APPROVE NON-SPECIFIED BENCHES.
- IF FEASIBLE, AN ADJACENT 36 BY 48 INCH CLEAR GROUND SPACE SHALL BE POSITIONED NEAR THE BENCH, IDEALLY FOR SHOULDER-TO-SHOULDER ALIGNMENT WITH BENCH, WITH ONE SIDE OF THE SPACE ADJOINING THE PEDESTRIAN ROUTE OR TRAIL. CLEAR GROUND SPACE SHALL HAVE A 5% MAXIMUM SLOPE IN ANY DIRECTION.

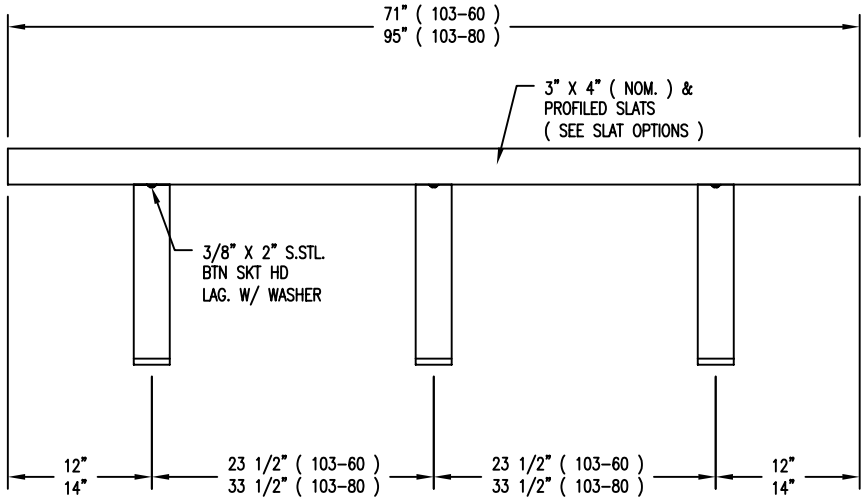
REGIONAL OPEN SPACE

BENCH

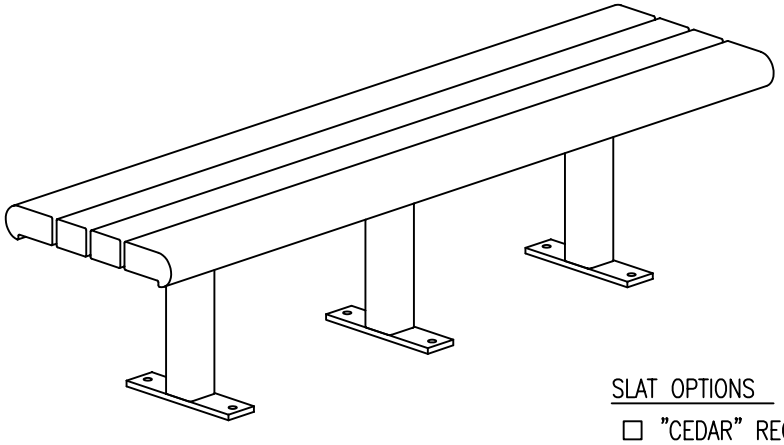
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6E Bench.dwg



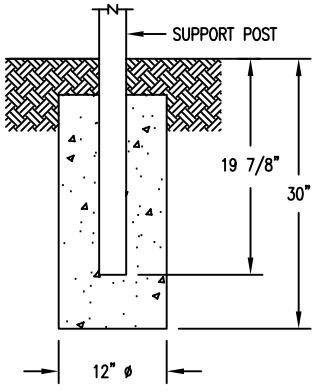


☐ S-2 SURFACE

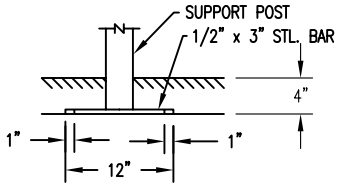


SLAT OPTIONS

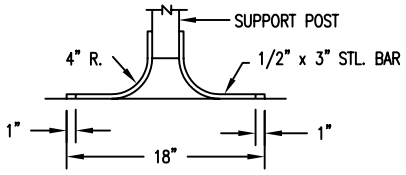
- ☐ "CEDAR" RECYCLED PLASTIC
- ☐ "GREY" RECYCLED PLASTIC
- ☐ "REDWOOD" RECYCLED PLASTIC
- ☐ "WALNUT" RECYCLED PLASTIC
- ☐ OTHER _____



☐ S-1 EMBEDMENT



☐ S-4 SUB FLOOR



☐ S-3 GULL WING

NOTES

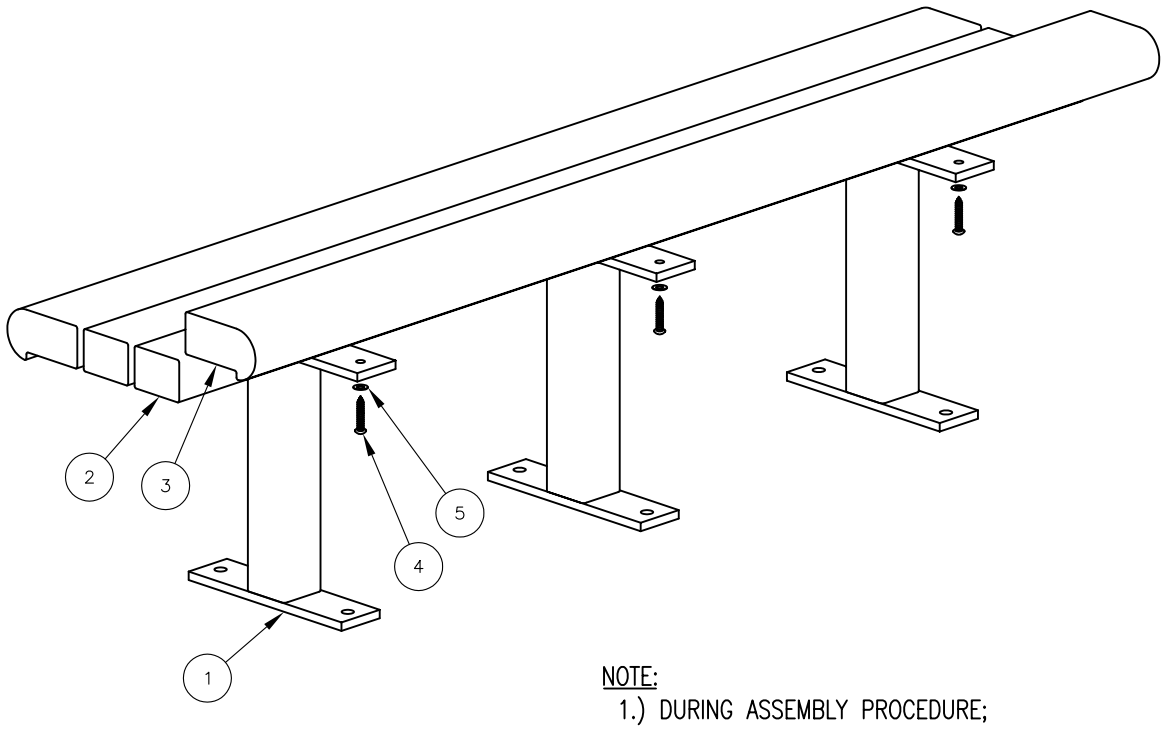
1.) ALL STL. MEMBERS COATED W/ ZINC RICH EPOXY THEN FINISHED W/ POLYESTER POWDER COATING.
2.) 1/2" X 3 3/4" EXPANSION ANCHOR BOLTS PROVIDED FOR S-2, S-3 & S-4 OPTIONS.

LENGTH OPTIONS

- ☐ 6' BENCH
- ☐ 8' BENCH

DuMor, inc.
P.O. Box 142 Mifflintown, PA 17059-0142

SCALE : NONE	TITLE : BENCH			
DATE DRAWN : 12/12/96				
DRAWN BY : AH	REV. D	DRAWING NUMBER 103 SERIES PL	SHEET 1 OF 2	
DATE REV. : 10/26/11				
REV. BY : JSB				



NOTE:

1.) DURING ASSEMBLY PROCEDURE;
DO NOT COMPLETELY TIGHTEN HARDWARE.

2.) THE ACTUAL PARTS WILL NOT BE NUMBERED:
NUMBERS ONLY APPLY TO DRAWING.

3.) SEE SPEC. SHEET 1 FOR MOUNTING OPTIONS.

STEP 1:

USE 3 – PCS. SUPPORT FOR SURFACE MOUNT (1)
2 – PCS. 3" X 4" X 71" PLASTIC INT'R SLAT (2)
2 – PCS. 71" PLASTIC EDGE SLAT (3)
12 – PCS. 3/8" X 2" SS. BTN. SKT. HD. LAG SCR. (4)
12 – PCS. 3/8" SS. FLAT WASHER (5)

ATTACH SLATS (2 & 3) TO SUPPORT FOR SURFACE MOUNT (1) USING HARDWARE (4 & 5). TIGHTEN TO SNUG FIT. REPEAT UNTIL ALL SLATS ARE ATTACHED.

STEP 2:

UPON COMPLETION OF BENCH ASSEMBLY SQUARE ALL COMPONENTS THEN TIGHTEN ALL HARDWARE.

STEP 3:

ANCHOR ACCORDING TO SUPPORT OPTION USED.

ITEM	QTY	PART NO	DESCRIPTION
1	3	0-103-00-01/S-2	SUPPORT FOR SURFACE MOUNT
2	2	0-88-60PL-02	3" X 4" X 71" PLASTIC INT'R SLAT
3	2	0-88-60PL-03	71" PLASTIC EDGE SLAT
4	12	1-13-016	3/8" X 2" SS BTN SKT HD LAG SCR
5	12	1-22-024	3/8" SS FLAT WASHER

DuMor, inc.
P.O. Box 142 Mifflintown, PA 17059-0142

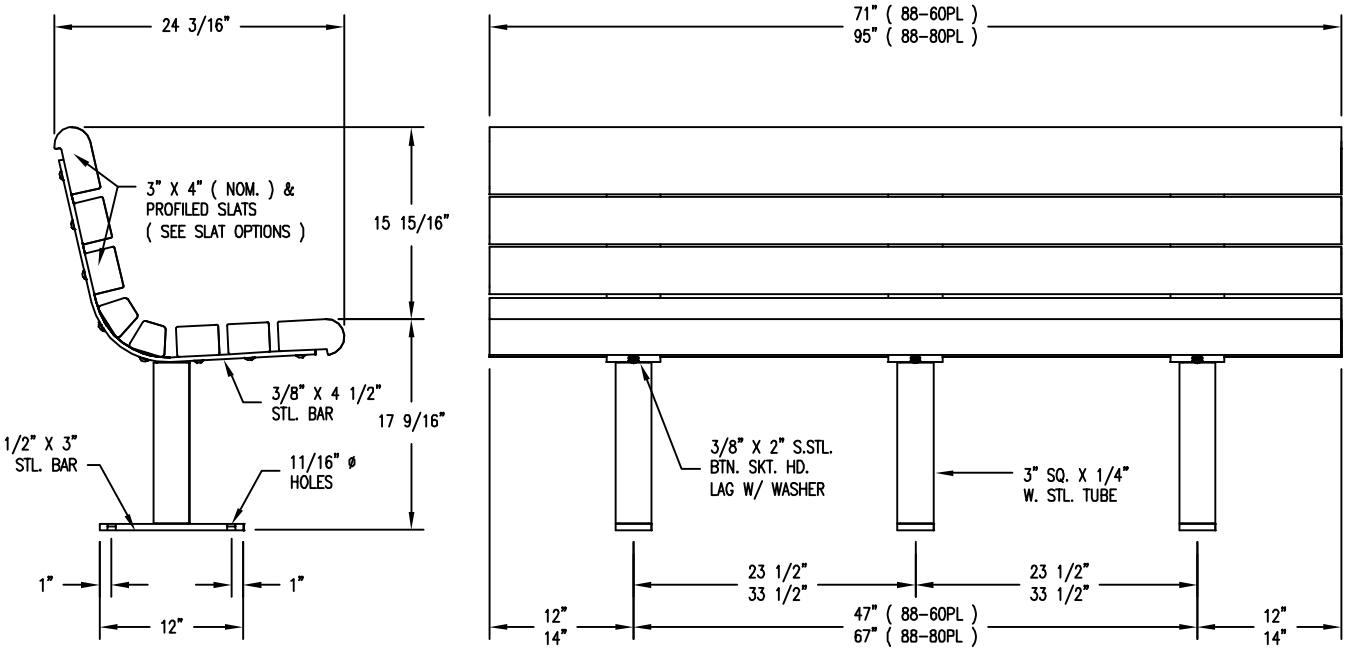
SCALE : NONE
DATE DRAWN : 12/15/96
DRAWN BY : AH
DATE REV. : 12/03/09
REV. BY : ESS

TITLE : BENCH ASSEMBLY

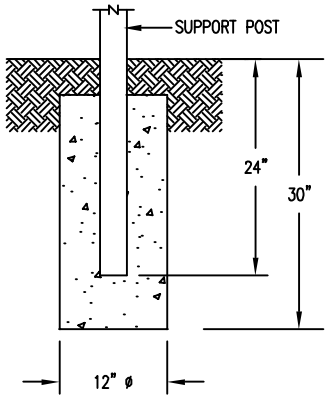
REV. C

DRAWING NUMBER 103 SERIES PL

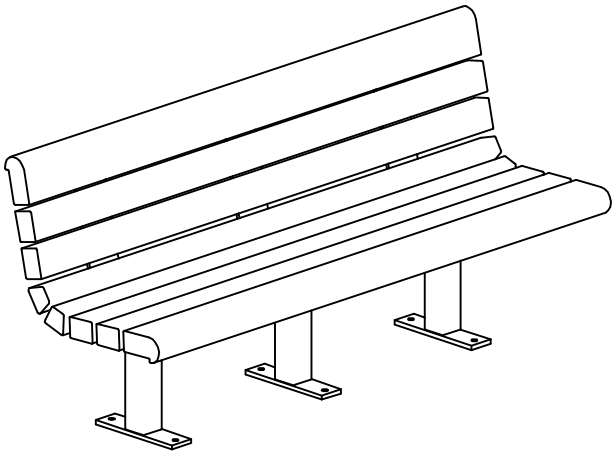
SHEET 2 OF 2

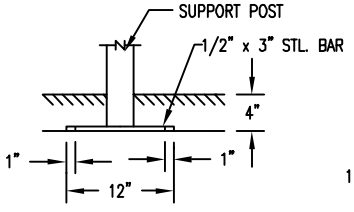


☐ S-2 SURFACE

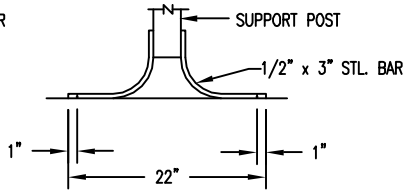


☐ S-1 EMBEDMENT





☐ S-4 SUB FLOOR



☐ S-3 GULL WING

LENGTH OPTIONS

- ☐ 6' BENCH
- ☐ 8' BENCH

NOTES

1.) ALL STL. MEMBERS COATED W/ ZINC RICH EPOXY THEN FINISHED W/ POLYESTER POWDER COATING.

2.) 1/2" X 3 3/4" EXPANSION ANCHOR BOLT PROVIDED FOR S-2, S-3 & S-4 OPTIONS.

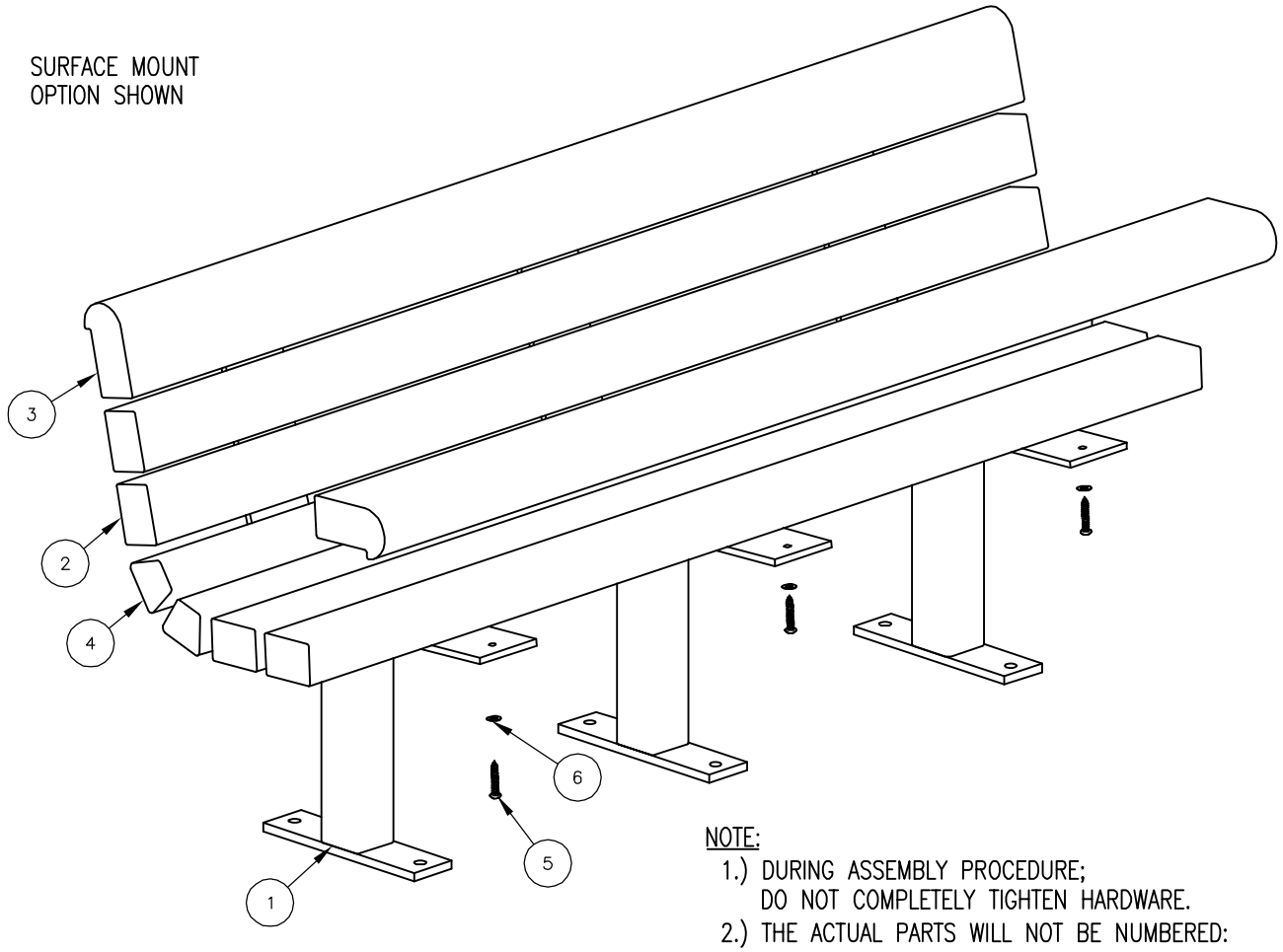
SLAT OPTIONS

- ☐ "CEDAR" RECYCLED PLASTIC
- ☐ "GREY" RECYCLED PLASTIC
- ☐ "REDWOOD" RECYCLED PLASTIC
- ☐ "WALNUT" RECYCLED PLASTIC
- ☐ OTHER _____

DuMor, inc.
P.O. Box 142 Mifflintown, PA 17059-0142

SCALE : NONE	TITLE : BENCH			
DATE DRAWN : 7/31/95				
DRAWN BY : AH	REV. D	DRAWING NUMBER 88 SERIES PL	SHEET 1 OF 2	
DATE REV. : 10/25/11				
REV. BY : RDH				

SURFACE MOUNT
OPTION SHOWN



NOTE:

1.) DURING ASSEMBLY PROCEDURE;
DO NOT COMPLETELY TIGHTEN HARDWARE.

2.) THE ACTUAL PARTS WILL NOT BE NUMBERED:
NUMBERS ONLY APPLY TO DRAWING.

3.) SEE SPEC. SHEET 1 FOR MOUNTING OPTION.

STEP 1:

USE 3 – PC. SUPPORT FOR SURFACE MOUNT (1)
4 – PCS. 3" X 4" X 71" PLASTIC INT'R SLAT (2)
2 – PCS. 71" PLASTIC EDGE SLAT (3)
2 – PCS. 71" PLASTIC TRAP SLAT (4)
24 – PCS. 3/8" X 2" SS. BTN. SKT. HD. LAG SCR. (5)
24 – PCS. 3/8" SS. FLAT WASHER (6)

ATTACH SLATS (2, 3, & 4) TO SUPPORT FOR SURFACE MOUNT (1) USING HARDWARE (5 & 6). TIGHTEN TO SNUG FIT.
REPEAT UNTIL ALL SLATS ARE ATTACHED.

STEP 2:

UPON COMPLETION OF BENCH ASSEMBLY SQUARE ALL COMPONENTS THEN TIGHTEN ALL HARDWARE.

STEP 3:

ANCHOR ACCORDING TO SUPPORT OPTION USED.

ITEM	QTY	PART NO	DESCRIPTION
1	3	0-88-00-01/S-2	BENCH SUPPORT FOR SURFACE MOUNT
2	4	0-88-60PL-02	3" X 4" X 71" PLASTIC INT'R SLAT
3	2	0-88-60PL-03	71" PLASTIC EDGE SLAT
4	2	0-88-60PL-04	71" PLASTIC TRAP SLAT
5	24	1-13-016	3/8" X 2" SS BTN SKT HD LAG SCR
6	24	1-22-024	3/8" SS FLAT WASHER

DuMor, inc.
P.O. Box 142 Mifflintown, PA 17059-0142

SCALE : NONE
DATE DRAWN : 7/31/95
DRAWN BY : AH
DATE REV. : 10/25/11
REV. BY : RDH

TITLE : BENCH ASSEMBLY

REV. D

DRAWING NUMBER 88 SERIES PL

SHEET 2 OF 2

BIKE RACK

1. THE SPECIFICATION FOR DISTRICT BICYCLE RACK IS:

MANUFACTURER:
BARCO PRODUCTS
11 N. BATAVIA AVE
BATAVIA, IL 60510
800-338-2697

MODEL:
PARK-IT BIKE RACKS (HTTPS://WWW.BARCOPRODUCTS.COM/PARK-IT-BIKE-RACKS)

COLOR:
BLACK

SIZE:
5, 7 OR 9 BIKE CAPACITY

INSTALLATION:
FOLLOW MANUFACTURER'S INSTRUCTIONS. IN GROUND OR SURFACE MOUNT.

NOTES:
SIZE DEPENDANT ON CAPACITY NEEDED.
A SIMILAR-LOOKING SUBSTITUTION WILL BE ACCEPTED WITH PRIOR WRITTEN APPROVAL OF THE DISTRICT.

REGIONAL OPEN SPACE

BIKE RACK

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6E Bike rack.dwg

BOOT BRUSH

1. THE SPECIFICATION FOR DISTRICT BOOT BRUSH IS:

MANUFACTURER:
CHASEBURG MANUFACTURING INC.
312 DEPOT STREET
PO BOX 7
CHASEBURG, WI 54621

PHONE:
1-800-658-9018 OR 608-452-304

MODEL:
DELUX SCRUSHER
HTTPS://WWW.SCRUSHER.COM/PRODUCTS/DELUXE-SCRUSHER

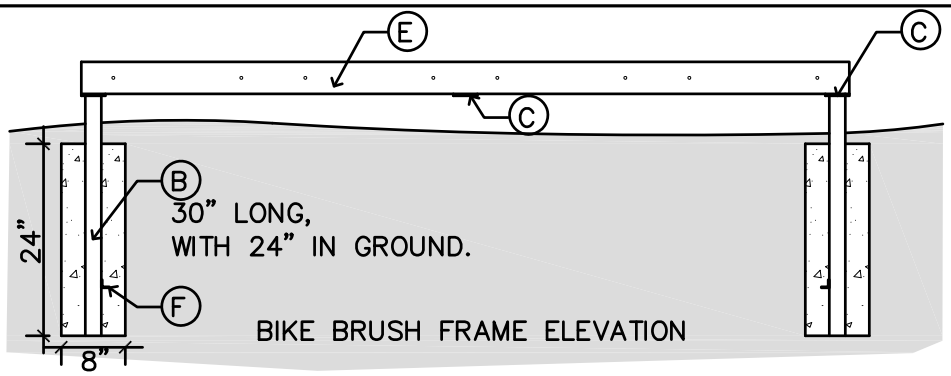
INSTALLATION:
MOUNTED ON 2'X2'X4" CONCRETE SLAB WITH WELDED WIRE REINFORCEMENT AND SECURED WITH CONCRETE ANCHORS.

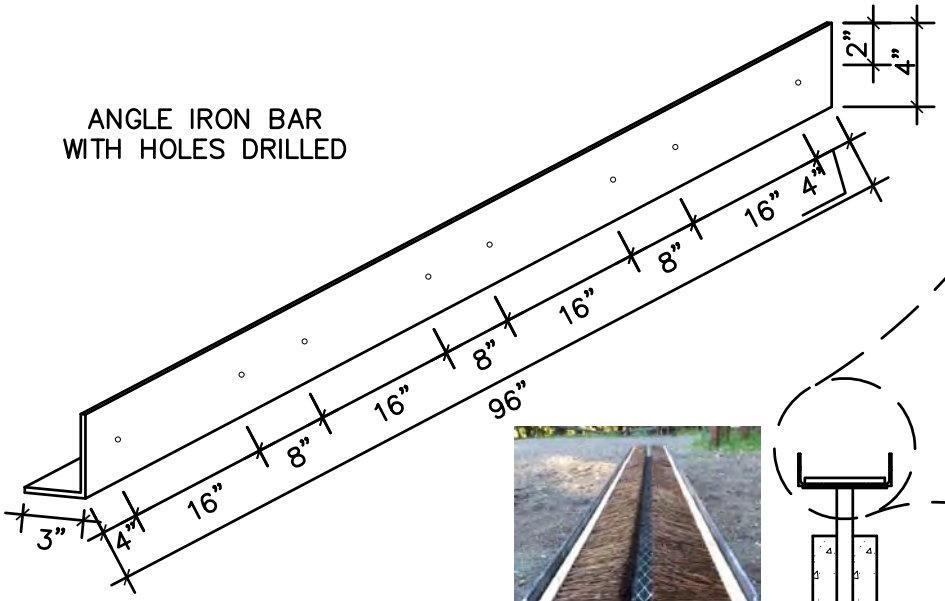
REGIONAL OPEN SPACE

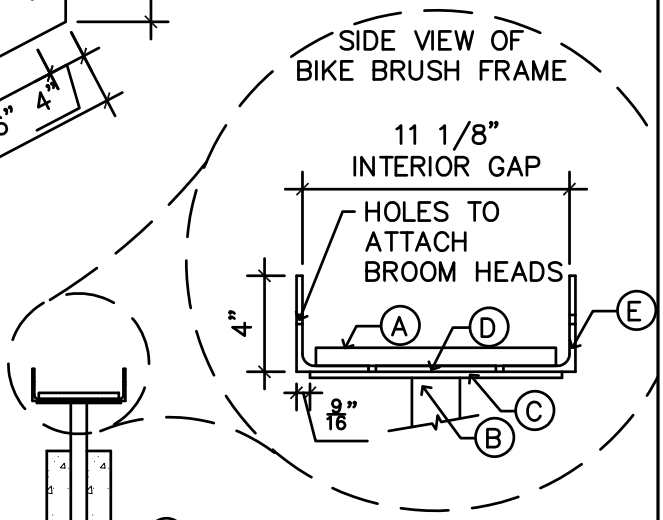
BOOT BRUSH

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

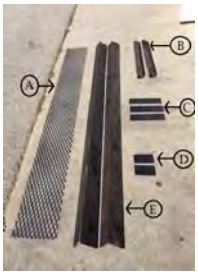
S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6E Boot brush.dwg







MATERIALS LIST		
ITEM	QTY	DESCRIPTION
A	1	3/4" X 9 GAUGE FLAT EXPANDED STEEL, CUT TO 8' X 10"
B	3	2" SQUARE STRUCTURAL TUBING, 30" LONG
C	3	10 ½" X 3" FLAT STEEL, ¼" THICK
D	3	5" X 3" FLAT STEEL, ¼" THICK
E	2	4" X 3" X 1/4" ANGLE IRON BARS, 8' LONG
F	2	1" ANGLE IRON, 4" LONG (DEADMEN)
G	8	HEAVY DUTY PUSH BROOM HEADS, 24" LONG WITH 4" LONG BRISTLES (ENVIRO–FRIENDLY NATURAL FIBERS, I.E. PALMYRA BRISTLES PREFERRED)
H	16	1/4" X 1 ½" LAG BOLTS, WITH 3/8" HEX HEAD
I	16	1/4" FLAT WASHERS
J	3–4	60 LBS BAGS CONCRETE



NOTES:
- THIS DETAIL IS INTENDED FOR USE AS A GUIDELINE. ADJUSTMENTS TO THE ACTUAL DESIGN MAY NEED TO OCCUR, AS DIRECTED BY DISTRICT REPRESENTATIVE.
- REFER TO BIKE BRUSH INSTRUCTION NOTES.

BIKE BRUSH

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 03/2020

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6E Bike brush.dwg

TOOLS LIST:

- 3/8" DRILL BIT, BULLET HEAD
- DRILL PRESS
- MACHINING OIL
- MIG WELDER, GLOVES, HELMET
- ANGLE GRINDER WITH METAL GRINDING WHEEL
- DRIVER WITH 3/8" HEX HEAD BIT
- DRILL WITH 5/32" DRILL BIT
- SINGLE-PERSON AUGER DIGGER DRILL WITH 8" AUGER BIT
- CONCRETE MIXER
- ROCK BAR
- POST HOLE DIGGER, FLAT HEAD SHOVELS OR OTHER PREFERRED DIGGING TOOLS
- LEVELS, LONG AND TORPEDO
- WOOD BLOCKS AND SHIMS

INSTRUCTIONS:

STEP 1:

- DRILL EIGHT 3/8 " HOLES IN EACH OF THE ANGLE IRON RAILS (ITEM E), ON THE 4" SIDE, AT THESE MEASUREMENTS ON CENTER: 4", 20", 28", 44", 52", 68", 76", 92". THESE HOLES WILL BE USED WHEN ATTACHING THE BROOM HEADS TO THE METAL FRAME.

STEP 2:

- WELD THE FRAME TOGETHER USING THREE 10.5" CONNECTOR PIECES (ITEM C) TO ATTACH THE TWO ANGLE IRON RAILS (ITEM E), SO THAT THEY ARE PARALLEL TO EACH OTHER AND MIRRORED. ONE CONNECTOR PIECE WILL BE AT THE CENTER OF THE TWO RAILS, AND THE OTHER TWO WILL BE FLUSH WITH THE END OF THE RAILS, ONE AT EACH END.
- WELD TWO 5" SPACER PIECES (ITEM D), INTO THE TWO SPACES BETWEEN THE 8' LONG RAILS, ONE AT EACH END, ON TOP OF THE 10.5" CONNECTOR PIECES (ITEM C). THE MIDDLE 10.5" CONNECTOR PIECE DOES NOT NEED A 5" SPACER PIECE ADDED TO IT.
- WELD THE EXPANDED STEEL (ITEM A) TO THE TOP OF THE 3" SIDE OF THE ANGLE IRON RAILS, INSIDE THE 11 1/8" GAP. TACK WELD EVERY OTHER X-SHAPED PORTION OF THE EXPANDED STEEL, ALL THE WAY DOWN BOTH SIDES OF THE 8' RAILS, AND ALONG THE TWO OPENING ENDS.

STEP 3:

- WELD TWO DEADMEN ONTO EACH LEG, 6" UP FROM THE BOTTOM, AND PARALLEL WITH THE SHORT SIDE OF THE FRAME.

STEP 4:

- GRIND OFF ALL OF THE SHARP EDGES OF THE FRAME WITH THE ANGLE GRINDER. PAY CLOSE ATTENTION TO THESE AREAS: THE POINTS OF THE EXPANDED STEEL THAT HANG OFF EACH END OF THE FRAME, THE CORNERS OF THE CONNECTOR PIECES AT EACH END, AND THE CORNERS OF THE 3" X 4" ANGLE IRON RAILS. THE GOAL IS TO HAVE NO SHARP OR POINTED EDGES THAT WILL HURT A USER'S ANKLES, AND NO SHARP SPOTS THAT WILL DAMAGE THE BIKE TIRES BEING RUN THROUGH THE BRUSHES.

STEP 5:

- DIG TWO HOLES (2' DEEP AND 8" WIDE) AT THE INSTALLATION SITE. THE CENTER OF HOLES WILL BE 93" APART.
- FILL HOLES WITH CONCRETE; THE TOP LEVEL OF CONCRETE SHOULD BE AN INCH OR TWO BELOW GROUND LEVEL.
- SET FRAME LEGS INTO CONCRETE. MOVE THE FRAME UP AND DOWN A FEW TIMES TO PUSH CONCRETE INTO THE HOLLOW LEGS AND TO REMOVE LARGE AIR BUBBLES FROM CONCRETE.
- SET THE FRAME ON BLOCKS AND USE WOOD SHIMS TO SET THE FRAME IN PLACE. MAKE THE SHORT SIDE OF THE FRAME LEVEL. MAKE THE LONG SIDE OF THE FRAME APPROXIMATELY PARALLEL WITH THE SURROUNDING TERRAIN. LET CONCRETE SET FOR AT LEAST 24 HOURS.
- REMOVE BLOCKS, AND FILL THE TOPS OF THE HOLES WITH SURROUNDING DIRT TO CAMOUFLAGE THE CONCRETE.

STEP 6:

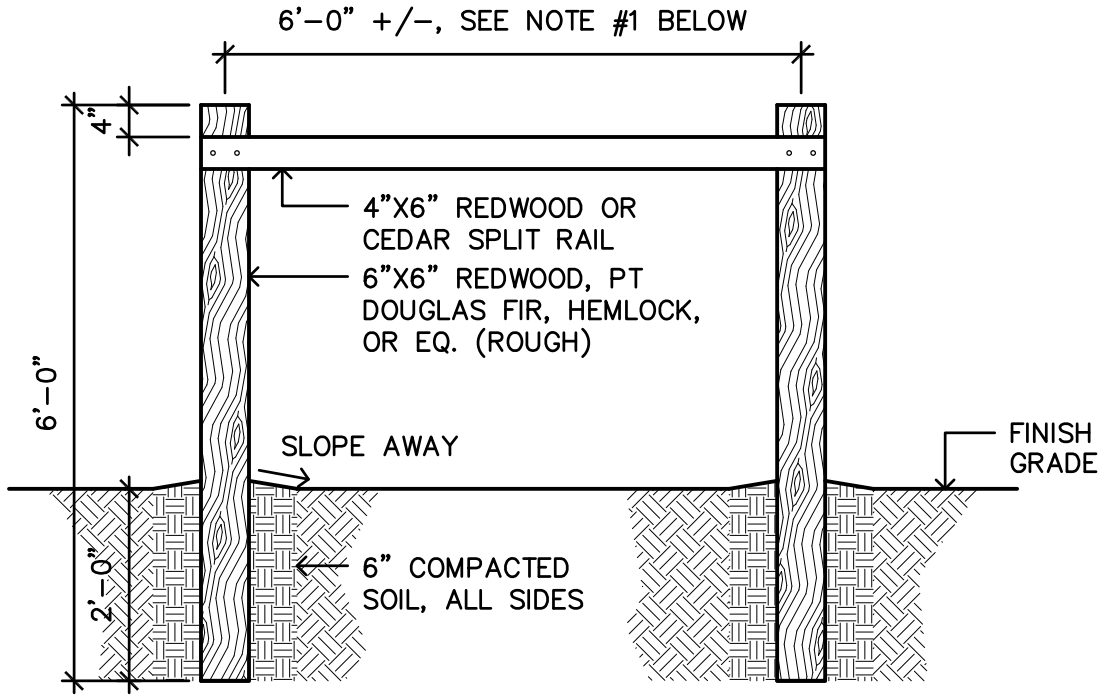
- ATTACH THE BROOM HEADS USING THE HOLES IN THE 4" SIDE OF THE ANGLE IRON RAILS.
- FOUR BROOMS FIT ON EACH SIDE OF THE RAILS. PLACE THE BROOM HEADS SO THAT THE BRISTLES FACE THE MIDDLE OF THE FRAME.
- PRE-DRILL 5/32" PILOT HOLES INTO THE WOODEN BROOM HEADS BEFORE SECURING THEM TO THE METAL RAILS WITH THE LAG BOLTS.
- USE ONE WASHER PER LAG BOLT, WITH THE WASHER ON THE OUTSIDE OF THE FRAME.

REGIONAL OPEN SPACE

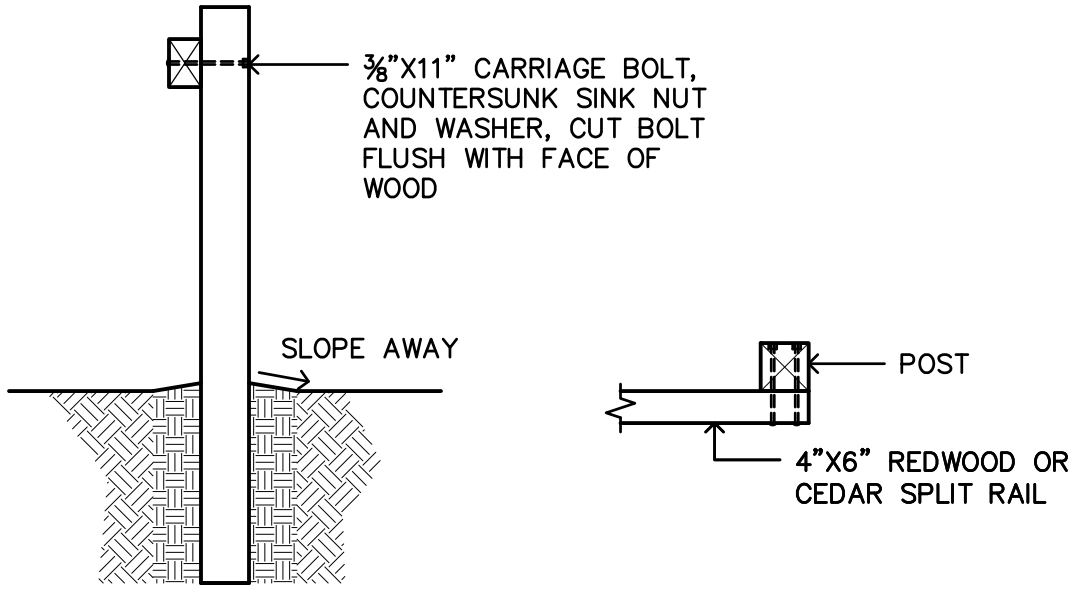
BIKE BRUSH INSTALLATION NOTES

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 03/2020

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6E Bike brush installation notes.dwg



SECTION ELEVATION



SECTION

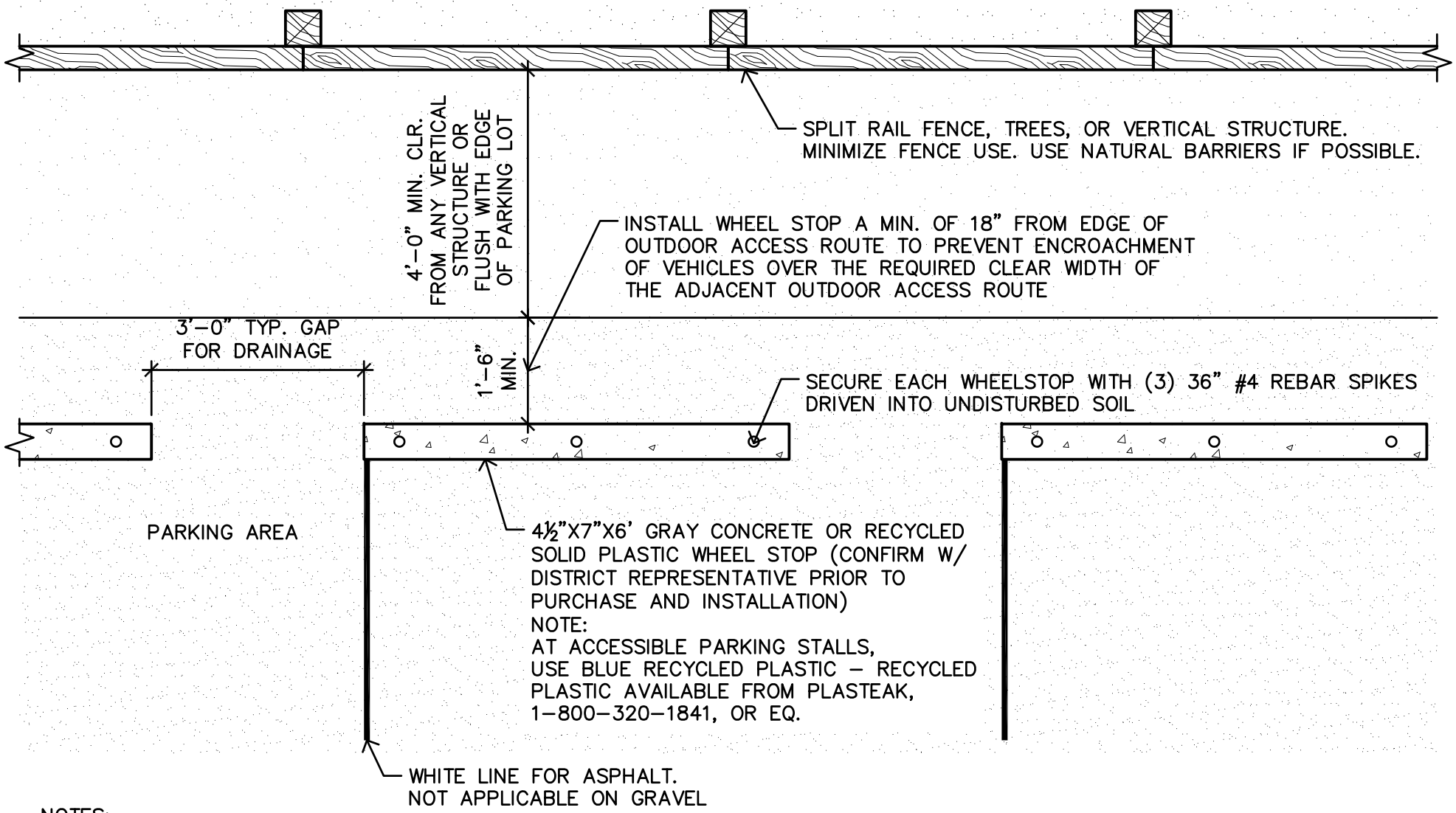
PLAN

NOTES:
1. IN AREAS OF HIGH USE, E.G. SURROUNDING PARKING AREAS, ETC., SPLIT RAIL SHALL BE USED.

HORSE HITCHING POST

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1" = 1'-0"	DATE: 11/17/2011

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6E Horse Hitching Post.dwg



NOTES:

1. IF RETROFITTING EXISTING LOT WITH WHEEL STOPS, AVOID REDUCING USABLE PARKING AREA AND SIGNIFICANTLY NARROWING WIDTH.
2. ACCESSIBLE PARKING SPACES MAY REQUIRE 6' AND 3' WHEEL STOP INSTALLED FLUSH TO ONE ANOTHER. TWO REBAR SPIKES PER 3' WHEEL STOP. SEE ACCESSIBLE PARKING SPACE DETAIL FOR LAYOUT INFORMATION.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		PARKING - TYPICAL WHEEL STOP
SCALE: 1/2" = 1'-0"	DATE: 04/2020	

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6E Parking-WheelStops.dwg

PICNIC TABLE

1. THE SPECIFICATION FOR DISTRICT PICNIC TABLE IS:

MANUFACTURER:
DUMOR
P.O.BOX 142
MIFFLINTON, PA 17059

MODEL:
PICNIC TABLE
DUMOR– TABLE 100 SERIES PL PICNIC TABLE,
RECYCLED PLASTIC SLATES (COLOR: CEDAR OR REDWOOD),
STEEL LEG SUPPORTS (COLOR: BLACK)
SIZE: 6' OR 8'
HTTPS://WWW.DUMOR.COM/PRODUCTS/TABLES/TABLE–100

ACCESSIBLE PICNIC TABLE
DUMOR – TABLE 100–68–1PL, RECYCLED PLASTIC SLATES (COLOR: CEDAR OR REDWOOD),
STEEL LEG SUPPORTS (COLOR: BLACK)
HTTPS://WWW.DUMOR.COM/PRODUCTS/TABLES/TABLE–100

INSTALLATION:
FOLLOW MANUFACTURER'S INSTRUCTIONS. TYPICALLY EMBEDMENT 2' IN CONCRETE,
BUT SURFACE MOUNTS AVAILABLE AS WELL.

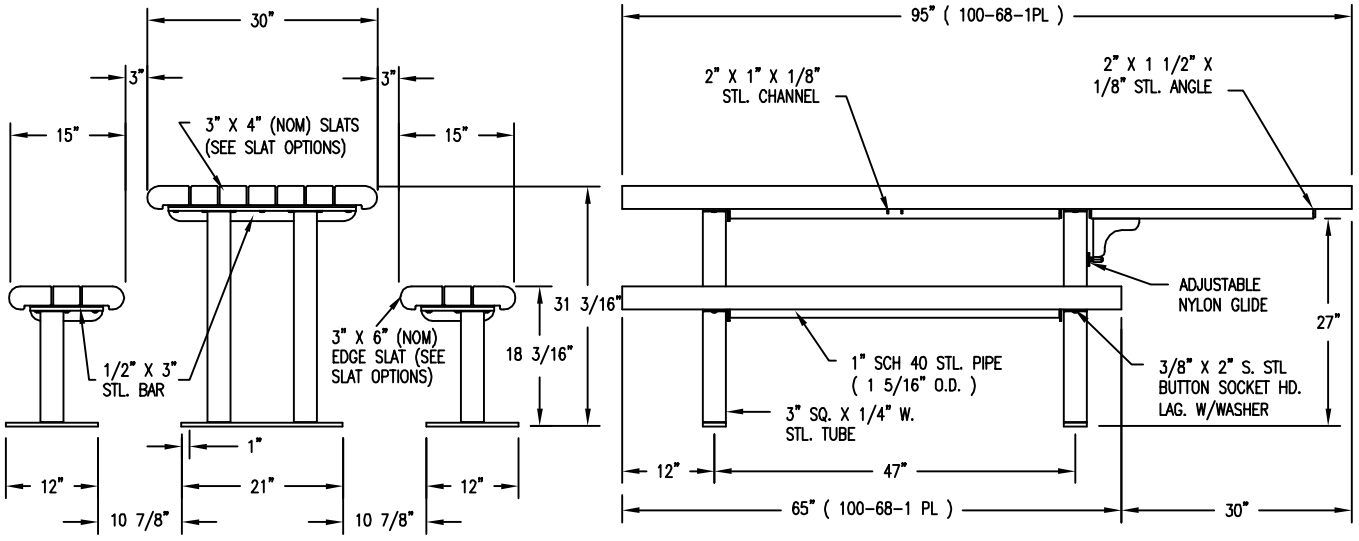
NOTES:
DISTRICT REPRESENTATIVE MAY ALSO SPECIFY REDWOOD OR DOUG FIR SLATS.
MEMORIAL PLAQUES AVAILABLE.

REGIONAL OPEN SPACE

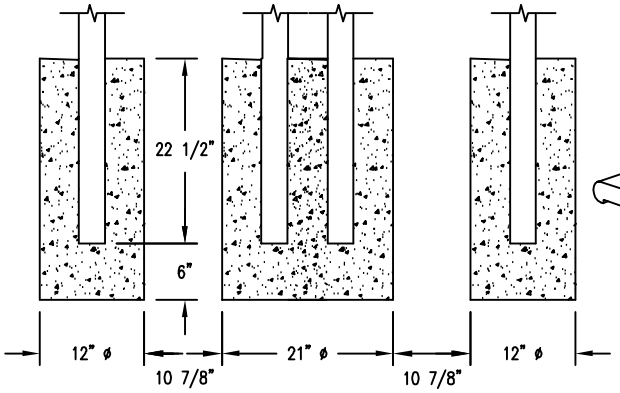
PICNIC TABLE

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

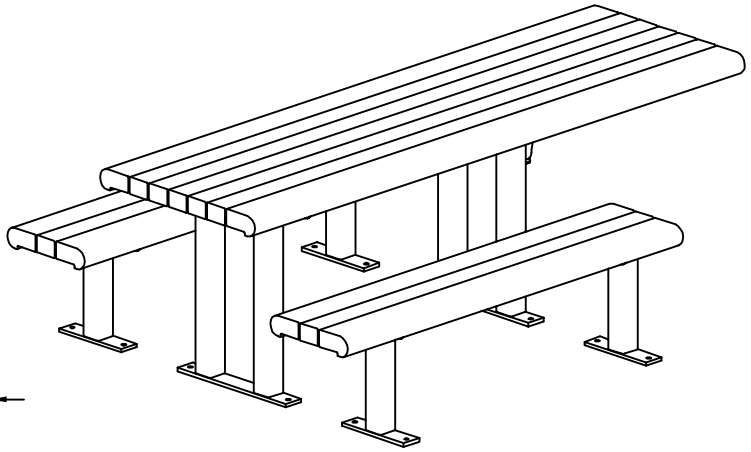
S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6E Picnic Table.dwg

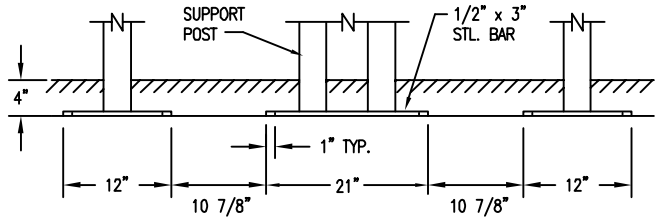


☐ S-2 SURFACE MOUNT



☐ S-1 EMBEDMENT





☐ S-4 SUB FLOOR

NOTES:

1.) ALL STL. MEMBERS COATED W/ ZINC RICH EPOXY THEN FINISHED W/ POLYESTER POWDER COATING.
2.) 1/2" X 3 3/4" EXPANSION ANCHOR BOLTS PROVIDED FOR OPTIONS S-2 & S-4.

SLAT OPTIONS

- ☐ "CEDAR" RECYCLED PLASTIC
- ☐ "GREY" RECYCLED PLASTIC
- ☐ "REDWOOD" RECYCLED PLASTIC
- ☐ "WALNUT" RECYCLED PLASTIC
- ☐ OTHER _____

DuMor, inc.	TABLE	DATE DRAWN : 04/01/96 DRAWN BY : AWH DATE REV. : 01/14/14 REV. BY : ESS	REV. F	DRAWING NUMBER 100-68-1 PL	SHEET 1 OF 2

NOTE:

1.) DURING ASSEMBLY PROCEDURE; DO NOT COMPLETELY TIGHTEN HARDWARE.
2.) THE ACTUAL PARTS WILL NOT BE NUMBERED. NUMBERS ONLY APPLY TO DRAWING.
3.) UPON COMPLETION OF ASSEMBLY SQUARE ALL COMPONENTS THEN TIGHTEN ALL HARDWARE.
4.) MOUNT AND ANCHOR AS SPECIFIED.

TOOLS REQ'D

3/4" WRENCH
9/16" WRENCH
1/4" ALLEN WRENCH
1/2" MASONRY DRILL BIT
DRILL

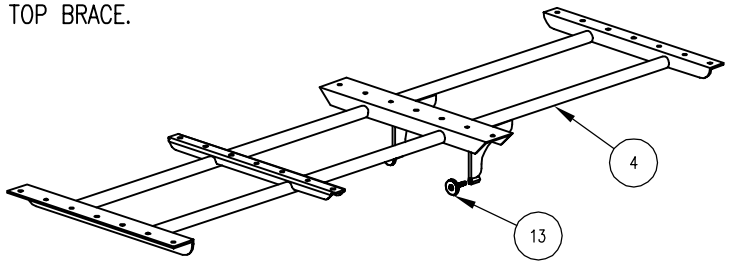
PARTS LIST FOR S-2

ITEM	QTY	PART NO	DESCRIPTION
1	2	0-100-00-01/S-2	TABLE TOP SUPPORT FOR SURFACE
2	4	0-100-00-02/S-2	SEAT SUPPORT FOR SURFACE MT
3	2	0-100-60-06	6' SEAT BRACE
4	1	0-100-68-1-05	TABLE TOP BRACE, HANDICAPPED
5	5	0-100-681PL-1	3" X 4" X 95" INT'R TABLE SLAT, PLASTIC
6	1	0-100-681PL-2	95" RIGHT EDGE TABLE SLAT, PLASTIC
7	2	0-100-681PL-3	3" X 4" X 65" INT'R SEAT SLAT, PLASTIC
8	2	0-100-681PL-4	65" RIGHT EDGE SEAT SLAT, PLASTIC
9	1	0-100-681PL-8	95" LEFT EDGE TABLE SLAT, PLASTIC
10	2	0-100-681PL-9	65" LEFT EDGE SEAT SLAT, PLASTIC
11	46	1-13-016	3/8" X 2" SS BTN SKT HD LAG SCR
12	46	1-22-024	3/8" SS FLAT WASHER
13	2	5-48-076	3/8" X 1 1/2" SWIVEL GLIDE

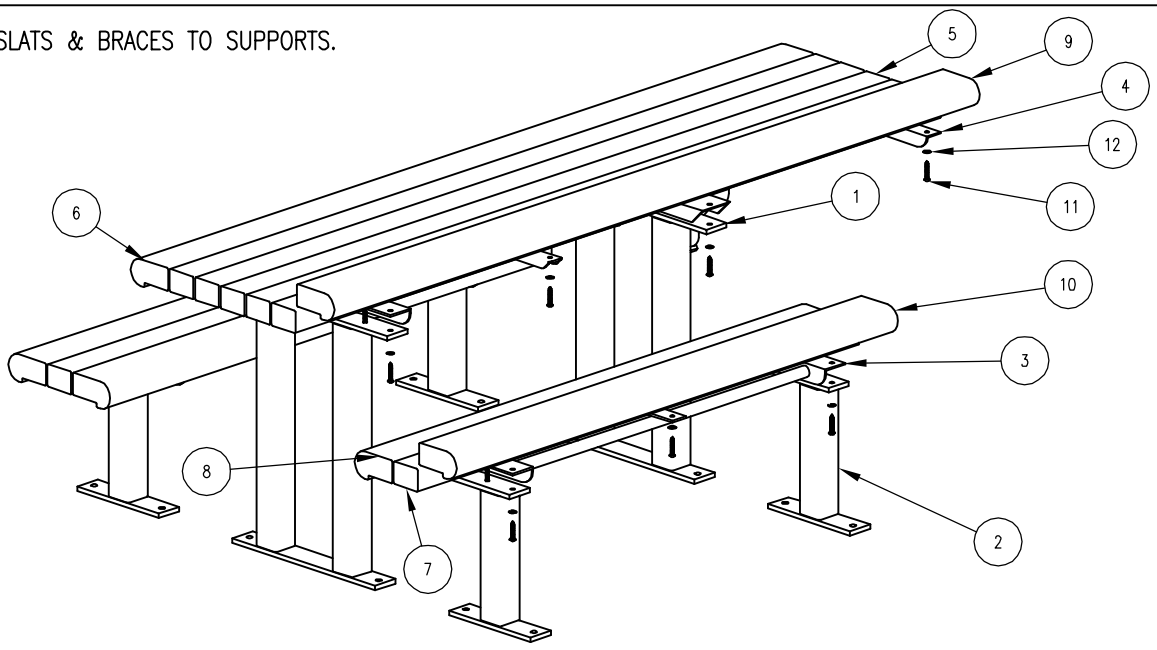
KITS PROVIDED FOR S-2

ITEM	QTY	PART NO	DESCRIPTION
14	3	K-ANC0860-4	1/2" X 3 3/4" SS ANCHOR KIT (4PC)
15	1	K-BL0632-48	3/8" LAG HARDWARE KIT (48PC)
16	1	K-GL0624-2	3/8" X 1 1/2" GLIDE KIT (2PCS)

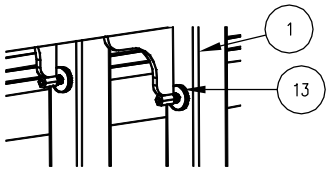
(1) ATTACH GLIDES TO TABLE TOP BRACE.



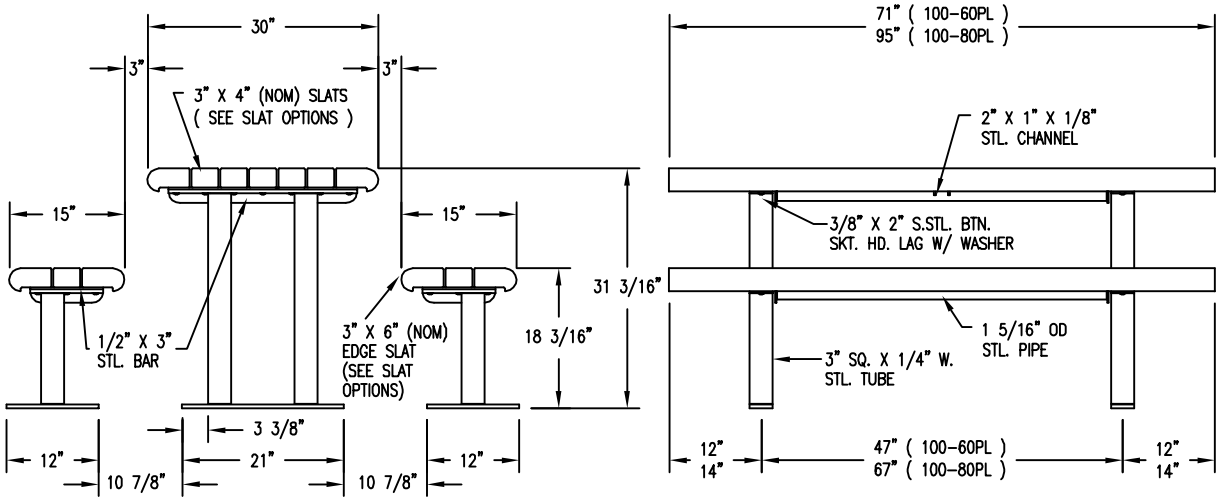
(2) ATTACH SLATS & BRACES TO SUPPORTS.



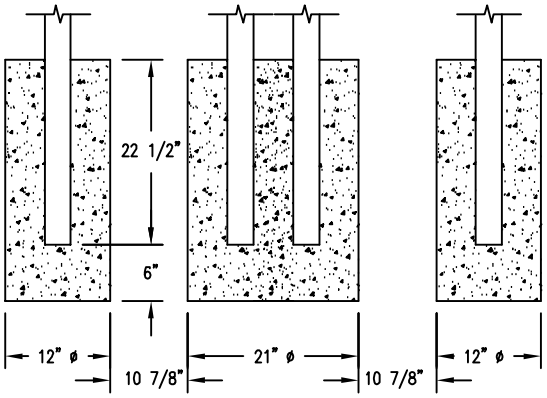
(3) UNSCREW SWIVEL GLIDE SO IT FITS TIGHT AGAINST SUPPORT POST TUBE AND TIGHTEN.



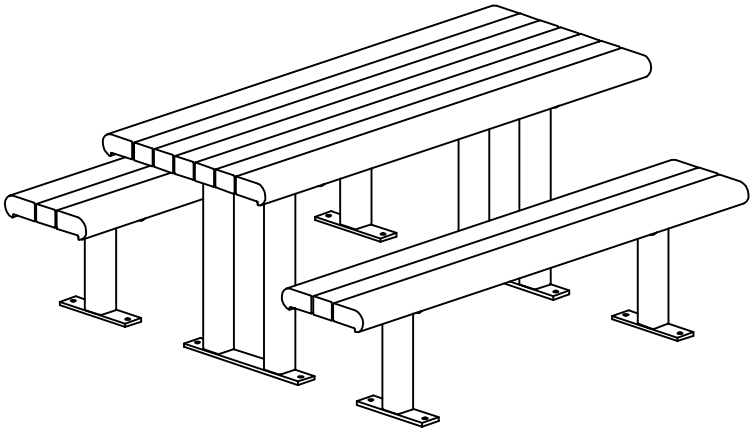
DuMor, inc.	ASSEMBLY INSTRUCTIONS	DATE DRAWN : 04/01/96 DRAWN BY : AWH DATE REV. : 01/14/14 REV. BY : ESS	REV. F	DRAWING NUMBER 100-68-1 PL	SHEET 2 OF 2

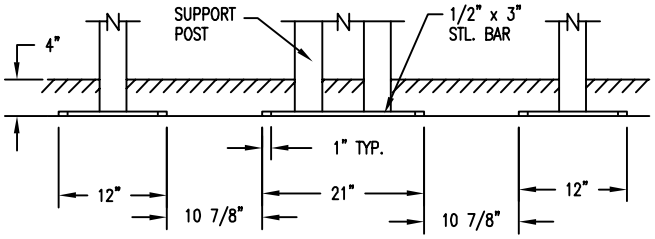


☐ S-2 SURFACE MOUNT



☐ S-1 EMBEDMENT





☐ S-4 SUB FLOOR

LENGTH OPTIONS

☐ 6' TABLE
☐ 8' TABLE

SLAT OPTIONS

☐ "CEDAR" RECYCLED PLASTIC
☐ "GREY" RECYCLED PLASTIC
☐ "REDWOOD" RECYCLED PLASTIC
☐ "WALNUT" RECYCLED PLASTIC
☐ OTHER _____

NOTES:

1.) ALL STL. MEMBERS COATED W/ ZINC RICH EPOXY THEN FINISHED W/ POLYESTER POWDER COATING.
2.) 1/2" X 3 3/4" EXPANSION ANCHOR BOLTS PROVIDED. FOR OPTIONS S-2 & S-4.

DuMor, inc.	TABLE	DATE DRAWN : 10/10/95 DRAWN BY : AH DATE REV. : 01/14/14 REV. BY : ESS	REV. F	DRAWING NUMBER 100 SERIES PL	SHEET 1 OF 2

NOTE:

1.) DURING ASSEMBLY PROCEDURE; DO NOT COMPLETELY TIGHTEN HARDWARE.
2.) THE ACTUAL PARTS WILL NOT BE NUMBERED. NUMBERS ONLY APPLY TO DRAWING.
3.) UPON COMPLETION OF ASSEMBLY SQUARE ALL COMPONENTS THEN TIGHTEN ALL HARDWARE.
4.) MOUNT AND ANCHOR AS SPECIFIED.

TOOLS REQ'D

3/4" WRENCH
1/4" ALLEN WRENCH
1/2" MASONRY DRILL BIT DRILL

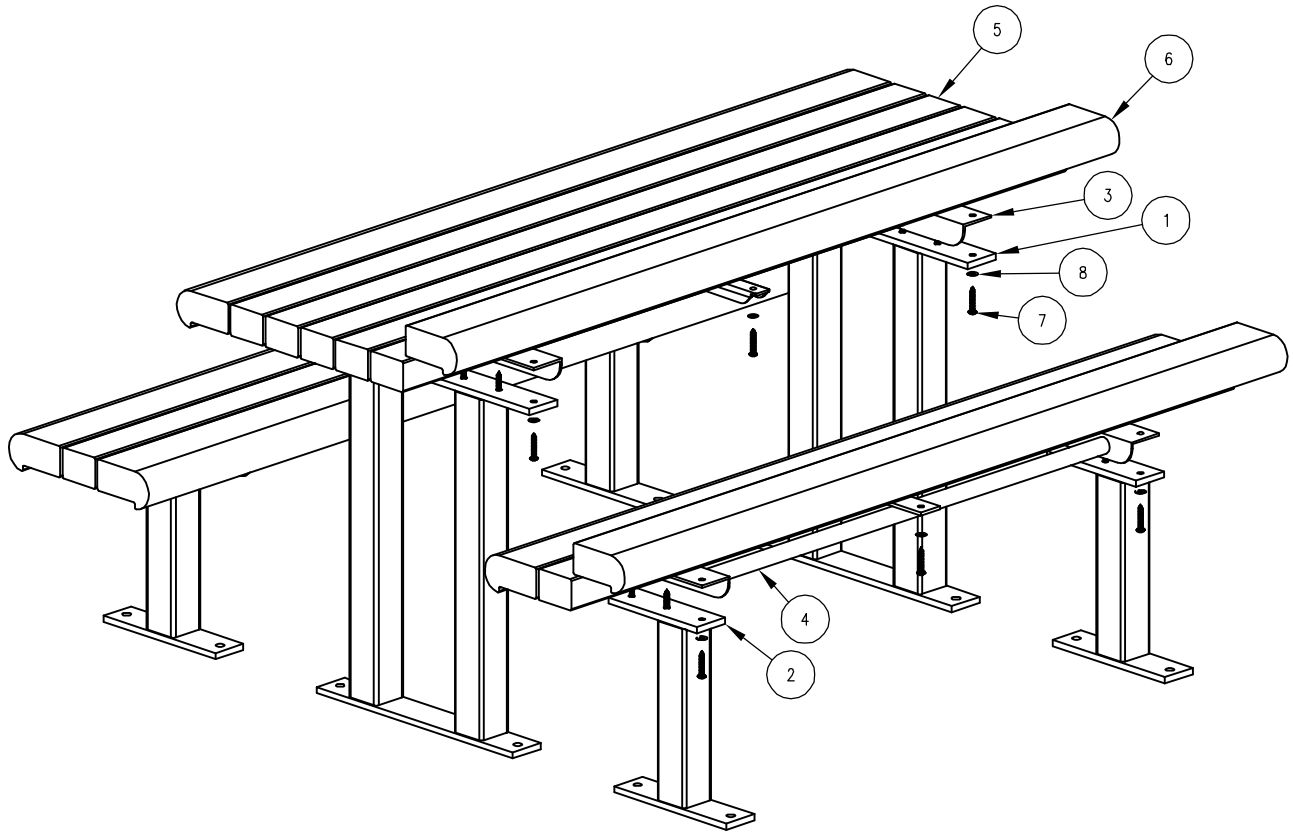
PARTS LIST FOR S-2

ITEM	QTY	PART NO	DESCRIPTION
1	2	0-100-00-01/S-2	TABLE TOP SUPPORT FOR SURFACE
2	4	0-100-00-02/S-2	SEAT SUPPORT FOR SURFACE MT
3	1	0-100-60-05	6' TABLE TOP BRACE
4	2	0-100-60-06	6' SEAT BRACE
5	7	0-88-60PL-02	3" X 4" X 71" INT'R SLAT, PLASTIC
6	6	0-88-60PL-03	71" EDGE SLAT, PLASTIC
7	39	1-13-016	3/8" X 2" SS BTN SKT HD LAG SCR
8	39	1-22-024	3/8" SS FLAT WASHER

KITS PROVIDED FOR S-2

ITEM	QTY	PART NO	DESCRIPTION
9	3	K-ANC0860-4	1/2" X 3 3/4" SS ANCHOR KIT (4PC)
10	1	K-BL0632-40	3/8" LAG HARDWARE KIT (40PC)

(1) ATTACH SLATS & BRACES TO SUPPORTS.



DuMor, inc.	ASSEMBLY INSTRUCTIONS	DATE DRAWN : 10/10/95 DRAWN BY : AWH DATE REV. : 01/14/14 REV. BY : ESS	REV. F	DRAWING NUMBER 100 SERIES PL	SHEET 2 OF 2

VAULT RESTROOM

1. THE SPECIFICATION FOR DISTRICT STANDARD VAULT RESTROOM IS:

MANUFACTURER:
CXT INC. (L.B. FOSTER SUBSIDIARY)
3808 N. SULLIVAN ROAD, BLDG. #7, SPOKANE, WA 99216
1-800-696-5766

MODEL:
GUNNISON SINGLE VAULT RESTROOM (HTTP://WWW.CXTINC.COM/GUNNISON.ASP)
TEXTURE: BARNWOOD WALLS IN NATURAL HONEY;
CEDAR SHAKE ROOF IN NUSS BROWN.

TIOGA DOUBLE VAULT RESTROOM WITH CHASE (HTTP://WWW.CXTINC.COM/TIOGA.ASP)
TEXTURE: BARNWOOD WALLS IN NATURAL HONEY;
CEDAR SHAKE ROOF IN NUSS BROWN.

NOTES:
- SEE GEOTECHNICAL REPORT FOR EXCAVATION, BACKFILL, COMPACTION AND GRADING REQUIREMENTS.
- USE BUILDING MATERIALS IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
- FOLLOW MANUFACTURE'S INSTALLATION INSTRUCTIONS.
- AN ALTERNATE PRODUCT MAY BE APPROVED BY DISTRICT REPRESENTATIVE.

GUNNISON SINGLE VAULT RESTROOM
(SPLIT FACE BLOCK WALLS WITH RIBBED METAL ROOF TEXTURE)

TIOGA DOUBLE VAULT RESTROOM
(BARNWOOD WALLS IN OATMEAL BUFF
CEDAR SHAKE ROOF IN JAVA BROWN)

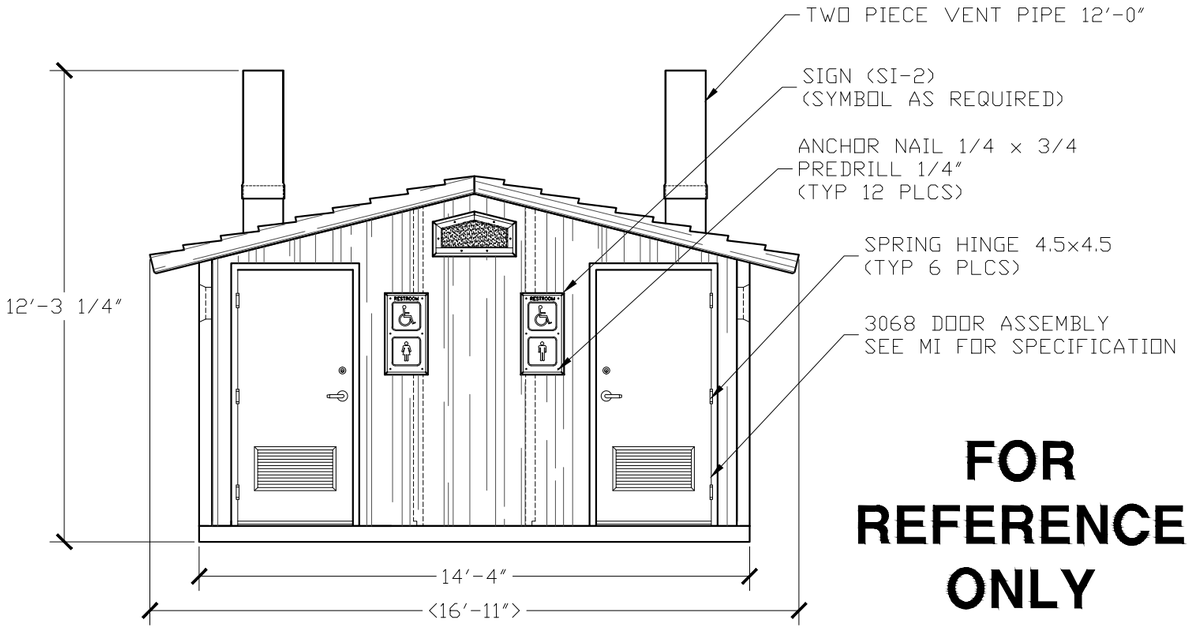
REGIONAL OPEN SPACE

VAULT RESTROOM

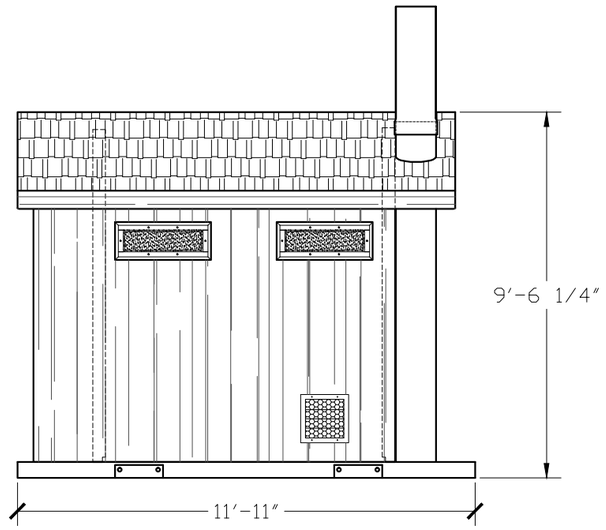
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 03/2020

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\6E Vault Restroom.dwg

©CXT PRECAST PRODUCTS

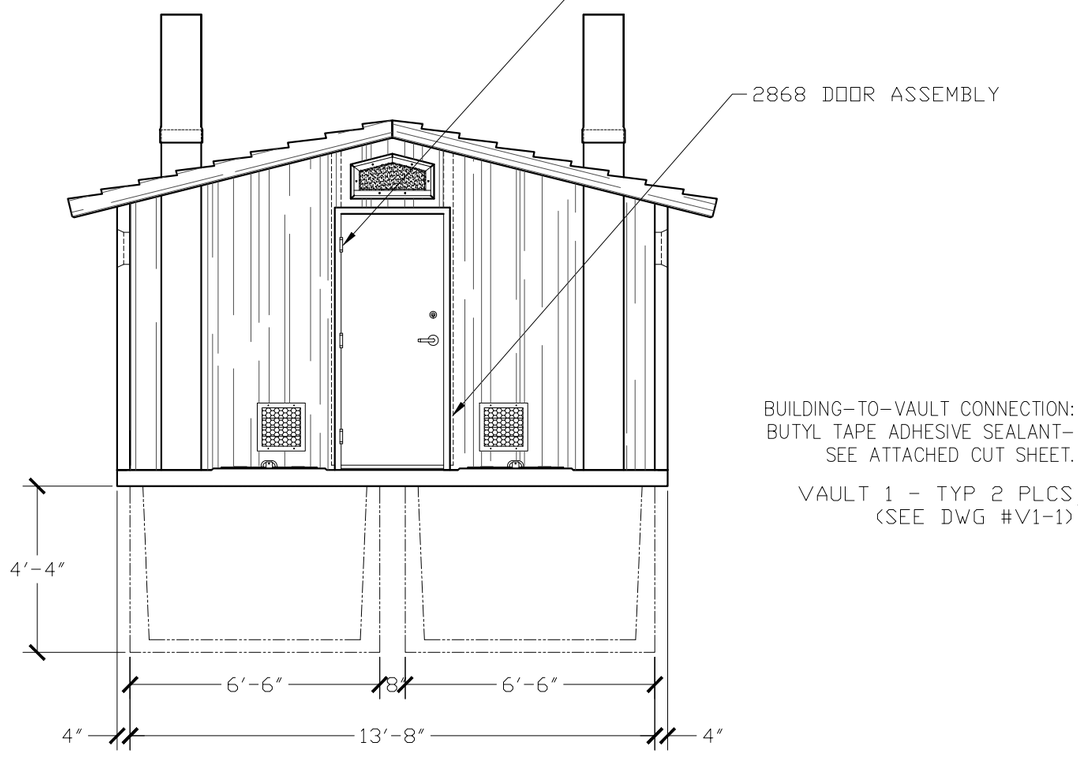


FRONT ELEVATION

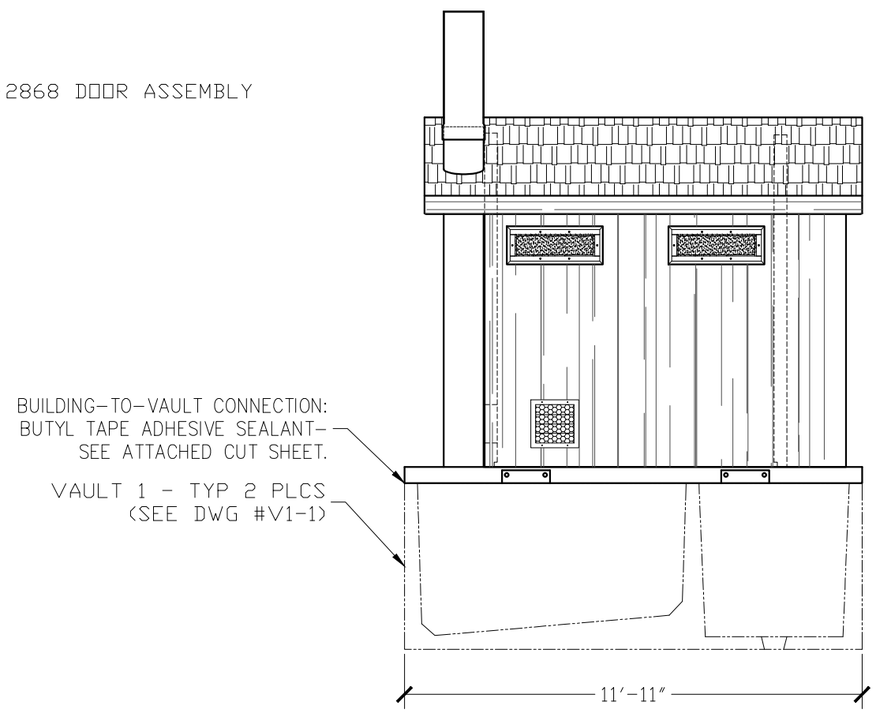


RIGHT SIDE ELEVATION

FOR REFERENCE ONLY



REAR ELEVATION



LEFT SIDE ELEVATION

EMBEDDED MATERIALS			
ITEM	QTY	ITEM	QTY
SI-2	2		
VENT PIPE 12'-0"	2		
3068 DOOR ASSEMBLY	2		
2868 DOOR ASSEMBLY	1		
ANCHOR NAIL 1/4x3/4	12		
SPRING HINGE 4.5x4.5	9		

CU. FT. CONC.	SQ. FT. W.W.F.	APPROXIMATE WEIGHT

Precast Products

PROJECT TITLE

TIOGA with CHASE

CXT STANDARD BUILDING

NOTICE

The information contained herein is proprietary and the exclusive property of CXT Incorporated. The information may only be used by the original recipient for the purpose intended. Reproduction or distribution of this information is strictly prohibited without the prior written consent of CXT Incorporated. By allowing use of this information, CXT Incorporated grants no warranty, express or implied, including a warranty of merchantability or of fitness for a particular purpose.

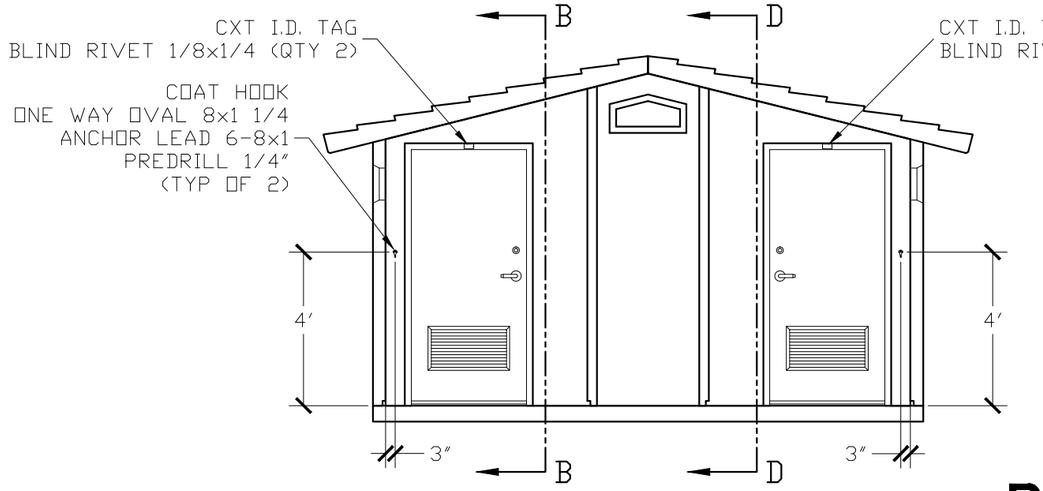
CXT Incorporated

REV.	DESCRIPTION	APPROVAL	DATE

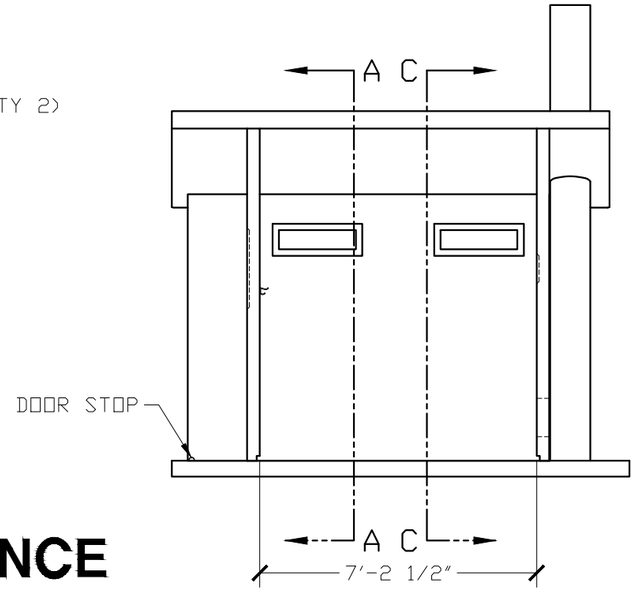
SCALE	1/4"=1'-0"	DATE	07-19-16
DRAWN		FILE NO.	PD-TWC02
CHECKED		PLOT	48

BUILDING ELEVATIONS

DWG NO.	SHEET	REV.
TWC-02		

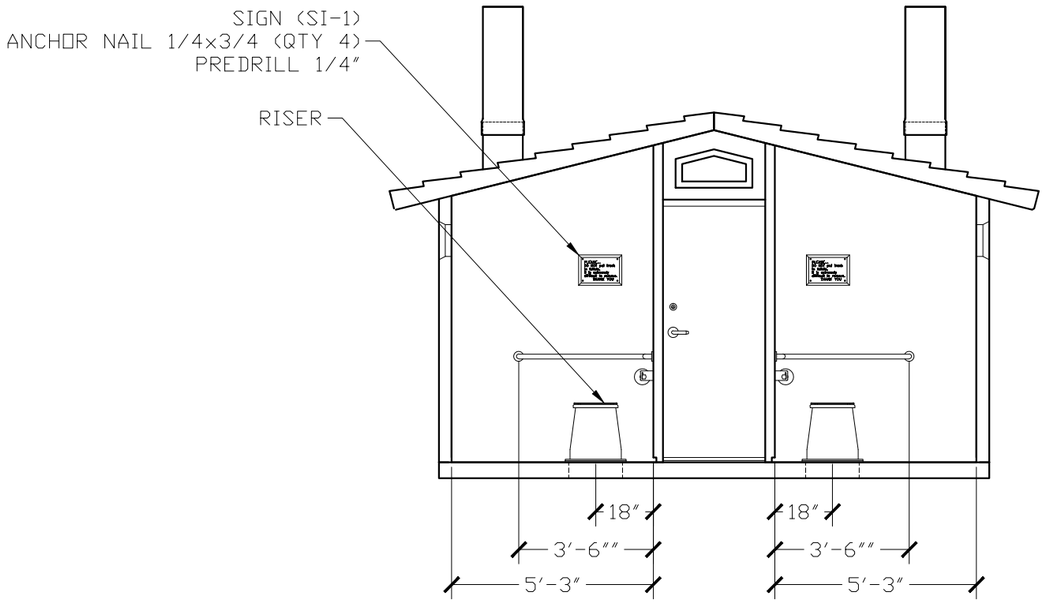


SECTION A – A

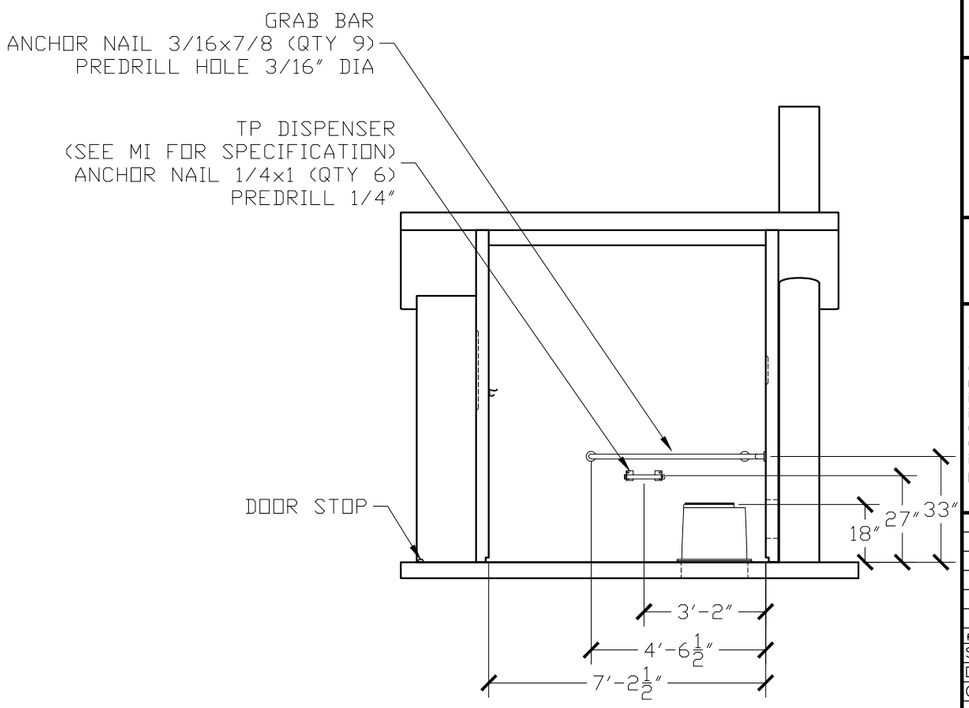


SECTION B – B

FOR REFERENCE ONLY



SECTION C – C



SECTION D – D

EMBEDDED MATERIALS			
ITEM	QTY	ITEM	QTY
RISER	2	ONE WAY OVAL 8x1 1/4	4
GRAB BAR	2	ANCHOR LEAD 6-8x1	4
TP DISPENSER	2		
TOILET PAPER ROLL	4-6		
COAT HOOK	2		
DOOR STOP	2		
SI-1	2		
BLIND RIVET 1/8x1/4	4		
CXT I.D. TAG	2		
ANCHOR NAIL 1/4x1	12		
ANCHOR NAIL 1/4x3/4	8		
ANCHOR NAIL 3/16x7/8	18		

CU. FT. CONC.	SQ. FT. W.W.F.	APPROXIMATE WEIGHT

Precast Products

PROJECT TITLE

TIOGA with CHASE

CXT STANDARD BUILDING

NOTICE

The information contained herein is proprietary and the exclusive property of CXT Incorporated. The information may only be used by the original recipient for the purpose intended. Reproduction or distribution of this information is strictly prohibited without the prior written consent of CXT Incorporated. By allowing use of this information, CXT Incorporated grants no warranty, express or implied, including a warranty of merchantability or of fitness for a particular purpose.

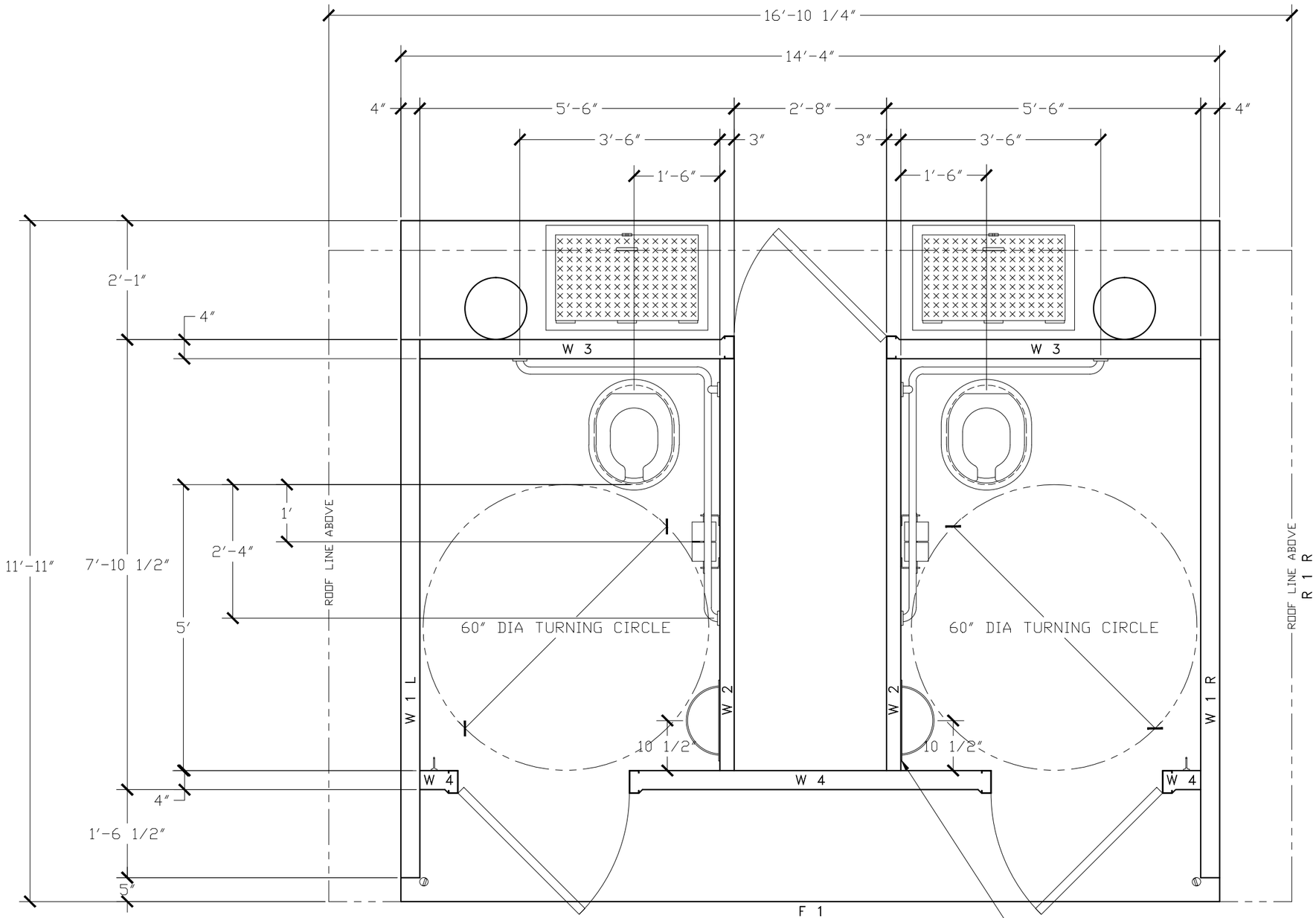
CXT Incorporated

REV.	DESCRIPTION	APPROVAL	DATE

SCALE	1/4"=1'-0"	DATE	07-19-16
DRAWN		FILE NO.	PD-TWC03
CHECKED		PLOT	48

INTERIOR ELEVATIONS

DWG NO.	SHEET	REV.
TWC-03		



FOR REFERENCE ONLY

Precast Products

PROJECT TITLE

TIOGA with CHASE

CXT STANDARD BUILDING

NOTICE

The information contained herein is proprietary and the exclusive property of CXT Incorporated. The information may only be used by the original recipient for the purpose intended. Reproduction or distribution of this information is strictly prohibited without the prior written consent of CXT Incorporated. By allowing use of this information, CXT Incorporated grants no warranty, express or implied, including a warranty of merchantability or of fitness for a particular purpose.

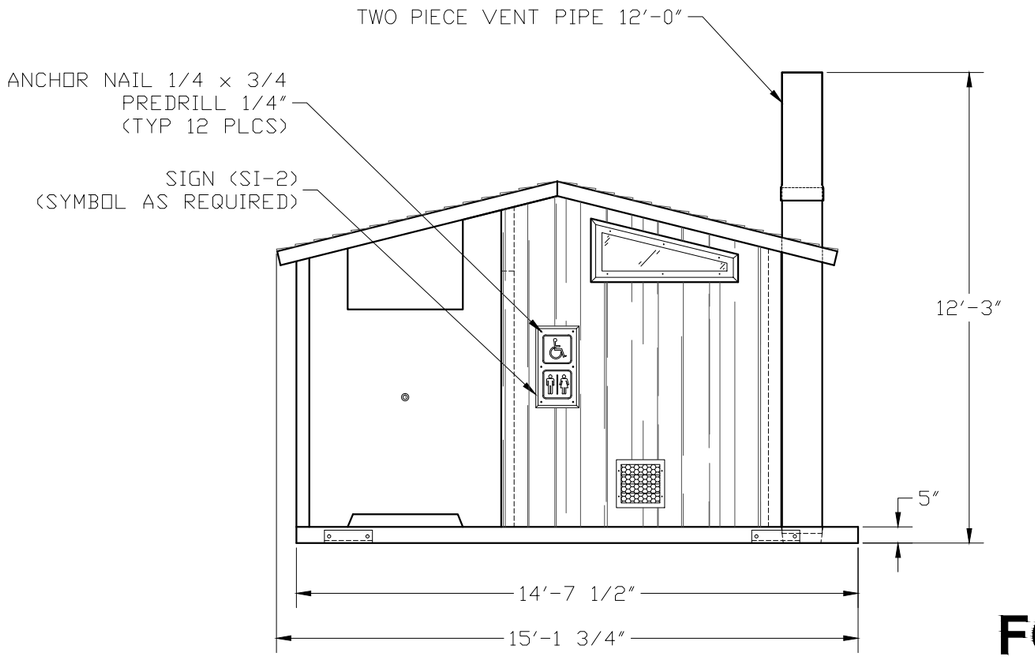
CXT Incorporated

REV.	DESCRIPTION	APPROVAL	DATE

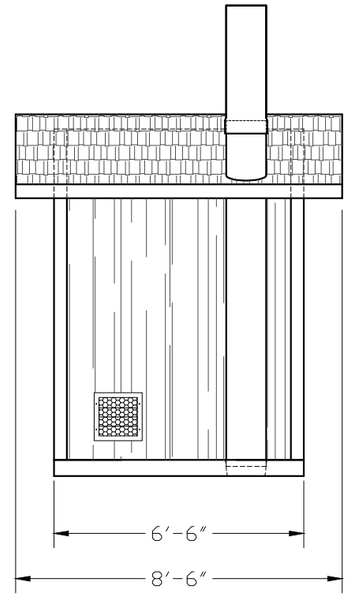
SCALE	1/2"=1'-0"	DATE	07-19-16
DRAWN		FILE NO.	PD-TWC04
CHECKED		PLOT	24

FLOOR PLAN

DWG NO.	SHEET	REV.
TWC-04		

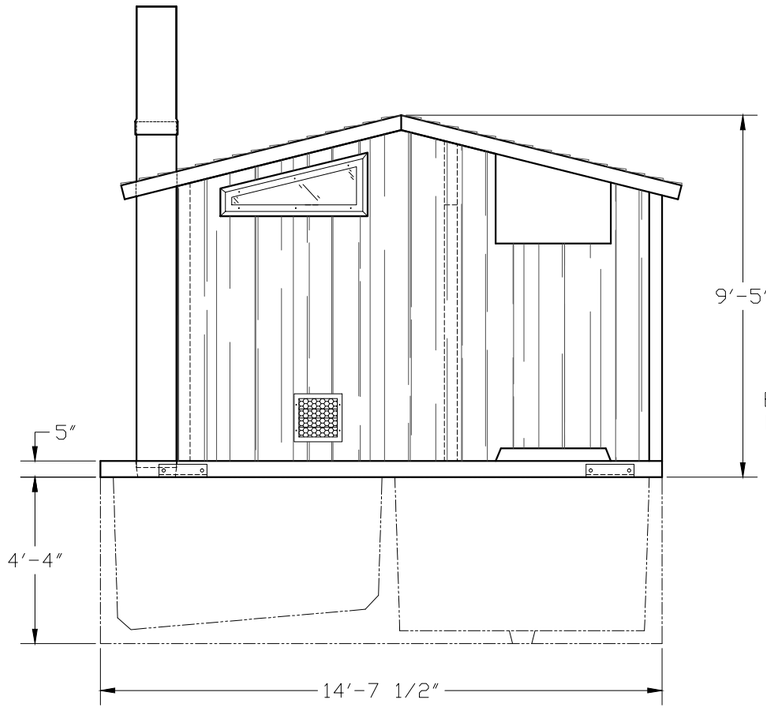


FRONT ELEVATION

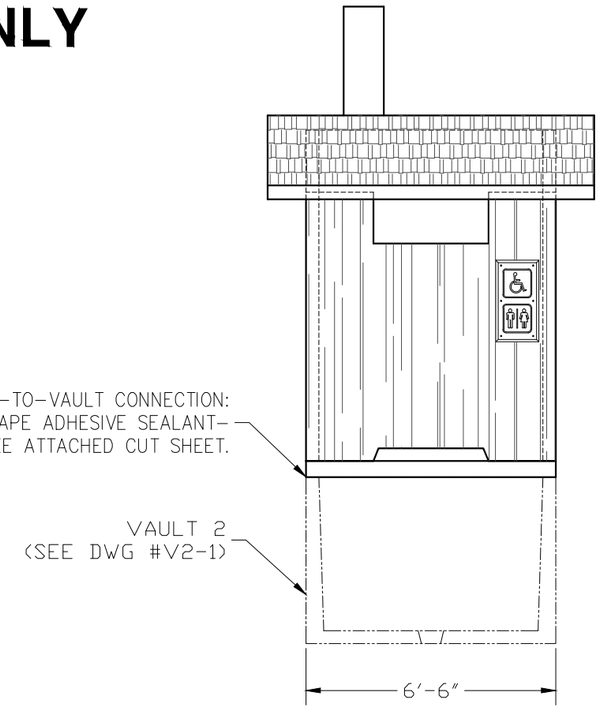


RIGHT SIDE ELEVATION

FOR REFERENCE ONLY



REAR ELEVATION



LEFT SIDE ELEVATION

EMBEDDED MATERIALS			
ITEM	QTY	ITEM	QTY
SI-2	2		
VENT PIPE 9'-0"	1		
ANCHOR NAIL 1/4x3/4	12		
VENT PIPE 3'-0"	1		

CU. FT. CONC.	SQ. FT. W.W.F.	APPROXIMATE WEIGHT

CXT Precast Products

PROJECT TITLE

GUNNISON LEFT HAND

CXT STANDARD BUILDING

NOTICE

The information contained herein is proprietary and the exclusive property of CXT Incorporated. The information may only be used by the original recipient for the purpose intended. Reproduction or distribution of this information is strictly prohibited without the prior written consent of CXT Incorporated. By allowing use of this information, CXT Incorporated grants no warranty, express or implied, including a warranty of merchantability or of fitness for a particular purpose.

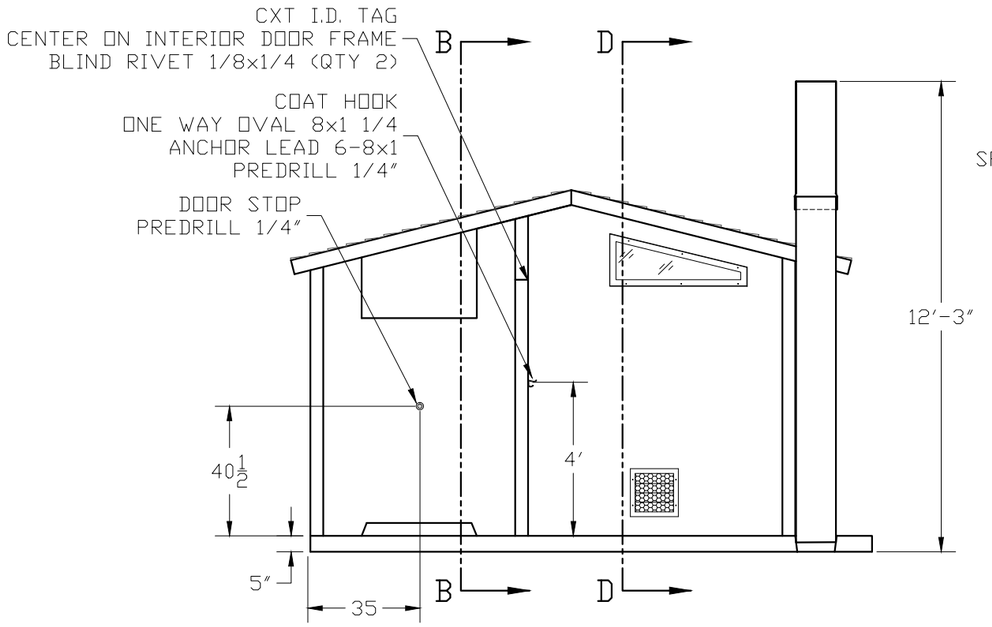
CXT Incorporated

REV.	DESCRIPTION	APPROVAL	DATE

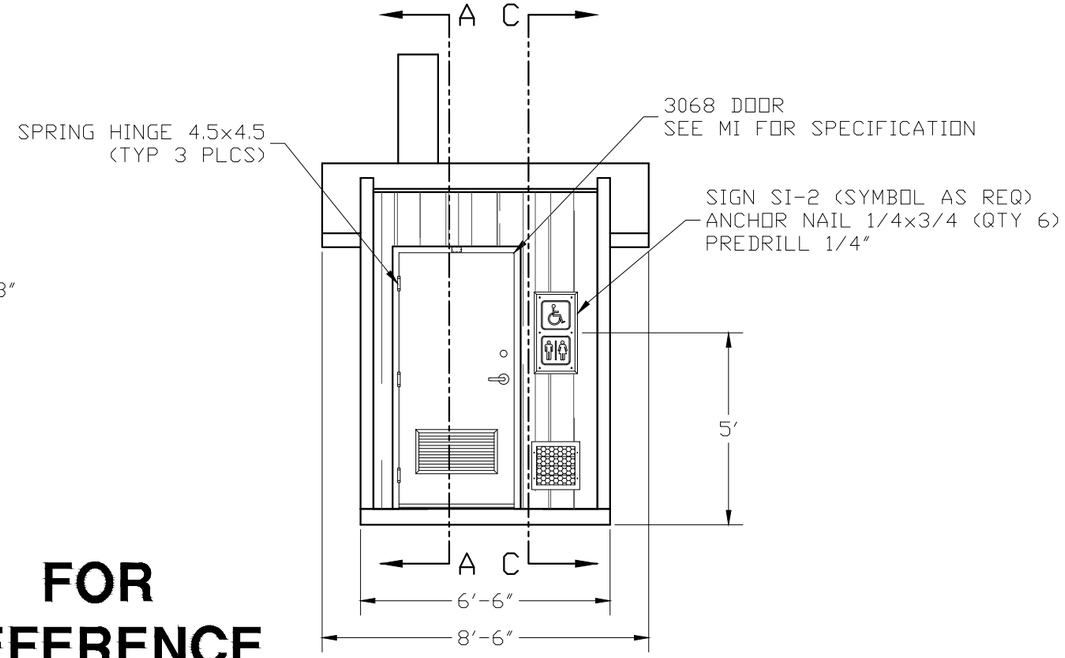
SCALE	1/4"=1'-0"	DATE	07-19-16
DRAWN		FILE NO.	PD-G02
CHECKED		PLOT	48

BUILDING ELEVATIONS

DWG NO.	SHEET	REV.
G-02		

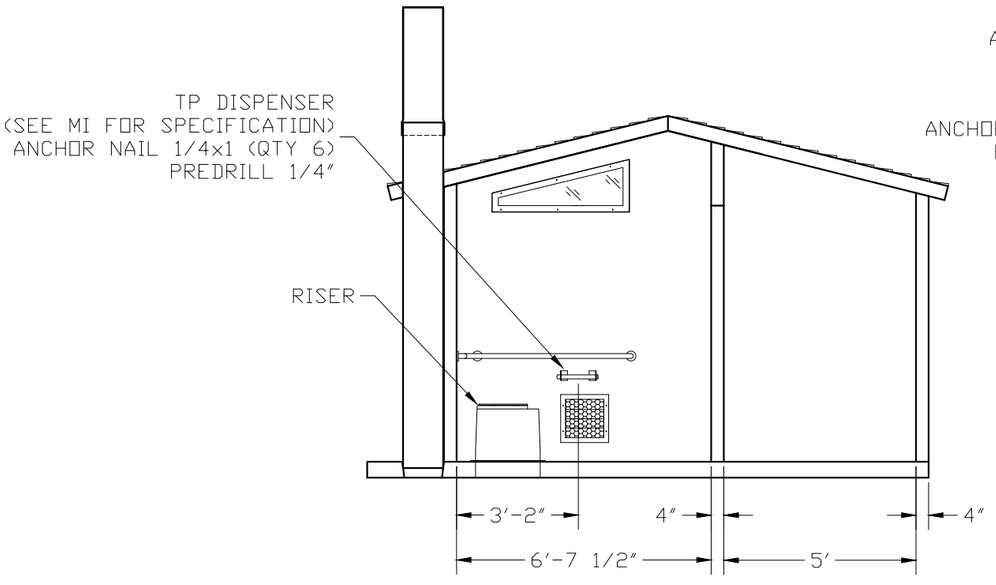


SECTION A – A

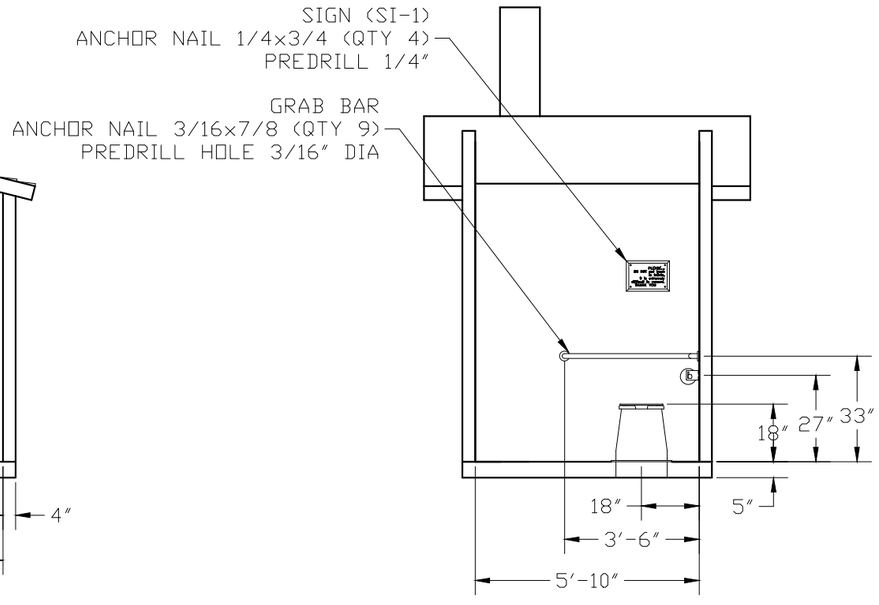


SECTION B – B

FOR REFERENCE ONLY



SECTION C – C



SECTION D – D

EMBEDDED MATERIALS			
ITEM	QTY	ITEM	QTY
RISER	1	ONE WAY OVAL 8x1 1/4	2
GRAB BAR	1	ANCHOR LEAD 6-8x1	2
TP DISPENSER	1	BLIND RIVET 1/8x1/4	2
TOILET PAPER ROLL	2-3	3068 DOOR ASSEMBLY	1
COAT HOOK	1	SPRING HINGE 4.5x4.5	3
DOOR STOP	1		
SI-1	1		
SI-2	1		
CXT I.D. TAG	1		
ANCHOR NAIL 1/4x1	6		
ANCHOR NAIL 1/4x3/4	10		
ANCHOR NAIL 3/16x7/8	9		
CU. FT. CONC.	SQ. FT. W.W.F.	APPROXIMATE WEIGHT	

CXT Precast Products

PROJECT TITLE

GUNNISON LEFT HAND

CXT STANDARD BUILDING

NOTICE

The information contained herein is proprietary and the exclusive property of CXT Incorporated. The information may only be used by the original recipient for the purpose intended. Reproduction or distribution of this information is strictly prohibited without the prior written consent of CXT Incorporated. By allowing use of this information, CXT Incorporated grants no warranty, express or implied, including a warranty of merchantability or of fitness for a particular purpose.

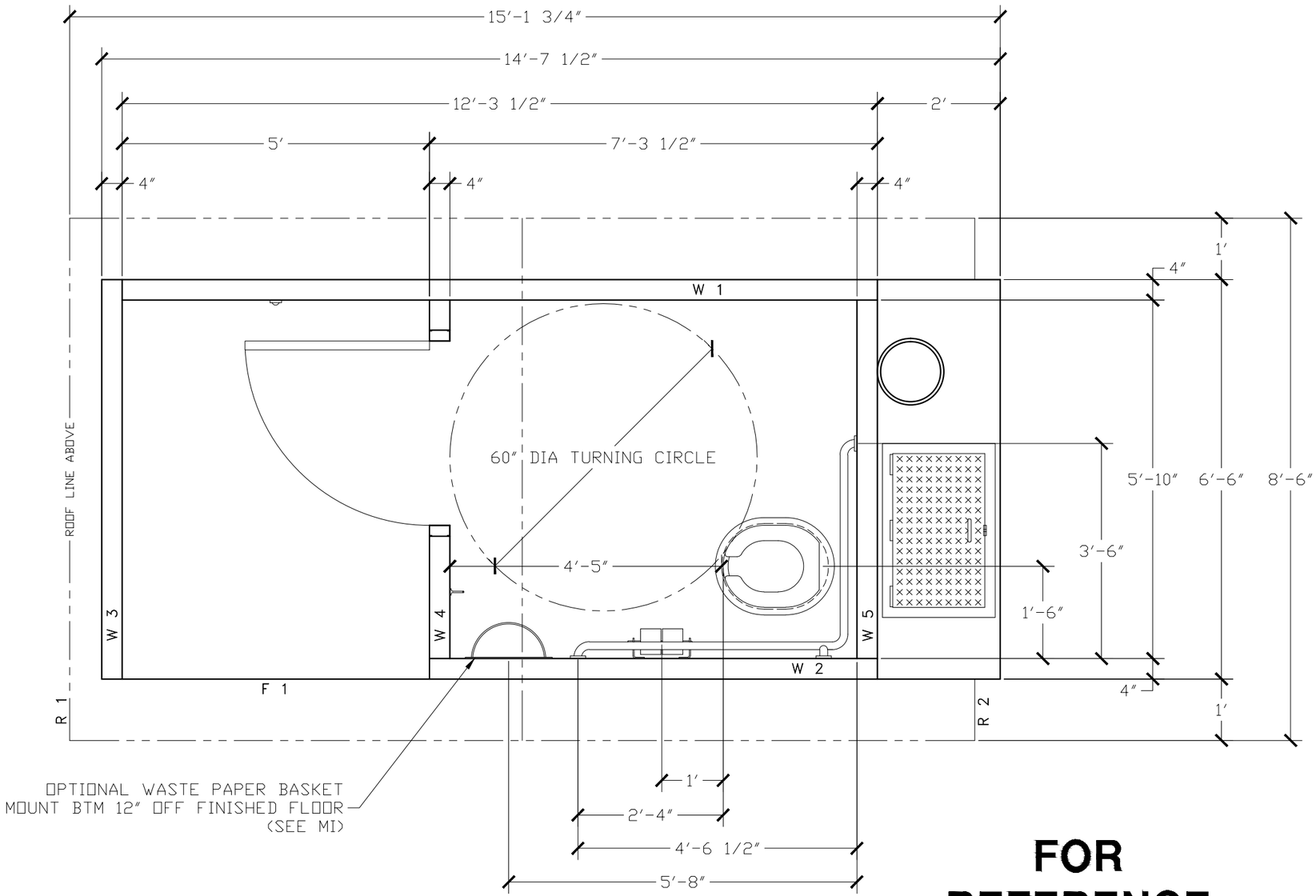
CXT Incorporated

REV.	DESCRIPTION	APPROVAL	DATE

SCALE	1/4"=1'-0"	DATE	07-19-16
DRAWN		FILE NO.	PD-G03
CHECKED		PLOT	48

INTERIOR ELEVATIONS

DWG NO.	SHEET	REV.
G-03		



FOR REFERENCE ONLY

Precast Products

PROJECT TITLE

GUNNISON LEFT HAND

CXT STANDARD BUILDING

NOTICE

The information contained herein is proprietary and the exclusive property of CXT Incorporated. The information may only be used by the original recipient for the purpose intended. Reproduction or distribution of this information is strictly prohibited without the prior written consent of CXT Incorporated. By allowing use of this information, CXT Incorporated grants no warranty, express or implied, including a warranty of merchantability or of fitness for a particular purpose.

CXT Incorporated

REV.	DESCRIPTION	APPROVAL	DATE

SCALE	1/2″=1′-0″	DATE	07-19-16
DRAWN		FILE NO.	PD-G04
CHECKED		PLOT	24

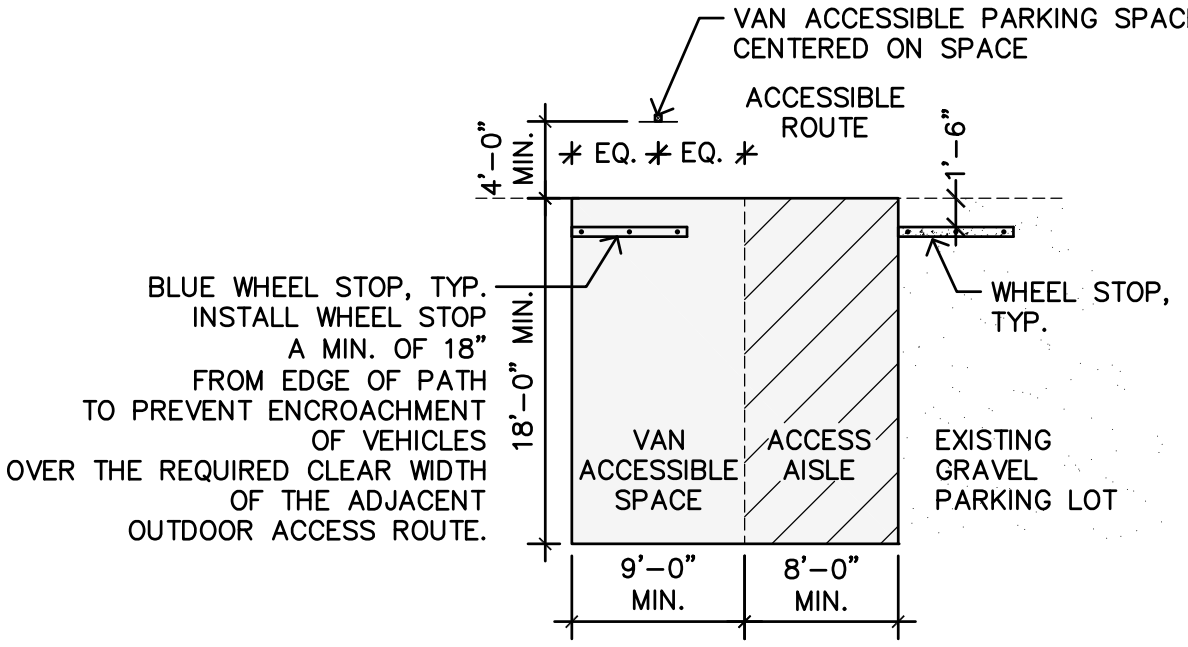
FLOOR PLAN

DWG NO.	SHEET	REV.
G-04		

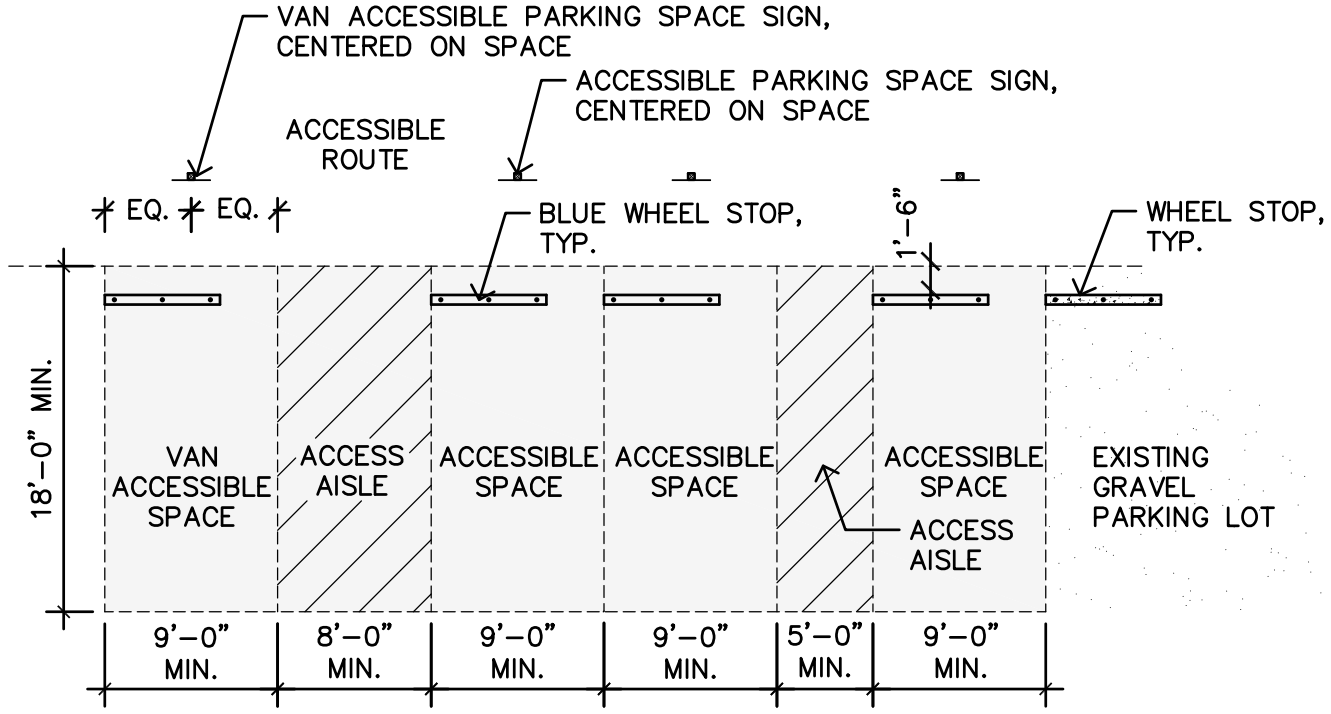
DETAILS AND SPECIFICATIONS GUIDELINES

SECTION 7

ACCESSIBILITY



MINIMUM ACCESSIBLE PARKING SPACE LAYOUT



MULTIPLE ACCESSIBLE PARKING SPACE LAYOUT

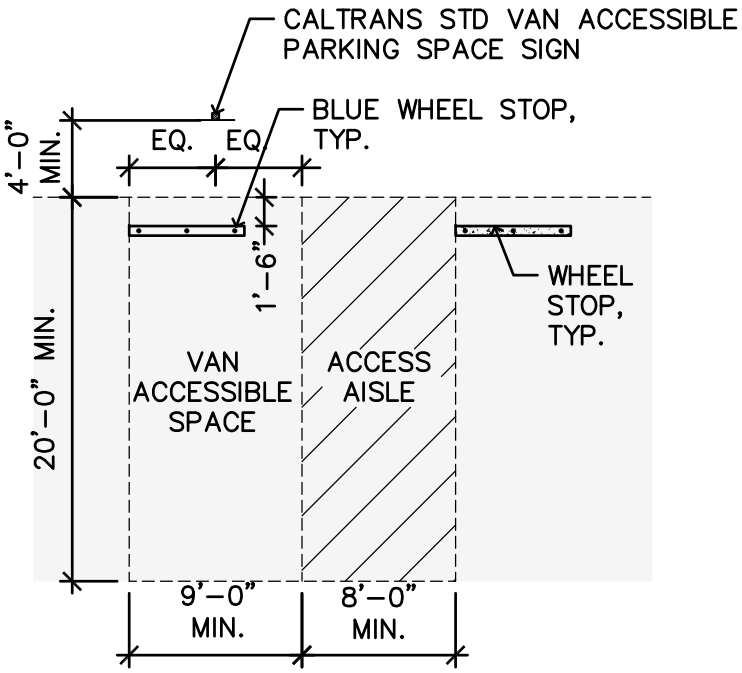
NOTES:

1. FOR THE RETROFIT OF EXISTING GRAVEL PARKING LOT.
2. MINIMUM ONE VAN ACCESSIBLE PARKING SPACE PER PARKING LOT. WHEN ONLY ONE ACCESSIBLE SPACE IS REQUIRED, IT SHALL BE A VAN ACCESSIBLE SPACE.
3. ACCESSIBLE SPACES MAY SHARE ACCESS AISLES AS SHOWN ABOVE.
4. SLOPES OF ACCESSIBLE SPACE AND ACCESS AISLE SHALL BE 2% MAX IN ANY DIRECTION.
5. FOR ACCESSIBLE SPACE AND ACCESS AISLE MARKING REQUIREMENTS, REFER TO 2019 CALIFORNIA BUILDING CODE SECTIONS 11B-502.3.3 AND 11B-502.6.4.1.
6. REFER TO DISTRICT STANDARD WHEEL STOP DETAIL.
7. REFER TO TRAFFIC/PARKING/ROAD SIGN DETAIL FOR SIGN INSTALLATION INFORMATION.

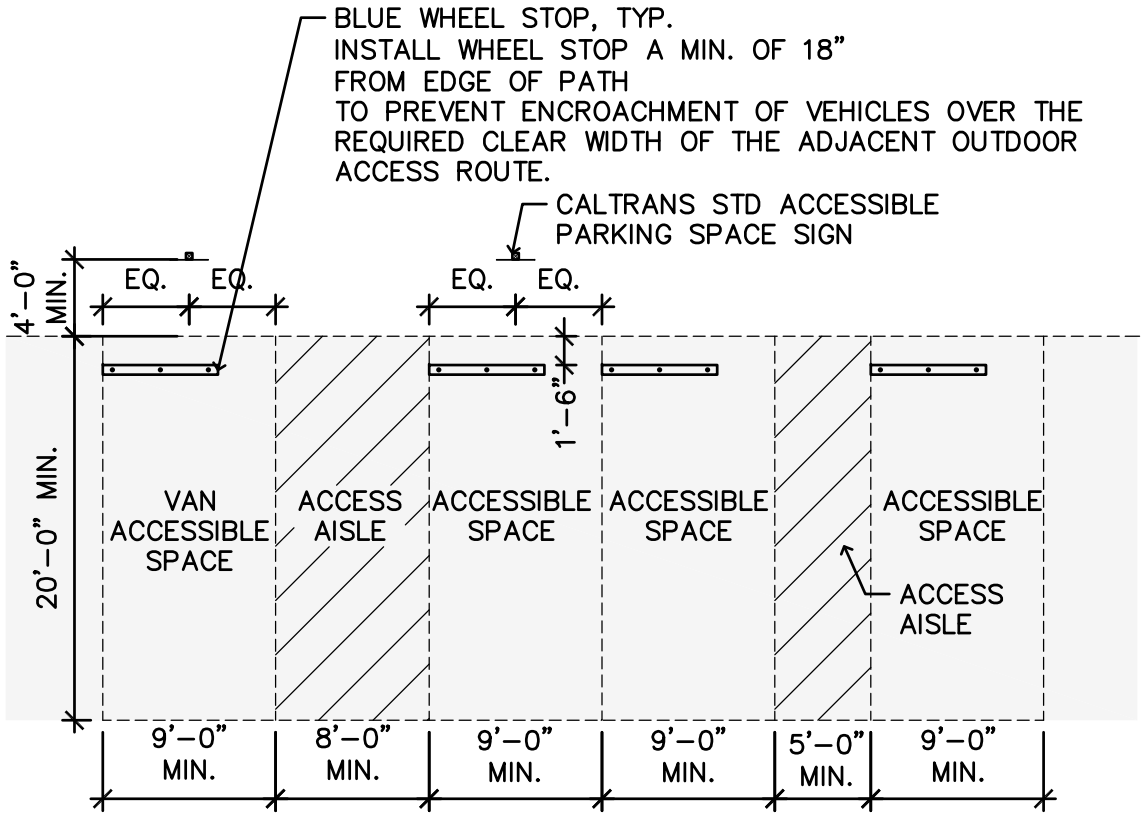
PARKING - ACCESSIBLE SPACE EXISTING GRAVEL LOT

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1"=10'-0"	DATE: 04/2020

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\7 Parking-AccessibleSpacesGravel.dwg



MINIMUM ACCESSIBLE PARKING SPACE LAYOUT



MULTIPLE ACCESSIBLE PARKING SPACE LAYOUT

NOTES:
1. MIN. ONE VAN ACCESSIBLE PARKING SPACE PER PARKING LOT. WHEN ONLY ONE ACCESSIBLE SPACE IS REQUIRED, IT SHALL BE A VAN ACCESSIBLE SPACE.
2. SLOPES OF ACCESSIBLE STALL AND ACCESS AISLE SHALL BE 2% MAX. IN ANY DIRECTION.
3. REFER TO PARKING SIGN DETAILS FOR SIGN INSTALLATION INFORMATION.
4. REFER TO DISTRICT STANDARD WHEEL STOP DETAIL.
5. REFER TO 2019 CALIFORNIA BUILDING CODE SECTIONS 11B–502.3.3 AND 11B–502.6.4.1 FOR ACCESSIBLE SPACE AND ACCESS AISLE SURFACE MARKING REQUIREMENTS.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		PARKING - ACCESSIBLE SPACES PAVED LOT
SCALE: 1" = 10'-0"	DATE: 04/2020	

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\7 Parking-AccessibleSpacesPavedLot.dwg

EASY ACCESS TRAILS

1. ALL EASY ACCESS TRAILS WILL BE DESIGNED TO PROMOTE ACCESS FOR THOSE WITH DISABILITIES AS WELL AS WHEELCHAIRS, STROLLERS, CHILDREN AND ANYONE DESIRING A LESS STRENUOUS EXPERIENCE.

2. GENERALLY THEY SHOULD BE CONSTRUCTED FOUR FEET WIDE AND TO A GRADE NOT TO EXCEED 5%.

3. GENERALLY THEY WILL BE CONSTRUCTED OF DECOMPOSED GRANITE WITH A STABILIZER, WELL COMPACTED BASE ROCK, OR CEMENT. THE SURFACE MUST BE FIRM AND RESIST DEFORMATION.

4. AT A MINIMUM EASY ACCESS TRAILS SHALL MEET THE FOLLOWING FEDERAL ACCESSIBILITY GUIDELINES WITHOUT USING EXCEPTION CRITERIA.

GATE
- 36" MIN. CLEAR WIDTH
- HANDLES MUST BE OPERABLE WITH A CLOSED FIST

TREAD
- SURFACE MUST BE FIRM AND STABLE
- 36" MIN. CLEAR WIDTH
- 5' X 5' PASSING SPACE IS REQUIRED PER 1,000' MAX. IF TREAD WIDTH LESS THAN 5', 5% MAX. RUNNING SLOPE, 2% MAX. CROSS SLOPE

TRAIL SLOPE

1) RUNNING SLOPE:

0 – 5%	FOR UNLIMITED DISTANCE
5.1 – 8.3%	FOR 200' MAX. BEFORE REST AREA REQUIRED
8.3 – 10%	FOR 30' MAX. BEFORE REST AREA REQUIRED
10 – 12%	FOR 10' MAX. BEFORE REST AREA REQUIRED
OVER 12%	NOT PERMISSIBLE ON AN ACCESSIBLE TRAIL

- NO MORE THAN 30% OF THE TOTAL LENGTH OF A TRAIL SHALL HAVE A RUNNING SLOPE STEEPER THAN 8.3%.

2) CROSS SLOPE:
- 2% MAX. IF TRAIL SURFACE IS ASPHALT, CONCRETE, OR BOARD
- 5% MAX. IF TRAIL SURFACE IS OTHER THAN ASPHALT, CONCRETE OR BOARD

REST AREA
- 5' MIN. X 5' MIN. REST AREA REQUIRED AT GRADE CHANGES IN RUNNING SLOPE; OR 5' MIN. IN DIRECTION OF TRAVEL BY 3' MIN. WIDE REST AREA REQUIRED IF ADJACENT TO TRAIL TREAD.
- 2% MAX. IN ANY DIRECTION FOR ASPHALT, CONCRETE, OR BOARD SURFACES
- 2% MAX. RUNNING SLOPE AND 5% MAX. CROSS SLOPE FOR OTHER SURFACES

TRAIL CLEARANCE
- 80" MIN. VERTICAL
- 36" MIN. HORIZONTAL

VERTICAL OBSTACLES IN TREAD
- 1/2" MAX. HIGH FOR TRAILS WITH ASPHALT, CONCRETE, OR BOARD SURFACES
- 2" MAX. HIGH FOR TRAILS WITH OTHER SURFACES
- MULTIPLE VERTICAL OBSTACLES IN TREAD MUST BE MIN. 48" APART FROM EACH OTHER

OPENINGS IN TREAD
- OPENINGS IN THE SURFACE OF TRAILS, PASSING SPACES, AND RESTING INTERVALS SHALL NOT ALLOW THE PASSAGE OF A SPHERE MORE THAN $\frac{1}{2}$ INCH IN DIAMETER.
- ELONGATED OPENINGS SHOULD BE PLACED SO THAT THE LONG DIMENSION IS PERPENDICULAR, OR AS CLOSE TO PERPENDICULAR AS POSSIBLE, TO THE DOMINANT DIRECTION OF TRAVEL.

REGIONAL OPEN SPACE

EASY ACCESS TRAILS SPECIFICATIONS

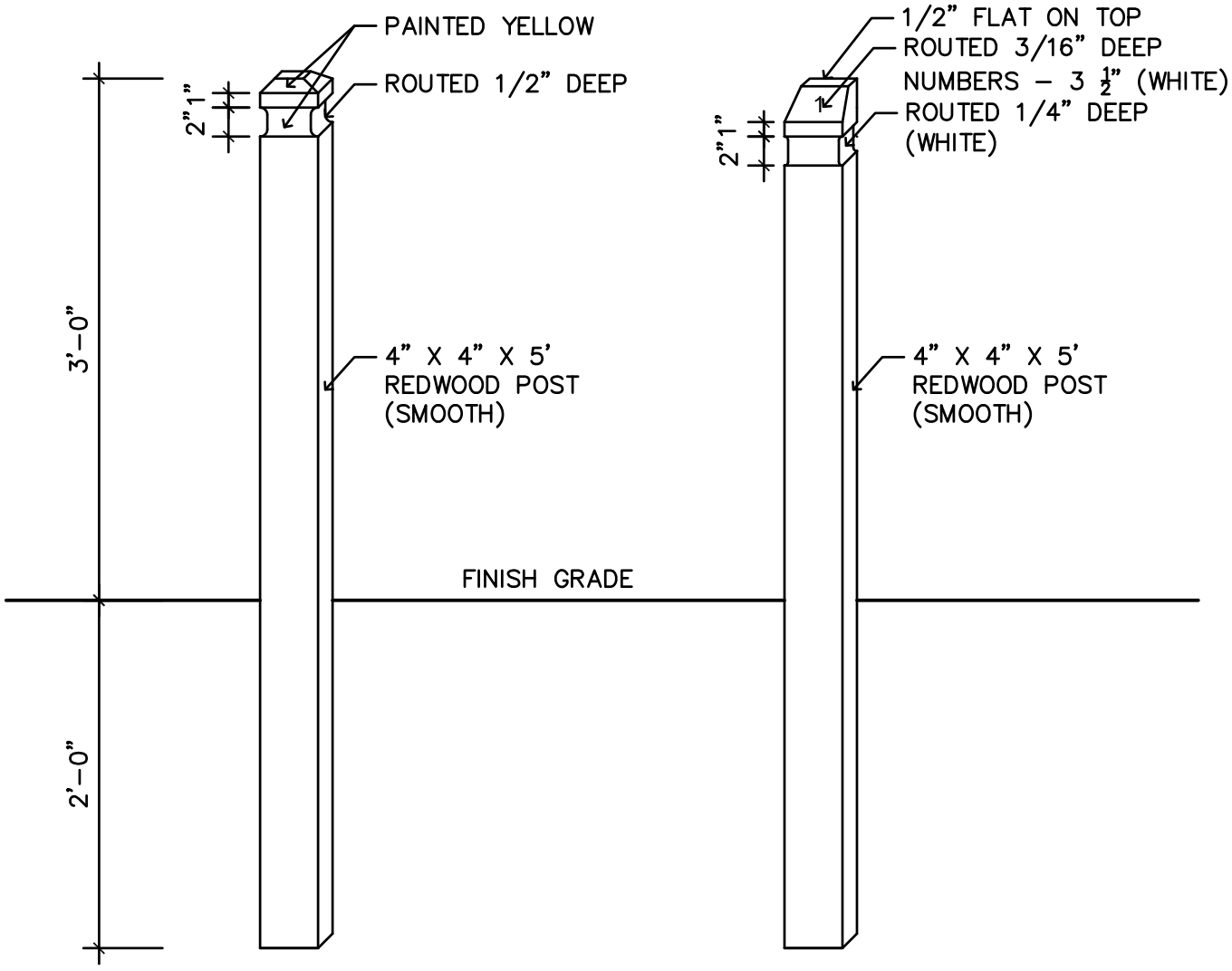
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 04/2020

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\7 Easy Access Trails.dwg

DETAILS AND SPECIFICATIONS GUIDELINES

SECTION 8

SIGN INSTALLATION

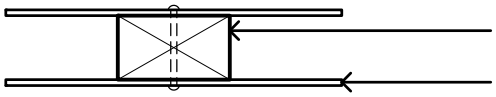


NOTE:
FAULT MARKERS SHALL BE PLACED IN LOCATIONS WHERE THEY PROVIDE CLEAR DIRECTION AND DO NOT INTERFERE WITH PEDESTRIAN OR VEHICULAR TRAFFIC.

PRESERVE SIGN - FAULT MARKER SIGN

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1" = 1'-0"	DATE: 02/1981

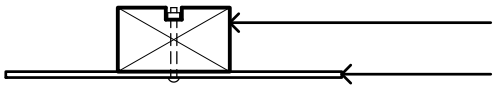
S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\8 Sign-PreserveSign-FaultMarker.dwg



POST

SIGN SECURED WITH TWO $\frac{3}{8}$" X $1\frac{1}{2}$" LAG BOLTS

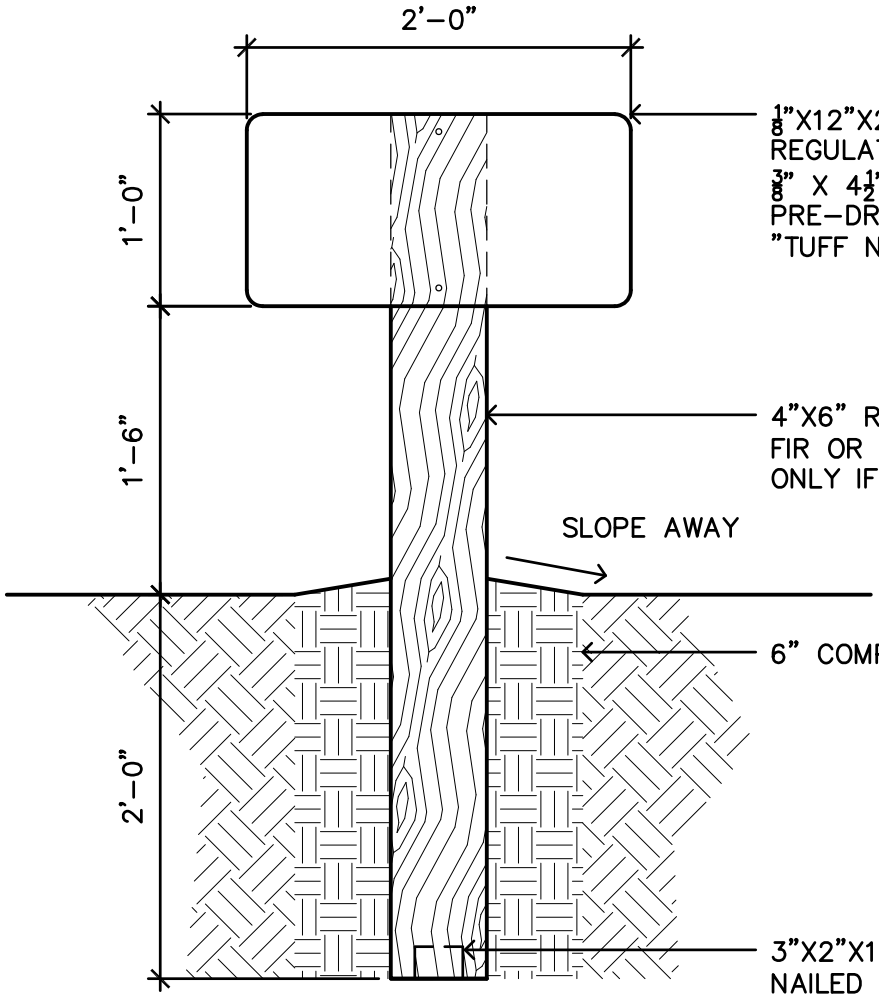
PLAN – TWO–SIDED



POST

SIGN SECURED WITH TWO $\frac{3}{8}$" X $4\frac{1}{2}$" CARRIAGE BOLTS

PLAN – ONE–SIDED



$\frac{1}{8}$"X12"X24" ALUMINUM PRINTED REGULATORY SIGN SECURED WITH TWO $\frac{3}{8}$" X $4\frac{1}{2}$" CARRIAGE BOLTS THROUGH PRE–DRILLED HOLES ON SIGN AND "TUFF NUTS"

4"X6" REDWOOD OR PT DOUGLAS FIR OR HEMLOCK, PLASTIC POST ONLY IF APPROVED BY DISTRICT

6" COMPACTED SOIL, ALL SIDES

3"X2"X1" MIN. SCRAP WOOD DEADMAN, NAILED OR SCREWED TO BOTTOM OF POST

SECTION ELEVATION

PLAN

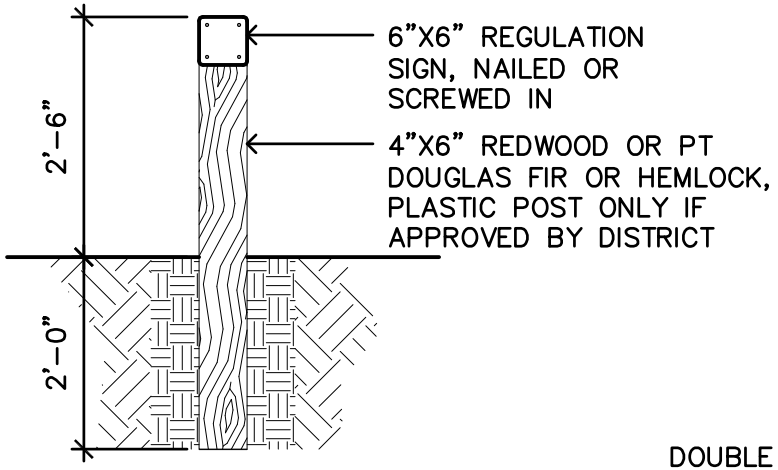
NOTES:

1. 12"X24" SIGNS VARY. TYPE AND QUANTITY TO BE SELECTED AND PROVIDED BY DISTRICT.
2. 12"X24" SIGNS SHALL BE PLACED IN LOCATIONS WHERE THEY PROVIDE CLEAR DIRECTION AND DO NOT INTERFERE WITH PEDESTRIAN OR VEHICULAR TRAFFIC.

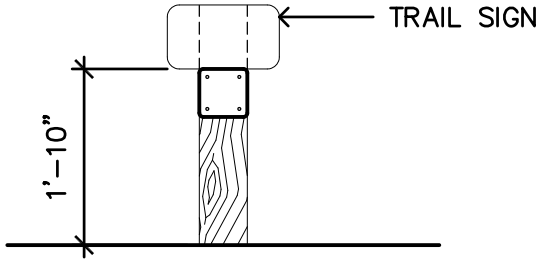
PRESERVE SIGN - REGULATORY 12"X24" SIGN

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1" = 1'-0"	DATE: 05/15/2012

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\8 Sign-PreserveSign-Regulatory-12x24.dwg



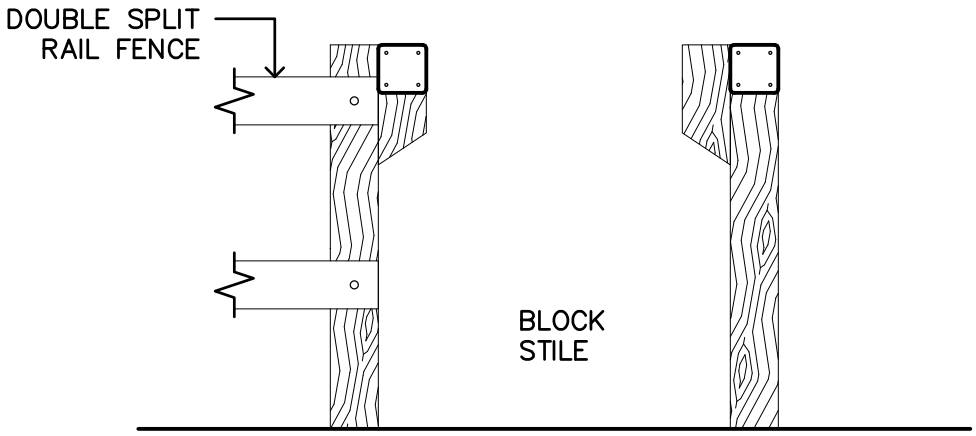
STAND ALONE INSTALLATION



ALTERNATE MOUNTING LOCATION:
COMBINED WITH TRAIL SIGN

NOTES:

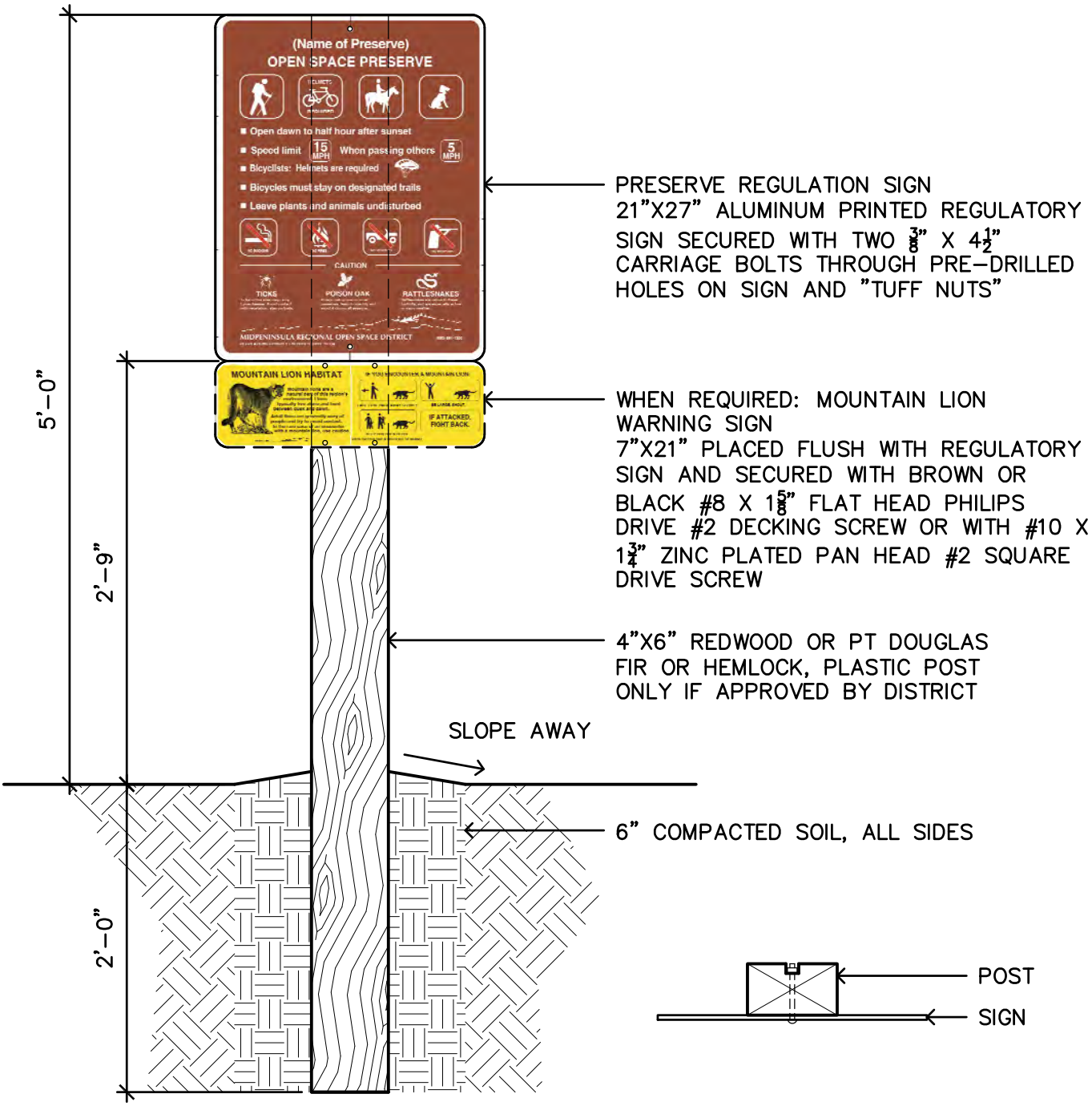
1. MOUNTING LOCATION MAY VARY DEPENDING ON SITE.
2. 6"X6" SIGNS INCLUDE SMALL REGULATION SIGNS, TRAIL ARROWS, "NOT A THROUGH TRAIL", BAY AREA RIDGE TRAIL SIGNS, "DO NOT BLOCK", ETC.
3. 6"X6" SIGNS SHALL BE PLACED IN LOCATIONS WHERE THEY PROVIDE CLEAR DIRECTION AND DO NOT INTERFERE WITH PEDESTRIAN OR VEHICULAR TRAFFIC.



ALTERNATE MOUNTING LOCATION:
COMBINED WITH BLOCK STILE (TWO POSSIBLE LOCATIONS)

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		PRESERVE SIGN REGULATORY 6"X 6" SIGN
SCALE: 1/2"=1'-0"	DATE: 11/17/2011	

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\8 Sign-PreserveSign-Regulatory-6x6.dwg



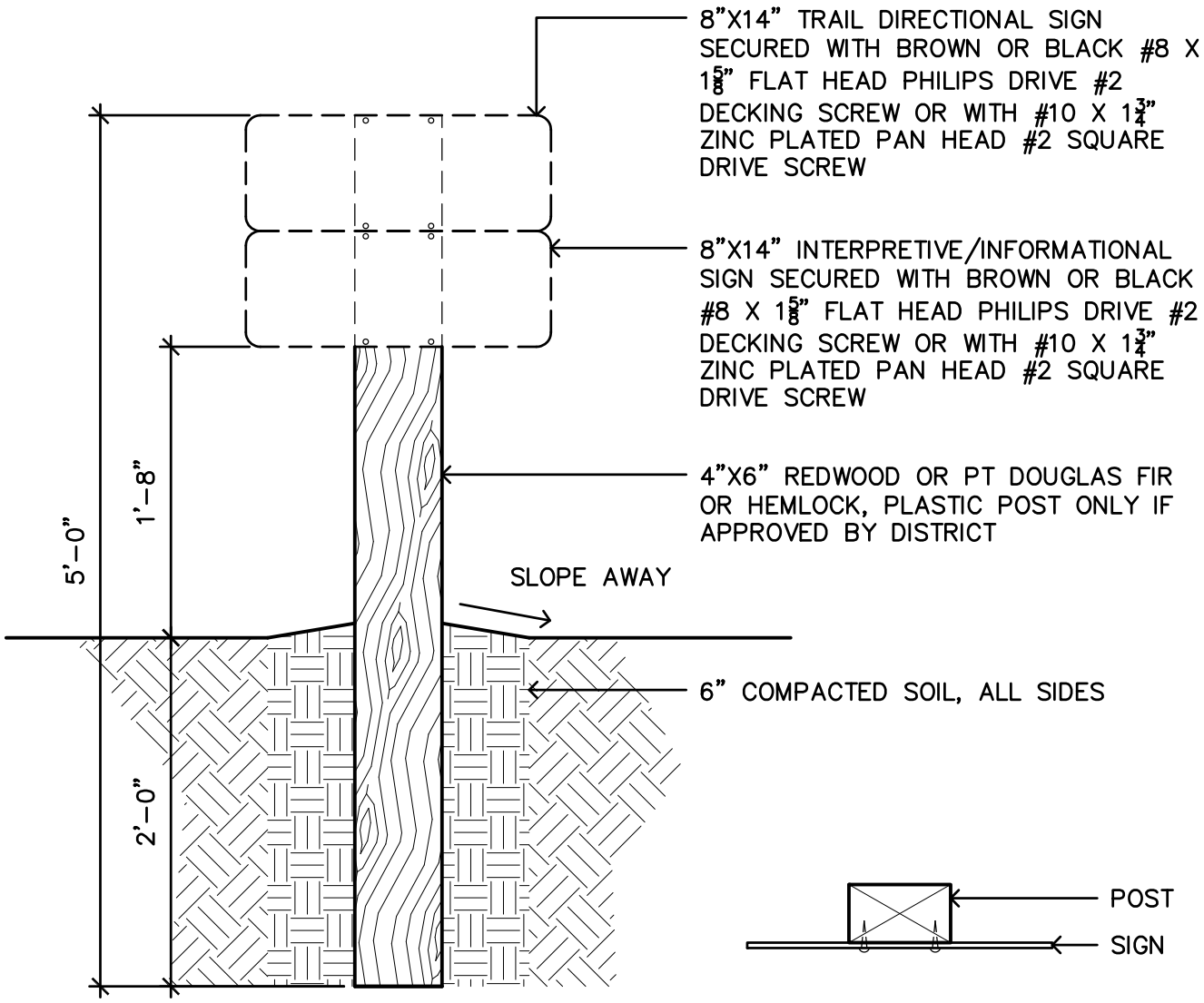
NOTES:

1. SIGNS SHOULD BE INSTALLED AT ALL DESIGNATED PRESERVE ENTRANCES FACING THE TRAILHEAD OPENING.
2. SIGNS SHOULD BE PLACED IN LOCATIONS WHERE THEY PROVIDE CLEAR DIRECTION AND DO NOT INTERFERE WITH PEDESTRIAN OR VEHICULAR TRAFFIC.
3. WHEN DIRECTED BY THE DISTRICT, "NO SMOKING, NO FIRE" SIGN MAY BE STAPLED BELOW MOUNTAIN LION SIGN ON PLYWOOD BACKING, PAINTED BROWN. HOWEVER, GATE IS PREFERRED LOCATION.

PRESERVE SIGN - REGULATION SIGN WITH MOUNTAIN LION SIGN

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1" = 1'-0"	DATE: 05/15/2012

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\8 Sign-PreserveSign-Regulation.dwg

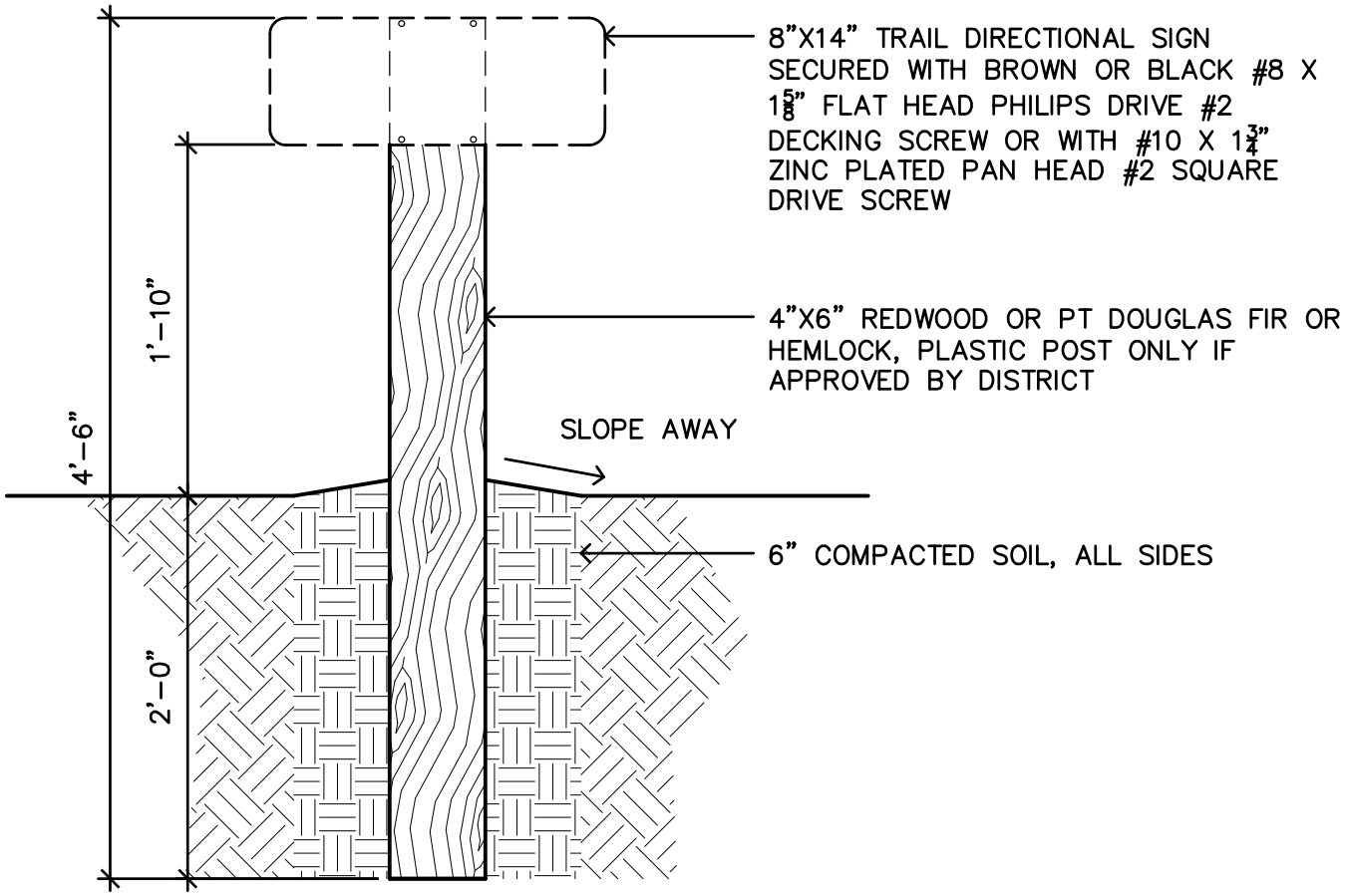


NOTES:
1. TRAIL SIGNS SHALL BE PLACED IN LOCATIONS WHERE THEY PROVIDE CLEAR DIRECTION AND DO NOT INTERFERE WITH PEDESTRIAN OR VEHICULAR TRAFFIC.
2. SIGNS PROVIDED BY THE DISTRICT.
3. NO OTHER SIGNS MAY BE POSTED WITHOUT PRIOR DISTRICT PERMISSION.

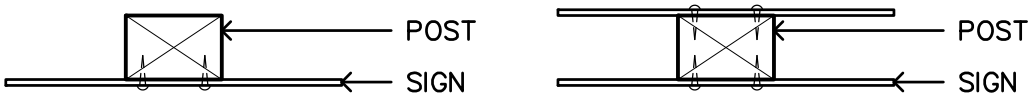
PRESERVE SIGN - COMBINATION INTERPRETIVE & TRAIL DIRECTIONAL SIGNS

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1" = 1'-0"	DATE: 11/17/2011

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\8 Sign-PreserveSign-InterpretiveTrailDirectionCombo.dwg



SECTION ELEVATION



PLAN – SINGLE–SIDE SIGN

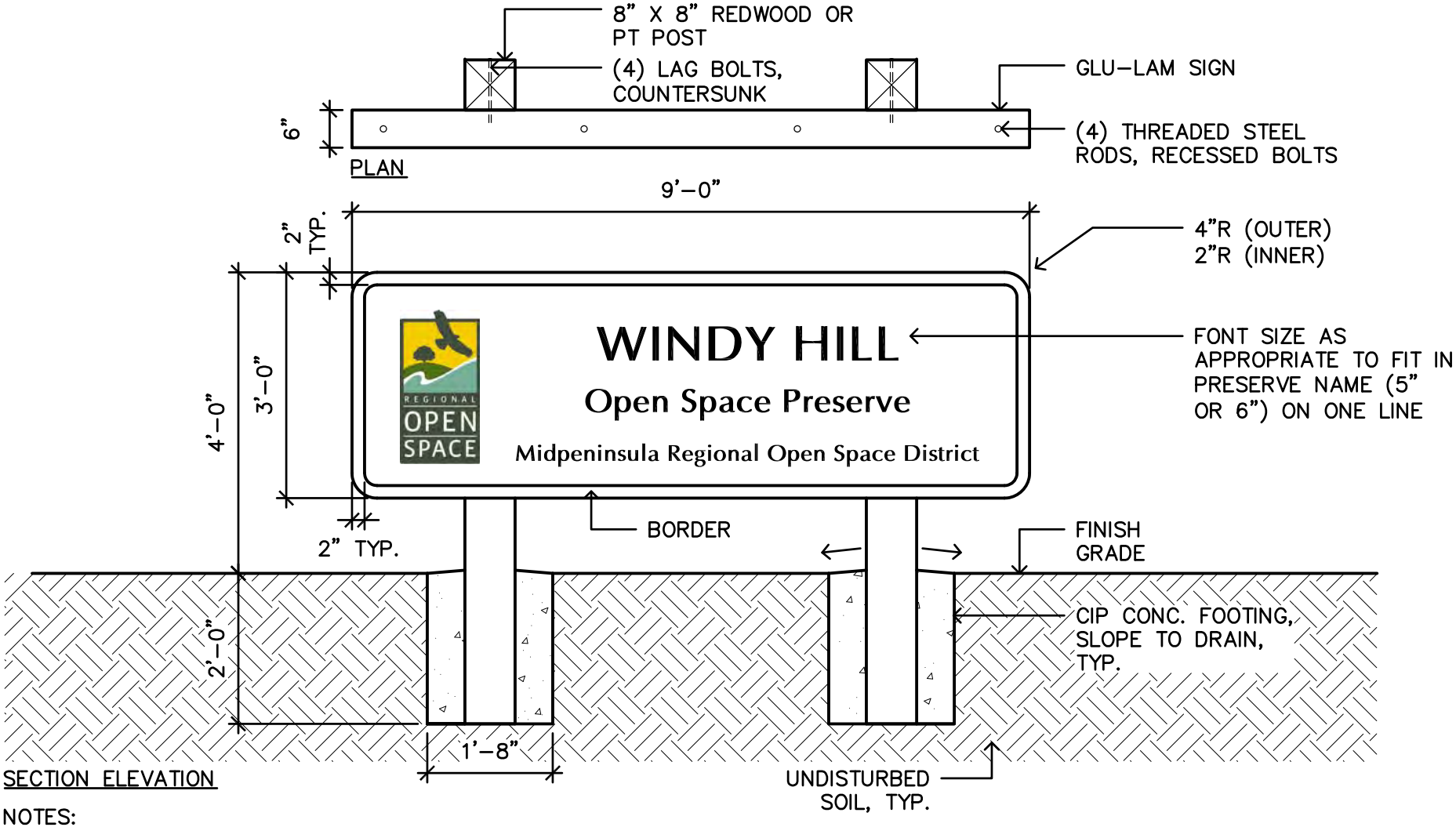
PLAN – DOUBLE–SIDED SIGN

NOTES:
1. TRAIL SIGNS SHALL BE PLACED IN LOCATIONS WHERE THEY PROVIDE CLEAR DIRECTION AND DO NOT INTERFERE WITH PEDESTRIAN OR VEHICULAR TRAFFIC.
2. SIGNS PROVIDED BY THE DISTRICT.
3. NO OTHER SIGNS MAY BE POSTED WITHOUT PRIOR DISTRICT PERMISSION.

PRESERVE SIGN - INTERPRETIVE OR TRAIL DIRECTIONAL SIGN

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1" = 1'-0"	DATE: 11/17/2011

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\8 Sign-PreserveSign-InterpretiveTrailDirection.dwg

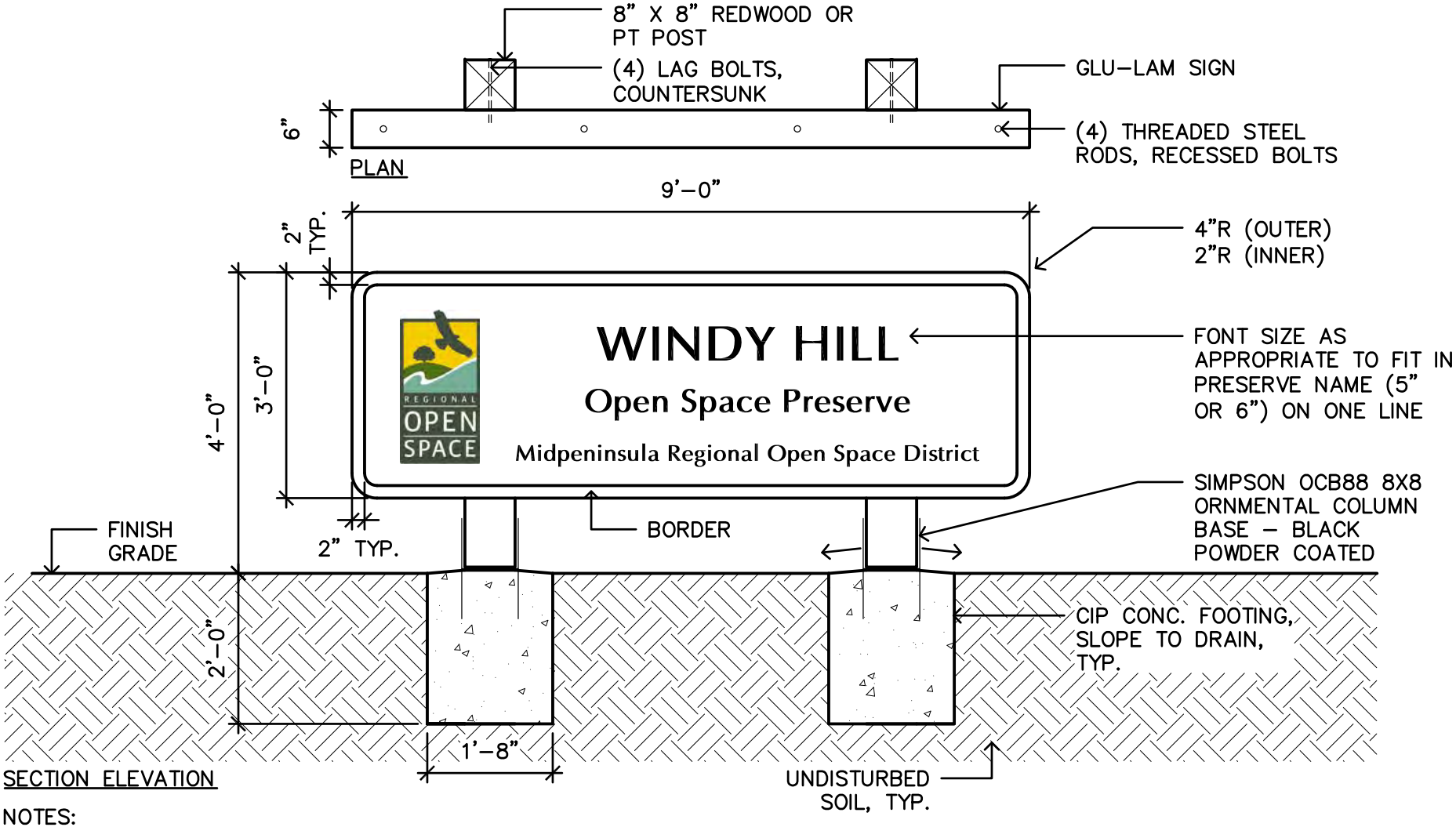


NOTES:

1. SIGN CONSTRUCTED OF 2" X 6" GLU-LAM REDWOOD.
2. RAISED LETTERING AND BORDER AS A RESULT OF SAND BLASTING. BORDER PAINTED WHITE.
3. LETTERING STYLE TO BE OPTIMA BOLD, PAINTED WHITE W/ DURABLE EXPOXY PAINT.
4. PRESERVE NAME SHALL BE IN CAPS. "Midpeninsula Regional Open Space District" AND "Open Space Preserve" SHALL BE INITIAL CAP ONLY.
5. WOOD TO BE PRESERVED USING 'CDW' OR EQ.
6. PROVIDE SHOP DWGS. FOR DISTRICT REVIEW PRIOR TO FABRICATION OR CONSTRUCTION.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		PRESERVE ENTRANCE SIGN 9 FT WIDTH
SCALE: 1/2"=1'-0"	DATE: 02/24/2017	

\\fileserv\shareall\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\8 Sign-PreserveSign-Entrance-9ft-Post-in-Conc.dwg

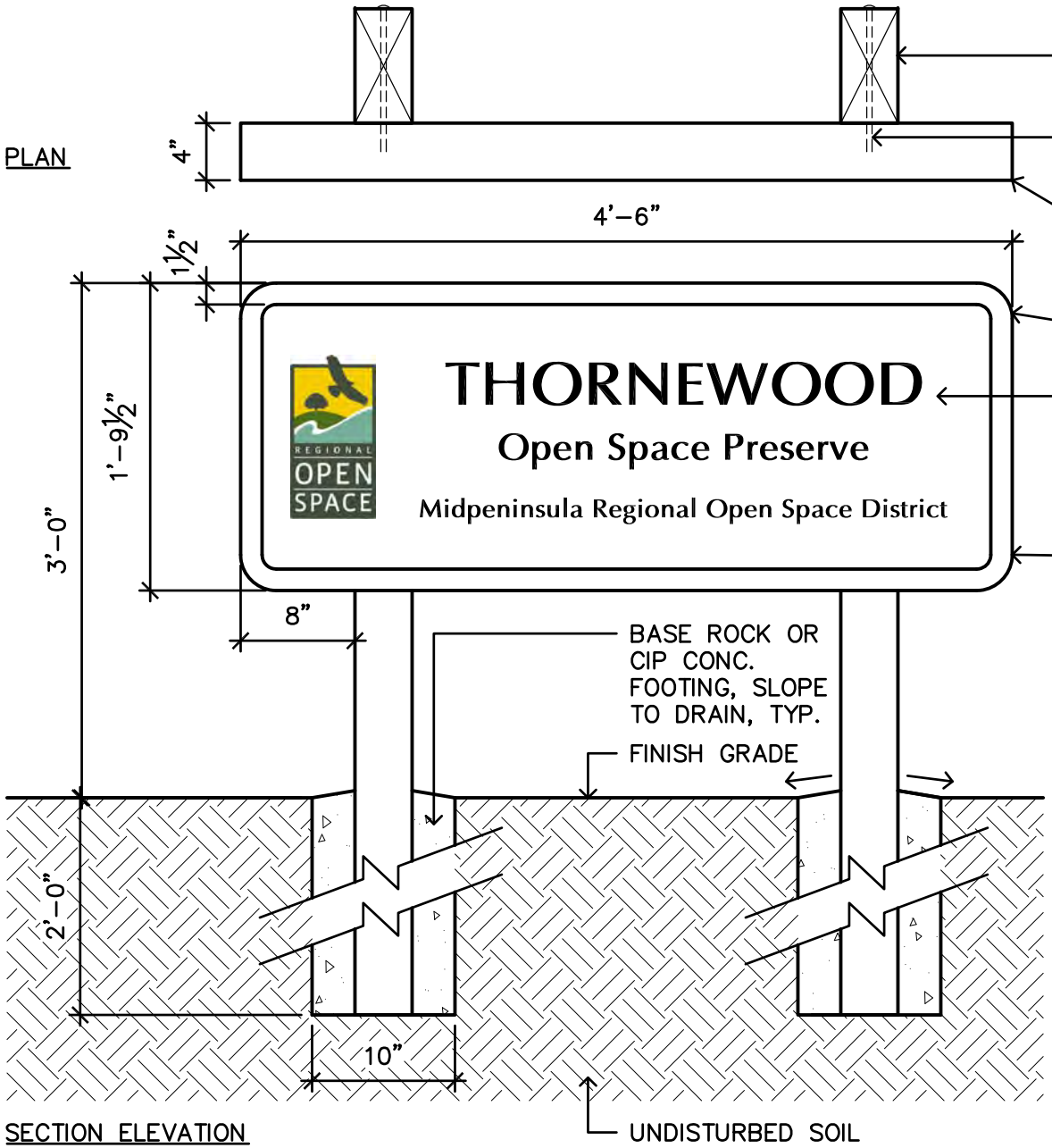


NOTES:

1. SIGN CONSTRUCTED OF 2" X 6" GLU-LAM REDWOOD AND MOUNTED LEVEL.
2. RAISED LETTERING AND BORDER AS A RESULT OF SAND BLASTING. BORDER PAINTED WHITE.
3. LETTERING STYLE TO BE OPTIMA BOLD, PAINTED WHITE W/ DURABLE EXPOXY PAINT.
4. PRESERVE NAME SHALL BE IN CAPS. "Midpeninsula Regional Open Space District" AND "Open Space Preserve" SHALL BE INITIAL CAP ONLY.
5. WOOD TO BE PRESERVED USING 'CDW' OR EQ.
6. PROVIDE SHOP DWGS. FOR DISTRICT REVIEW PRIOR TO FABRICATION OR CONSTRUCTION.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		PRESERVE ENTRANCE SIGN ALT - H-BRACKET 9 FT WIDTH
SCALE: 1/2"=1'-0"	DATE: 06/23/2017	

\\fileserv\shareall\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\8 Sign-PreserveSign-Entrance-9ft-ALT-H-Bracket.dwg

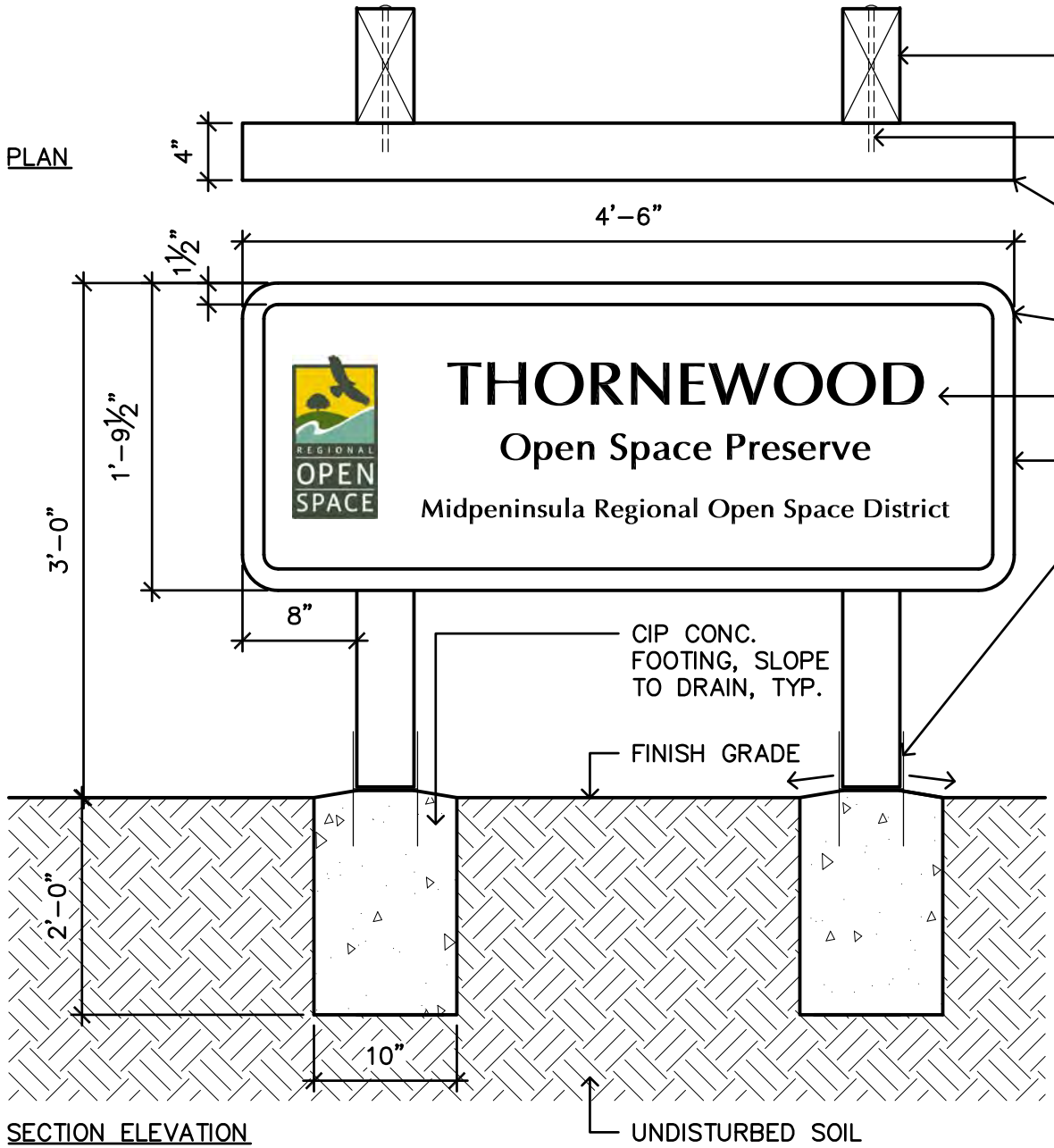


NOTES:

1. SIGN CONSTRUCTED OF 2" X 4" GLU–LAM REDWOOD.
2. RAISED LETTERING AND BORDER AS A RESULT OF SAND BLASTING. BORDER PAINTED WHITE.
3. LETTERING STYLE TO BE OPTIMA BOLD, PAINTED WHITE W/ DURABLE EXPOXY PAINT.
4. PRESERVE NAME SHALL BE IN CAPS. "Midpeninsula Regional Open Space District" AND "Open Space Preserve" SHALL BE INITIAL CAP ONLY.
5. WOOD TO BE PRESERVED USING 'CDW' OR EQ.
6. PROVIDE SHOP DWGS. FOR DISTRICT REVIEW PRIOR TO FABRICATION OR CONSTRUCTION.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	PRESERVE ENTRANCE SIGN 4.5 FT WIDTH
SCALE: 1"=1'-0"	DATE: 02/24/2017

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\8 Sign-PreserveSign-Entrance-4.5ft-Post-in-Conc.dwg

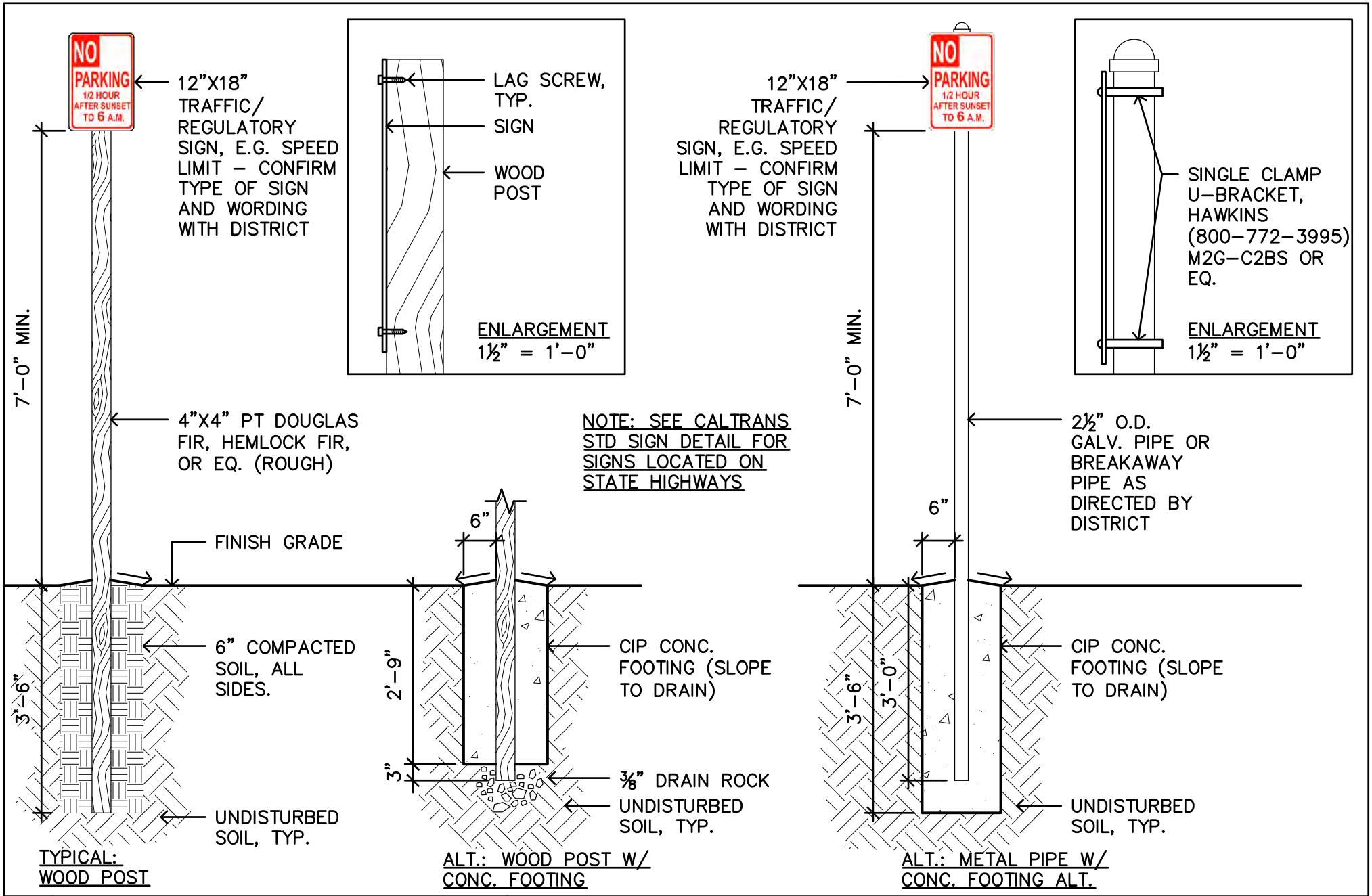


NOTES:

1. SIGN CONSTRUCTED OF 2" X 4" GLU–LAM REDWOOD AND MOUNTED LEVEL.
2. RAISED LETTERING AND BORDER AS A RESULT OF SAND BLASTING. BORDER PAINTED WHITE.
3. LETTERING STYLE TO BE OPTIMA BOLD, PAINTED WHITE W/ DURABLE EXPOXY PAINT.
4. PRESERVE NAME SHALL BE IN CAPS. "Midpeninsula Regional Open Space District" AND "Open Space Preserve" SHALL BE INITIAL CAP ONLY.
5. WOOD TO BE PRESERVED USING 'CDW' OR EQ.
6. PROVIDE SHOP DWGS. FOR DISTRICT REVIEW PRIOR TO FABRICATION OR CONSTRUCTION.

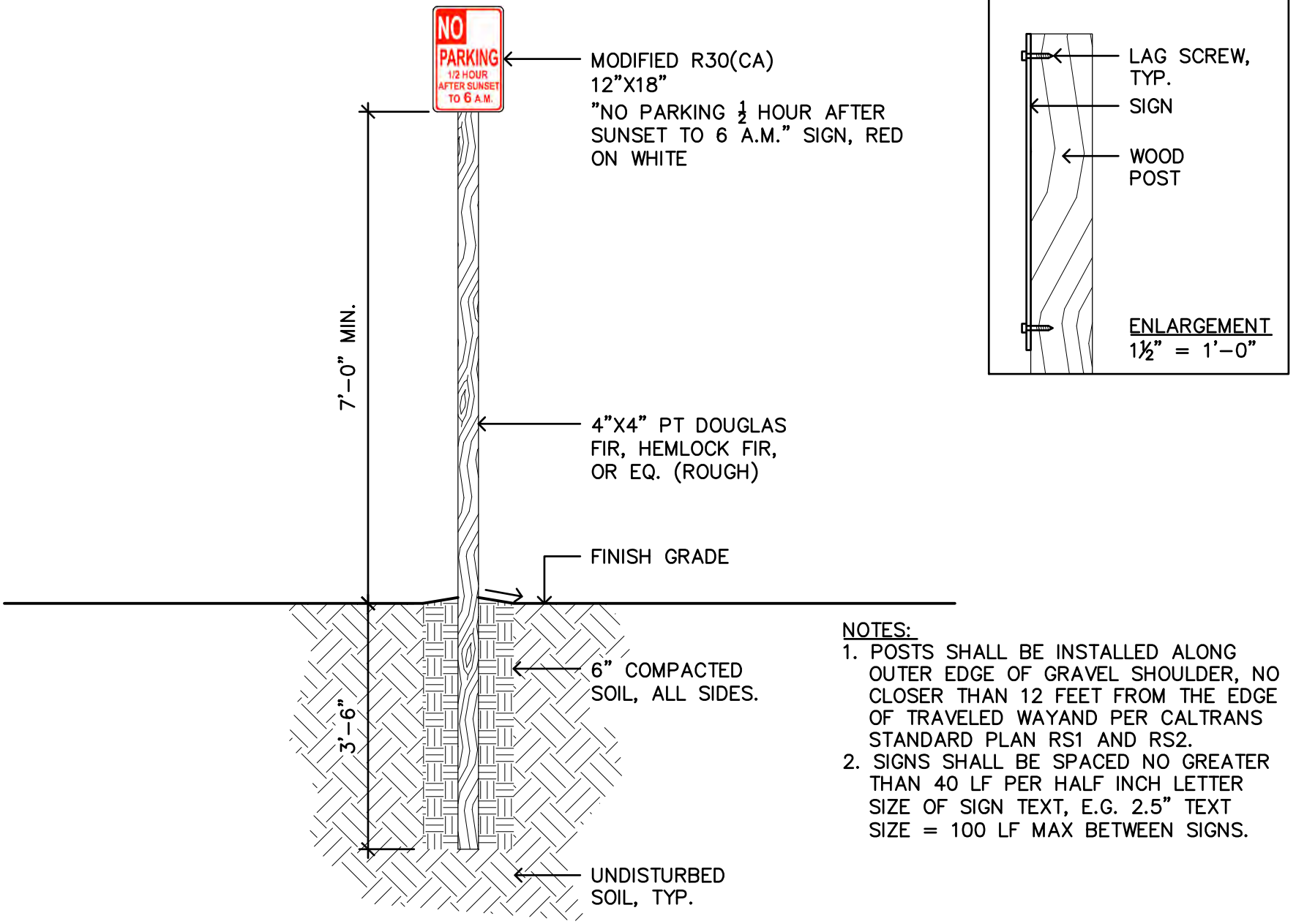
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	
SCALE: 1"=1'-0"	DATE: 06/23/2017

PRESERVE ENTRANCE SIGN ALT - H-BRACKET 4.5 FT WIDTH



MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		REGULATORY/TRAFFIC SIGN DISTRICT
SCALE: 1/2"=1'-0"	DATE: 11/17/2011	

\\fileserv\shareall\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\8 Sign-TrafficRegulatory-District.dwg

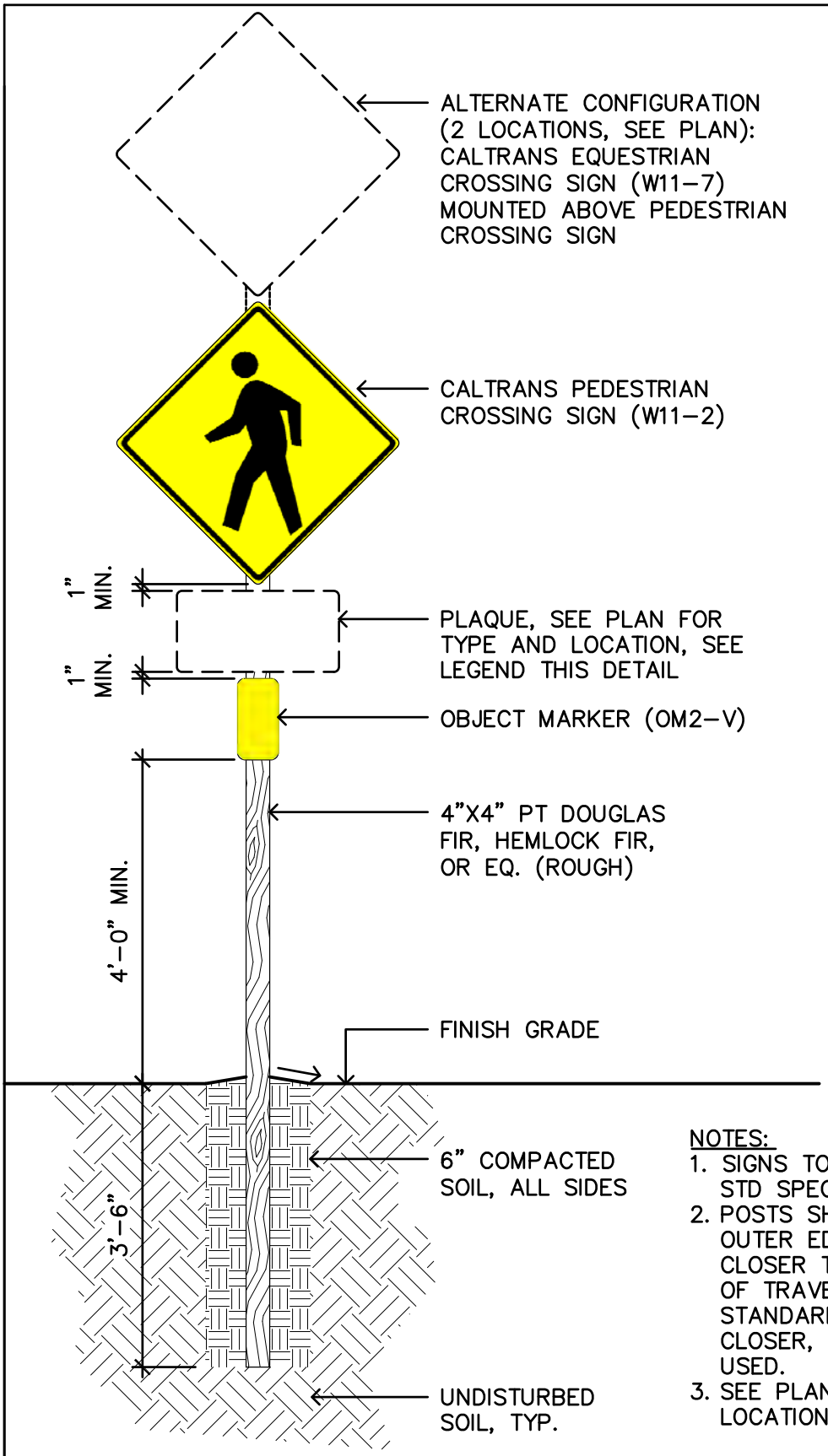


NOTES:

1. POSTS SHALL BE INSTALLED ALONG OUTER EDGE OF GRAVEL SHOULDER, NO CLOSER THAN 12 FEET FROM THE EDGE OF TRAVELED WAYAND PER CALTRANS STANDARD PLAN RS1 AND RS2.
2. SIGNS SHALL BE SPACED NO GREATER THAN 40 LF PER HALF INCH LETTER SIZE OF SIGN TEXT, E.G. 2.5" TEXT SIZE = 100 LF MAX BETWEEN SIGNS.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		REGULATORY SIGN CALTRANS "NO PARKING" SIGN
SCALE: 1/2"=1'-0"	DATE: 11/17/2011	

\\fileserv\shareall\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\8 Sign-TrafficRegulatory-Caltrans-NoParking.dwg



PLAQUE LEGEND

TYPICAL:
W16-7pL - DOWNWARD POINTING ARROW PLAQUE (LEFT POINTING)

OINLY WHEN NOTED:
W16-7pR - DOWNWARD POINTING ARROW PLAQUE (RIGHT POINTING)

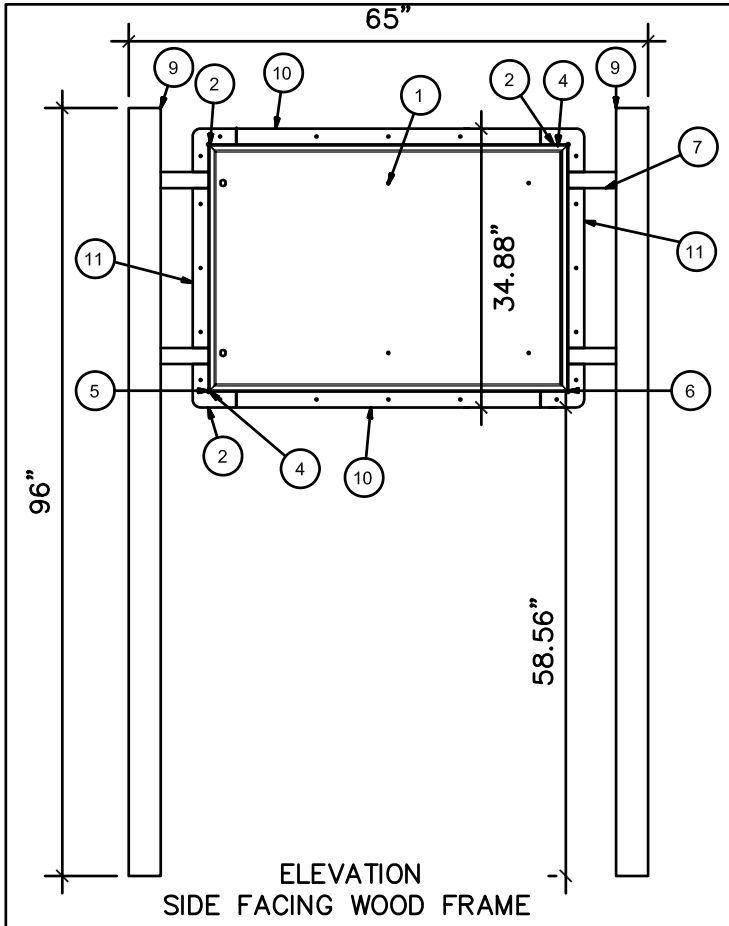
W16-2a "750 FT" - DISTANCE AHEAD PLAQUE

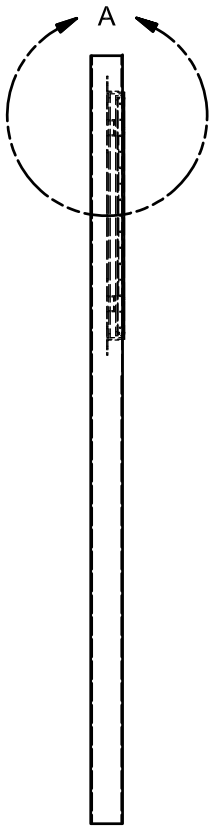
NOTES:
1. SIGNS TO BE INSTALLED PER CALTRANS STD SPECIFICATIONS.
2. POSTS SHALL BE INSTALLED ALONG OUTER EDGE OF GRAVEL SHOULDER, NO CLOSER THAN 12 FEET FROM THE EDGE OF TRAVELED WAYAND PER CALTRANS STANDARD PLAN RS1 AND RS2. WHERE CLOSER, OBJECT MARKER SHALL BE USED.
3. SEE PLANS FOR SIGN TYPES AND LOCATION.

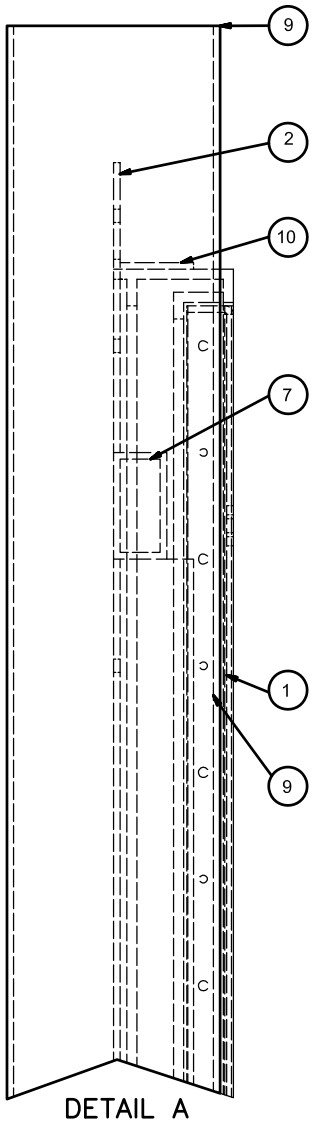
WARNING SIGN - CALTRANS CROSSING SIGN W/ OPTIONAL PLAQUES

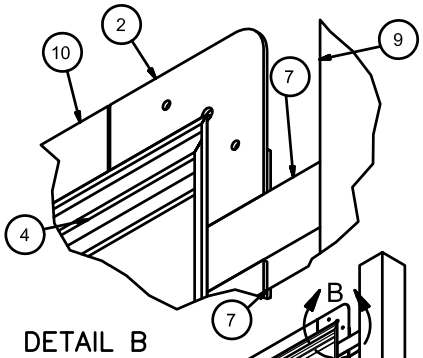
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1/2" = 1'-0"	DATE: 11/17/2011

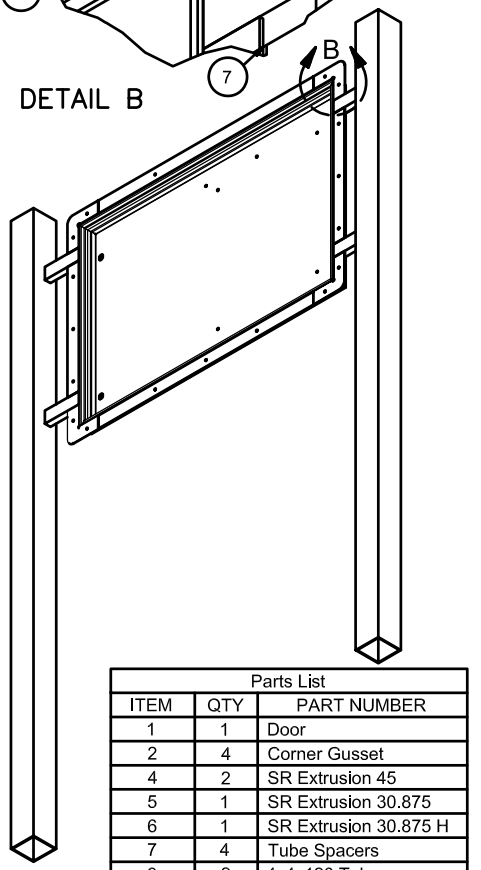
S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\8 Sign-TrafficRegulatory-Caltrans-X-ing.dwg

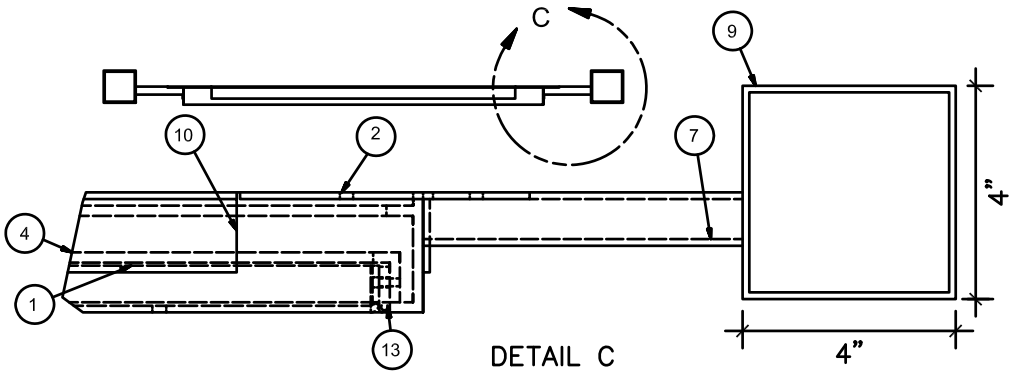












Parts List		
ITEM	QTY	PART NUMBER
1	1	Door
2	4	Corner Gusset
4	2	SR Extrusion 45
5	1	SR Extrusion 30.875
6	1	SR Extrusion 30.875 H
7	4	Tube Spacers
9	2	4x4x120 Tube
10	2	Angle 38
11	2	Angle 20
13	1	Hinge

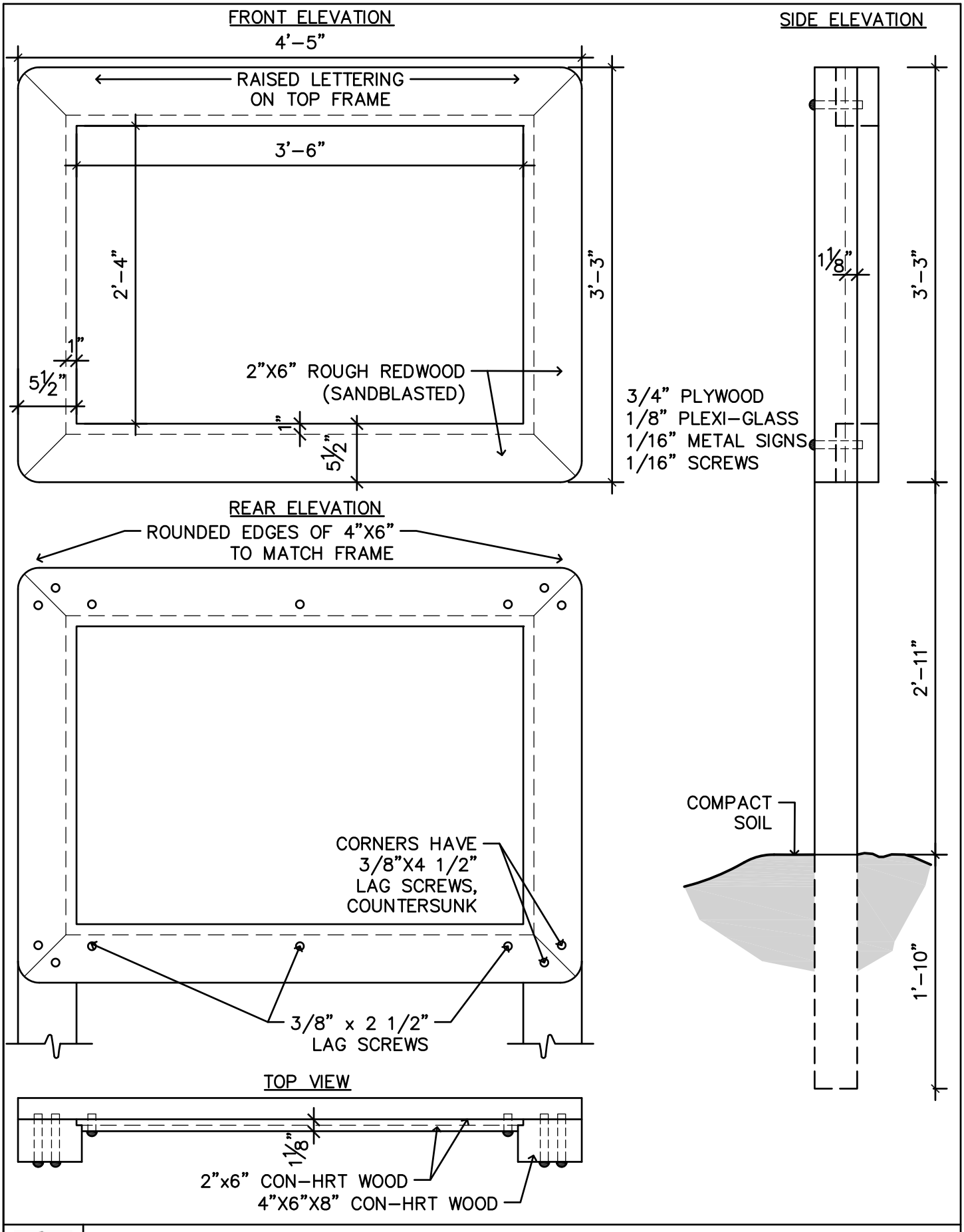
NOTE:
THIS DETAIL IS INTENDED FOR USE AS A GUIDELINE ONLY. A SUBSTITUTION MAY BE APPROVED BY DISTRICT REPRESENTATIVE.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT

SCALE: NTS | DATE: 03/2020

SIGN BOARD
NON-LITERATURE HOLDING UNIT

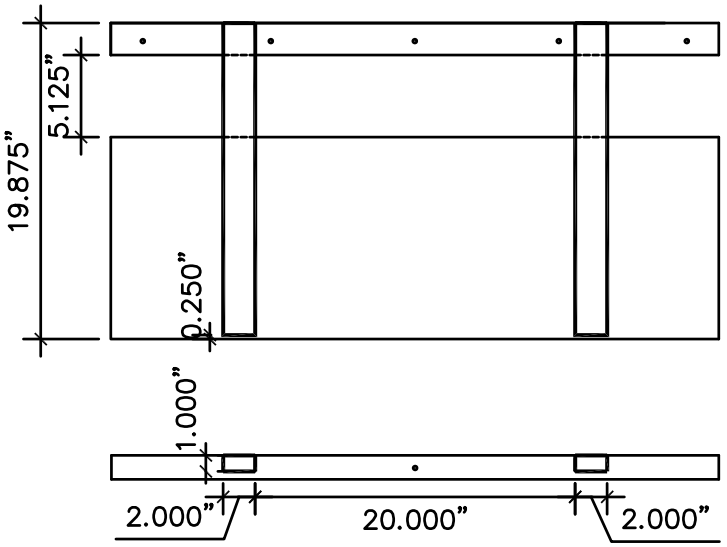
S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\8 Sign Board.dwg

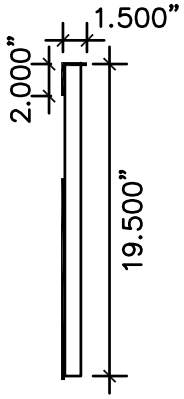


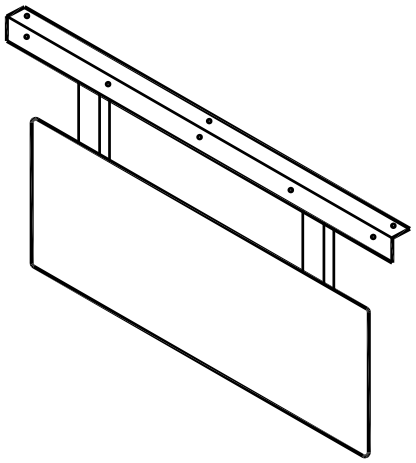
MAP AND BULLETIN BOARD

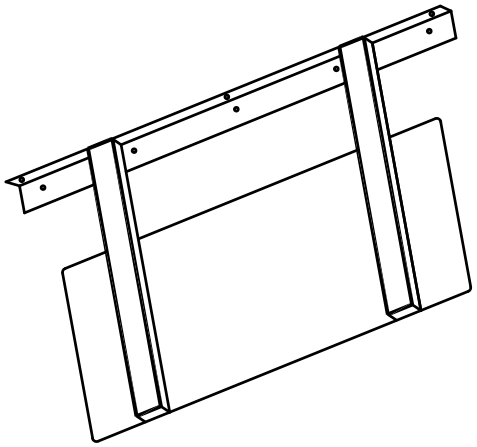
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1" = 1'-0"	DATE: 03/2020

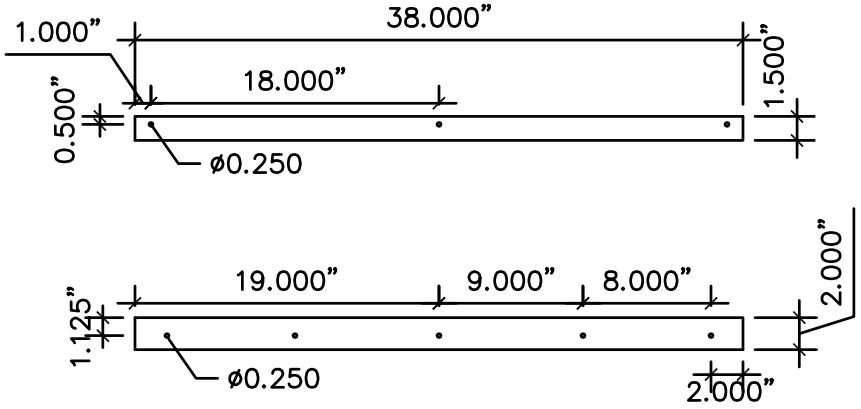
S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\8 Map and Bulletin Board.dwg









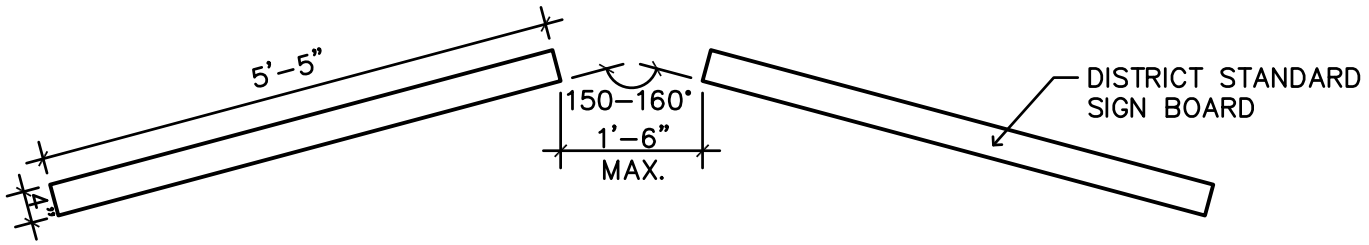


NOTES:

THIS DETAIL IS TYPICAL AND INTENDED FOR USE AS A GUIDELINE. ADJUSTMENTS TO THE ACTUAL DESIGN MAY NEED TO OCCUR, AS DIRECTED BY DISTRICT STAFF.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		REMOVABLE LITERATURE HOLDER
SCALE: 1" = 1'-0"	DATE: 03/2020	

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\8 Lit Holder.dwg



TYPICAL LAYOUT PLAN

NOTES:
1. REFER TO DISTRICT STANDARD SIGN BOARD AND BROCHURE BOX DETAILS.
2. PLACED SIGN BOARDS <1'-6" APART AT A 10-15° ANGLE.
3. SIGN BOARDS MUST BE KEPT LEVEL ON UNEVEN GROUND.
4. REMOVABLE LITERATURE HOLDER SHOULD BE INCLUDED ON MAP SIGN BOARD.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		SIGN BOARD TYPICAL LAYOUT
SCALE: 1/2"=1'-0"	DATE: 03/2020	

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\8 Sign Board Typical Layout.dwg

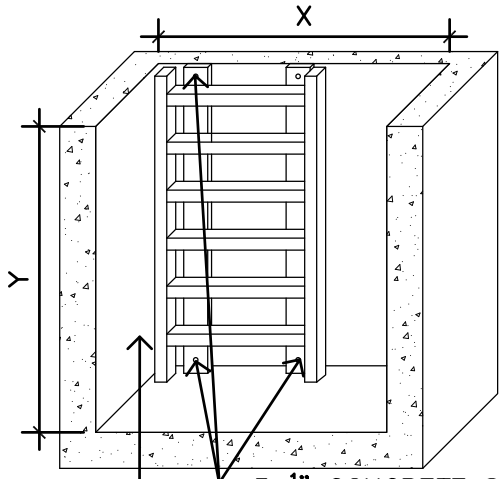
DETAILS AND SPECIFICATIONS GUIDELINES

SECTION 9

WILDLIFE

POSSIBLE WILDLIFE ESCAPE LADDERS FOR EXISTING SPRING BOXES

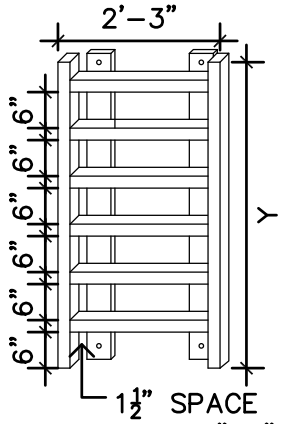
CONCRETE SPRING BOX



3 ½" CONCRETE SCREW (4) TO ATTACH LADDER TO WALL.
X = INTERIOR WIDTH,
Y = INTERIOR HEIGHT

± 1 ½" SPACE BETWEEN LADDER AND CONCRETE WALL

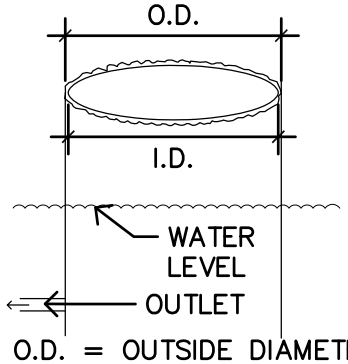
LADDER



- ROUGH REDWOOD 2"X4" BOARDS
- 6" BETWEEN LADDER RUNGS
- 2' LENGTH OF EACH HORIZONTAL RUNG
- 1½" BETWEEN LADDER VERTICALS & CONCRETE ATTACHMENTS VERTICALS
- 8–3½" EXT. DECK SCREWS PER RUNG –2 SCREWS FROM EACH VERTICAL INTO RUNG

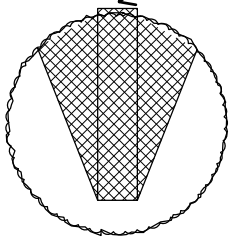
STAND PIPE STYLE SPRING BOX

SIDE VIEW



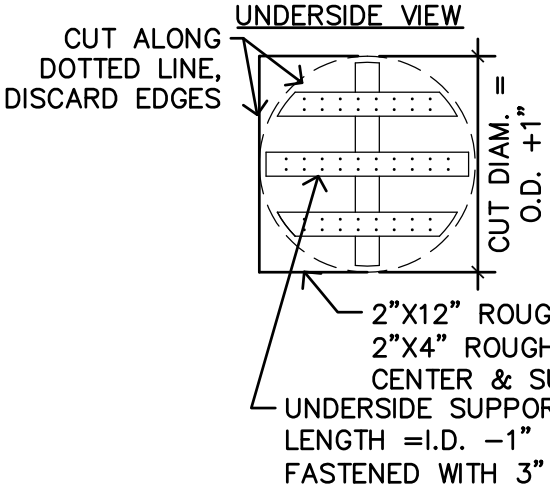
O.D. = OUTSIDE DIAMETER
I.D. = INSIDE DIAMETER

TOP VIEW (W/O LID)

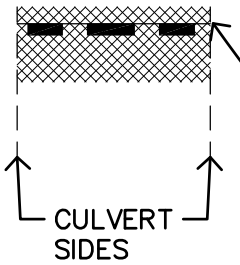


RECOMMENDED ESCAPE STRUCTURE 614/645 WATERING FACILITY WILDLIFE ESCAPE LADDER DESIGN
– RAISED EXPANDED METAL RAMP, ½" X #13 GAUGE
– HOOK ON THE CULVERT
– SIDES FLARED OUT @45°, CONTACTING CULVERT EDGE (SEE ATTACHED FIGURE)
– ESCAPE STRUCTURE MUST EXTEND DEEP ENOUGH TO BE SUBMERGED UNDER NORMAL HYDRO SCENARIOS.

LID DESIGN UNDERSIDE VIEW



LID SIDE VIEW

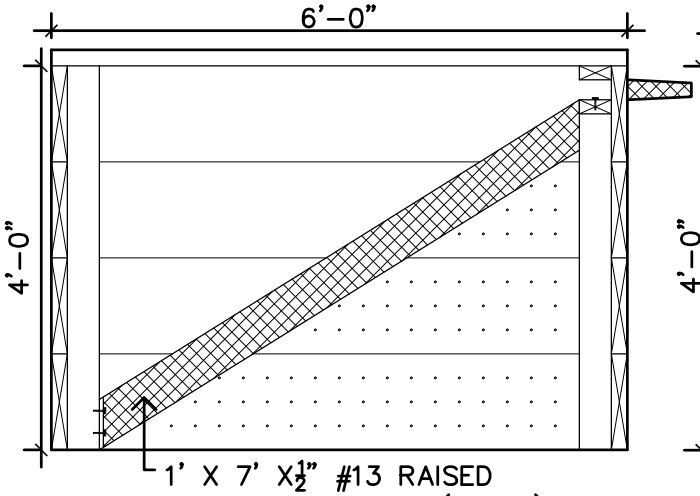


WILDLIFE ESCAPE LADDER FOR SPRING BOX

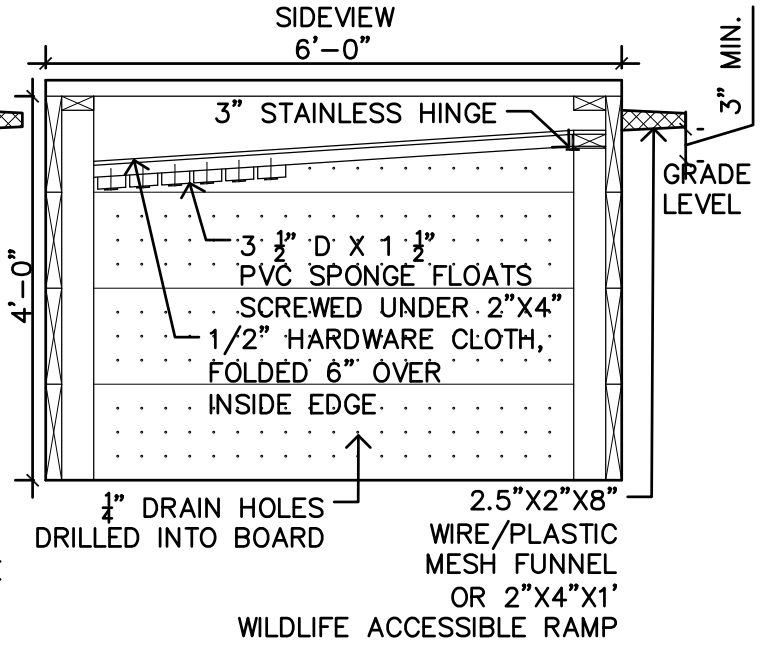
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 3/8" = 1'-0"	DATE: 03/2020

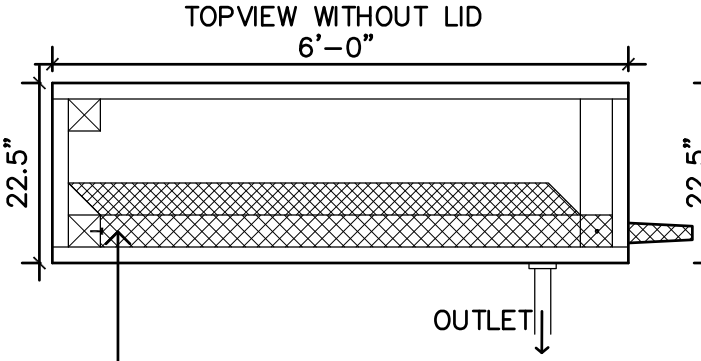
S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\9 Wildlife Escape Ladder for Spring box.dwg

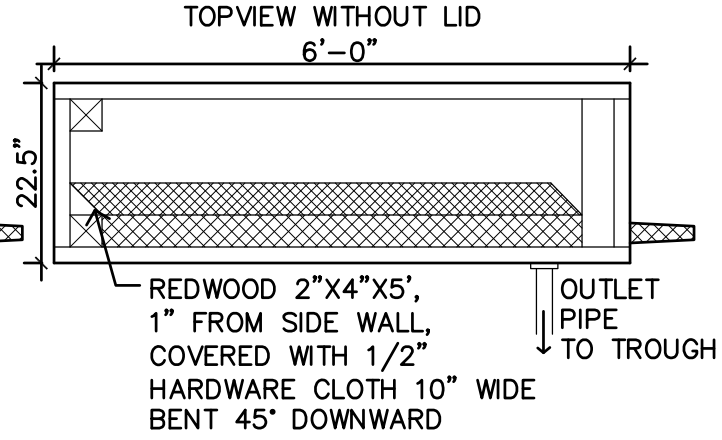
OPTION 1– FIXED ESCAPE RAMP
PREFERRED



OPTION 2– FLOATING ESCAPE RAMP

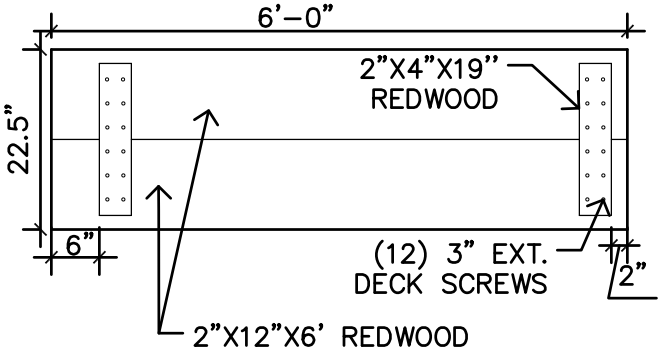




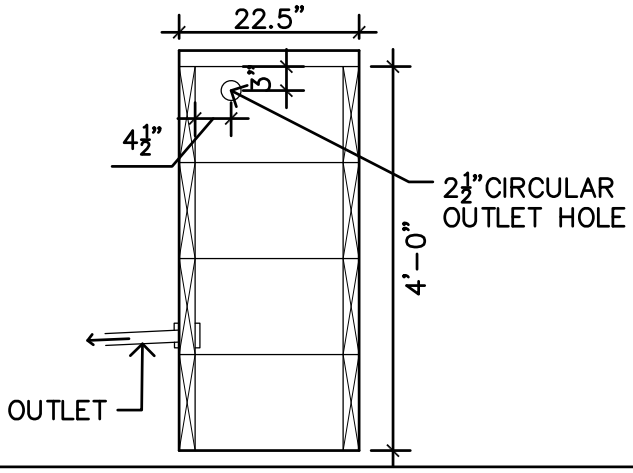


CONSTRUCTION MATERIALS:
2"X12" ROUGH REDWOOD: FOR BOX & LID
2"X4" ROUGH REDWOOD: SUPPORT FOR LID& LADDER
4"X4" ROUGH REDWOOD: CORNER SUPPORTS

OPTION 1& 2
BOTTOM VIEW (REMOVABLE LID)



OPTION 1& 2
ENDVIEW (OUTLET SIDE)

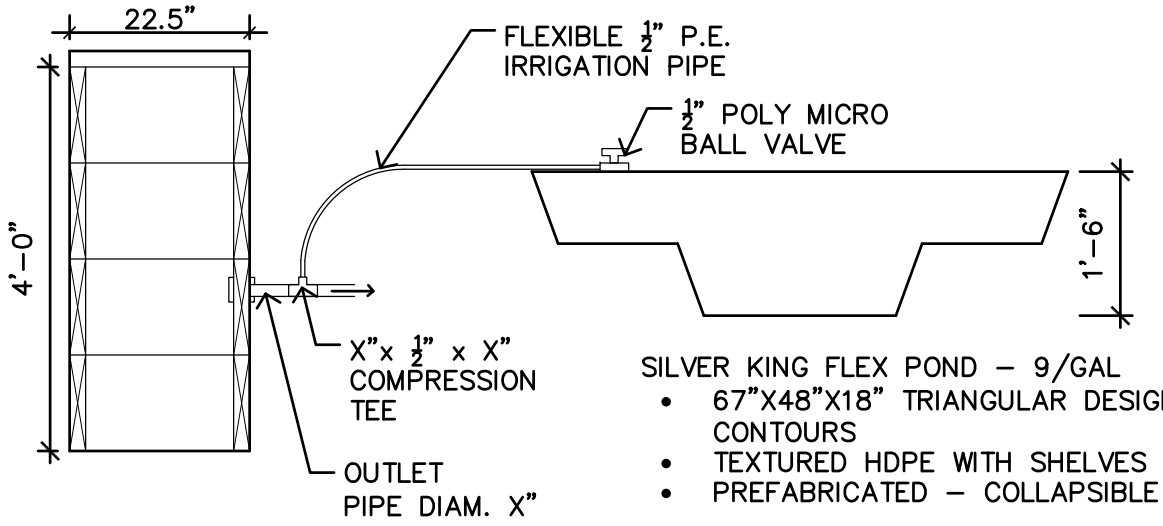


SPRING BOX

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: 1/2" = 1'-0"	DATE: 03/2020

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\9 Spring box.dwg

SPRING BOX OVERFLOW BASIN



SILVER KING FLEX POND – 9/GAL

- 67"X48"X18" TRIANGULAR DESIGN – FLEXIBLE TO NATURAL CONTOURS
- TEXTURED HDPE WITH SHELVES – ALLOW EDGES
- PREFABRICATED – COLLAPSIBLE DESIGN FOR TRANSPORT

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		SPRING BOX OVERFLOW BASIN
SCALE: 1/2" = 1'-0"	DATE: 03/2020	(DEVELOPING WATER SOURCES SPECIFICALLY FOR WILDLIFE USE)

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\9 Spring box overflow basin.dwg

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT

BEST MANAGEMENT PRACTICES (BMPs) MANUAL

(DRAFT)

DISCLAIMER
This is a working document and is provided for information only.
The information contained herein is subject to change.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT
BEST MANAGEMENT PRACTICES (BMPs) MANUAL

TABLE OF CONTENTS

1. Midpen BMPs for Routine Maintenance Activities in Water Courses 157

a. Characteristics of Storm-proofed Roads 159

b. Road Upgrading Treatments 160

c. Culvert and Trash Rack Installation 161

i. Permanent Culvert Typical Specifications 163

ii. Embedded Culvert Typical Specifications 165

d. Ford and Armored Fill Stream Crossings 167

i. Armored Fill Crossings 167

ii. Rock Ford (Road) Typical Specifications 169

iii. Rock Ford (Trail) Typical Specifications 171

e. Removal of Unstable Sidecast Material 172

i. Perched Fill Removal Typical Specifications 173

f. Outsloping Pitch for Roads 174

g. Ditch Relief Culverts 174

i. Ditch Relief Culverts Typical Specifications 175

h. Downspout Typical Specifications 176

i. Subdrain 177

j. Rolling Dip Installation Instructions 179

i. Rolling Dip Specifications 179

ii. Reverse Grade Dip, Existing Road/Trail 180

iii. Reverse Grade Dip, New Trail Construction 181

k. Waterbar Typical Specifications 182

l. Brushlayering with Soil Wrap 184

m. Brushlayering with Rock Toe Protection 188

n. Brush Mattress (Brush Mat) 190

o. Coir Rolls with Brushlayering 195

p. Energy Dissipater 198

i. Energy Dissipater Typical Specification 200

q. Erosion Control Blankets and Mats 201

r. Grass-lined Channels 206

s. Instream Diversion Techniques 209

t. Instream Isolation Techniques 212

u. Large Woody Debris Management and Removal 217
v. Live Pole Drains 219
w. Live Siltation 222
x. Modified Live Siltation 224
y. Live Staking 226
z. Pole Planting 229
aa. Riprap 231
bb. Riprap Revetment 234
cc. Rootwad Revetment with Vegetated Riprap 235
dd. Silt Fence Installation 239
i. Straw Silt Fence Typical Specifications 243
ee. Slope Drain 244
ff. Straw Rolls 247
i. Straw Roll Placement Typical Specifications 248
gg. Structural Streambank Stabilization 249
hh. Temporary Diversion Dike 252
ii. Vegetated Mechanically Stabilized Earth 254
jj. Vegetated Riprap 257
kk. Wattle (Live Fascines) 264
ll. Trail Puncheons 268
mm. Bridge Abutment Armor 269
nn. Temporary Splitter Stream Crossing 270
oo. Knick 271
pp. Inside Ditch 272
qq. Trail Cross Slopes 273
rr. Cross Vane Structure Typical Specifications 274
ss. Rock Chute/ Step Pool Typical Specifications 275
tt. Log Grade Check Typical Specifications 279
uu. Erosion Control Notes 280
vv. Crossing Removal 281
ww. Rock Grade Check Typical Specifications 282
xx. Wood Grade Check Typical Specifications 283

2. Midpen BMP Revegetation Plans (c4.2 2017) 284

3. Midpen Major Watersheds Plan 295

4. 2018 CDFW LWD FRGP Manual 296

a. Part VIII Project Implementation
i. Selection of Stable Sites 297

ii. Hydraulic Impacts 299
iii. Selection of Materials 302
iv. Anchoring Techniques 306
v. Instream Habitat Improvements 320
5. San Francisco Dusky-Footed Woodrat (SFDFW) Protocol 340
6. Bat Species BMPs 344

Regional OpenSpace | Midpeninsula Regional Open Space District

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT

BEST MANAGEMENT PRACTICIES (BMPs) FOR ROUTINE MAINTENANCE ACTIVITES IN WATER COURSES

Sources

*	California Salmonid Stream habitat Restoration Manual, State of California Resources Agency, Department of Fish and Game (2002)
+	Timothy C. Best, Certified Engineering Geologist (CEG), Engineering Geology and Hydrology, Santa Cruz, California (2006-2012)
^	Erosion Draw 5.0, Bio Draw 3.0, Environmentally-Sensitive Streambank Restoration (ESenSS), John McCullah, Salix Applied Earthcare, Redding California (2004)
°	Midpeninsula Regional Open Space District (2007)

Page #	Source	BMP#	BMP Title	Detail
1	*	1	Characteristics of Storm-proofed Roads	N
2	*	2	Road Upgrading Treatments	N
3	*	3	Culvert and Trash Rack Installation	Y
5	+		Permanent Culvert Typical Specifications	Y
7	+		Embedded Culvert Typical Specifications	Y
9	*	4	Ford and Armored Fill Stream Crossings	Y
10	*		Armored Fill Crossings	Y
11	+		Rock Ford (Road) Typical Specifications	Y
13	+		Rock Ford (Trail) Typical Specifications	Y
14	*	5	Removal of Unstable Sidecast Material	Y
15	+		Perched Fill Removal Typical Specifications	Y
16	*	6	Outsloping Pitch for Roads	N
16	*	7	Ditch Relief Culverts	Y
17	+		Ditch Relief Culverts Typical Specifications	Y
18	+	8	Downspout Typical Specifications	Y
19	+	9	Subdrain	Y
20	*	10	Rolling Dip Installation Instructions	N
21	*		Rolling Dip Specifications	Y
22	+		Reverse Grade Dip, Existing Road/Trail	Y
23	+		Reverse Grade Dip, New Trail Construction	Y
24	+	11	Waterbar Typical Specifications	Y
25	+		Large Waterbar Typical Specifications	Y
26	^	12	Brushlayering with Soil Wrap	Y
30	^	13	Brushlayering with Rock Toe Protection	Y
32	^	14	Brush Mattress (Brush Mat)	Y
37	^	15	Coir Rolls with Brushlayering	Y
40	^	16	Energy Dissapater	Y

42	*		Energy Dissapater Typical Specification	Y
43	^	17	Erosion Control Blankets and Mats	Y
48	^	18	Grass-lined Channels	Y
51	^	19	Instream Diversion Techniques	Y
54	^	20	Instream Isolation Techniques	Y
59	°	21	Large Woody Debris Management and Removal	N
61	^	22	Live Pole Drains	Y
64	^	23	Live Siltation	Y
66	^	24	Modified Live Siltation	Y
68	^	25	Live Staking	Y
71	^	26	Pole Planting	Y
73	^	27	Riprap	Y
76	*	28	Riprap Revetment	Y
77	^	29	Rootwad Revetment with Vegetated Riprap	Y
81	^	30	Silt Fence Installation	Y
85	*		Straw Silt Fence Typical Specifications	Y
86	^	31	Slope Drain	Y
88	^	32	Straw Rolls	Y
90	*		Straw Roll Placement Typical Specifications	Y
91	^	33	Structural Streambank Stabilization	Y
94	^	34	Temporary Diversion Dike	Y
96	^	35	Vegetated Mechanically Stabilized Earth	Y
99	^	36	Vegetated Riprap	Y
106	^	37	Wattle (Live Fascines)	Y
110	*	38	Trail Puncheons	Y
111	*	39	Bridge Abutment Armor	Y
112	*	40	Temporary Splitter Stream Crossing	Y
113	*	41	Knick	Y
114	*	42	Inside Ditch	Y
115	*	43	Trail Cross Slopes	Y
116	*	44	Cross Vane Structure Typical Specifications	Y
117	*	45	Rock Chute/Step Pool Typical Specifications	Y
121	*	46	Log Grade Check Typical Specifications	Y
122	*	47	Erosion Control Notes	N
123	*	48	Crossing Removal	Y
124	*	49	Rock Grade Check Typical Specifications	Y
125	*	50	Wood Grade Check Typical Specifications	Y

Characteristics of Storm-proofed Roads

Storm-proofed stream crossings

- All stream crossings have a drainage structure designed for the 100-year flow (with debris).
- Stream crossings have no diversion potential (functional critical dips are in place).
- Stream crossing inlets have low plug potential (trash barriers & graded drainage).
- Protect stream crossing outlets from erosion (extended, transported or dissipated).
- Culvert inlet, outlet and bottom are open and in sound condition.
- Undersized culverts in deep fills (greater than backhoe reach) have emergency overflow culvert.
- Bridges have stable, non-eroding abutments and do not significantly restrict 100-year flood flow.
- Fills are stable (unstable fills are removed or stabilized).
- Road surfaces and ditches are "disconnected" from streams and stream crossing culverts.
- Class I stream crossings meet DFG and NMFS fish passage criteria (Part IX).

Storm-proofed fills

- Unstable and potentially unstable road and landing fills are excavated or structurally stabilized.
- Excavated spoil is placed in locations where it will not enter a stream.
- Excavated spoil is placed where it will not cause a slope failure or landslide.

Road surface drainage

- Road surfaces and ditches are "disconnected" from streams and stream crossing culverts.
- Ditches are drained frequently by functional rolling dips or ditch relief culverts.
- Outflow from ditch relief culverts does not discharge to streams.
- Gullies (including those below ditch relief culverts) are dewatered to the extent possible.
- Ditches do not discharge (through culverts or rolling dips) onto active or potential landslides.
- Decommissioned roads have permanent drainage and do not rely on ditches.
- Fine sediment contributions from roads, cutbanks and ditches are minimized by utilizing seasonal closures and installing a variety of surface drainage techniques including berm removal, road surface shaping (outsloping, insloping or crowning), rolling dips, ditch relief culverts, water bars and other measures to disperse road surface runoff and reduce or eliminate sediment delivery to the stream.

Figure X-9. Common characteristics of storm-proofed roads.

Road Upgrading Treatments

In general, road upgrading consists of stream crossing upgrades, excavation of selected unstable or potential unstable fillslopes, and dispersion of road runoff (Figure X-9).

Stream Crossing Upgrading

- Eliminate stream diversion potential by dipping the entire stream crossing fill or by installing a critical dip (Figure X-13). A critical dip is a rolling dip that is constructed on or close to the down-road hinge line of a stream crossing that displays a diversion potential.
- Upgrade stream crossings by installing culverts sized for the 100 year flood flow, including sufficient capacity for expected wood and sediment (Figure X-13 and Figure X-14). These requirements are determined by both field observation and calculations using a procedure such as the Rational Formula (PWA 1994). Where necessary, install inlet protection (trash barriers) to prevent culvert plugging on non-fish bearing streams.
- Replace large high-risk culverts with bridges. Consider replacing any culvert greater than 72 inches in diameter with a bridge, especially in Class 1 streams.
- Replace culverted fills with hardened fords or armored fills (Figure X-15 and Figure X-16) on non-fish bearing streams where regular winter inspections and culvert maintenance is not feasible, or on steep gradient stream crossings where the culvert plug potential will always be high.
- Install armored crossings (Figure X-15 and Figure X-16) in areas where debris torrents are common, can be expected or where small steep gradient streams cross the road. Armored fill crossings are for sites where it will be very difficult to prevent frequent culvert plugging due to high amounts of transported sediment and debris. The treatment requires excavating the fill in the stream crossing and leaving a very broad dip in the axis of the natural channel, with long and gently sloping ramps into and out of the stream crossing. This treatment may be most appropriate along roads built on a floodplain and terrace, or where roads cross steep gradient stream channels with relatively small depths of fill at the outboard edge of the road.

Excavation of Unstable Fillslope

Remove unstable sidecast and fill materials from steep slopes (Figure X-17), steep headwater swales, and along road approaches to deeply incised stream channels, where there is potential for sediment delivery.

Stream Crossing Culvert Installation for Non-fish Bearing Streams

- Align culverts with the natural stream channel orientation to ensure proper function, prevent bank erosion and minimize debris plugging problems.
- Place culverts at the base of the fill and at the grade of the original streambed or install a downspout past the base of the fill (Figure X-14).
- Culverts should be set slightly below the original stream grade so that the water drops several inches as it enters the pipe.
- Culvert beds should be composed of rock-free soil or gravel, evenly distributed under the length of the pipe.
- Compact the base and sidewall material before placing the pipe in its bed.
- To allow for sagging after burial, an upward camber should be between 1.5 to 3 inches per 10 feet culvert pipe length.
- Backfill material should be free of rocks, limbs or other debris that could dent or puncture the pipe or allow water to seep around the pipe.
- Cover one end of the culvert pipe, then the other end. Once the ends are secure, cover the center.
- Tamp and compact backfill material throughout the entire process, using water as necessary for compaction.
- Backfill compacting will be done in 0.5 - 1.0 foot lifts until 1/3 of the diameter of the culvert has been covered (Figure X-14). A gas powered tamper or sheep's foot roller should be used for this work.
- Armor inlets and outlets with rock, or mulch and seed with grass as needed (not all stream crossings need to be armored)
- Install a trash rack (only on non-fish bearing streams) upstream from the culvert inlet where there is a high hazard of floating debris plugging the culvert
- Push layers of fill over the crossing to achieve the final design road grade, at a minimum of one third to one-half the culvert diameter

Trash Racks

All trash racks require on-going maintenance. Two efficient trash rack designs include:

- On streams with culverts 48 inches diameter or greater, build a grate or sieve across the entire channel to collect the large material that would otherwise plug the culvert inlet. Locate the trash rack anywhere from five to 25 feet upstream from the culvert inlet.
- On streams with culverts under 48 inches diameter, set a single post vertically in the stream bed, centered directly upstream from the culvert inlet, and located one culvert diameter distance upstream from the inlet. Size the post and set the post deep into the streambed to withstand the size of woody debris transported by the stream during extreme runoff events.

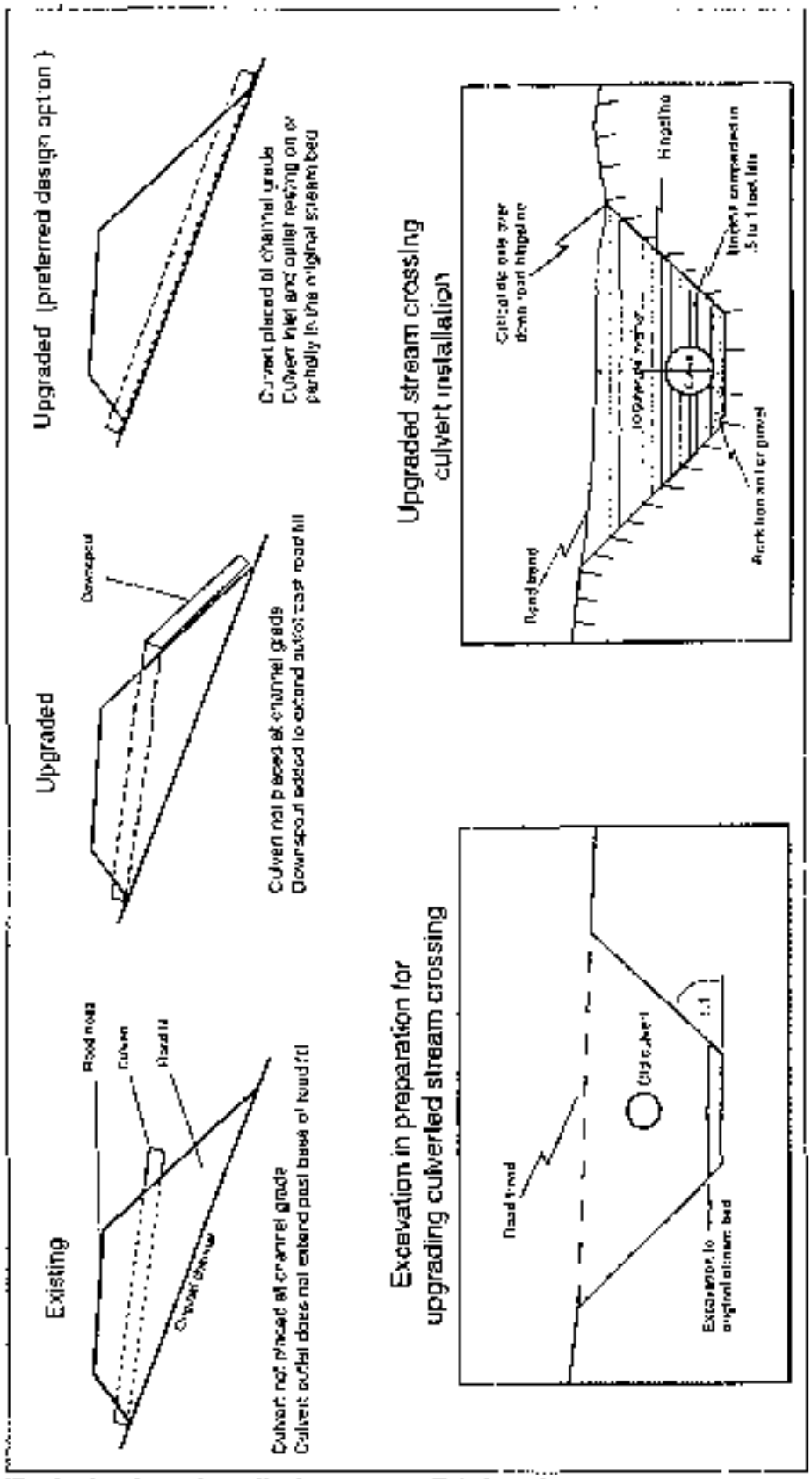
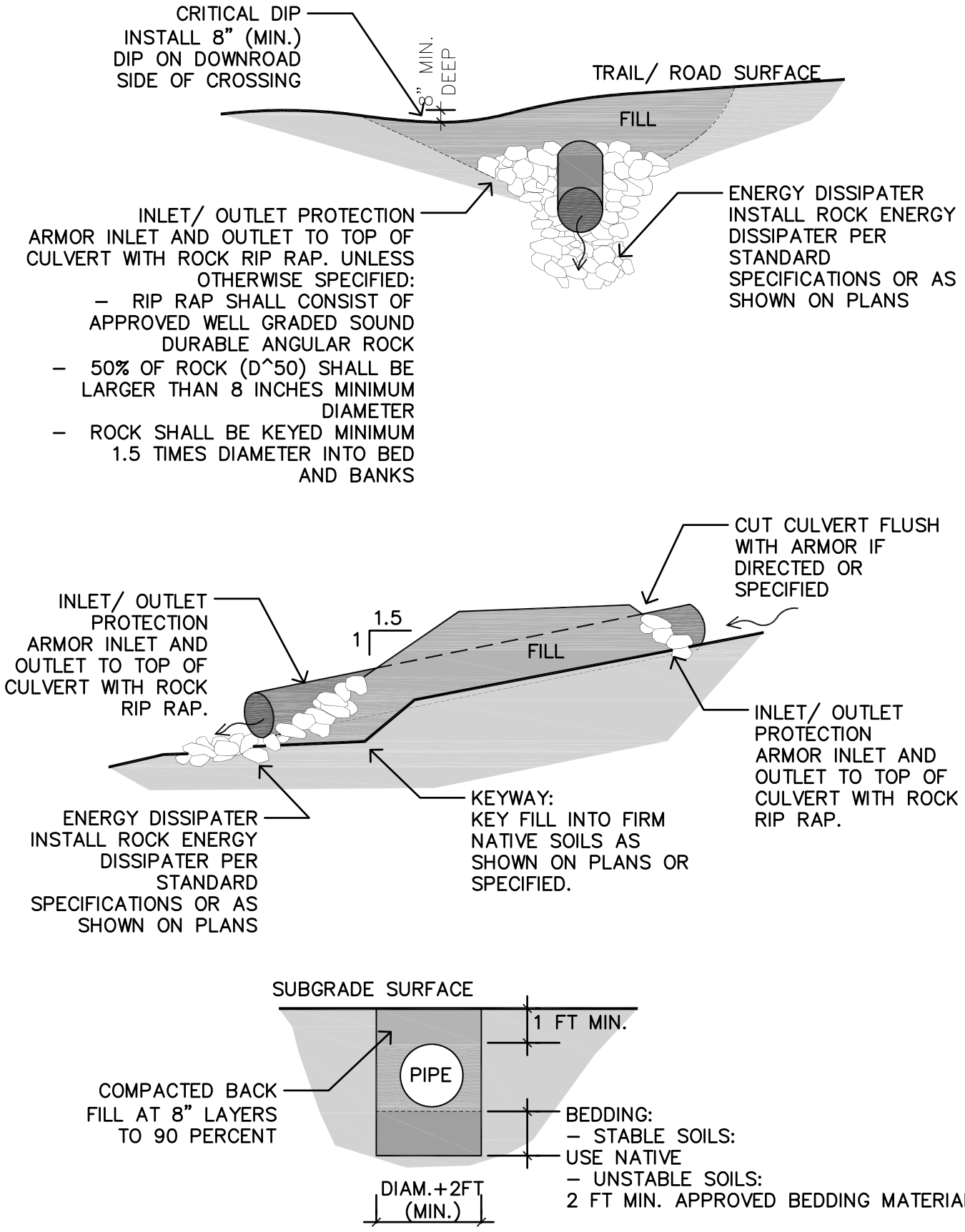


Figure X-14. Typical culvert installation on non fish-bearing streams.



PERMANENT CULVERT - RURAL ROAD

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 permanent culvert.dwg

©TIMOTHY C. BEST, CEG

NOTES

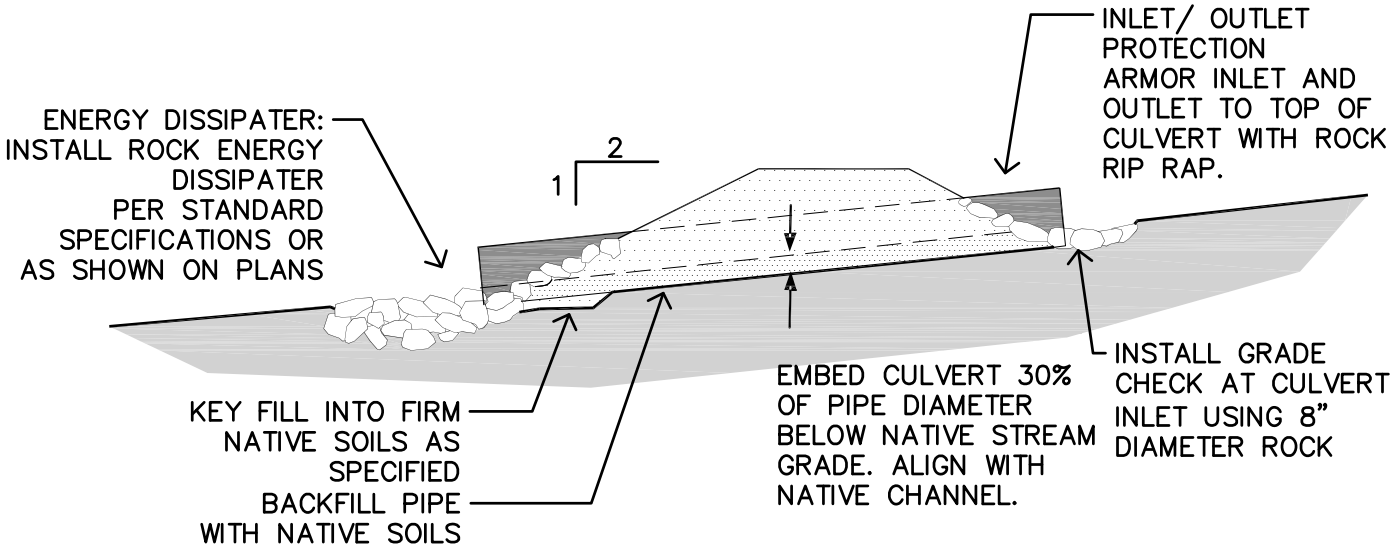
- CULVERT ORIENTATION
  - CULVERT SHOULD BE INSTALLED AT THE NATURAL STREAM LEVEL, GRADE AND ORIENTATION
- CULVERT BED
  - THE WIDTH OF TRENCHES SHALL PERMIT SATISFACTORY JOINING AND THROUGH TAMPING OF THE BACKFILL MATERIAL.
  - THE CULVERT BED SHALL BE CLEAN AND FREE OF LARGE WOODY DEBRIS AND LARGE ROCKS. UNSUITABLE MATERIAL SHALL BE REPLACED WITH SELECTED GRANULAR FOUNDATION MATERIAL AND COMPACTED TO OBTAIN UNIFORM BED.
  - WHERE ROCK, HARDPAN, OR OTHER UNYIELDING MATERIAL IS ENCOUNTERED, IT SHALL BE REMOVED BELOW THE FOUNDATION GRADE FOR A DEPTH OF AT LEAST 1 FOOT AND A WIDTH OF AT LEAST 2 FEET PLUS THE CULVERT DIAMETER. THIS MATERIAL SHALL BE REPLACED WITH SELECTED ENGINEER FILL.
  - THE INLET TO THE CULVERT SHOULD BE A COUNTERSUNK 10% OF THE PIPE DIAMETER BELOW STREAM GRADE SO THAT THE WATER FALLS INTO THE CULVERT INLET.
- LAYING PIPE
  - CULVERT SHALL BE LAID IN CENTER OF TRENCH ON UNIFORM GRADE LINE TO CONFORM TO THE FLOW LINE OF THE STREAM. THE ENTIRE LENGTH OF PIPE SHALL BE IN CONTACT WITH THE CULVERT BEDDING.
  - UNLESS OTHERWISE SPECIFIED, THE CULVERT SHALL HAVE A MINIMUM GRADE OF 2%.
  - CULVERT SHALL BE JOINED AND ANCHORED PER MANUFACTURES GUIDELINES.
- BACKFILL
  - FILL SHALL BE KEYED AND BENCH INTO FIRM NATIVE SOILS. AREAS TO RECEIVE FILL SHALL BE STRIPPED TO REMOVE VEGETATION, NEAR SURFACE ROOTS, BRUSH, HIGHLY ORGANIC SOILS AND OTHER UNSUITABLE FILL MATERIAL.
  - SELECT MINERAL SOIL SHALL BE USED FOR CULVERT BACK FILL. THE BACK FILL SHALL HAVE NO ROCKS GREATER THAN 3 INCHES IN ANY DIMENSIONS PLACED CLOSER THAN 1 FOOT TO THE CULVERT.
  - BACKFILL SHALL BE ADEQUATELY COMPACTED THROUGHOUT THE ENTIRE PROCESS TO A DEGREE GREATER THAN THE SURROUNDING MATERIALS (APPROXIMATELY 85 PERCENT RELATIVE COMPACTION). DURING PLACEMENT AND COMPACTION OF ILL, THE MOISTURE CONTENT OF THE MATERIALS BEING PLACED SHALL BE MAINTAINED.
  - FILL SHALL BE BROUGHT UP TO GRADE AT A 1.5:1 SLOPE UNLESS OTHERWISE SPECIFIED.
- CULVERTS
  - CULVERTS SHALL BE SMOOTH BORE, DOUBLE WALL (ASTM D3350 AND AASHTO M294, TYPE S)
  - CULVERTS SHALL BE CUT FLUSH WITH ARMORED EMBANKMENT/HEADWALL IF DIRECTED OR SPECIFIED.
- INLET/OUTLET PROTECTION
  - ARMOR INLET AND OUTLET TO TOP OF CULVERT WITH ROCK RIP RAP.
  - RIPRAP SHALL CONSIST OF APPROVED WELL GRADED SOUND DURABLE ANGULAR ROCK UNLESS OTHERWISE SPECIFIED.
  - 50% OF ROCK (D_{50}) SHALL BE LARGER THAN 8 INCHES MINIMUM DIAMETER UNLESS OTHERWISE SPECIFIED.
  - ROCK SHALL BE KEYED MINIMUM 1.5 TIMES DIAMETER INTO BED AND BANKS UNLESS OTHERWISE SPECIFIED.
- ENERGY DISSIPATER
  - CULVERT SHALL DISCHARGE ONTO ROCK APRON PER GENERAL SPECIFICATIONS.
- EROSION CONTROL
  - ON RUNNING STREAMS, WATER WILL BE PUMPED OR DIVERTED PAST THE CROSSING AND INTO THE DOWNSTREAM CHANNEL DURING THE CONSTRUCTION PROCESS.
  - CRITICAL DIP (8" MIN) SHALL BE INSTALLED ON THE DOWN ROAD SIDE OF CROSSING.
  - EXPOSED SOILS SHALL BE MULCHED PER STANDARD SPECIFICATION. INSTALL COIR ROLL AT BASE OF EXPOSED SOILS.
- DEPARTMENT OF FISH AND GAME AGREEMENT
  - CONFORM TO DEPARTMENT OF FISH AND GAME 1600 AGREEMENT WHERE APPLICABLE.

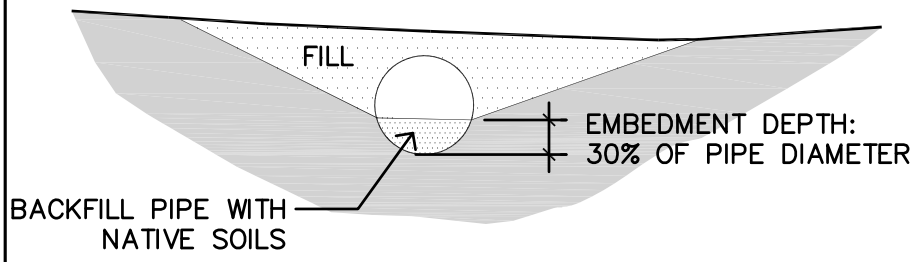
PERMANENT CULVERT SPECIFICATION

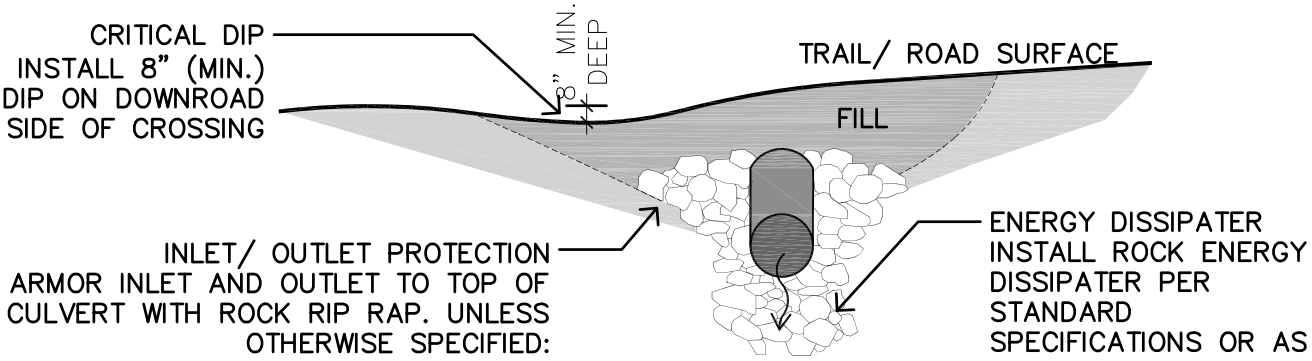
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

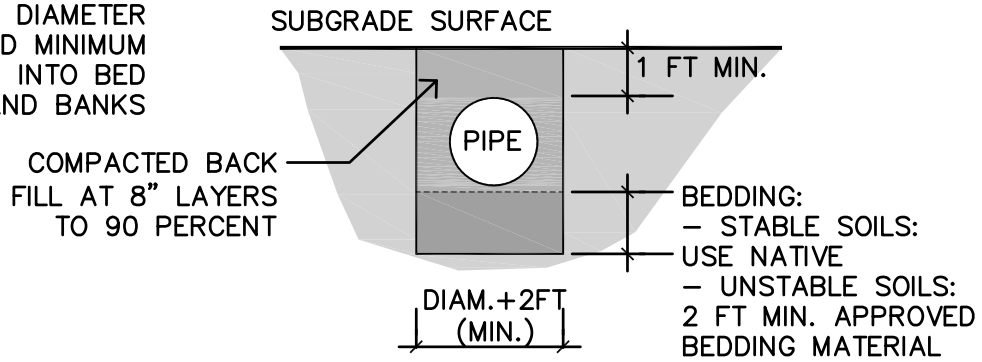
S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 permanent culvert notes.dwg

©TIMOTHY C. BEST, CEG









EMBEDDED CULVERT

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 05/2009

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 embedded culvert.dwg

©TIMOTHY C. BEST, CEG

NOTES

- CULVERT ORIENTATION
  - CULVERT SHOULD BE INSTALLED AT THE NATURAL STREAM LEVEL, GRADE AND ORIENTATION
- CULVERT BED
  - THE WIDTH OF TRENCHES SHALL PERMIT SATISFACTORY JOINING AND THROUGH TAMPING OF THE BACKFILL MATERIAL
  - THE CULVERT BED SHALL BE CLEAN AND FREE OF LARGE WOODY DEBRIS AND LARGE ROCKS. UNSUITABLE MATERIAL SHALL BE REPLACED WITH SELECTED GRANULAR FOUNDATION MATERIAL AND COMPACTED TO OBTAIN UNIFORM BED
  - WHERE ROCK, HARDPAN, OR OTHER UNYIELDING MATERIAL IS ENCOUNTERED, IT SHALL BE REMOVED BELOW THE FOUNDATION GRADE FOR A DEPTH OF AT LEAST 1 FOOT AND A WIDTH OF AT LEAST 2 FEET PLUS THE CULVERT DIAMETER. THIS MATERIAL SHALL BE REPLACED WITH SELECTED ENGINEER FILL.
- BACKFILL
  - THE BOTTOM OF THE CULVERT SHALL BE BURIED (EMBEDDED) INTO THE NATIVE CHANNEL NOT LESS THAN 30%
- LAYING PIPE
  - CULVERT SHALL BE LAID IN CENTER OF TRENCH ON UNIFORM GRADE LINE TO CONFORM TO THE FLOW LINE OF THE STREAM. THE ENTIRE LENGTH OF PIPE SHALL BE IN CONTACT WITH THE CULVERT BEDDING
  - THE BOTTOM OF THE CULVERT SHALL BE BURIED (EMBEDDED) INTO THE NATIVE CHANNEL NOT LESS THAN 30% OF THE CULVERT DIAMETER AND BACKFILLED WITH APPROVED NATIVE SOIL
  - CULVERT SHALL BE JOINED AND ANCHORED PER MANUFACTURES GUIDELINES
- CULVERTS
  - FILL SHALL BE KEYED AND BENCH INTO FIRM NATIVE SOILS. AREAS TO RECEIVE FILL SHALL BE STRIPPED TO REMOVE VEGETATION, NEAR SURFACE ROOTS, BRUSH, HIGHLY ORGANIC SOILS AND OTHER UNSUITABLE FILL MATERIAL.
  - SELECT MINERAL SOIL SHALL BE USED FOR CULVERT BACK FILL. THE BACK FILL SHALL HAVE NO ROCKS GREATER THAN 3 INCHES IN ANY DIMENSIONS PLACED CLOSER THAN 1 FOOT TO THE CULVERT.
  - BACKFILL SHALL BE ADEQUATELY COMPACTED THROUGHOUT THE ENTIRE PROCESS TO A DEGREE GREATER THAN THE SURROUNDING MATERIALS (APPROXIMATELY 85 PERCENT RELATIVE COMPACTION). DURING PLACEMENT AND COMPACTION OF FILL, THE MOISTURE CONTENT OF THE MATERIALS BEING PLACED SHALL BE MAINTAINED.
  - FILL SHALL BE BROUGHT UP TO GRADE AT A 1.5:1 SLOPE UNLESS OTHERWISE SPECIFIED
  - CULVERTS SHALL BE SMOOTH BORE, DOUBLE WALL (ASTM D3350 AND AASHTO M294, TYPE S)
  - CULVERTS DISTORTED MORE THAN 10% OF NORMAL DIMENSION, RUPTURED OR BROKEN SHALL BE REPLACED
  - CULVERTS SHALL BE CUT FLUSH WITH ARMORED EMBANKMENT/HEADWALL IF DIRECTED OR SPECIFIED
- INLET/ OUTLET PROTECTION
  - ARMOR INLET AND OUTLET TO TOP OF CULVERT WITH ROCK RIP RAP
  - RIPRAP SHALL CONSIST OF APPROVED WELL GRADED SOUND DURABLE ANGULAR ROCK UNLESS OTHERWISE SPECIFIED
  - 50% OF ROCK (D50) SHALL BE LARGER THAN 8 INCHES MINIMUM DIAMETER UNLESS – THERWISE SPECIFIED
  - ROCK SHALL BE KEYED MINIMUM 1.5 TIMES DIAMETER INTO BED AND BANKS UNLESS – THERWISE SPECIFIED
  - INSTALL ROCK GRADE CHECK AT CULVERT INLET USING 8 INCH MINIMUM DIAMETER ROCK. EXTEND ROCK 2 TIMES CULVERT DIAMETER UPSTREAM.
- ENERGY DISSIPATER
  - CULVERT SHALL DISCHARGE ONTO ROCK APRON PER GENERAL SPECIFICATIONS
- EROSION CONTROL
  - ON RUNNING STREAMS, WATER WILL BE PUMPED OR DIVERTED PAST THE CROSSING AND INTO THE DOWNSTREAM CHANNEL DURING THE CONSTRUCTION PROCESS.
  - CRITICAL DIP (8"MIN) SHALL BE INSTALLED ON THE DOWN ROAD SIDE OF CROSSING
  - EXPOSED SOILS SHALL BE MULCHED PER STANDARD SPECIFICATION. INSTALL COIR ROLL AT BASE OF EXPOSED SOILS
- DEPARTMENT OF FISH AND GAME AGREEMENT
  - CONFORM TO DEPARTMENT OF FISH AND GAME 1600 AGREEMENT WHERE APPLICABLE

EMBEDDED CULVERT SPECIFICATION

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 05/2009

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 embedded culvert notes.dwg

©TIMOTHY C. BEST, CEG

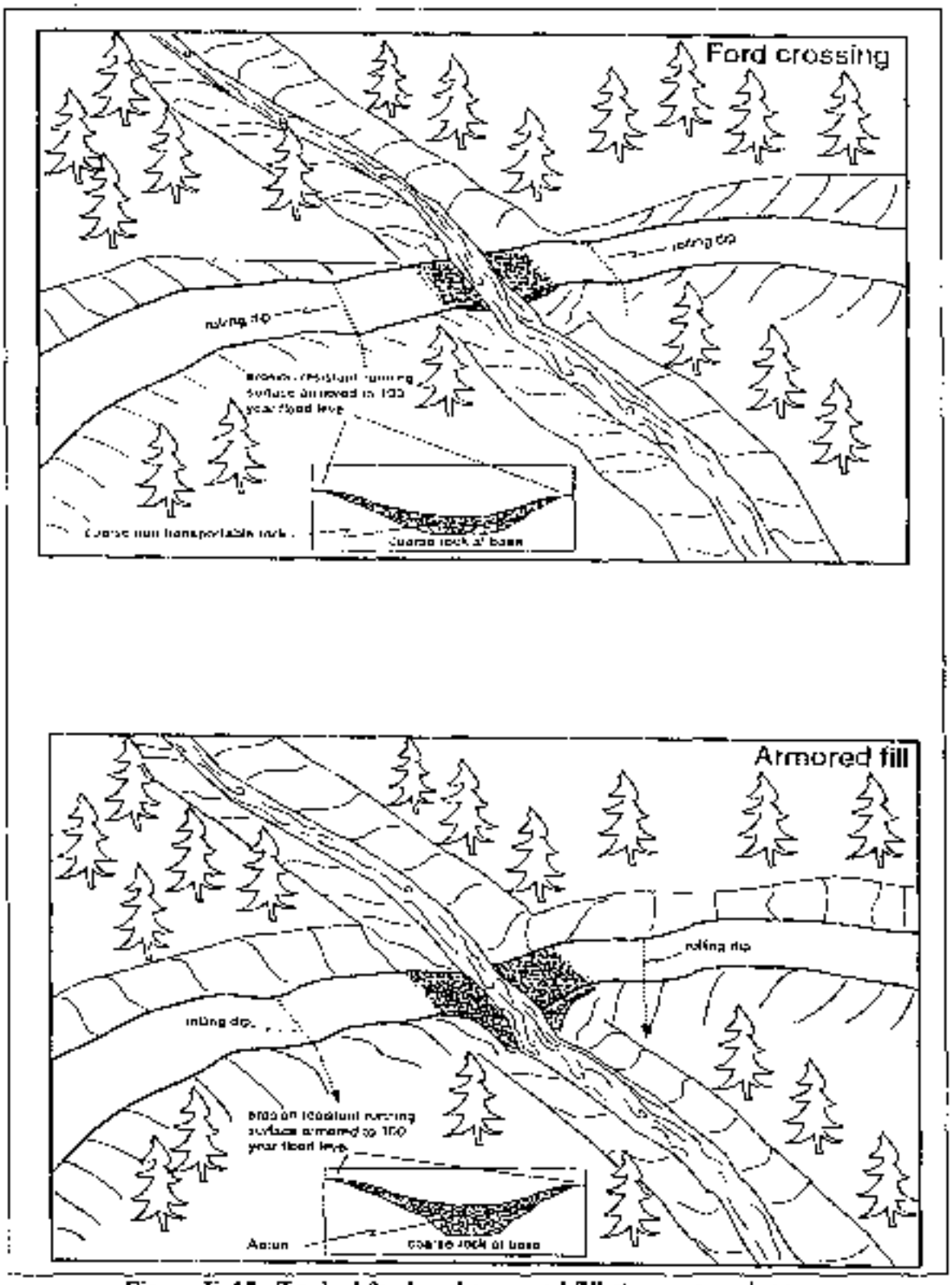
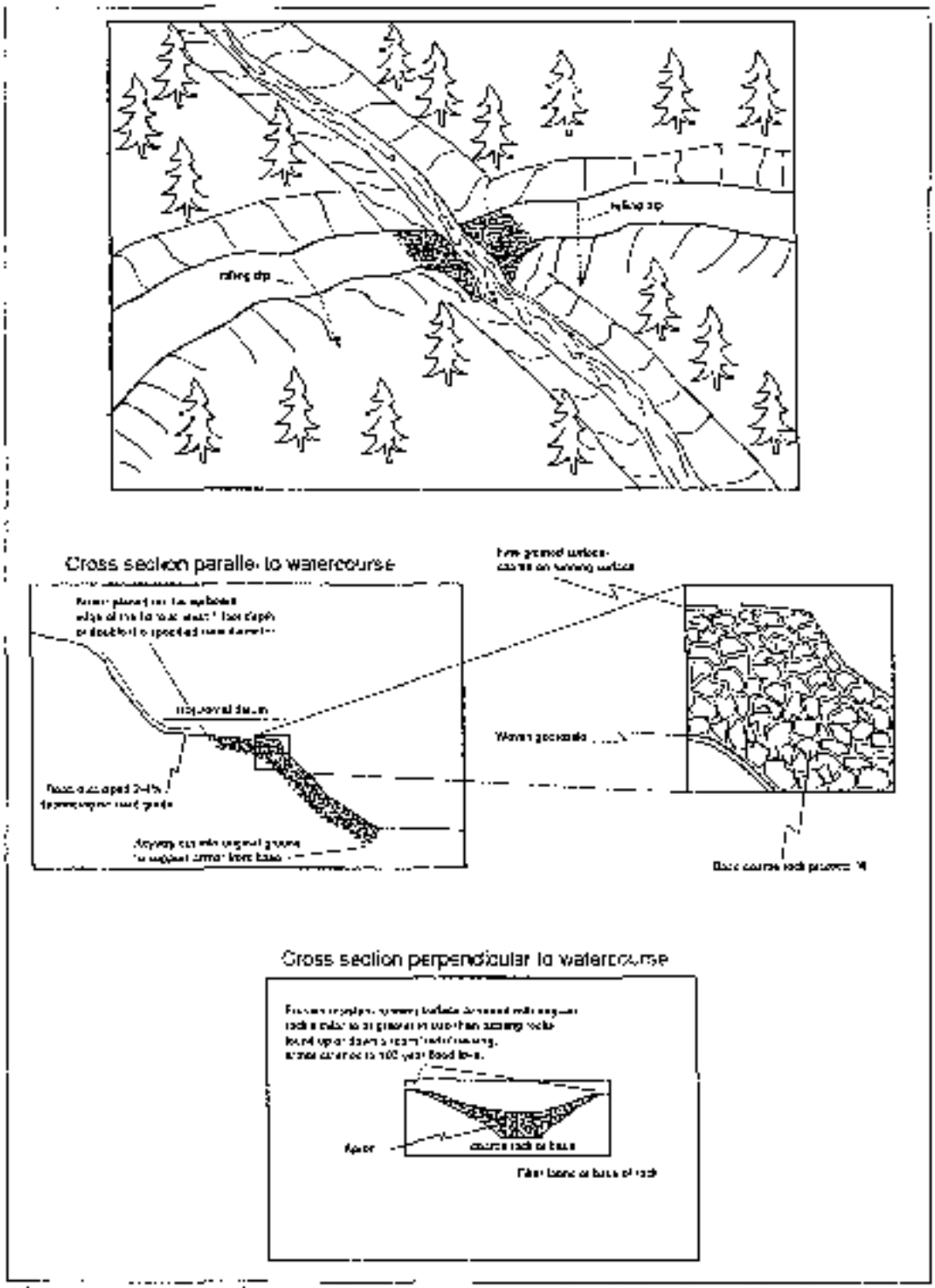


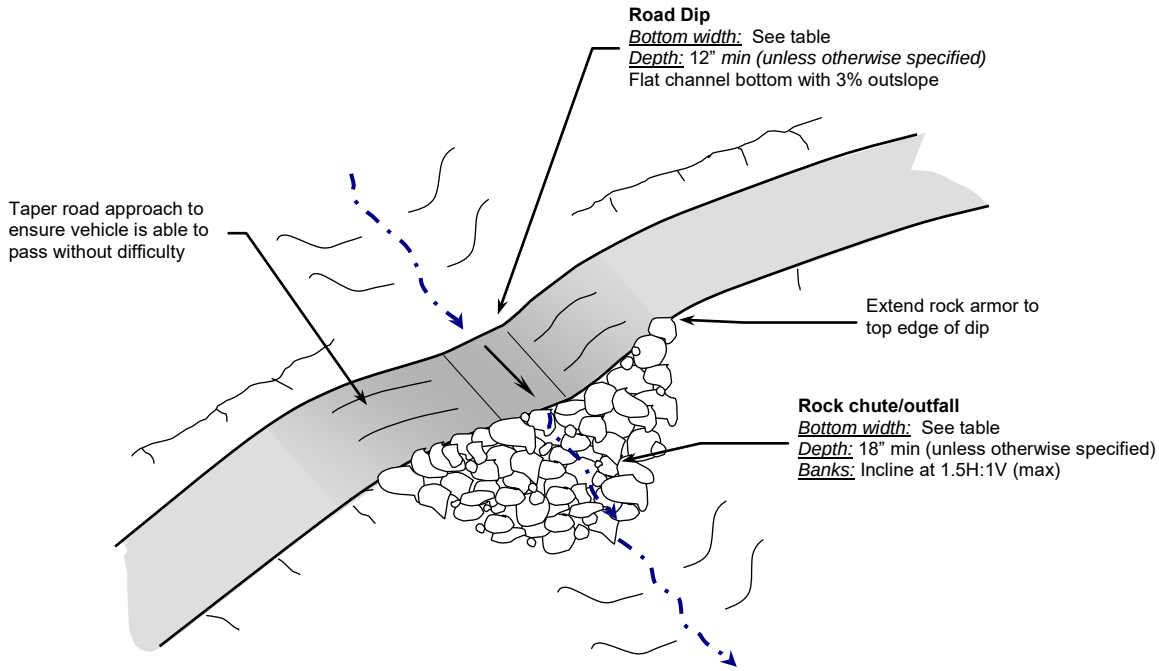
Figure X-15. Typical ford and armored fill stream crossings.



Note: Where geotextile fabric may interfere with passage of amphibians in any Class 2 or 3 crossing, bury geotextile fabric with at least 6 inches of rock. Do not use geotextile fabric in fish-bearing streams.

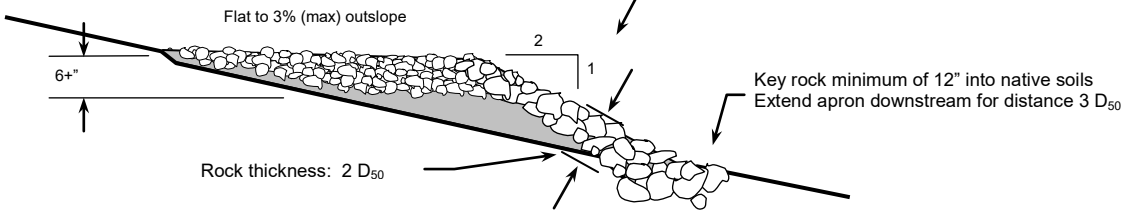
Figure X-16. Installation and specification of typical armored fill crossing.

5C ROCK FORD – FOREST ROAD
NTS



AGGREGATE ROAD BASE:
- See table for rock size
- Place rock minimum 6" deep
- *Note: If specified separate base from native with woven geotextile fabric (Mirifi 700X or equivalent)*

OUTFALL ARMOR:
- See table for D_{50} rock size *(unless otherwise specified)*.
- Rock rip-rap shall consist of approved sound durable angular rock
- Rock should generally be well graded (incorporating mix of sizes: See table for range)
- Voids shall be filled with smaller rock to prevent piping around the larger rock.
- Larger rock to be placed at base of apron
- $2D_{50}$ minimum rock thickness
- Incline no steeper than 2H:1V



TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

ROCK FORD – FOREST ROAD
TYPICAL SPECIFICATIONS

Standard Detail 5C-1

Date: February 22, 2012

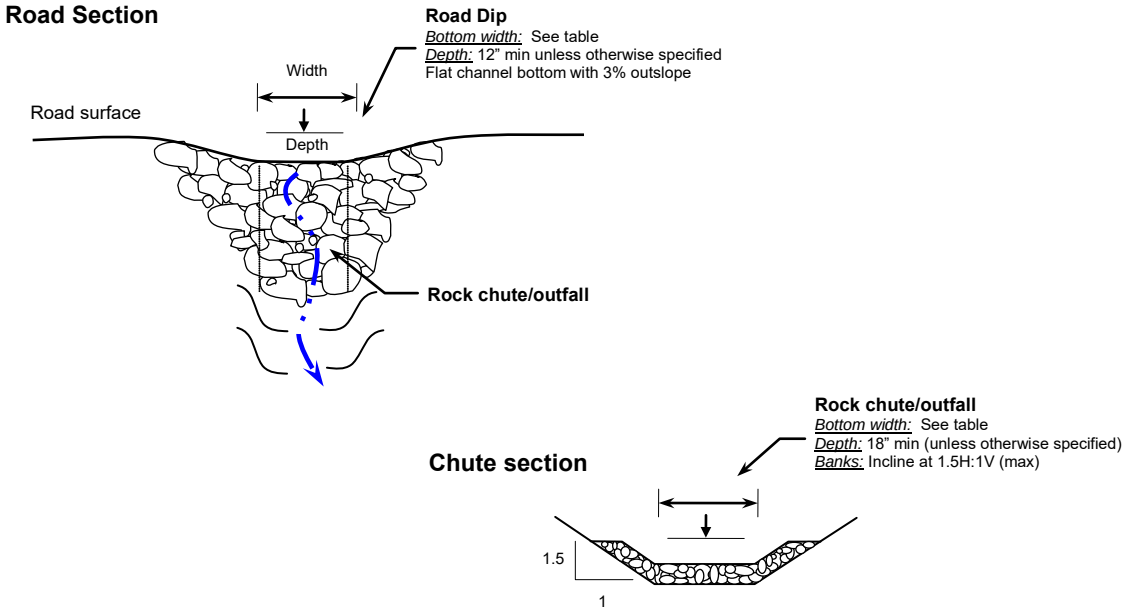


TABLE 1
CHANNEL WIDTH AND ROCK SIZE

Peak Discharge Q (Cfs)	Minimum Channel Bottom Width (ft)	Rock Chute/outfall		Road surface
		Median rock diameter D_{50} (in)	Range $D_{10} – D_{85}$ (in)	Median Rock diameter D_{50} (in)
2	2'	6"	5" - 8"	3" minus
5	2'	9"	6" - 12"	3" minus
10	2'	12"	10" - 16"	3" minus
15	2'	14"	10" - 18"	3" minus
20	4'	14"	10" - 18"	3" minus
30	4'	16"	12" - 20"	3" – 6"
40	4'	18"	12" - 24"	3" – 6"
>40	Site specific design required			

NOTE

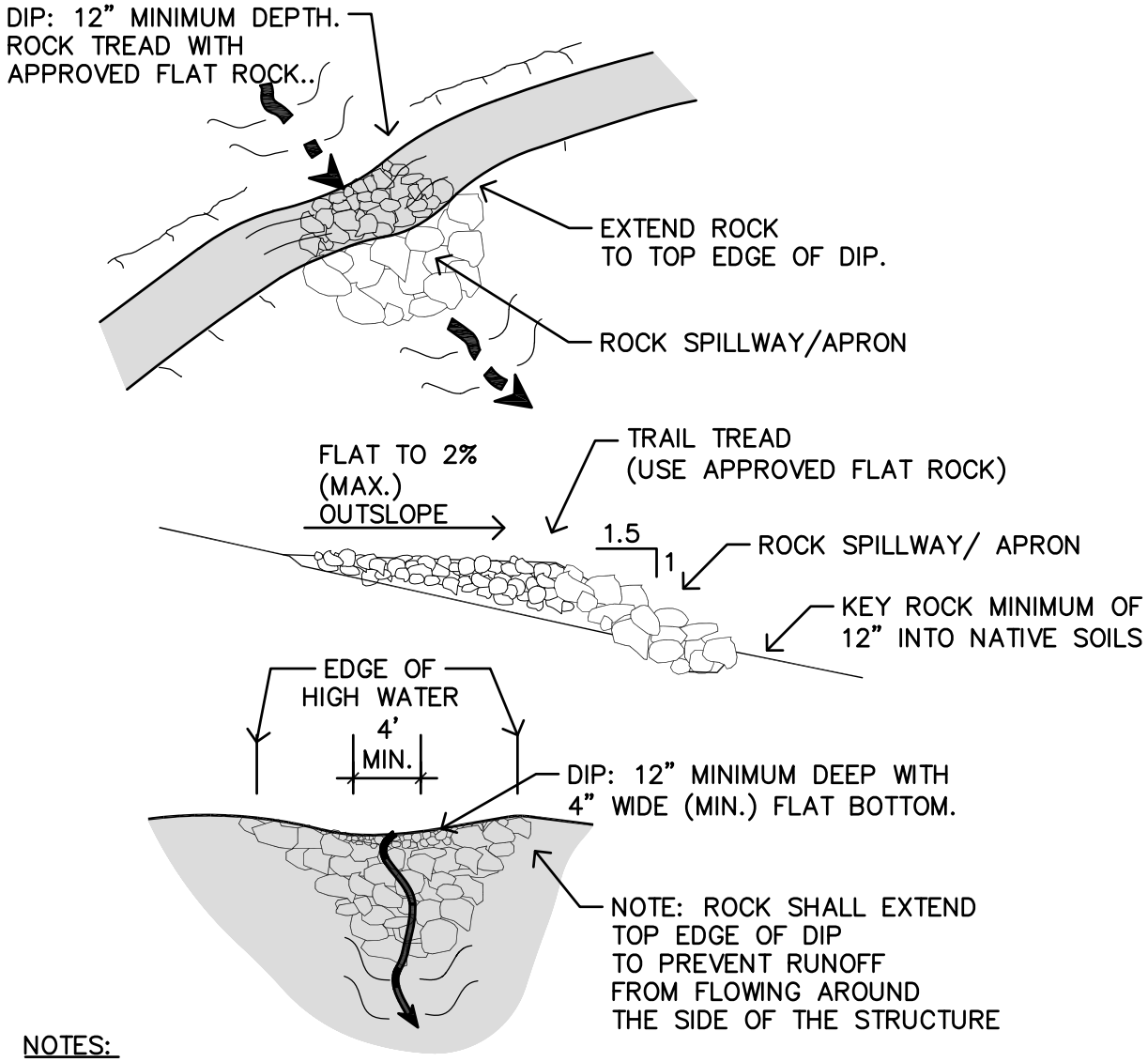
- **Details are typical and intended for use as a guideline. Adjustments may be required to local site conditions.**
- **It is the responsibility of the RPF or design professional to ensure the applicability of these specifications at any given site.**
- Specifications apply to low to moderate gradient watercourses where the outfall of the ford is inclined no steeper than 2H:1V (50%) and where the maximum discharge is less than 40 cfs.
- Rock fords are not recommended on roads steeper than 15% grade due to the difficulty in installing an adequate sized dip.
- The design specifications here are based on *Design of Rock Chutes* (Robinson et al., 1998), US Forest Service publications *Low-water Crossings: Geomorphic, Biologic and Engineering Design Considerations* (Clarkin et al., 2006) and *Low-Volume Roads Engineering: Best Management Field Guide* (Keller and Sherar, 2003),

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

ROCK FORD – FOREST ROAD
TYPICAL SPECIFICATIONS

Standard Detail 5C-2

Date: February 22, 2012



NOTES:

- CONSTRUCT TRAIL TO DIP THROUGH WATERCOURSE.
  - BOTTOM OF DIP TO BE A MINIMUM OF 4 FEET WIDE AND 12 INCHES DEEP UNLESS OTHERWISE SPECIFIED OR DIRECTED.
  - ESTABLISH WELL DEFINED SPILLWAY AT DIP OUTLET.
- ARMOR OUTSIDE TRAIL EDGE WITH ROCK TO FORM APRON IN THE SPILLWAY
  - ROCK SHALL CONSIST OF APPROVED SOUND DURABLE ANGULAR ROCK.
  - 50% (D_{50}) OF ROCK SHALL BE GREATER THAN 18 INCHES MINIMUM DIAMETER (UNLESS OTHERWISE SPECIFIED).
  - ROCK SHOULD GENERALLY BE WELL GRADED (INCORPORATING MIX OF SIZES).
  - VOIDS SHALL BE FILLED WITH SMALLER ROCK TO PREVENT PIPING AROUND THE LARGER ROCK.
  - LARGER ROCK TO BE PLACED AT BASE OF APRON.
  - EXTEND ROCK TO TOP EDGE OF DIP. ROCK MUST BE PLACED HIGH ENOUGH TO FORM A WELL DEFINED SPILLWAY TO PREVENT HIGH FLOWS FROM ERODING AROUND THE EDGE OF THE ROCK.
  - ROCK TO BE PLACED NO STEEPER THAN 1.5:1.
- ARMOR TRAIL TREAD WITH ROCK
  - USE 6" OR LARGER DIAMETER SOUND DURABLE ROCK (UNLESS OTHERWISE SPECIFIED)
  - ROCK SHALL BE FLAT AND PLACED TO CREATE EVEN TRAIL TREAD.
  - BACKFILL LARGER ROCKS WITH SMALLER ROCKS, SOIL OR BASE ROCK.
- SPECIFICATIONS ARE INTENDED ONLY AS GUIDELINES. MODIFICATIONS MAY BE MADE IN THE FIELD BY GEOTECHNICAL CONSULTANT OR DESIGNEE.

ROCK FORD - TRAIL

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 rock ford - trail.dwg

©TIMOTHY C. BEST, CEG

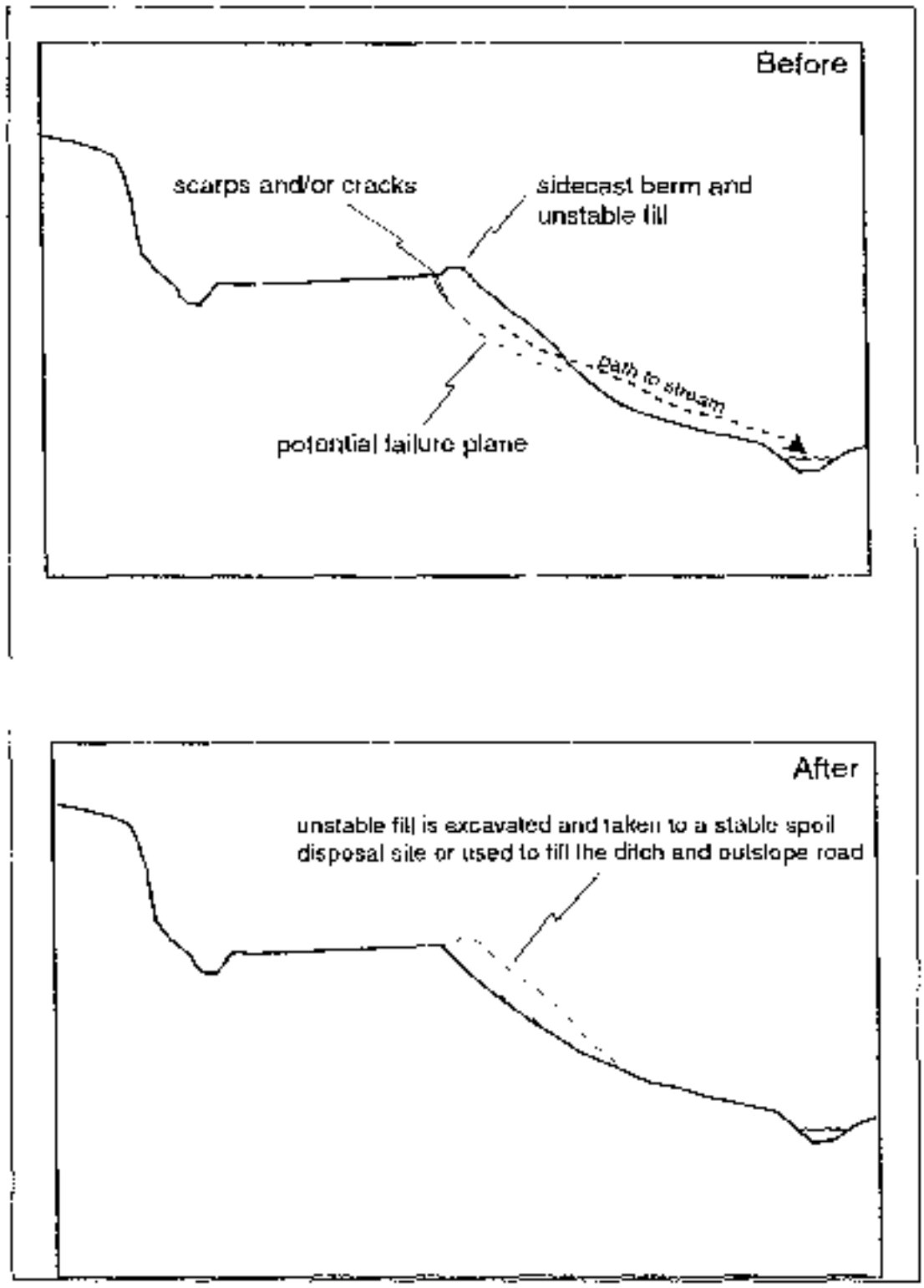
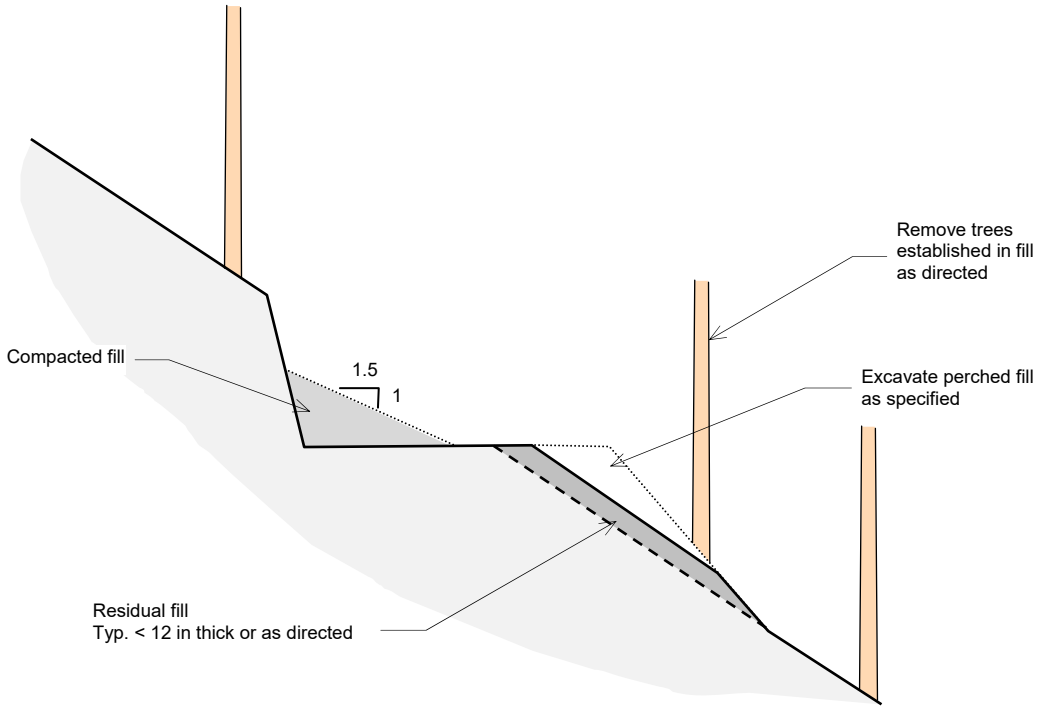


Figure X-17. Removal of unstable sidecast materials.



NOTES

- Remove trees established in roadway and in fill as directed
  - Trees greater than 6 inch diameter shall be marked by District prior to removal
- Excavate perched fill as specified and directed
  - Limits of fill removal to be identified in the field by project geologist or designee
- Spoils shall be compacted along inboard edge of road
  - Spoils shall not be placed in any areas where seasonal bank seeps or wet areas are present
  - Areas to receive fill shall be cleared of vegetation
  - Spoils shall be placed in thin lifts not to exceed 8 inches in maximum thickness and compacted (minimum 85 percent relative compaction). Compacting may include track walking with a dozer, bucket of the excavator, roller or hand tamper. Spoils may need to be moisture conditioned to achieve a suitable level of compaction.
  - Spoils shall be placed a maximum of 5 feet deep with an embankment face inclined no steeper than 1.5:1 (65%) unless otherwise directed or specified
  - Project geotechnical consultant or designee shall approve all spoil sites prior to fill placement
- Specifications are indented only as guideline, modifications may be made in the field by project geotechnical consultant or designee

9A **PERCHED FILL REMOVAL**
NTS

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

PERCHED FILL REMOVAL
TYPICAL SPECIFICATIONS

Standard Detail 9A

Date: May 3, 2009

Outsloping pitch for roads up to 12% grade		
Road Grade	Outslope Pitch forUnsurfaced roads	Outslope Pitch for Surfaced Roads
4% or less	3/8" per foot	½" per foot
5%	½" per foot	5/8" per foot
6%	5/8" per foot	¾" per foot
7%	¾" per foot	7/8" per foot
12% or more	1" per foot	1-1/4" per foot

Table X-6. Outsloping pitch for roads up to 12% grade.

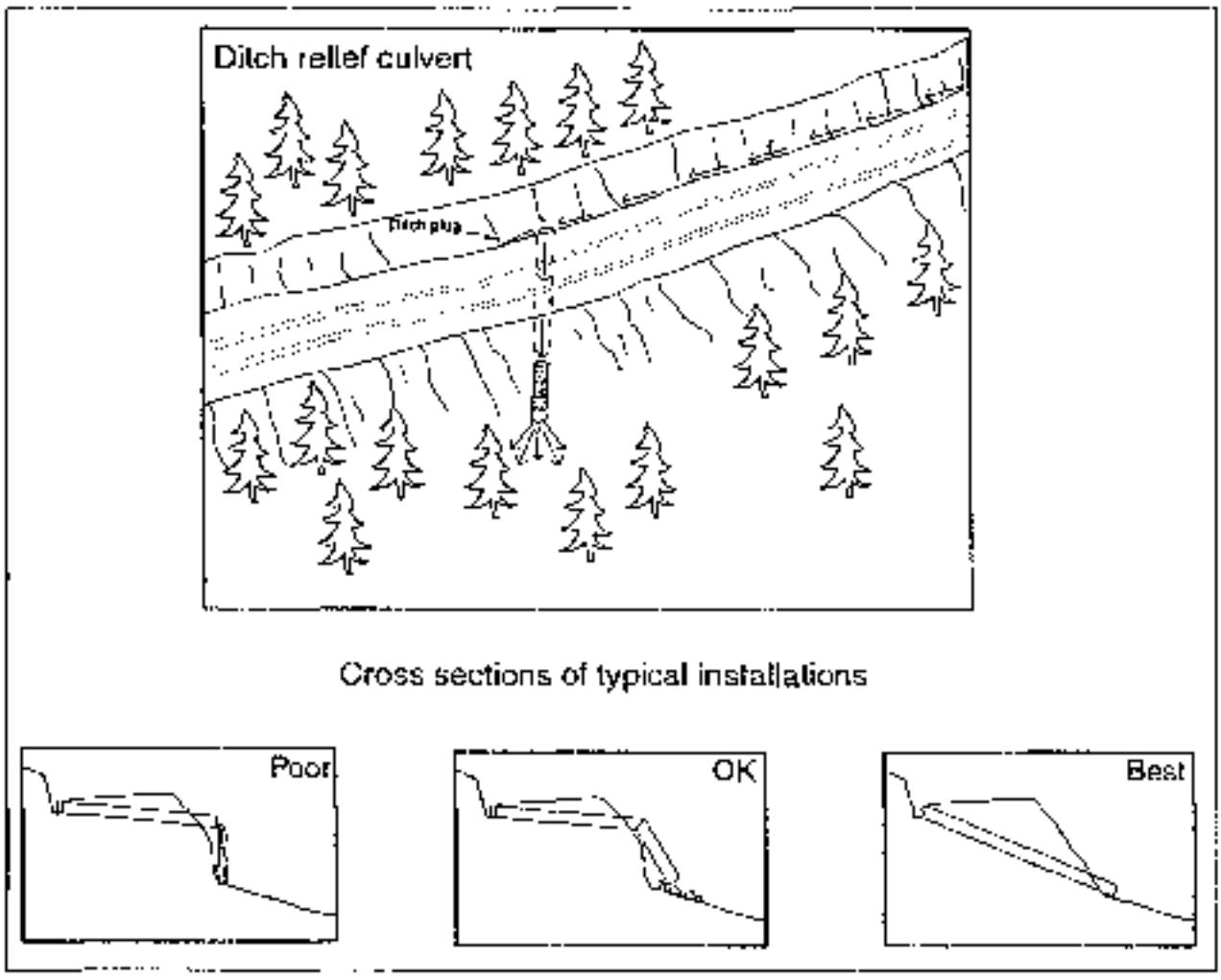
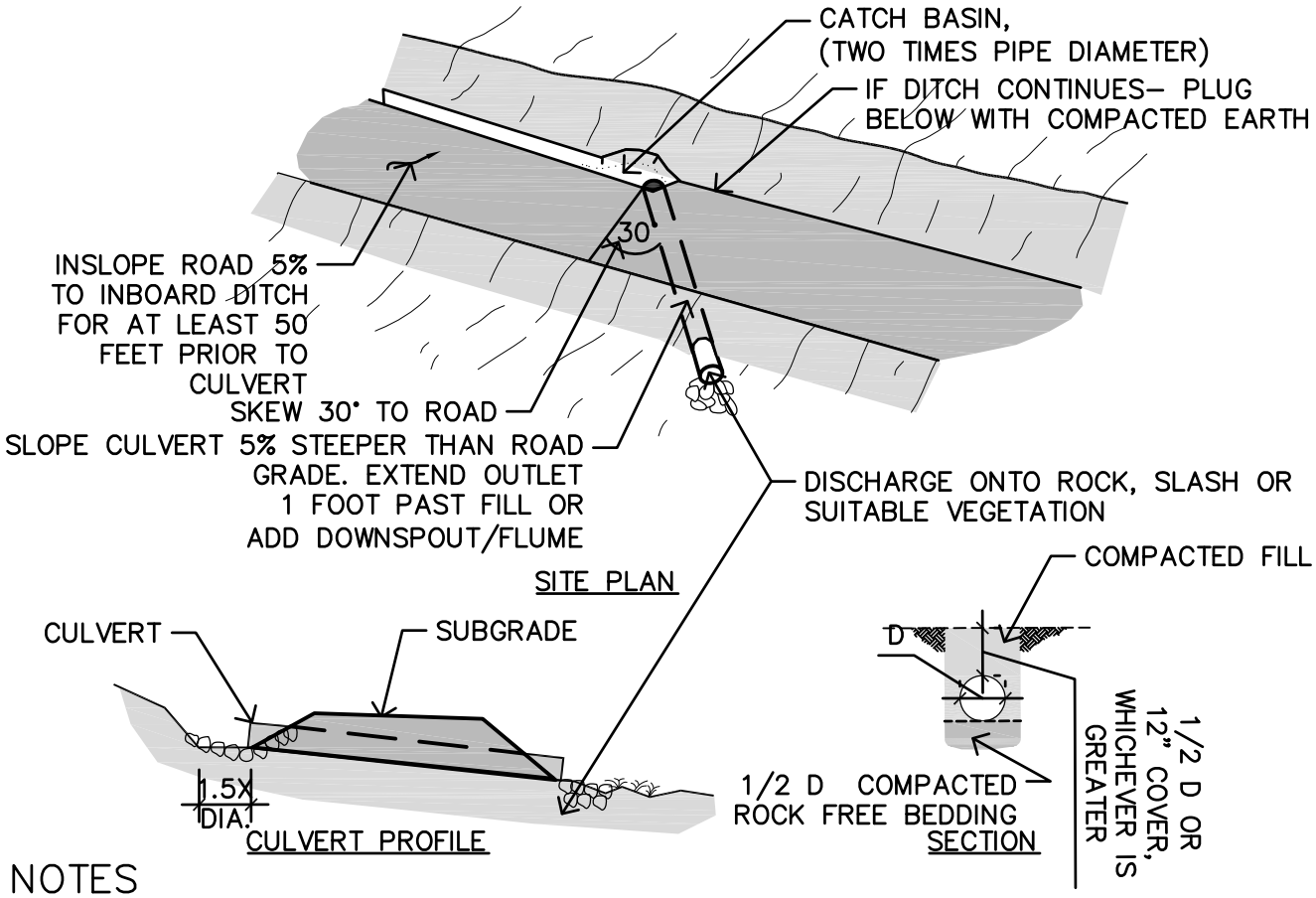


Figure X-19. Typical ditch relief culvert installation.



NOTES

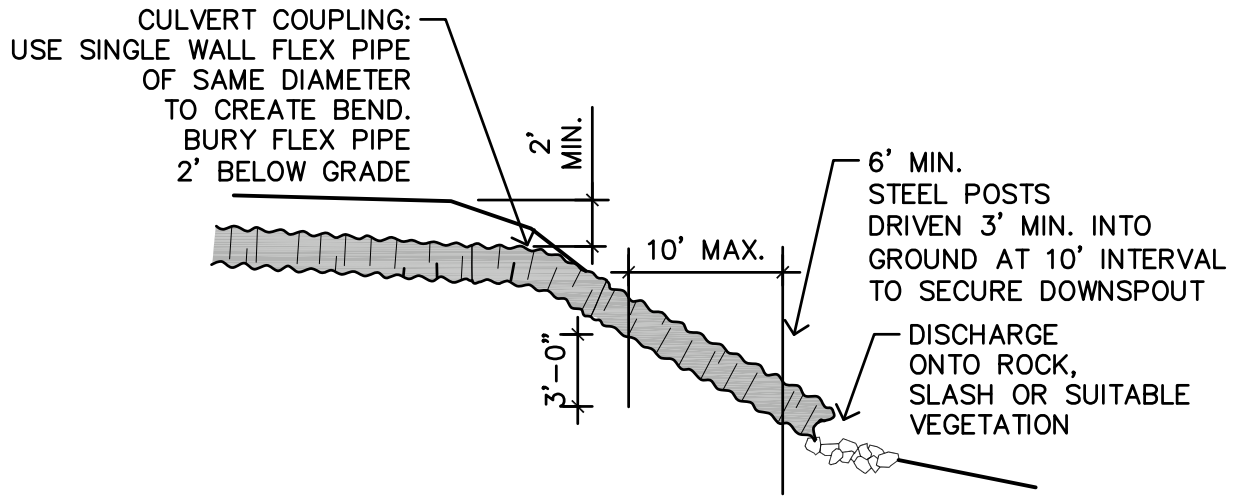
1. INSTALL DITCH RELIEF CULVERTS AT FLAGGED LOCATIONS OR AS IDENTIFIED ON PLANS. THE MAXIMUM SPACING OF CULVERTS SHALL BE 150 FEET UNLESS OTHERWISE SPECIFIED OR DIRECTED.
2. CULVERTS SHALL BE 12–INCH DIAMETER SMOOTH BORE, DOUBLE WALL HDPE (ASTM D3350 AND AASHTO M294, TYPE S) UNLESS OTHERWISE SPECIFIED.
3. PLACE CULVERTS AT A 30 DEGREE SKEW ANGLE DOWN GRADE (WHERE ALLOWABLE) WITH A GRADIENT 5% STEEPER THAN THAT OF THE ROAD. CULVERTS SHOULD EXTEND A MINIMUM OF 1' BEYOUND BASE OF ROAD FILL.
4. WHERE NECESSARY, OUTLET DITCH SHALL BE CONSTRUCTED AT A STEEPER GRADIENT THAN THE CULVERT, AT LEAST ONE PIPE DIAMETER IN WIDTH, AND WITH BANK TAPERED BACK TO A 1:1 SLOPE.
5. THE CULVERT BEDDING SHALL BE PLACED TO A DEPTH OF ½ DIAMETER OF THE CULVERT, AND BE CLEAN AND FREE OF LARGE WOODY DEBRIS AND LARGE ROCKS. TRENCH SHALL BE ADEQUATE WIDTH TO FACILITATE COMPACTION.
6. THE BACKFILL SHALL CONSIST OF APPROVED MINERAL SOIL, WITH NO ROCKS GREATER THAN 3 INCHES IN ANY DIMENSION PLACED CLOSER THAN 1 FOOT TO THE CULVERT. BACKFILL SHALL BE ADEQUATELY COMPACTED THROUGHOUT THE ENTIRE PROCESS TO 95 PERCENT ASTM 1557 UNLESS OTHERWISE SPECIFIED. DURING PLACEMENT AND COMPACTION OF FILL, THE MOISTURE CONTENT OF THE MATERIALS BEING PLACED SHALL BE MAINTAINED AS DIRECTED BY THE ENGINEER.
7. COMPACTED FILL MINIMUM COVER SHALL BE THE GREATER OF 12" OR HALF THE PIPE DIAMETER.
8. ROCK, SLASH OR SUITABLE VEGETATION SHOULD BE USED AT DISCHARGE POINT AS DIRECTED OR SPECIFIED.
9. PLACE A DITCH BLOCK IMMEDIATELY DOWNSLOPE OF THE CULVERT INTAKE TO PREVENT DITCH FLOW FROM BYPASSING THE PIPE INLET.
10. SPECIFICATIONS ARE INTENDED ONLY AS GUIDELINES; MODIFICATIONS MAY BE MADE IN FE FIELD BY GEOTECHNICAL CONSULTANT OR DESIGNEE.

DITCH RELIEF CULVERT

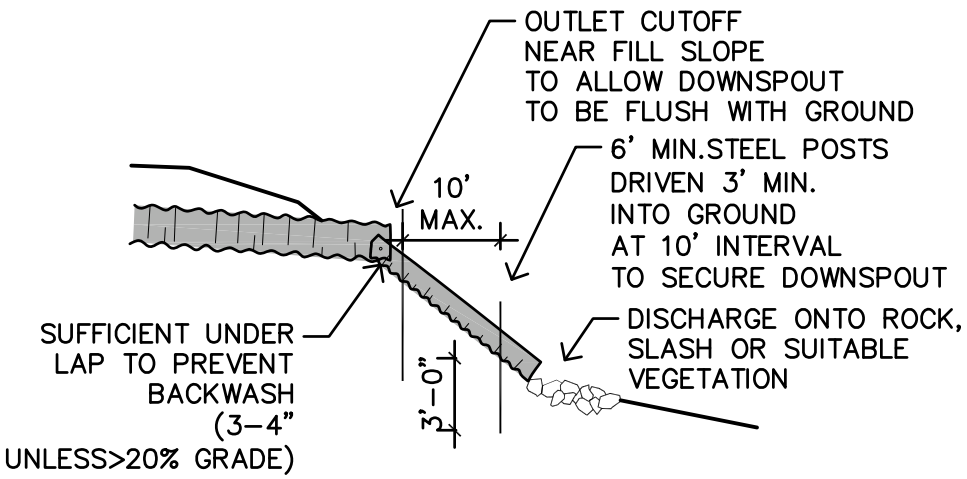
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

©TIMOTHY C. BEST, CEG

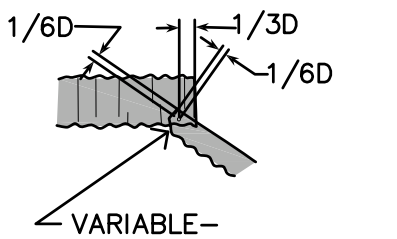
FULL–ROUND DOWNSPOUT



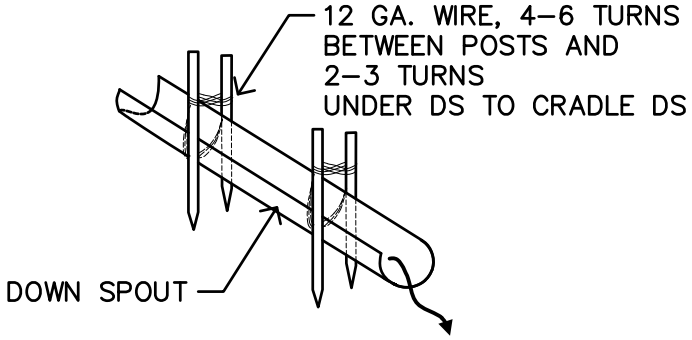
HALF–ROUND DOWNSPOUT



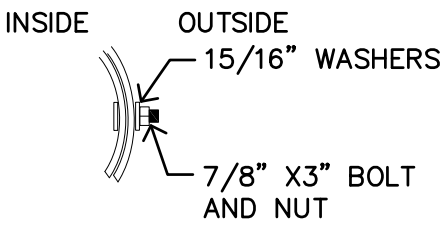
HALF ROUND CONNECTION



DOWNSPOUT STAKE WIRING DETAIL



BOLT DETAIL

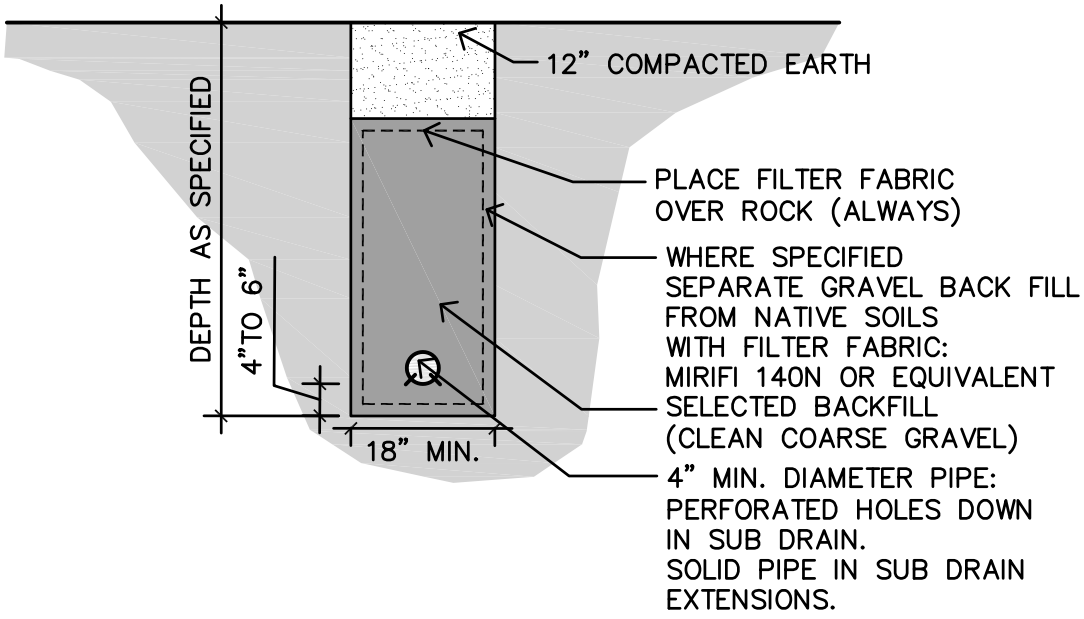


DOWNSPOUT

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 03/2009

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 downspout.dwg

©TIMOTHY C. BEST, CEG



NOTES

1. EXCAVATE 12+" WIDE TRENCH AS SPECIFIED. TRENCH SHOULD HAVE POSITIVE GRADIENT TO DISCHARGE POINT.
2. WHERE SPECIFIED, LINE TRENCH WITH APPROVED FILTER FABRIC (MIRIFI 180N OR EQUIVALENT).
3. PLACE PERFORATED PIPE 4" TO 6" FROM BOTTOM OF TRENCH. SOLID PIPE SHOULD EXTEND FROM TRENCH TO DISCHARGE POINT.
4. BACK FILL TRENCH WITH CLEAN COARSE GRAVEL TO WITHIN 12" OF GRADE.
5. PLACE FABRIC OVER TOP OF GRAVEL BACK FILL.
6. CAP WITH 12" OF COMPACTED EARTH.
7. DISCHARGE IN A REASONABLE AND CONTROLLED MANNER.

SUBDRAIN

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 05/2009

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 subdrain.dwg

©TIMOTHY C. BEST, CEG

Dispersion of Road Runoff

Disperse and disconnect road surface runoff from streams. Road cutbanks and road ditches are known to deliver substantial volumes of fine sediment to streams in some watersheds (e g , Reid 1981; Reid and Dunne 1984) and they have been found to significantly affect watershed hydrology (Wemple 1994). Relatively simple treatments can be performed to upgrade road drainage systems to significantly reduce or largely eliminate this source of fine sediment delivery to streams. Sediment may be minimized by utilizing seasonal closures or traffic restrictions, and dispersing road runoff. Choose from a variety or combination of surface drainage techniques including berm removal, water bars (Figure X-10), road surface shaping (outsloping, insloping or crowning (Figure X-18 and Table X-6), ditch relief culverts (Figure X-19), rolling dips (Figure X-20), and other measures that effectively disperse road surface runoff and reduce or eliminate sediment delivery to the stream. To be effective, they must effectively disperse most road runoff and ditch flow before it reaches the stream. It is critical that all road surface drainage techniques effectively drain the road surface and be drivable for the expected traffic

Road Upgrading Installation Instructions

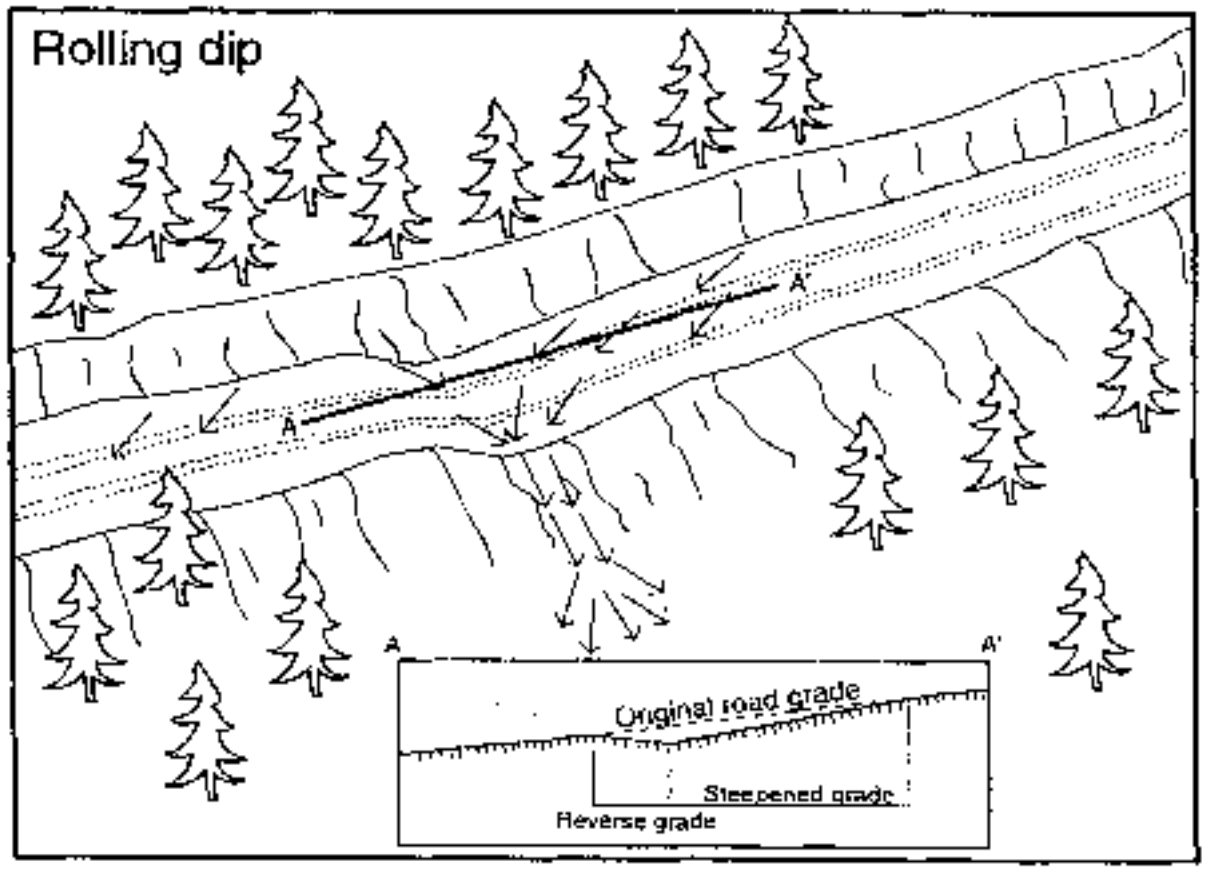
The following summarizes standard road upgrading techniques. For more detail, see *Handbook for Forest and Ranch Roads* (PWA 1994) or the corresponding video *Forest and Ranch Roads* (PWA 2003).

Rolling Dip Installation

- Install rolling dips in the roadbed as needed to drain the road surface. Rolling dips can be sloped either into the ditch or to the outside of the road edge as required to properly drain the road and disperse surface runoff.
- If the rolling dip is designed to divert both road surface and ditch runoff, block the down-road ditch with compacted fill.
- Rolling dips are usually built directly across the road alignment with a cross grade at least one percent greater than the grade of the road (so that it will drain).
- Excavate the rolling dip with a medium size bulldozer (D-7 size) with rippers or with a grader
- Begin excavation of the dip approximately 50 to 100 feet up-road from the proposed axis of the dip (Figure X-18). Progressively excavate material from the roadbed, with the grade becoming steeper, until reaching the axis (Figure X-20).
- Determine the depth of the dip, by the grade of the road (Figure X-18). In all cases, rolling dip dimensions must be consistent with the type of vehicles that will be using the road (Figure X-20).
- On the down-road side of the rolling dip axis, install a grade change to prevent runoff from continuing down the road. Carry the rise in grade for about 15 to 25 feet, or more, and then fall back to the original slope (Figure X-20). The axis of the dip must be a broad "u" shape to facilitate good driveability.
- In all cases, the rolling dip must be drivable and not significantly inhibit traffic and road use. It must also effectively drain the road surface

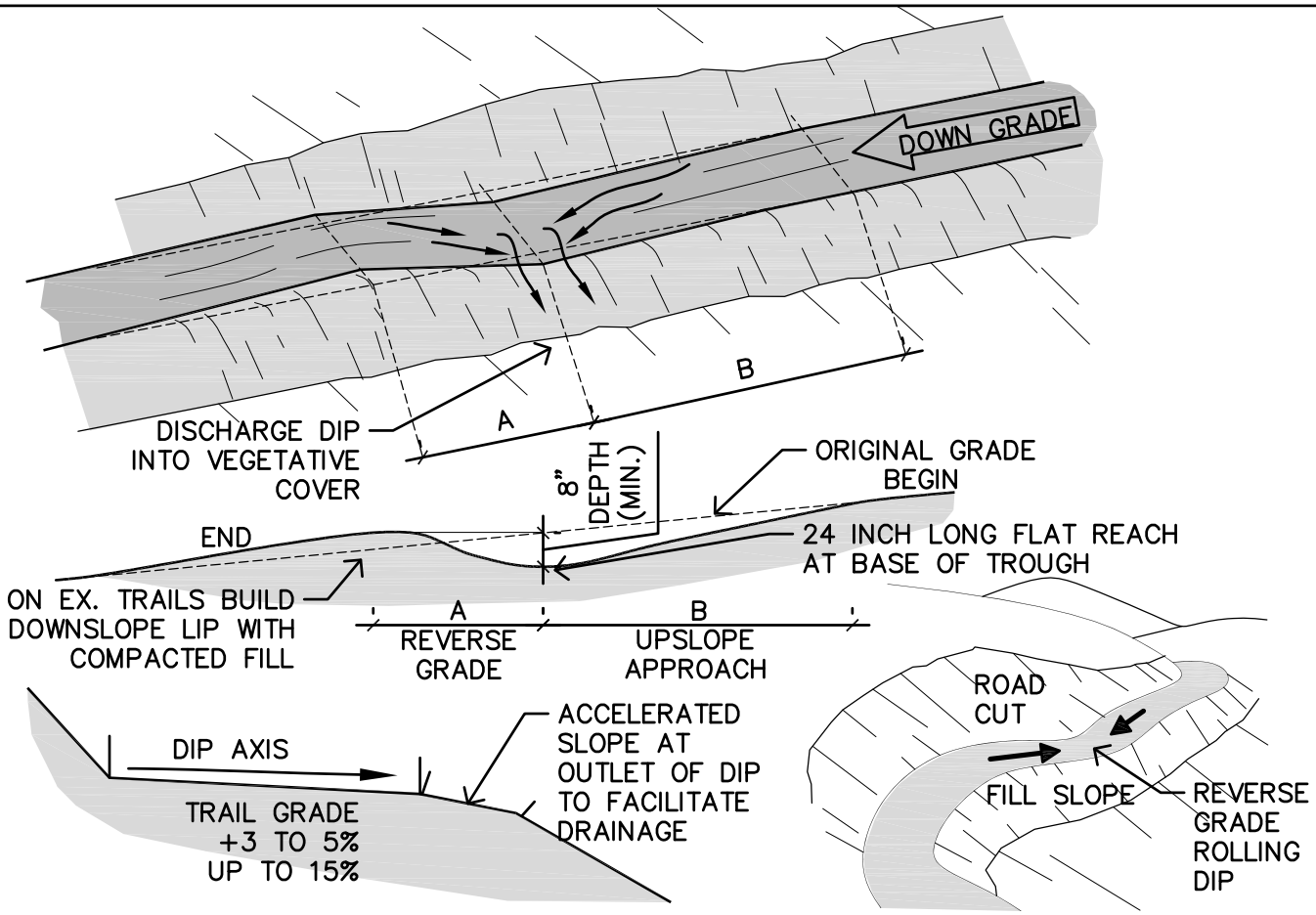
Table of Rolling Dip Dimensions				
Road grade %	Upslope approach (distance from up-road start of rolling dip to trough) (ft)	Reverse grade (distance from trough to crest)	Depth below average road grade at discharge end of trough (ft)	Depth below average road grade at upslope end of trough (ft)
<6	55	15-20	0.9	0.3
8	65	15-20	1.0	0.2
10	75	15-20	1.1	.01
12	85	20-25	1.2	.01
>12	100	20-25	1.3	.01

Table X-7. Table of rolling dip dimensions.



Note: Rolling dips must drain the road surface and be driveable for the expected traffic

Figure X-20. Specifications and use of rolling dips to reduce ditch erosion and surface runoff.



EX. TRAIL ROAD GRADE (%)	TROUGH	A: REVERSE GRADE		B: UPSLOPE APPROACH	
	MIN. DEPTH BELOW DOWNSLOPE CREST	DISTANCE FROM TROUGH AXIS TO DOWNROAD CREST (FT)	GRADE (%)	DISTANCE FROM UP-ROAD START OF ROLLING DIP TO TROUGH AXIS (FT)	GRADE (%)
<5%	8"	7 MIN, 15 PREFERRED	-5 TO 10%	30	10%
10%	8"	7 MIN, 15 PREFERRED	-5 TO 10%	45	15%
15%	8"	7 MIN, 15 PREFERRED	-5 TO 10%	60	20%
>15%	8"	10	-10%	60	25%

NOTES

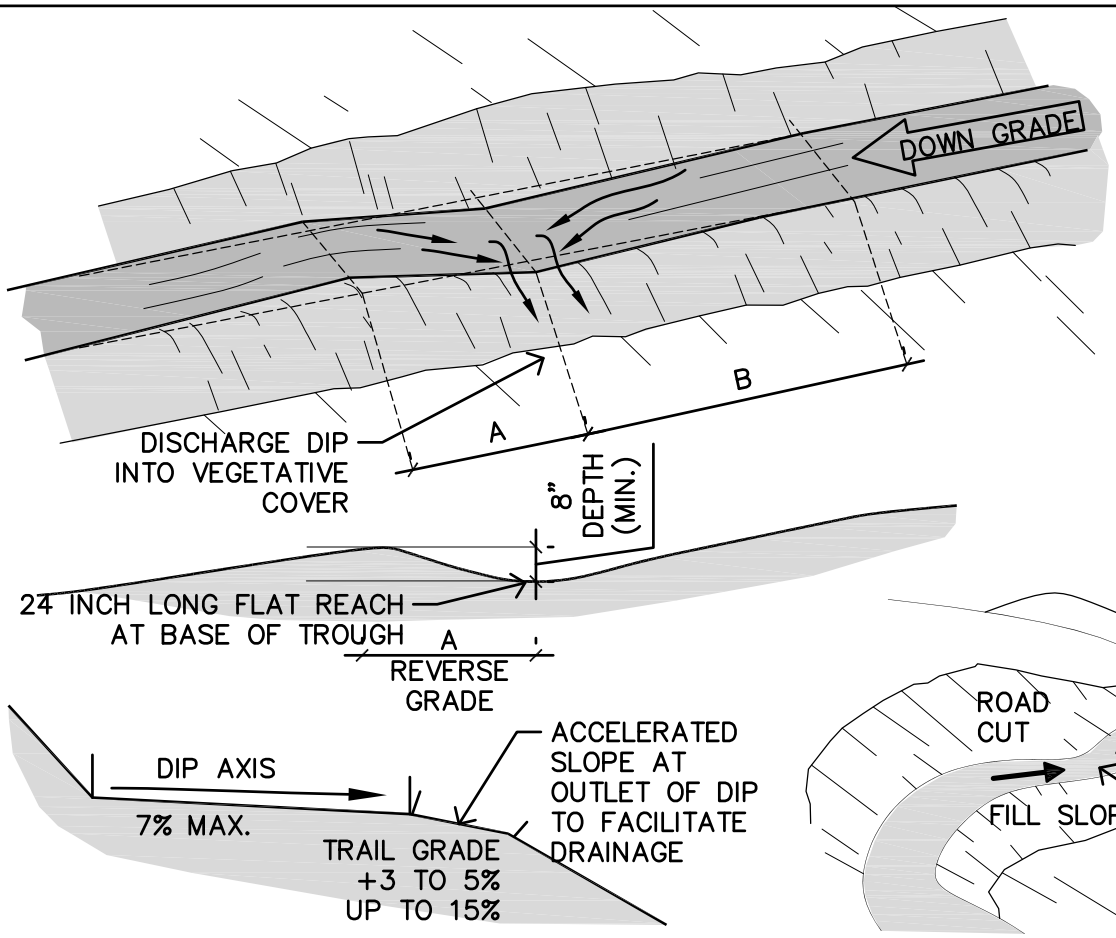
1. A REVERSE GRADE DIP (OR ROLLING DIP) IS A BROAD LONG PERMANENT DIP CONSTRUCTED INTO NATIVE SOILS. IT IS INTENDED TO DRAIN THE TRAIL/ ROAD WHILE NOT SIGNIFICANTLY IMPEDING TRAFFIC.
2. ON EXISTING TRAILS/ ROADS THE DIP IS CUT INTO THE EXISTING TRAIL WITH THE DOWN ROAD DIP BUILT UP ON COMPACTED FILL.
3. THE DOWN ROAD REVERSE GRADE OF THE DIP SHALL BE 5-10%, FOR A MIN. OF 7 FEET (AT 10%) OR MIN. OF 15 FEET (AT 5%), TO FORM A MIN. 8 INCH DEEP DIP AND INCORPORATE A 2-FOOT LONG FLAT REACH AT THE BASE OF THE TROUGH (UNLESS OTHERWISE DIRECTED). THE DIP AXIS SHOULD BE OUTSLOPED THE TRAIL GRADE PLUS 3-5% UP TO 15%.
4. DIP OUTLETS SHOULD BE LOCATED TO DRAIN INTO AREAS WITH ADEQUATE SEDIMENT FILTER QUALITY AND NON-ERODIBLE MATERIAL SUCH AS ROCK, SLASH, BRUSH, ETC. WHERE SPECIFIED, THE BOTTOM OF THE OUTFALL OF THE DIP WILL BE SURFACE ROCKED.
5. WHERE NATURAL SLOPES EXCEED 50%, FILL SHALL NOT BE PUSHED OVER THE DIP OUTLET. A BACKHOE OR EXCAVATOR MAY BE REQUIRED TO PULL BACK FILL AT OUTLET OF EXISTING DIPS.
6. DIPS SHALL BE PLACED AS SPECIFIED IN THE PLANS. IF NOT SPECIFIED THEN DIPS SHALL BE PLACED AT MAX. 75 FOOT SPACINGS.

REVERSE GRADE DIP EXISTING TRAIL, TYP.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT | SCALE: NTS | DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 reverse grade dip existing trail.dwg

©TIMOTHY C. BEST, CEG



NEW CONSTRUCTION GRADE (%)	TROUGH	A: REVERSE GRADE		B: UPSLOPE APPROACH	
	MIN. DEPTH BELOW DOWNSLOPE CREST	DISTANCE FROM TROUGH AXIS TO DOWNROAD CREST (FT)	GRADE (%)	DISTANCE FROM UP-ROAD START OF ROLLING DIP TO TROUGH AXIS (FT)	GRADE (%)
<5%	8"	7 MIN, 15 PREFERRED	-5 TO 10%	N/A. SHOULD BE CONSISTENT GRADE	
10%	8"	7 MIN, 15 PREFERRED	-5 TO 10%	N/A. SHOULD BE CONSISTENT GRADE	
15%	8"	7 MIN, 15 PREFERRED	-5 TO 10%	N/A. SHOULD BE CONSISTENT GRADE	
>15%	8"	10	-10%	N/A. SHOULD BE CONSISTENT GRADE	

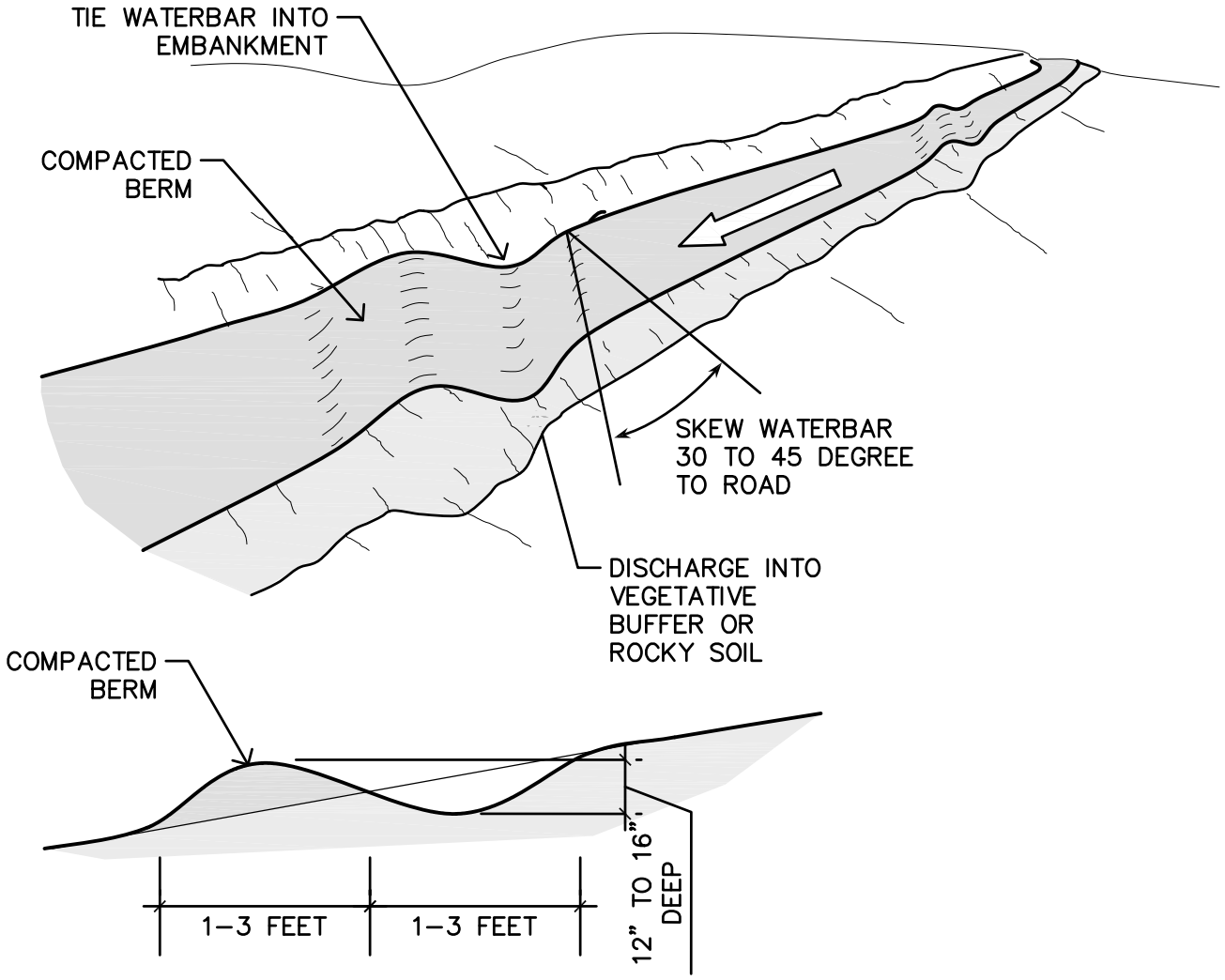
NOTES

1. A REVERSE GRADE DIP (OR ROLLING DIP) IS A BROAD LONG PERMANENT DIP CONSTRUCTED INTO NATIVE SOILS. IT IS INTENDED TO DRAIN THE TRAIL/ ROAD WHILE NOT SIGNIFICANTLY IMPEDING TRAFFIC.
2. ON NEW TRAILS AND ROADS THE DIP IS INCORPORATED INTO THE TRAIL/ROAD DESIGN.
3. THE DOWN ROAD REVERSE GRADE OF THE DIP SHALL BE 5-10%, FOR A MIN. OF 7 FEET (AT 10%) OR MIN. OF 15 FEET (AT 5%), TO FORM A MIN. 8 INCH DEEP DIP AND INCORPORATE A 2-FOOT LONG FLAT REACH AT THE BASE OF THE TROUGH (UNLESS OTHERWISE DIRECTED). THE DIP AXIS SHOULD BE OUTSLOPED THE TRAIL GRADE PLUS 3-5% UP TO 15%.
4. DIP OUTLETS SHOULD BE LOCATED TO DRAIN INTO AREAS WITH ADEQUATE SEDIMENT FILTER QUALITY AND THE TRAIL GRADE PLUS 3 TO 5% UP TO 15%. WHERE SPECIFIED, THE BOTTOM OF THE OUTFALL OF THE DIP WILL BE SURFACE ROCKED.
5. WHERE NATURAL SLOPES EXCEED 50%, FILL SHALL NOT BE PUSHED OVER THE DIP OUTLET. A BACKHOE OR EXCAVATOR MAY BE REQUIRED TO PULL BACK FILL AT OUTLET OF EXISTING DIPS.

REVERSE GRADE DIP NEW CONSTRUCTION, TYP.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT | SCALE: NTS | DATE: 10/2019

©TIMOTHY C. BEST, CEG



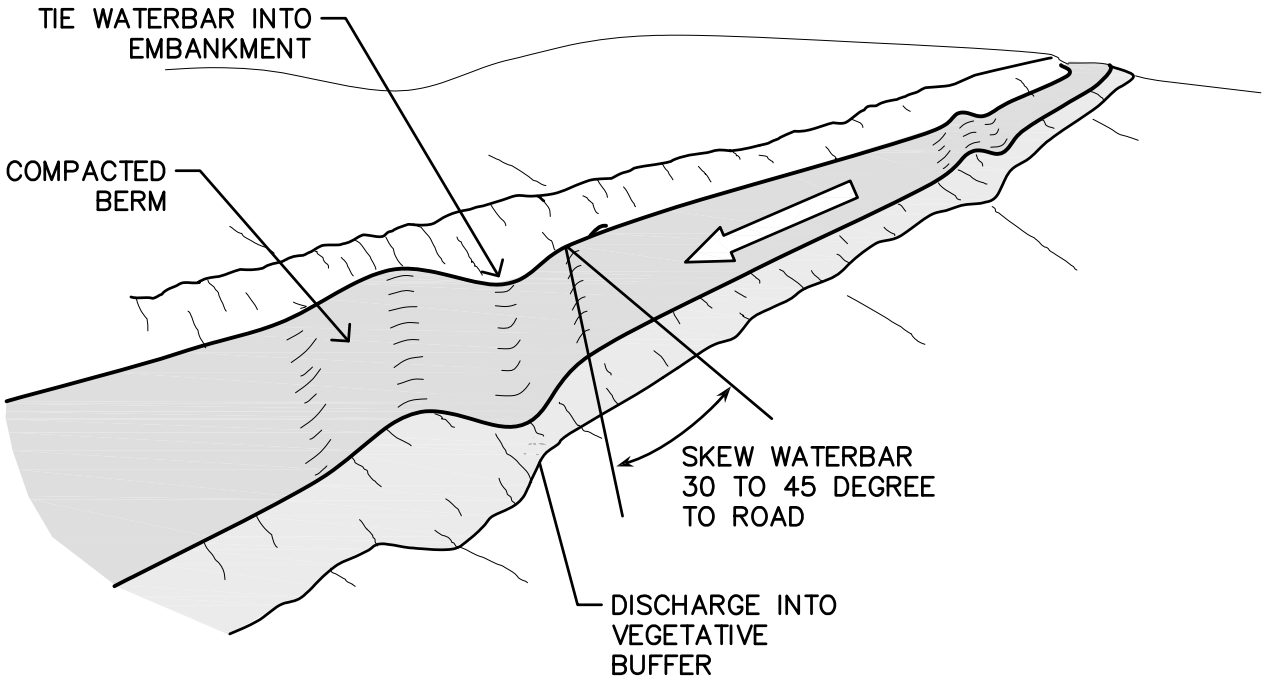
NOTES

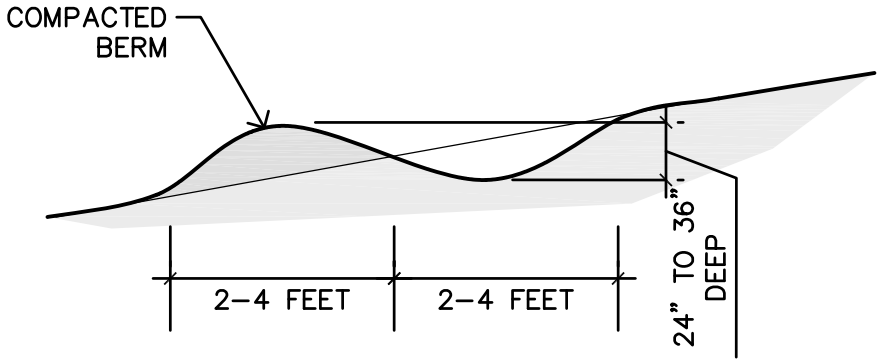
1. IDENTIFY WATERBAR LOCATIONS THAT TAKE ADVANTAGE OF NATURAL DRAINAGE FEATURES AND MINIMIZE THE AMOUNT OF DISTURBANCE REQUIRED FOR WATERBAR CONSTRUCTION.
2. ALL WATERBARS SHALL BEGIN AT THE INTERSECTION OF THE ROADBED SURFACE AND THE CUT SLOPE AND RUN THE ENTIRE WIDTH OF THE ROAD SURFACE PRISM.
3. WATERBAR LENGTH SHALL NOT EXCEED 1.5 TIMES THE WIDTH OF THE ROAD SURFACE.
4. ACCEPTABLE WATERBARS SHALL BE SKEWED 30 TO 45 DEGREES.
5. ALL WATERBARS SHALL HAVE FREE FLOWING OUTLETS WITH MINIMUM 2% GRADE IN THE BOTTOM OF THE CHANNEL THAT DISCHARGE ONTO VEGETATIVE SURFACES OR LESS ERODIBLE MATERIAL WHERE POSSIBLE.
6. NATIVE MATERIALS USED TO CONSTRUCT DOWNSLOPE BERM SHALL BE COMPACTED WITH EQUIPMENT TO MINIMIZE WEAR RESULTING FROM TRESPASS AND/OR ADMINISTRATIVE USE.
7. WATERBAR DEPTH MEASURED FROM THE BOTTOM OF THE WATERBAR CHANNEL TO THE TOP OF THE COMPACTED BERM MUST BE BETWEEN 12" AND 16" HIGH.
8. COMPACTED WATERBARS MUST BE PASSABLE IN A 4WD VEHICLE UNLESS OTHERWISE SPECIFIED IN THE CONTRACT.

WATERBAR

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 05/2009

©TIMOTHY C. BEST, CEG





NOTES

1. LARGE WATERBARS ARE TO BE USED ON ROADS PROPOSED FOR ABANDONMENT TO CORRECT DRAINAGE AND PREVENT VEHICLE ACCESS.
2. IDENTIFY WATERBAR LOCATIONS THAT TAKE ADVANTAGE OF NATURAL DRAINAGE FEATURES ARE MINIMIZE THE AMOUNT OF DISTURBANCE REQUIRED FOR WATERBAR CONSTRUCTION.
3. ACCEPTABLE WATERBARS SHALL BE SKEWED 30 TO 45 DEGREES.
4. ALL WATERBARS SHALL HAVE FREE FLOWING OUTLETS WITH MIN. 2% GRADE IN THE BOTTOM OF THE CHANNEL THAT DISCHARGE ONTO VEGETATIVE SURFACES OR LESS ERODIBLE MATERIAL WHERE POSSIBLE. PULL BACK PERCHED FILL AT DIP OUTLET.
5. NATIVE MATERIALS USED TO CONSTRUCT DOWNSLOPE BERM SHALL BE COMPACTED WITH EQUIPMENT TO MINIMIZE WEAR RESULTING FROM TRESPASS.
6. WATERBAR DEPTH MEASURED FROM THE BOTTOM OF THE WATERBAR CHANNEL TO THE TOP OF THE COMPACTED BERM MUST BE BETWEEN 24" AND 36" HIGH.

LARGE WATERBAR

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 03/2012

©TIMOTHY C. BEST, CEG

Brushlayering with Soil Wrap

This technique consists of live cut branches (brushlayers) interspersed between layers of soil wrapped in natural or synthetic geotextile materials. The brush is placed in a crisscross or overlapping pattern so that the tips of the branches protrude just beyond the face of the fill, where they act as horizontal drains and improve slope stability by redirecting the flow direction. Natural geofabrics, such as coir netting, are typically wrapped around the soil layer to provide additional soil surface protection and reinforcement.

Conditions Where Practice Applies

Brushlayering with geotextile soil wraps can be used to stabilize very steep slopes. They provide an alternative to vertical retaining structures for grade separation purposes and in situations that require avoiding right-of-way encroachment at the base or top of slopes. Geotextile soil wraps can also be used to protect slopes that are subject to periodic scour or tractive stresses, such as drainage channels or upper portions of streambanks.

Materials

Long branches of trees and brush which are capable of vegetative propagation, usually willows. The length of the branches will vary with the type of application (embankment or buttress fill) and desired depth of reinforcement; ideally they should be long enough to reach the back of a buttress fill. The inert construction material consists of natural geofabrics such as coir netting, or synthetic, polymeric geogrids. Natural geofabrics or geogrids are then wrapped around the soil layers to protect the slope face and provide a stable planting surface.

Implementation

Begin at the base of the slope and proceed upward. See typical drawing below for the step by step procedures of brushlayering with soil wrap. The vegetated soil wrap structure should be supported on a rock toe or base and be battered or inclined at an angle of at least 10 to 20 degrees to minimize lateral earth forces. A trench should be excavated to a competent horizon as well as below the likely depth of scour.

The fabric is installed by placing it on top of the soil so that at least 0.5 m (3 feet) can be anchored by wooden stakes to the soil-gravel layer. Allow 2 m (6 feet) of fabric to extend beyond the brushlayer so that it will lap over and cover the soil-gravel mix , then stake into place. Crisscross layers of dormant cuttings and/or transplants on top of the soil wrap, placing the cut ends into the slope with the tips extending beyond the edge of the bench (no more than ¼ of the total branch length). Care should be taken to place the branches at random with regard to size and age and species composition. Deposit a layer of topsoil over the cuttings and tamp into place.

Brushlayering with Soil Wrap (continued)

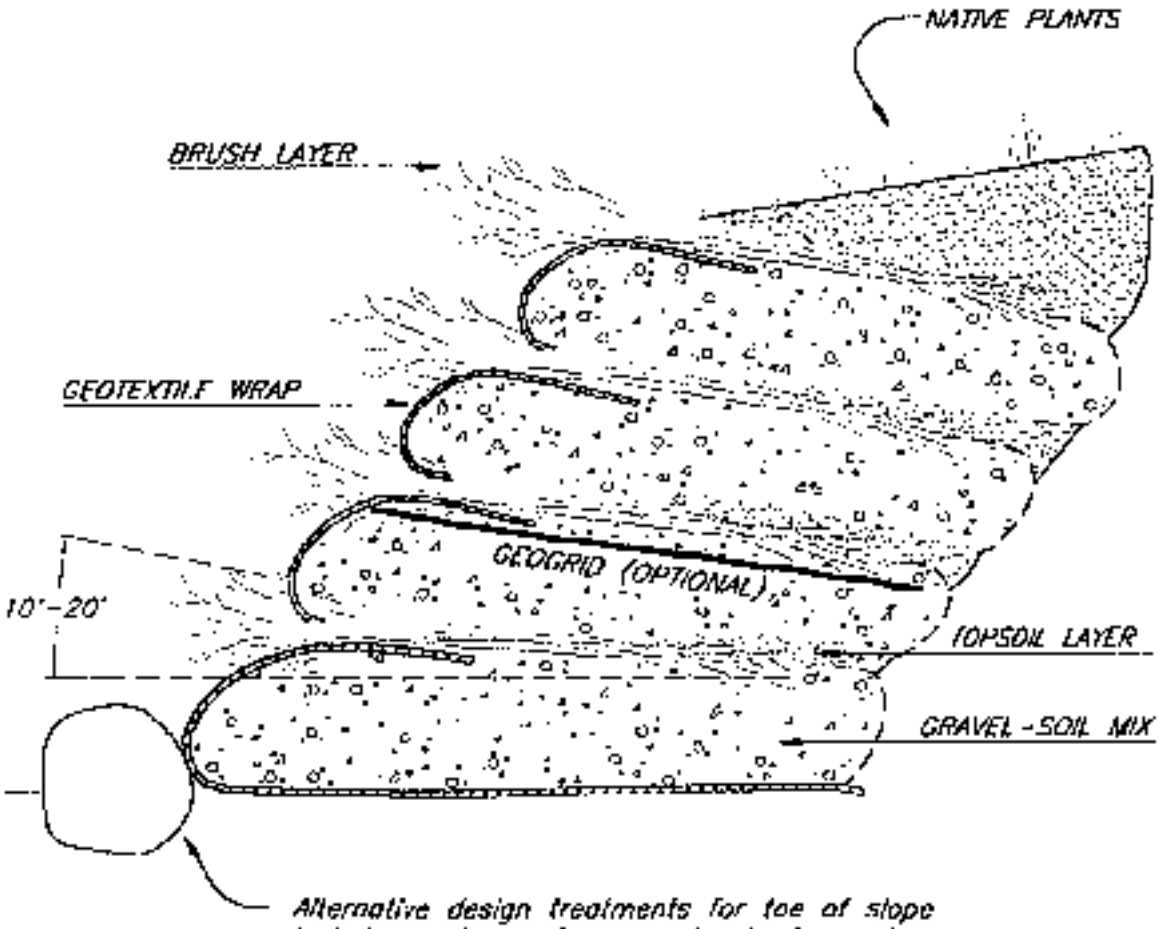
Repeat the branch, topsoil, and wrapped soil-gravel mix layering sequence until the desired bank height is achieved. Fill slopes can be created at the same time a brushlayer is installed. On a cut slope and existing streambanks, each layer is excavated at the time the brush layer is installed.

BRUSHLAYERING

Construction Specifications:

- Cuttings shall be harvested and planted when the willows, or other chosen species, are dormant. This period is generally from late fall to early spring.
- Choose plant materials that are adapted to the site conditions from species that root easily.
- Branch cuttings shall be 4-8 feet (1.2-2.5 m) long, 3/4-2 inches (20-50 mm) in diameter.
- Pre-soak cuttings for a minimum of 24 hours before installing.
- The surface of the bench shall be sloped so the outside edge is higher that the inside so the butt ends angle down slightly into the slope.
- Place branch cuttings, 3-8 inches (76-203 mm) thick, in a crisscross or over lapping configuration. The growing tips shall protrude 6-12 inches (152-305 mm) from the slope face with the butt end dipping into the slope.
- Immediately cover brushlayer with 6 inches (152 mm) of fill soil and compact according to construction specifications. Water the soil cover immediately to wet the cuttings and achieve adequate compaction.
- Earth moving equipment shall not travel directly over the cuttings. Six inches (152 mm) of soil must be maintained between the brushlayer and equipment at all times.
- Fill and compact the soil placed above the brushlayer in successive lifts, maximum 6-8 inches (152-203 mm) deep.
- Install the next brushlayer 3-8 feet (1-2.5 m) above the previous row.
- Seed and mulch slope. Shallow slopes, generally 3:1 or flatter may be seeded and mulched by hand. Steeper slopes should have seed applied hydraulically and the mulch shall be anchored with tackifier or other approved methods.

Inspection and Maintenance: Regular inspection and maintenance of bioengineering installations should be conducted, particularly during the first year. Prompt correction of any failures is essential to prevent major problems from developing.



NOTES:
1. Brush layers, geofabrics and geogrids are tensile inclusions, which modify shear stress.
2. Additionally, once established the root systems bind the entire system together as a coherent mass.
3. Live brush layers act as horizontal drains and improve slope stability by redirecting the flow direction.
4. Cut branches 3' to 12' long from appropriate salix, cornus or populus species.
5. Branches up to 12' long can be used on fillslope installations. Branches for cutslope installation can be 2' to 10' long depending on the bench excavation.
6. Natural geofabrics (coir netting) or geogrids can be wrapped around soil layers to provide additional soil reinforcement.

BRUSHLAYERING WITH GEOTEXTILE SOIL WRAP

© 1999 JOHN WILEY & SONS, INC.

FILE: SOILWRAP

Brushlayering with Rock Toe Protection

Brushlayers with rock toe are rows of live woody cuttings that are layered, alternating with successive lifts of soil fill, to construct a reinforced slope or embankment above a rock toe that armors the bank until the vegetation becomes established.

Conditions Where Practice Applies

Streambanks with low velocities, and slopes up to 2:1 that are susceptible to shallow mass movement. Sea or lake shores with light to moderate wave energy.

Materials

Live willow branches (or cuttings of other adventitiously-rooting species) at least 6 ft long, with a minimum diameter of ¾ in. Rock sized appropriately to resist velocities at design discharge.

Advantages

Brushlayering involves relatively simple construction. Among the ground stabilizing techniques, the brushlayer has an immediate impact, its protective and stabilizing effect extending into lower soil horizons. At extreme sites where erosion, deposition, and rockfall are particular hazards, brush layers and the pioneer vegetation that develops with them gradually eliminate these problems. Fast establishment of a stable soil-root complex is possible. Relatively short and spreading branches of the scrub willows growing in mountainous regions can be used. Simultaneous brushlayering construction during fill operations is possible. It is one of the best techniques for revegetating and stabilizing streambanks and slopes. Living and non-living brush layers along streambanks also provide valuable fish habitat.

Brushlayers also provide a flexible strengthening system to fills. A bank can sag or distort without pulling apart the brushlayers. The brushlayers will “stretch” because they are laid in to the slope on a diagonal, and are also self-repairing to the extent that they regrow roots in the case of a shear failure. Brushlayers act as horizontal drains and favorably modify the soil water flow regime.

Implementation

Place rock as designed. The rock should extend up the bank to the expected mean high water. Construct by excavating or filling a terrace above the rock protection. The terrace must slope back into the slope 10-20 degrees minimum. Place branches at least 6 ft long on the terrace. Branches shall crisscross at random with regard to size and age. Place 5-8 branches per linear foot (20/linear m), and 8-18" should protrude beyond the face of the slope. Cover and compact (add water if necessary) the brush layer with 6-18" of soil and construct another terrace and brushlayer. Proceed up the bank as desired.

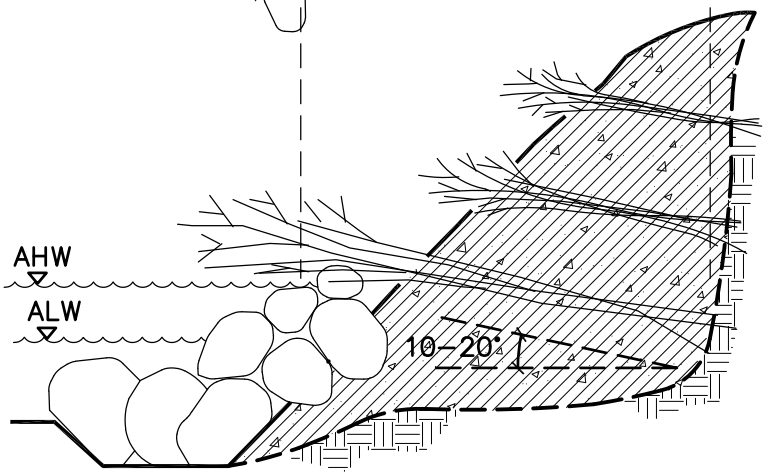
PLAN VIEW

FRONT OF SLOPE

BACK OF SLOPE

CRISSCROSS BRANCHES
5–8 BRANCHES/FT. MIN.
(20/ LINEAR METER)
PLACED AT RANDOM WITH
REGARD TO SIZE AND AGE.

SECTION



NOTES:

1. USE LIVE WILLOW BRANCHES AT LEAST 6' LONG AND ¾" IN DIAMETER, AND MIN. 1/4 TON RIP RAP.
2. KEY RIP RAP 1.5 TIMES LARGEST BOULDER SIZE. EXTEND ROCK UPSLOPE ABOVE EXPECTED HIGH WATER.
3. CONSTRUCT BY EXCAVATING OR FILLING TERRACES, SLOPED 10–20 DEGREES BACK INTO SLOPE.
4. PLACE BRANCHES AND CRISCROSS AT RANDOM (5–8 PER LINEAR FOOT) WITH 8–18" PROTRUDING.
5. COVER AND COMPACT WITH 6–18" OF SOIL. REPEAT UNTIL AT TOP OF SLOPE.

BRUSHLAYERING WITH ROCK TOE PROTECTION

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\5 brushlayering with rock toe protection.dwg

©1994 JOHN MCCULLAH

Brush Mattress (Brush Mat)

A brush mattress or brush mat is a revegetation technique that provides a protective covering to a slope or streambank as soon as it is installed. A brush mattress is typically constructed using live willow branches or other species that root easily from cuttings, but can also be constructed with any brushy, woody branches in order to provide immediate and effective slope protection.

Conditions Where Practice Applies

Brush mattresses are ideal for eroding streambanks or slopes where immediate protection is needed. Streambanks which are in jeopardy of being scoured due to high erosive forces can be rapidly stabilized by installation of a brush mattress along the eroding reach. Because of the dense layer of brush, the brush mattress can deflect water from the bank and protect it from scouring, while also providing habitat directly along the waters' edge. Brush mattresses also work well for shoreline protection. The density of the mat will break the impact of waves and instantly provide a thick protective layer of brush along the shoreline. If the desire is to stabilize and revegetate an eroding streambank or shoreline and discourage foot trails along sensitive areas, brush mats work well as impenetrable barriers, giving time for vegetation to become established. On slopes, brush mattressing provides rapid protection against surficial erosion. Brush mats are often combined with other soil stabilization techniques such as vegetated riprap, wattles, live Fascines, root wads, live siltation, or coir logs, which may be needed to secure the toe of the slope. The brush mattress technique is usually most effective on slopes no steeper than 2H:1V.

Advantages

Brush mattresses quickly stabilize a slope or streambank by providing a dense network of branches which prevent surficial erosion, while also collecting soil and native seeds. The overlapping branches provide an ideal environment for native seeds to germinate and establish. As the live branches root and grow, the soil is reinforced with an underground matrix of spreading roots. If used on streambanks, a brush mat will trap sediments during high water, and eventually the plant growth on the stabilized streambank will provide aquatic habitat. Brush mattresses work well for stabilizing reconstructed stream channels, as they provide immediate cover for fish and instant bank protection, even before they become established and grow.

Of all the streambank biotechnical practices, brush mattresses can withstand the highest velocities. Studies conducted by Christoph Gerstgraser, Universitat fur Bodenkultur, Vienna, Austria, demonstrated that brush mattresses stabilized the bank in a test flume against velocities exceeding 7 m/s (20 f/s), while other techniques, even rock riprap, failed.

Brush Mattress (Brush Mat) (continued)

Disadvantages

Large numbers of cuttings are required, probably more than any other biotechnical method, and the availability of plant material should be carefully evaluated before including this technique in a revegetation design. Brush mat installation is a labor-intensive construction method. As with most biotechnical projects, if using live cuttings, brush mattresses must be installed during the dormancy period of species used. In areas which receive little rainfall, brush mattresses installed on dry slopes may not survive long, as this technique does not entrench the branches deeply into the soil.

Implementation

- Prepare the slope or streambank by clearing away large debris, and the slope should be graded so that branches will lay flat on the bank. Do not disturb the slope or bank any more than necessary. Excavate a horizontal trench, 8 to 12 inches deep, at the toe of the streambank or at the base of applicable area on the slope. The basal ends of the branches should extend into moist soil.

- Lay the cuttings flat against the graded slope, slightly crisscrossed, with the basal ends placed as deeply into the trench as possible. Continue to lay the cuttings along the face of the bank or slope until about 80% groundcover is achieved (about 6-12 inches thick). If the length of the slope or bank is longer than the cuttings, stagger and overlap the cuttings so the entire area has adequate coverage. Rooted plants can be planted within the brush mattress, but these should be planted before the branches are laid, as it is too difficult to plant through the mattress afterward.

- Pound in a grid of 24 to 36 inch long stakes into the mattress at 3 to 4 foot centers. Do not pound the stakes completely in, as this will be done after tying. Use longer stakes in less cohesive (sandy) soil. Secure the brush mattress by using cord, rope, or 10-12 gauge galvanized wire tied in a diamond pattern between each row of stakes. (Tie the cord or wire to the stakes in such a manner that if it breaks, the integrity of the remaining cord or wire is still maintained). Notching or drilling stakes may make securing cord or wire to stakes easier, but is not necessary.

- After networking the mattress with cord or wire, drive the stakes in further to compress the mattress tightly against the slope. If constructing a brush mattress on a streambank, be careful not to leave loose overhanging branches which may catch on material floating down the stream channel. The mattress may be ripped from the streambank if this occurs.

Brush Mattress (Brush Mat) (continued)

- Secure the toe of the mattress using the technique best suitable for the site conditions. To secure the toe of the mattress using a willow wattle, first construct a wattle the length of the area to be treated (see wattle technique). Make sure the wattle is tied together tightly. Place the wattle in the trench over the cut ends of the brush mattress. Secure the wattle with 18 to 48 inch long wedge-shaped wooden stakes every 3-4 feet. In some cases, such as small streams or gentle slopes, simply placing large locally collected rocks around and on top of the basal ends of the cuttings is enough to secure the toe of the mattress. Other techniques which may be used include vegetated riprap, wattles, live fascines, rootwad revetments, live siltation, or coir logs.

- Backfill around and in between the branches of the mattress by using material excavated from the trench, working the soil in well. Buckets of water will help to wash the soil down into the stems. It is most important for the thicker, basal ends of the mattress to get good soil cover for rooting, but generally cover at least 1/4 of the depth of the mattress with soil. If installed along a stream, make sure the upstream end of the mattress and wattle is keyed into the streambank to prevent high flows from scouring behind the mattress. It is also a good idea to protect this area with some revetment, large rocks, or tree trunks. If possible, tie the mattress to existing vegetation or roots on the bank for extra security.

Maintenance

It is important to monitor the brush mattress after it has been installed. Periodic monitoring of the project will provide valuable insight into the stabilization process and may offer important information for future biotechnical projects. If the willow does not grow, the mattress will still provide stability, especially if it is backfilled and seeded with native grasses, sedges, or rushes.

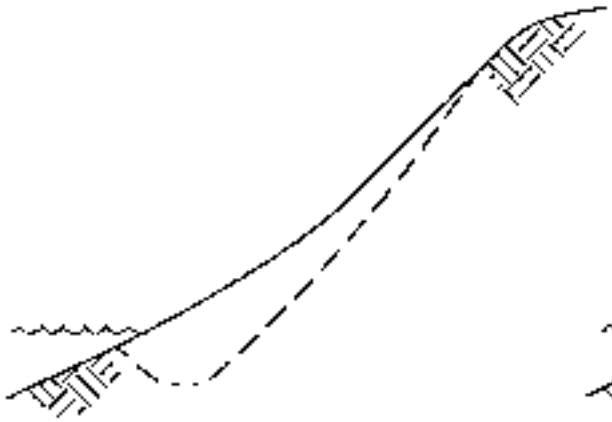
Periodic maintenance includes making sure the stakes and cord/wire are still securing the mattress to the streambank. The upstream end should be carefully checked to make sure flows are not getting behind the mattress. To ensure the highest success for the treated area, determine the land management practices that created the eroded streambanks and modify those practices as necessary (From Bentrup and Hoag, 1998).

If the area is grazed, restrict livestock from treated area to allow the eroded section of the streambank to heal. Exclosure fences are the most efficient means to accomplish this goal. Managers should resist the temptation to put the exclosure fences at the high water line. The exclosure area should include enough of the

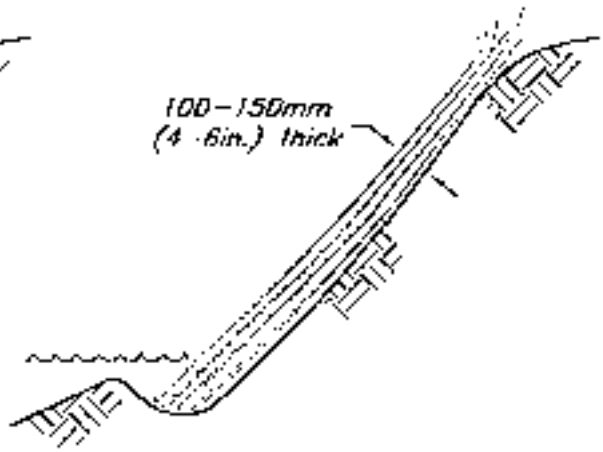
riparian zone to allow the stream to shift naturally over time.

If the area is farmed, a riparian buffer strip should be established and maintained. A buffer strip on both sides of the stream should be set aside to allow for natural riparian vegetation and stream function. A wider buffer strip is strongly encouraged and will yield greater benefits.

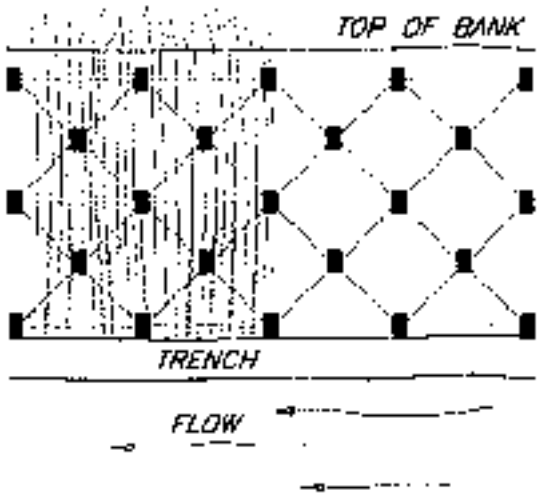
Finally, a stream is an interconnected system. Land use practices both upstream and downstream will affect the success of your bioengineering work.



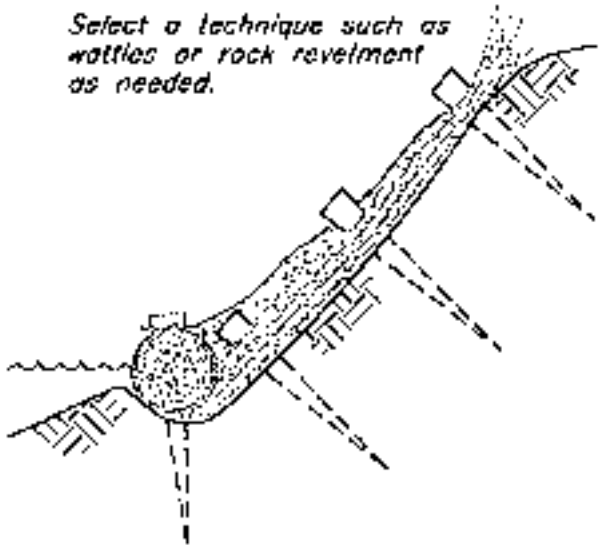
Step 1: Excavate trench and grade bank.



Step 2: Place willow branches making sure that the butt ends reach the bottom.



Step 3: Place stake (notched) on 1.0m (3ft.) centers and secure the mattress with twine, rope or wire.



Select a technique such as wattles or rock revetment as needed.

Step 4: Drive the stakes deeply into the bank to tightly compress the branches against the soil. Cover and partially bury the mattress to encourage rooting.

BRUSH MATTRESS

© 2000 JOHN WILEY & SONS, INC.

FILE: BRUSHMAT

Coir Rolls with Brushlayering

Coir logs (also called coir rolls or fiberschines) are long cylindrical tubes that are composed of interwoven coconut fibers which are bound together with durable coir netting. Coir rolls are particularly applicable for wetland, streambank, and shoreline projects. Coir rolls are most commonly available in 12 inch diameters and 20 foot lengths. These rolls can be linked together to form longer tubes, and are often used in combination with other biotechnical techniques, such as brushlayering or live siltation. Coir logs encourage siltation and wetland/floodplain creation.

Conditions Where Practice Applies

The tough, long-lasting coconut fibers make coir rolls appropriate for wetland, streambank, and shoreline applications. Coir rolls work well when immediate erosion control is needed. Brushlayers work well with coir roll applications, adding further stabilization with a live root system, while also providing excellent habitat features. The coir roll provides a base for the brushlayer cuttings to be laid upon at an appropriate angle which benefits the growth of cuttings. The cuttings provide further protection from breaking waves and high flows.

Materials

Coir rolls of the appropriate size and length, live cuttings for brushlayering, and strong rope and wooden stakes are necessary. Also needed is machinery and/or tools for leveling and compacting soil. If using a soil wrap, material (blanket or mats) appropriate to the application conditions is needed. If planning to plant coir rolls with container plants, suitable plant material such as wetland grasses are needed.

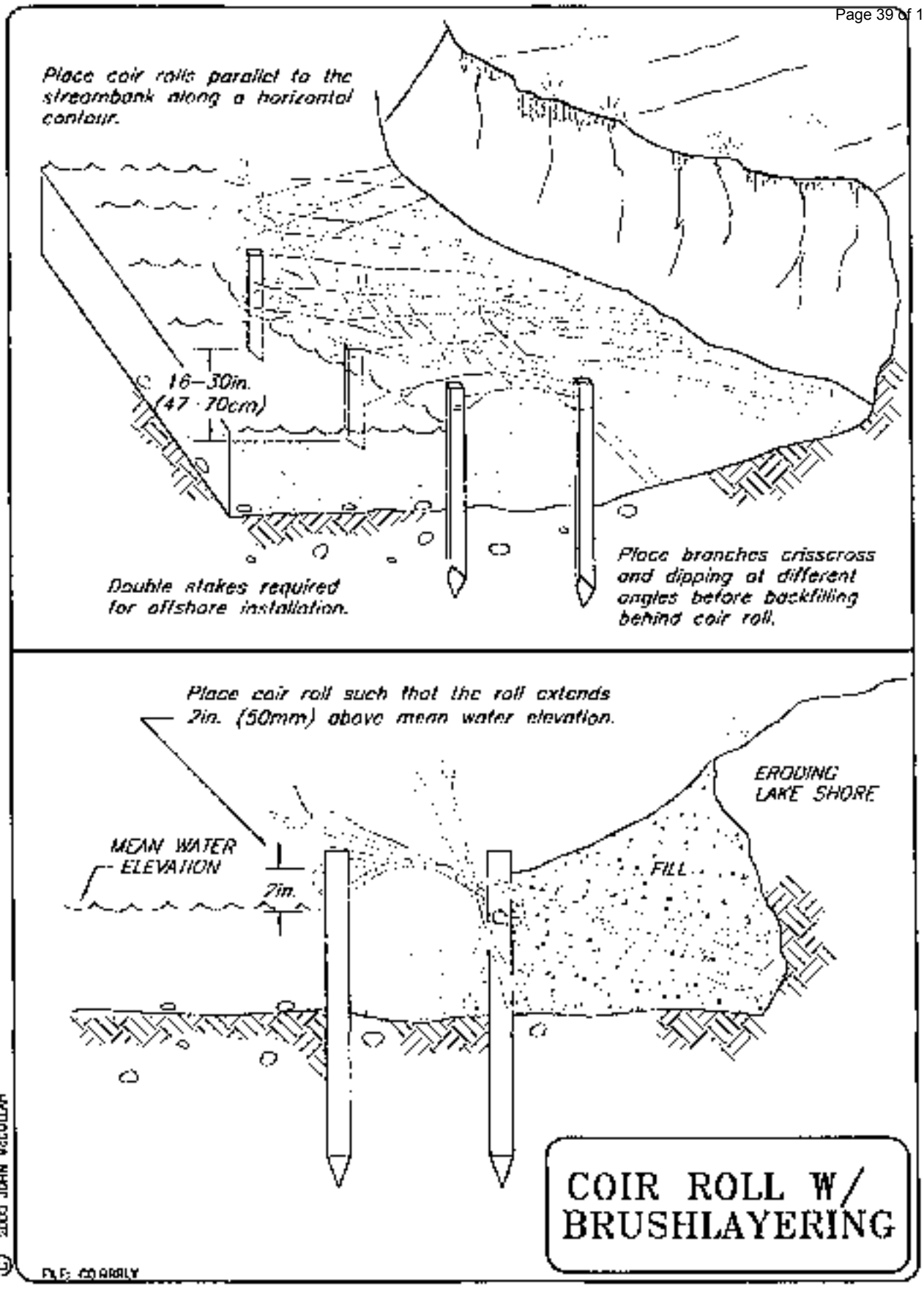
Advantages

Provides a "soft" engineering method for shoreline and streambank stabilization as opposed to "hard" engineering such as gabions and riprap alone. This makes coir rolls with brushlayering more appropriate for recreational use areas where swimmers could be injured by wire or rocks, or critical fisheries where habitat-friendly streambank stabilization is needed. The coir roll/brushlayering combination provides immediate shoreline and streambank protection, with additional benefits of riparian enhancement when the cuttings become established.

Implementation

Clear debris away and level area of application. Install coir rolls as specified (see fiberschines/coir rolls for implementation information). Prepare soil bed behind installed coir rolls for laying brushlayer cuttings. Determine soil level by laying a straight cutting on the coir roll with approximately 20% of the cutting sticking out past the roll, and with the basal ends slipping down into the soil. It is important that the bud ends of the live cuttings angle up to some degree from the basal ends. Lay cuttings in this fashion, slightly crisscrossed for additional strength. (See Brushlayering)

Next, backfill over cuttings with soil, covering the lower 80% of the branches. At this time, soil can be leveled and prepared for a soil wrap for additional height and soil stability. If simply covering the cuttings with soil, compact slightly and grade slope to appropriate angle. Use water to wash soil in between branch layers. Mulch and seed exposed areas with native species.


Place coir rolls parallel to the streambank along a horizontal contour.
16–30in.
(47–70cm)
Double stakes required for offshore installation.
Place branches crisscross and dipping at different angles before backfilling behind coir roll.
Place coir roll such that the roll extends 2in. (50mm) above mean water elevation.
MEAN WATER ELEVATION
2in.
FILL
ERODING LAKE SHORE
COIR ROLL W/ BRUSHLAYERING
© 2000 JOHN McCULLAH
FILE: COIRBRSH

ENERGY DISSIPATOR

Construction Specifications:

- Ensure that the subgrade for the filter and riprap follows the required lines and grades shown in the plan. Compact any fill required in the subgrade to the density of the surrounding undisturbed material. Low areas in the subgrade on undisturbed soil may also be filled by increasing the riprap thickness.

- The riprap and gravel filter must conform to the specified grading limits shown on the plans.

- Filter cloth, when used, must meet design requirements and be properly protected from puncturing or tearing during installation. Repair any damaged fabric by removing the riprap and placing another piece of filter cloth over the damaged area. All connecting joints should overlap a minimum of 1 foot (0.3 m). If the damage is extensive, replace the entire filter cloth.

- Riprap may be placed by equipment, but take care to avoid damaging the filter.

- The minimum thickness of the riprap should be 1.5 times the maximum stone diameter.

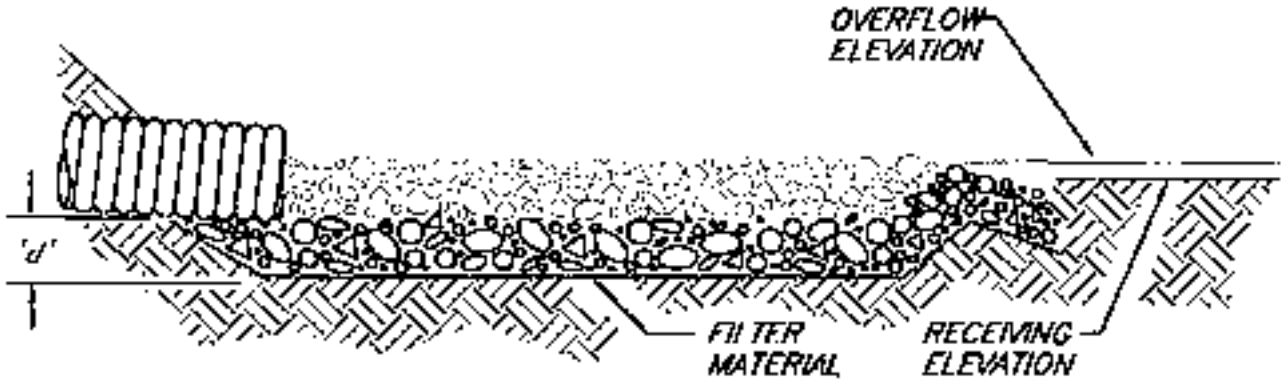
- Riprap may be field stone or rough quarry stone. It should be hard, angular, highly weather resistant and well graded.

- Construct the apron on zero grade with no overfall at the end. Make the top of the riprap at the downstream end level with the receiving area or slightly below it.

- Ensure that the apron is properly aligned with the receiving stream and preferably straight throughout its length. If a curve is needed to fit site conditions, place it in the upper section of the apron.

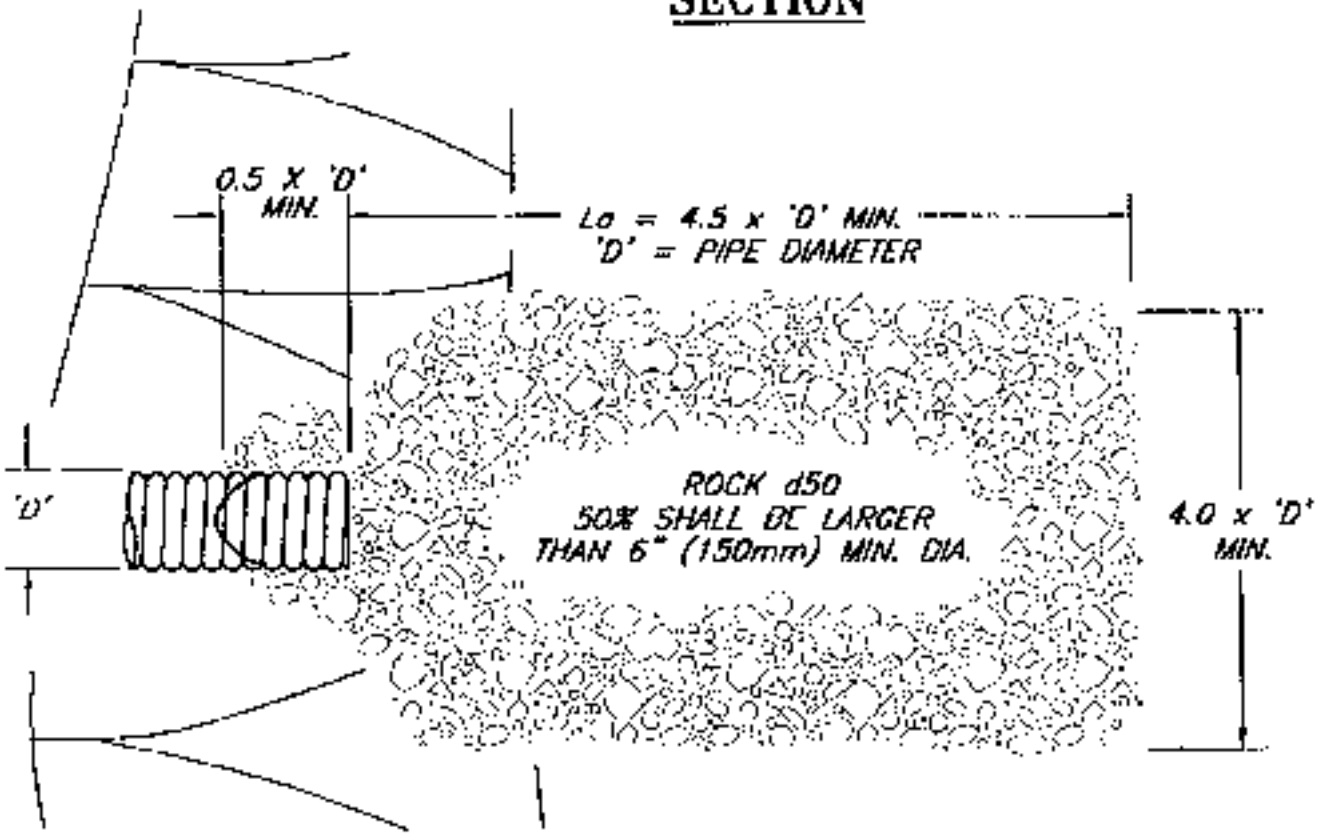
- Immediately after construction, stabilize all disturbed areas with vegetation.

Inspection and Maintenance: Inspect riprap outlet structures after heavy rains to see if any erosion around or below the riprap has taken place or if stones have been dislodged. Immediately make all needed repairs to prevent further damage.



THICKNESS ('d') = 1.5 x MAX. ROCK DIAMETER – 6" (150mm) MIN.

SECTION



PLAN

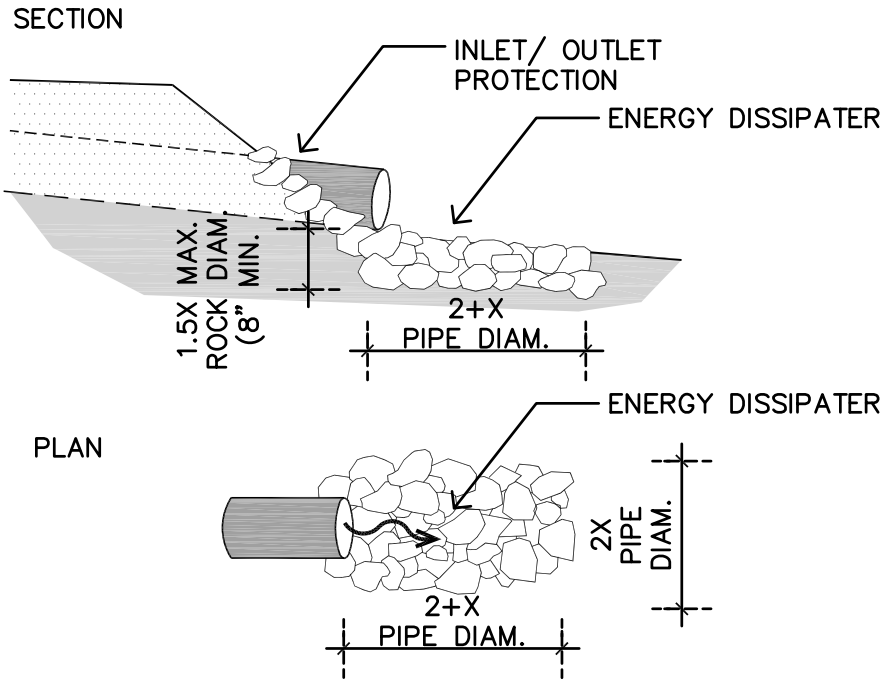
NOTES:

1. 'La' = LENGTH OF APRON. DISTANCE 'La' SHALL BE OF SUFFICIENT LENGTH TO DISSIPATE ENERGY.
2. APRON SHALL BE SET AT A ZERO GRADE AND ALIGNED STRAIGHT.
3. FILTER MATERIAL SHALL BE FILTER FABRIC OR 6" (150mm) THICK MINIMUM GRADED GRAVEL LAYER.

ENERGY DISSIPATOR

© 1994 J. McCULLAH

FILE: ENRGYDIS



NOTES:

– INLET/ OUTLET PROTECTION

1. ARMOR INLET AND OUTLET TO THE TOP OF THE CULVERT WITH ROCK RIPRAP, AS SHOWN.
2. RIPRAP SHALL CONSIST OF APPROVED WELL GRADED SOUND DURABLE ANGULAR ROCK UNLESS OTHERWISE SPECIFIED.
3. 50% OF ROCK (D_{50}) SHALL BE LARGER THAN 8 INCHES MINIMUM DIAMETER UNLESS OTHERWISE SPECIFIED.
4. ROCK SHALL BE KEYED MINIMUM 1.5 TIMES DIAMETER INTO BED AND BANKS UNLESS OTHERWISE SPECIFIED.

– ENERGY DISSIPATER

1. CULVERT SHALL DISCHARGE ONTO ROCK ENERGY DISSIPATER/ APRON ALIGNED WITH NATIVE CHANNEL AS SHOWN ON PLANS OR DIRECTED.
2. UNLESS OTHERWISE SPECIFIED IN PLANS OR DIRECTED BY GEOTECHNICAL CONSULTANT, ARMOR SHALL CONSIST OF APPROVED SOUND DURABLE ANGULAR ROCK ADEQUATELY SIZED FOR DESIGN FLOW. PRELIMINARY ROCK SIZE IS SPECIFIED IN TABLE C.
3. ROCK APRON SHALL EXTEND A MINIMUM OF 2 TIME PIPE DIAMETER DOWNSTREAM OF OUTLET AND BE A MINIMUM OF 2 TIMES PIPE DIAMETER WIDE. APRON MAY TAPER DOWNSTREAM ON STEEPER GRADIENT CHANNELS.
4. ROCK SHALL BE EMBEDDED INTO CHANNEL A MINIMUM OF 1.5 TIMES MAXIMUM ROCK DIAMETER. SUBEXCAVATE CHANNEL BED AND BANKS IN AREAS TO RECEIVE ROCK. ROCK SHALL BE PLACED TO FORM A UNIFORM GRADE AT THE PIPE OUTLET IN A MANNER TO PREVENT FLOW FROM ERODING AROUND THE EDGE OF THE APRON.
5. SEPARATE ROCK FROM NATIVE SOILS WITH APPROVED GEOTEXTILE FABRIC IF SPECIFIED ON PLANS OR DIRECTED.
6. COMPACT LOOSE SOILS ADJACENT TO ROCK RIP RAP.

TABLE C

PIPE DIAMETER	D_{50} ROCK SIZE (50% OF ROCK LARGER THAN SPECIFIED)	
	DIAMETER	WEIGHT
<18"	8"	GABION +
24"	12"	0.25 T
36"	24"	0.5 T
48"	36"	1.5 T

ENERGY DISSIPATER

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT | SCALE: NTS | DATE: 10/2019

©TIMOTHY C. BEST, CEG

EROSION CONTROL BLANKETS AND MATS

Construction Specifications:

Site Preparation:

- Proper site preparation is essential to ensure complete contact of the protection matting with the soil
- Grade and shape area of installation
- Remove all rocks, clods, vegetative or other obstructions so that the installed blankets or mats will have direct contact with the soil.
- Prepare seedbed by loosening 2-3 inches (50 8-76 2 mm) of topsoil above final grade
- Incorporate amendments, such as lime and fertilizer, into soil according to soil test and the seeding plan

Seeding:

- Seed area before blanket installation for erosion control and re-vegetation Seeding after mat installation is often specified for turf reinforcement application When seeding prior to blanket installation, all check slots and other areas disturbed during installation must be reseeded
- Where soil filling is specified, seed the matting and the entire disturbed area after installation and prior to filling the mat with soil

Anchoring: U-shaped wire staples, metal geotextile stake pins, or triangular wooden stakes can be used to anchor mats to the ground surface Wire staples should be a minimum of 11 gauge Metal stake pins should be 3/16 inch (4 8 mm) diameter steel with a 1 1/2 inch (38 1 mm) steel washer at the head of the pin Wire staples and metal stakes should be driven flush to the soil surface All anchors should be 6 8 inches (0.2-0 5 m) long and have sufficient ground penetration to resist pullout. Longer anchors may be required for loose soils.

Installation on Slopes:

- Begin at the top of the slope and anchor its blanket in a 6 inch (0 2 m) deep x 6 inch (0 2 m) wide trench Backfill trench and tamp earth firmly
- Unroll blanket downslope in the direction of the water flow
- The edges of adjacent parallel rolls must be overlapped 2-3 inches (5 1-76 mm) and be stapled every 3 feet (0 9 m)
- When blankets must be spliced, place blankets end over end (shingle style) with 6 inch (0 2 m) overlap Staple through overlapped area, approximately 12 inches (0 3 m) apart
- Lay blankets loosely and maintain direct contact with the soil - do not stretch
- Blankets shall be stapled sufficiently to anchor blanket and maintain contact with the soil. Staples shall be placed down the center and staggered with the staples placed along the edges Steep slopes, 1:1 to 2:1, require 2 staples per square yard Moderate slopes, 2:1 to 3:1, require 1-2 staples per square yard (1 staple 3' o c) Gentle slopes require 1 staple per square yard

Installation in channels:

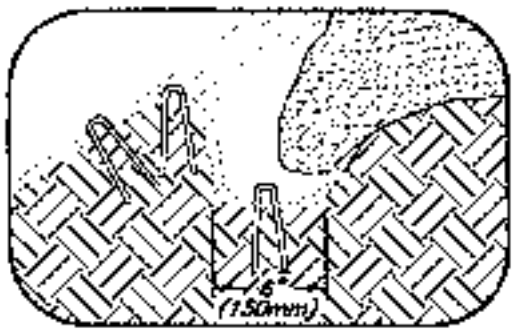
- Dig initial anchor trench 12 inches (0.3 m) deep and 6 inches (0.2 m) wide across the channel at the lower end of the project area
- Excavate intermittent check slots, 6 inches (0.2 m) deep and 6 inches (0.2 m) wide across the channel at 25-30 foot (7.6-9.1 m) intervals along the channel
- Cut longitudinal channel anchor slots 4 inches (101 mm) deep and 4 inches (101 mm) wide along each side of the installation to bury edges of matting. Whenever possible extend matting 2-3 inches (51-76 mm) above the crest of channel side slopes
- Beginning at the downstream end and in the center of the channel, place the initial end of the first roll in the anchor trench and secure with fastening devices at 1 foot (.3 m) intervals. Note: matting will initially be upside down in anchor trench.
- In the same manner, position adjacent rolls in anchor trench, overlapping the preceding roll a minimum of 3 inches (7.6 cm)
- Secure these initial ends of mats with anchors at 1 foot (0.3 m) intervals, backfill and compact soil
- Unroll center strip of matting upstream. Stop at next check slot or terminal anchor trench
- Unroll adjacent mats upstream in similar fashion, maintaining a 3 inch (76 mm) overlap
- Fold and secure all rolls of matting snugly into all transverse check slots. Lay mat in the bottom of the slot then fold back against itself. Anchor through both layers of mat at 1 inch (25.4 mm) intervals, then backfill and compact soil. Continue rolling all mat widths upstream to the next check slot or terminal anchor trench
- Alternate method for nonvertical installations: place two rows of anchors on 6 inch (0.2 m) centers at 25-30 foot (7.6-9.1 m) intervals in lieu of excavated check slots
- Shingle-lap spliced ends by a minimum of 1 foot (0.3 m) with upstream mat on top to prevent uplifting by water or begin new rolls in a check slot. Anchor overlapped area by placing two rows of anchors, 1 foot (0.3 m) apart on 1 foot (0.3 m) intervals
- Place edges of outside mats in previously excavated longitudinal slots, anchor using prescribed staple pattern, backfill and compact soil
- Anchor, fill and compact upstream end of mat in a 12 inch (0.3 m) x 6 inch (0.2 m) terminal trench
- Secure mat to ground surface using U-shaped wire staples geotextile pins or wooden stakes
- Seed and fill turf reinforcement matting with soil, if specified

Soil filling if specified for turf reinforcement:

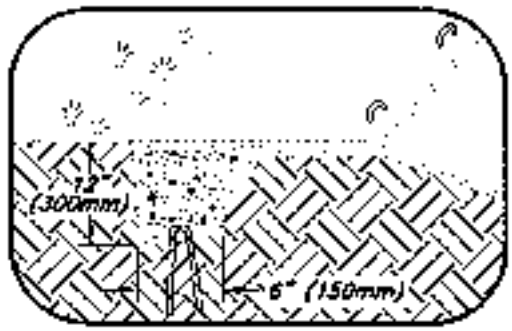
- After seeding, spread and lightly rake 1/2-3/4 inches (12.7-19.1 mm) of fine topsoil into the mat apertures to completely fill mat thickness. Use backside of rake or other flat implement
- Spread topsoil using lightweight loader, backhoe, or other power equipment. Avoid sharp turns with equipment
- Do not drive tracked or heavy equipment over mat
- Avoid any traffic over matting if loose or wet soil conditions exist.
- Use shovels, rakes or brooms for fine grading and touch up
- Smooth out soil filling, just exposing top netting of matrix

Inspection and Maintenance:

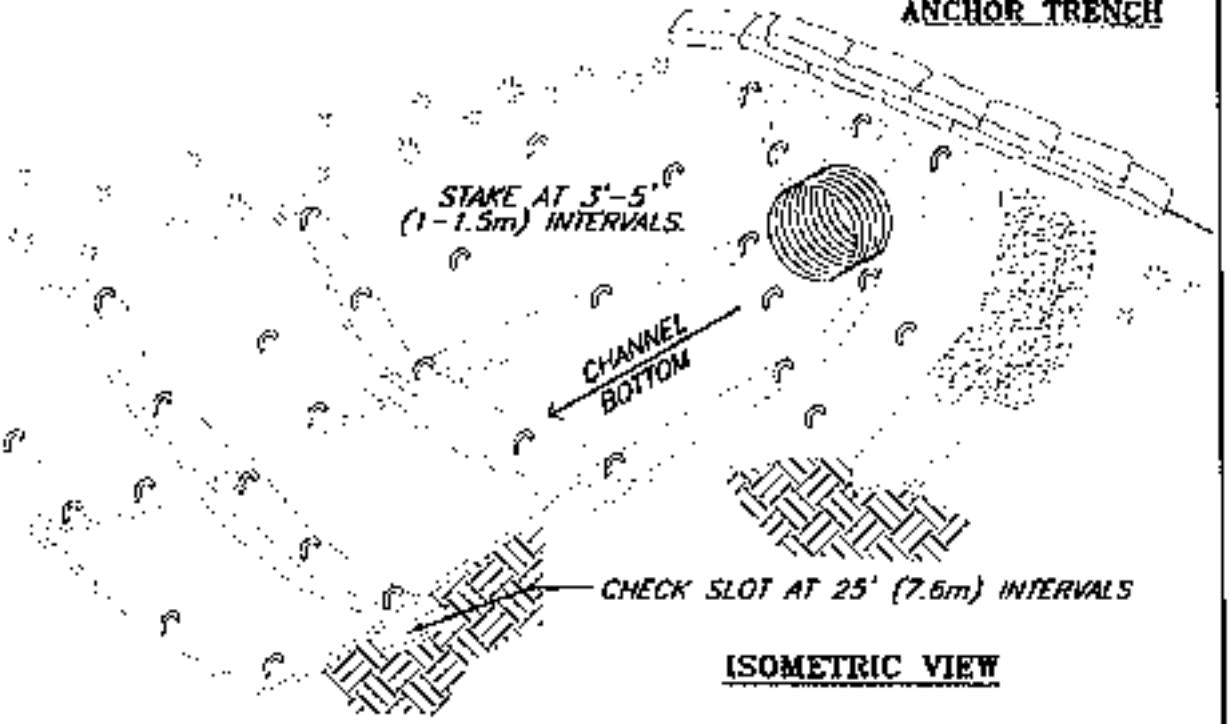
- All blanket and mats should be inspected periodically following installation
- Inspect installation after significant rainstorms to check for erosion and undermining. Any failure should be repaired immediately.
- If washout or breakage occurs, re-install the material after repairing the damage to the slope or drainageway



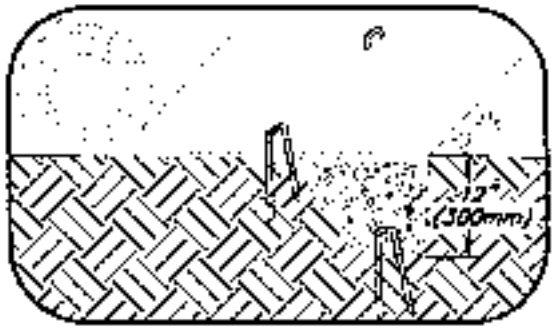
LONGITUDINAL ANCHOR TRENCH



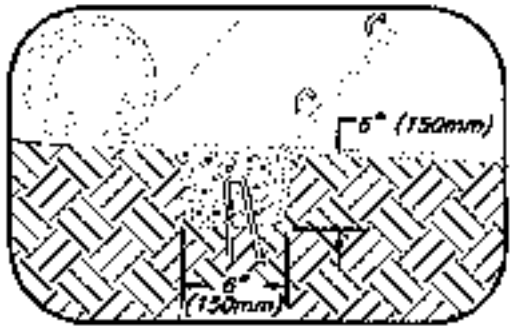
TERMINAL SLOPE AND CHANNEL ANCHOR TRENCH



ISOMETRIC VIEW



INITIAL CHANNEL ANCHOR TRENCH



INTERMITTENT CHECK SLOT

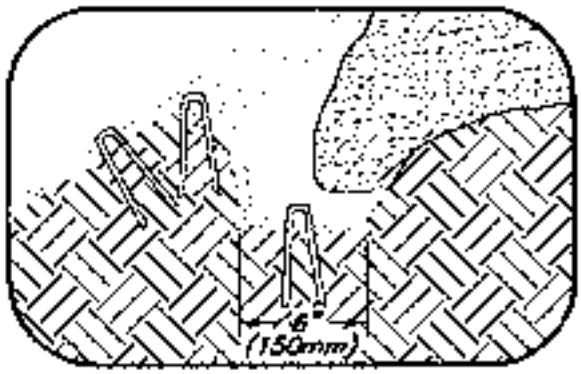
NOTES:

1. CHECK SLOTS TO BE CONSTRUCTED PER MANUFACTURERS SPECIFICATIONS.
2. STAKING OR STAPLING LAYOUT PER MANUFACTURERS SPECIFICATIONS.

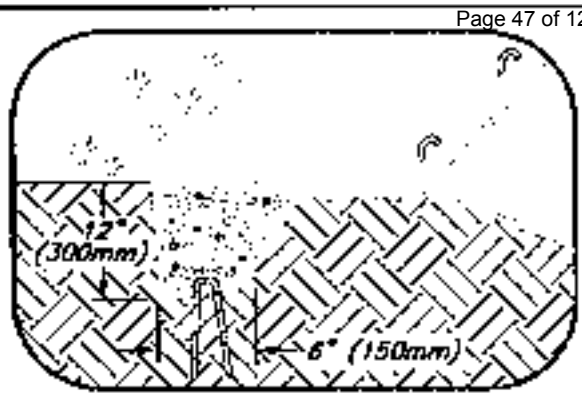
EROSION BLANKETS & TURF REINFORCEMENT MATS CHANNEL INSTALLATION

© 1994 JOHN McCULLAH

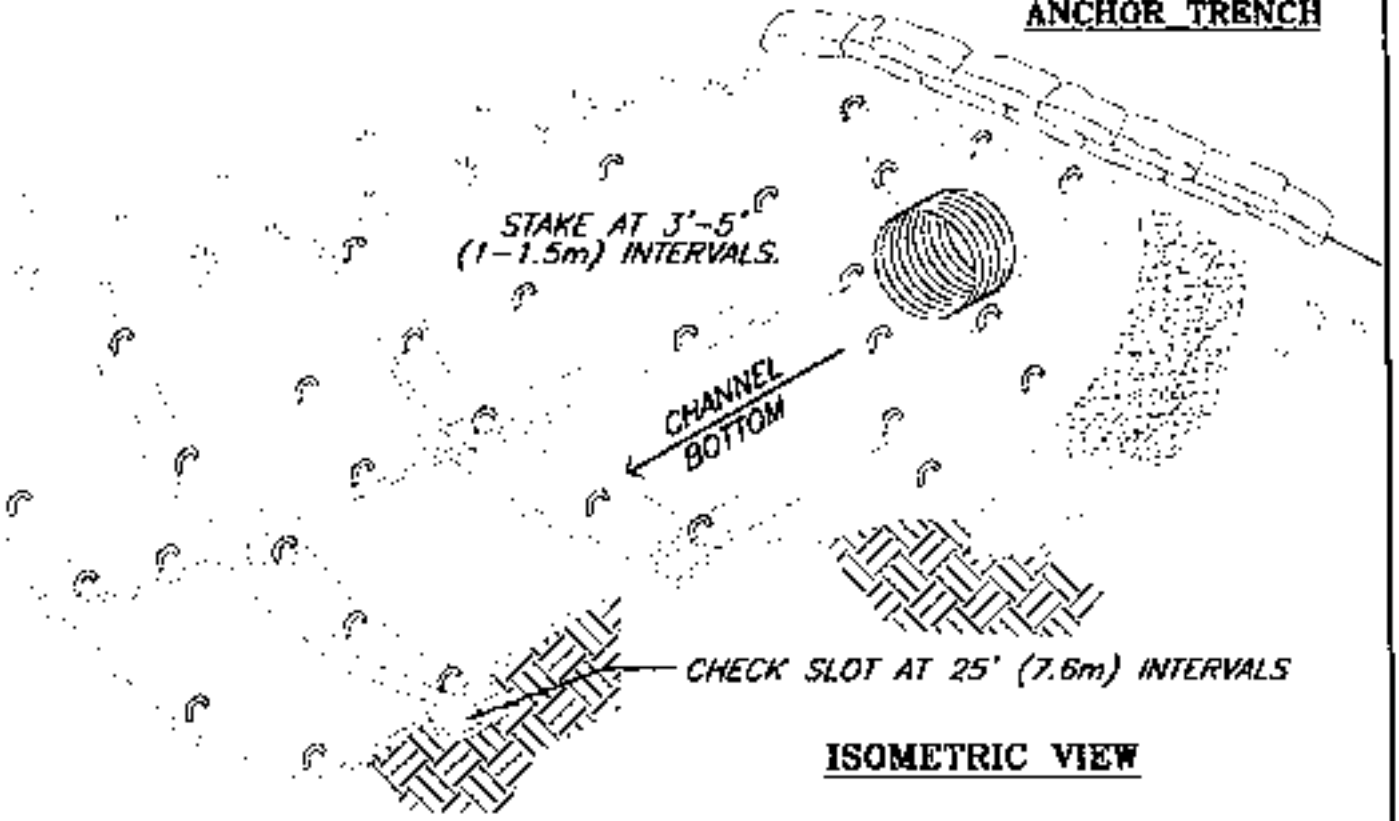
FILE: BLANKTCHA



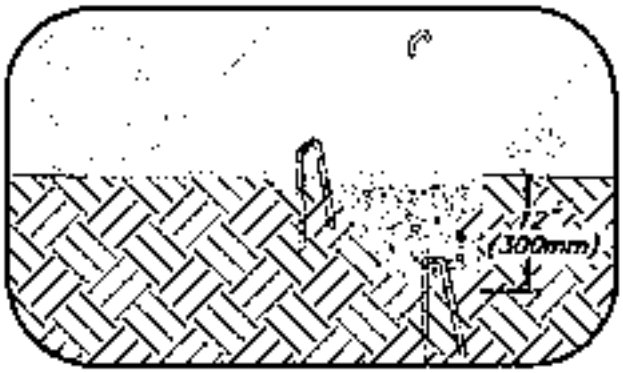
LONGITUDINAL ANCHOR TRENCH



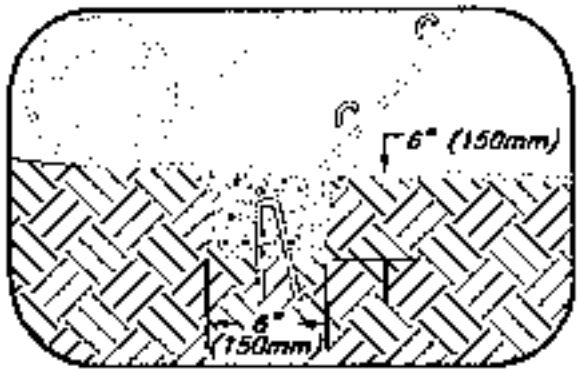
TERMINAL SLOPE AND CHANNEL ANCHOR TRENCH



ISOMETRIC VIEW



INITIAL CHANNEL ANCHOR TRENCH



INTERMITTENT CHECK SLOT

NOTES:

1. CHECK SLOTS TO BE CONSTRUCTED PER MANUFACTURERS SPECIFICATIONS.
2. STAKING OR STAPLING LAYOUT PER MANUFACTURERS SPECIFICATIONS.

EROSION BLANKETS & TURF REINFORCEMENT MATS CHANNEL INSTALLATION

© 1994 J. McCULLAH

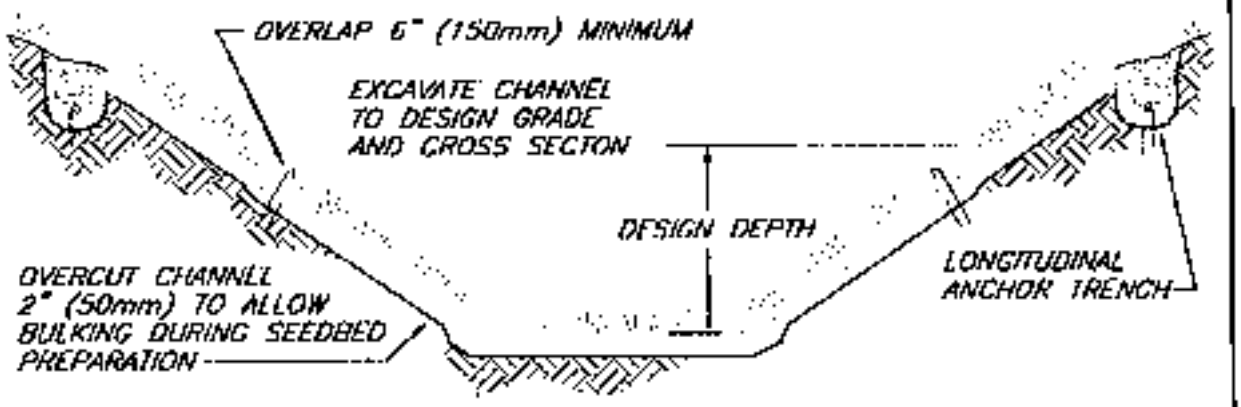
FILE: BLNKTCHA

GRASSED-LINED CHANNELS

Construction Specifications: See Permanent Seeding and Erosion Control Blankets and Mats BMPs

Inspection and Maintenance:

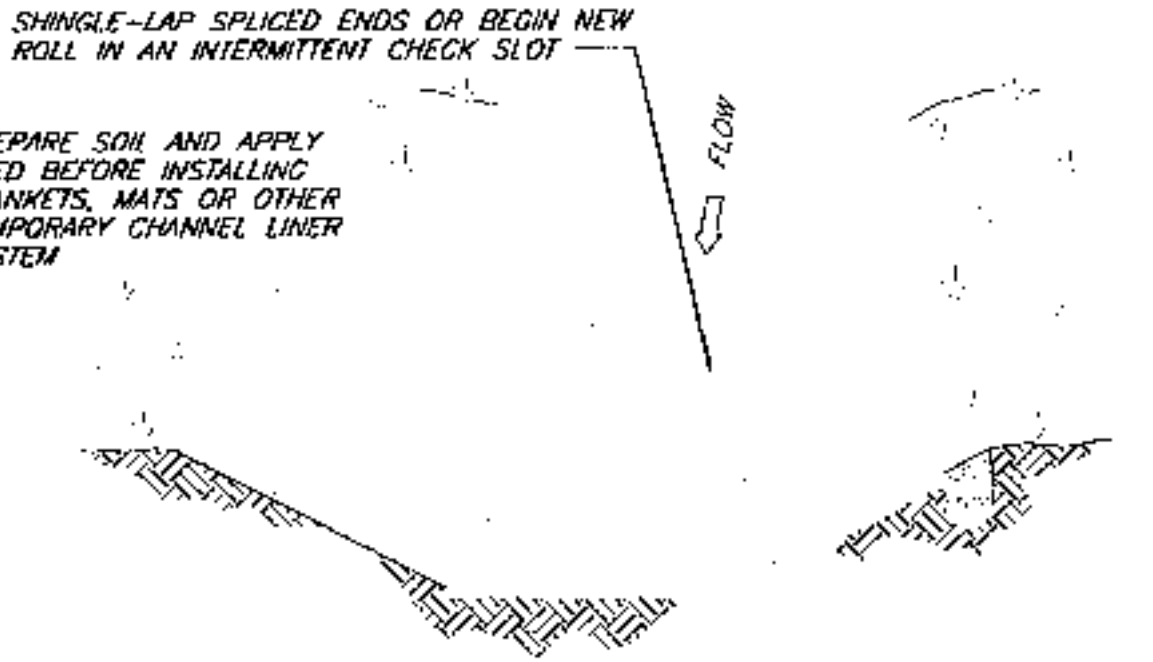
- During the initial establishment, grass-lined channels should be repaired and grass re-established if necessary
- After grass has become established, the channel should be checked periodically to determine if the channel is withstanding flow velocities without damage
- Check the channel for debris, scour, or erosion and immediately make repairs. It is particularly important to check the channel outlet and all road crossings for bank stability and evidence of piping or scour holes and make repairs immediately
- Remove all significant sediment accumulations to maintain the designed carrying capacity
- Keep the grass in a healthy, vigorous condition at all times, since it is the primary erosion protection for the channel
- Permanent grassed waterways should be seasonally maintained by mowing or irrigating, depending on the type of vegetation selected



TYPICAL INSTALLATION WITH EROSION CONTROL BLANKETS OR TURF REINFORCEMENT MATS

INTERMITTENT CHECK SLOT

LONGITUDINAL ANCHOR TRENCH



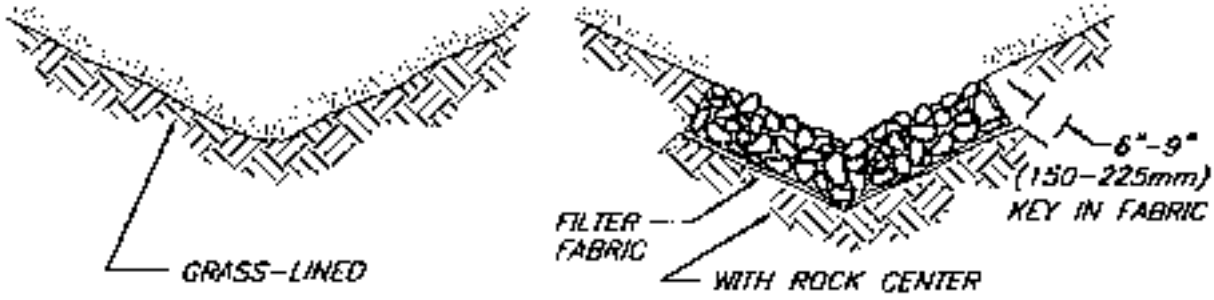
NOTES:
1. DESIGN VELOCITIES EXCEEDING 2 FT/SEC (0.5m/sec) REQUIRE TEMPORARY BLANKETS, MATS OR SIMILAR LINERS TO PROTECT SEED AND SOIL UNTIL VEGETATION BECOMES ESTABLISHED.
2. GRASS-LINED CHANNELS WITH DESIGN VELOCITIES EXCEEDING 6 FT/SEC (2m/sec) SHOULD INCLUDE TURF REINFORCEMENT MATS.

NOT TO SCALE

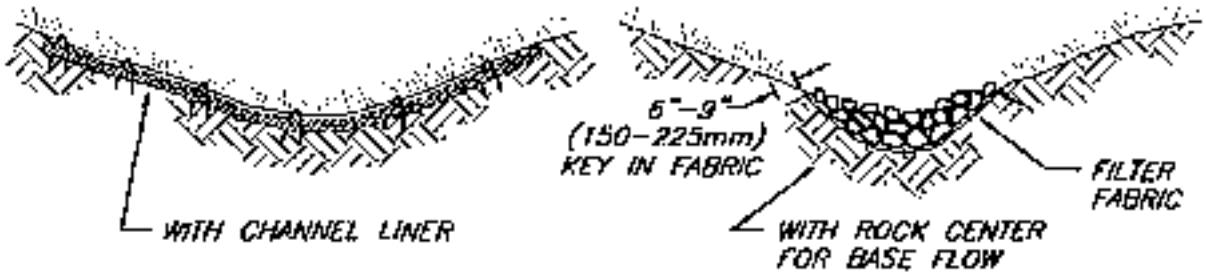
GRASS-LINED CHANNEL
TYPICAL INSTALLATION

© 1998 JOHN McCULLAH

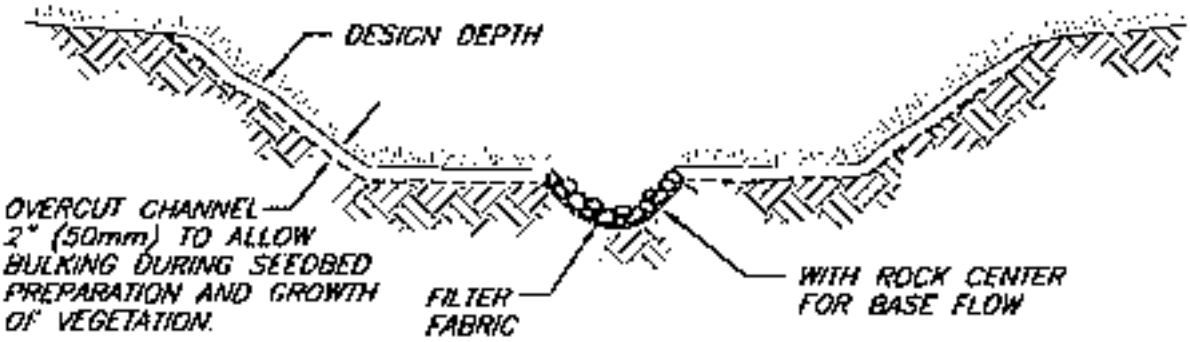
FILE: GRSCINST



TYPICAL V-SHAPED CHANNEL CROSS-SECTION



TYPICAL PARABOLIC CHANNEL CROSS-SECTION



TYPICAL TRAPEZOIDAL CHANNEL CROSS-SECTION

GRASS-LINED CHANNEL TYPICAL CROSS SECTIONS

© 1993 JOHN McCULLAH

Instream Diversion Techniques

Definition: A stream diversion is a temporary bypass through a pipe, flume, or excavated channel that carries water flow around work areas. Stream diversion is commonly used during culvert installation or replacement. Where possible, a stream diversion should be the first choice to control erosion and sediment during the construction of culverts or other instream structures.

Purpose: During construction in a watercourse, particularly culvert installation and repair, these temporary water bypass structures are an effective sediment and erosion control technique.

Design Considerations: The selection of which stream diversion technique to use will depend upon the type of work involved, physical characteristics of the site, and the volume of water flowing through the project.

Advantages of a pumped diversion include:

- Downstream sediment transport can almost be eliminated
- De-watering of the work area is possible
- Pipes can be moved about to allow construction operations
- The dams can serve as temporary access.
- Increased flows can be managed by adding more pumping capacity.

Some disadvantages of a pumped diversion are:

- Flow volume is limited by pump capacity
- Requires 24-hour monitoring of pumps
- Sudden rain could overtop dams
- Minor in-stream disturbance to install and remove dams

Advantages of excavated channels and flumes are:

- Isolates work from water flow and allows dewatering
- Can handle larger flows than pumps

Disadvantages of excavated channels and flumes are:

- Bypass channel or flume must be sized to handle flows, including possible floods
- Channels must be protected from erosion
- Flow diversion and then re-direction with small dams causes in-stream disturbance and sediment

Stream diversions should not be used:

- Without identifying potential impacts to the stream channel
- In or adjacent to water bodies until all necessary permits have been obtained

Instream Diversion Techniques (continued)

Construction Specifications:

Guidelines will vary based on existing site conditions.

The pumped diversion is suitable for intermittent and low flow streams that can be pumped. Pump capacity must be sufficient for design flow. The upper limit is about $10ft^3$/sec, the capacity of two 8 inch pumps. A temporary dam is constructed upstream and downstream of the work area and water is pumped through the construction project in pipes. Dam materials should be selected to be erosion resistant, such as steel plate, sheetpile, sandbags, continuous berms, inflatable water bladders, etc.

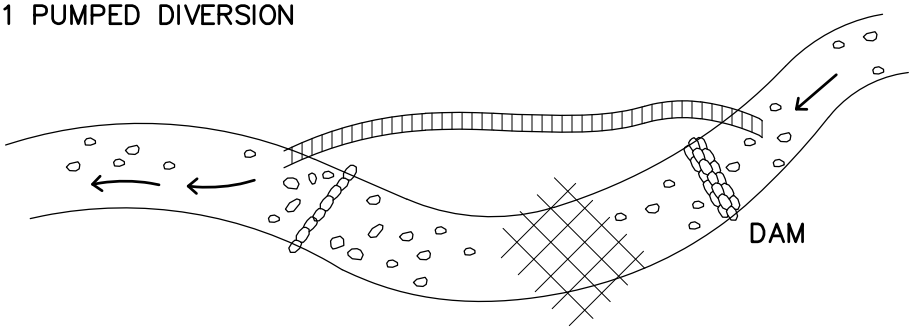
A temporary bypass channel can also be constructed by excavating a temporary channel or passing the flow through a heavy pipe (called a "flume), and excavating a trench under it. Typical stream sizes are less than 20 ft wide and less than 100 ft^3/sec.

Inspection and Maintenance:

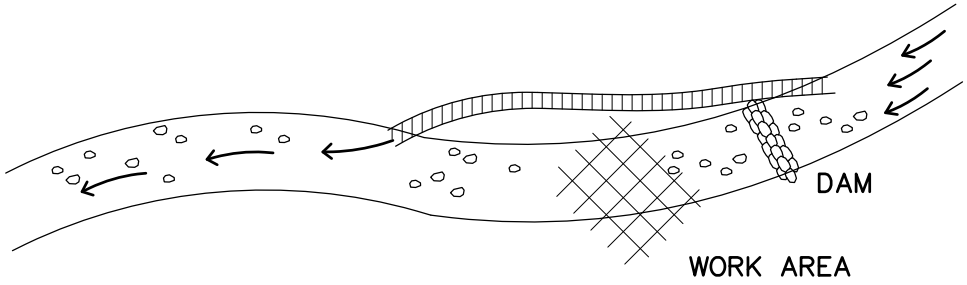
- All stream diversions must be closely maintained and monitored
- Pumped diversions require 24-hour monitoring of pumps
- Upon completion of the work performed, the stream diversion should be removed and flow should be re-directed through the new culvert or back into the original stream channel.

TYPICAL STREAM DIVERSIONTECHNIQUES

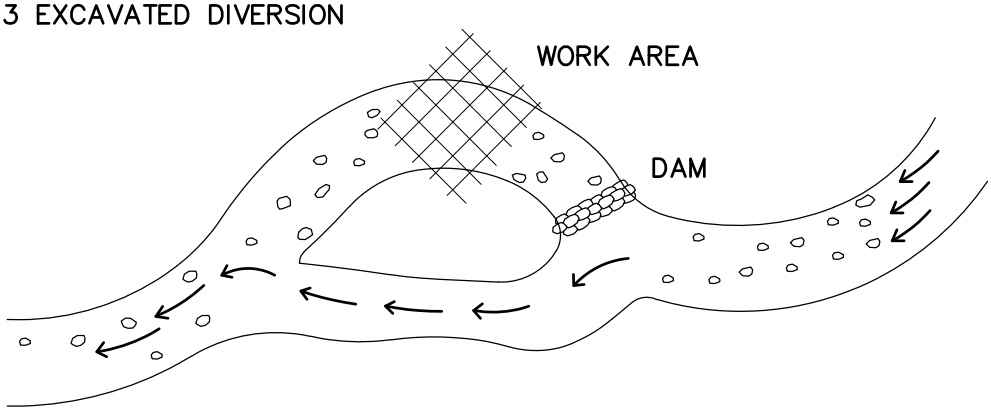
1 PUMPED DIVERSION



2 PUMP/FLUME DIVERSION



3 EXCAVATED DIVERSION



STREAM DIVERSION TECHNIQUES TYP.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 stream diversion.dwg

©CALTRAIN

Instream Isolation Techniques

Definition: An instream isolation technique is a temporary structure built into a waterway to enclose a construction area and reduce sediment pollution from construction work in or adjacent to water. The structures may be made of rock, sand bags, wood or water-filled geotextiles (aqua barriers).

Purpose: During construction in a watercourse, these structures are designed to reduce turbidity and sediment discharge, allowing contractors to follow clean water regulations.

Design Considerations: Isolation structures may be used in construction activities such as streambank stabilization, culvert installation, bridges, piers or abutments. It may be used in combination with other methods such as clean water bypasses and/or pumps.

This technique should not be used:

- If there is insufficient streamflow to support aquatic species
- In deep water unless designed or reviewed by an engineer
- To completely dam streamflows

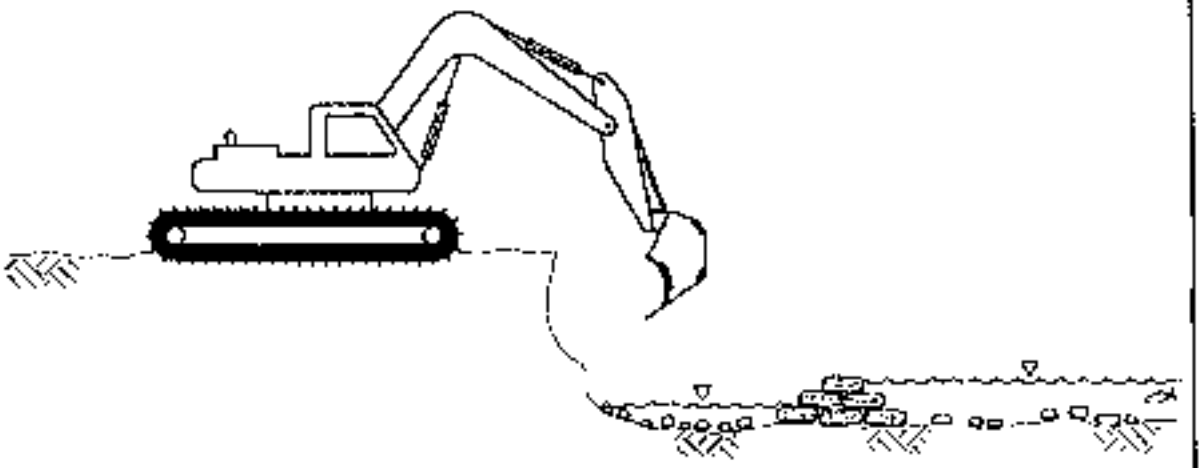
Construction Specifications: When used in watercourses or streams, cofferdams must be used in accordance with permit requirements. Materials for cofferdams should be selected based on ease of maintenance and complete removal following construction activities.

Inspection and Maintenance:

- During construction, inspect daily during the work week.
- Schedule additional inspections during storm events.
- Immediately repair any gaps, holes or scour.

Upon construction completion, the structure is removed.

- Remove sediment buildup.
- Remove structure. Recycle or re-use if applicable.
- Revegetate areas disturbed by cofferdam removal if applicable.



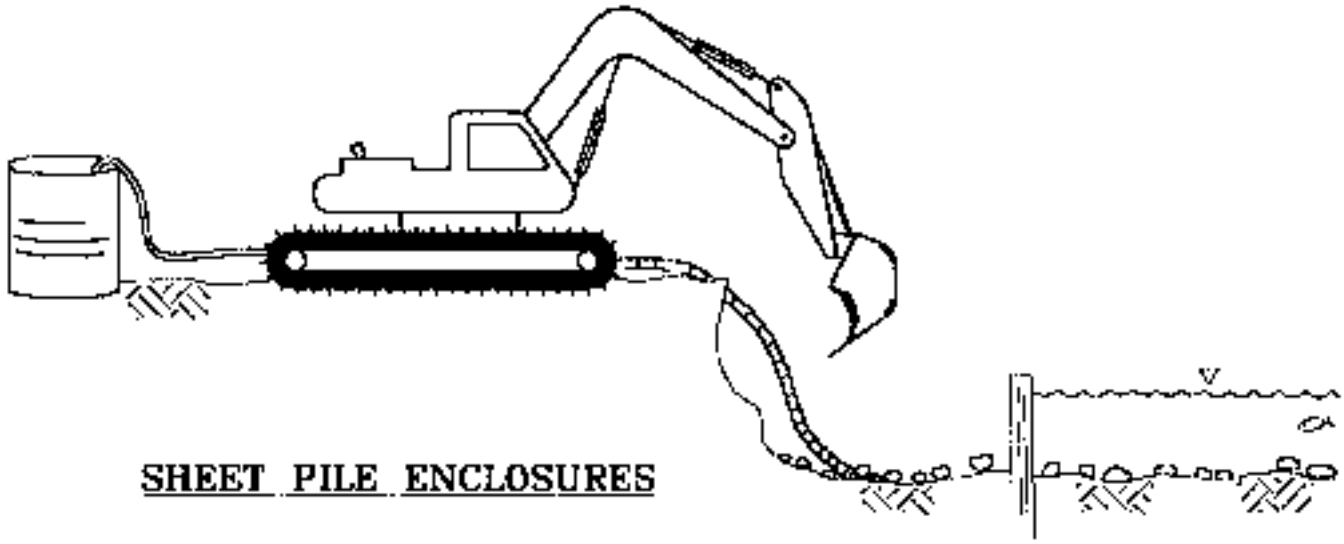
BENEFITS/LIMITATIONS
- Difficult to dewater
- Inexpensive
- Labor intensive to install and remove
- Sand may be deposited in stream if bags break, better to use clean gravel

SAND BAG/GRAVEL BAG TECHNIQUE

INSTREAM EROSION AND SEDIMENT CONTROL ISOLATION TECHNIQUES

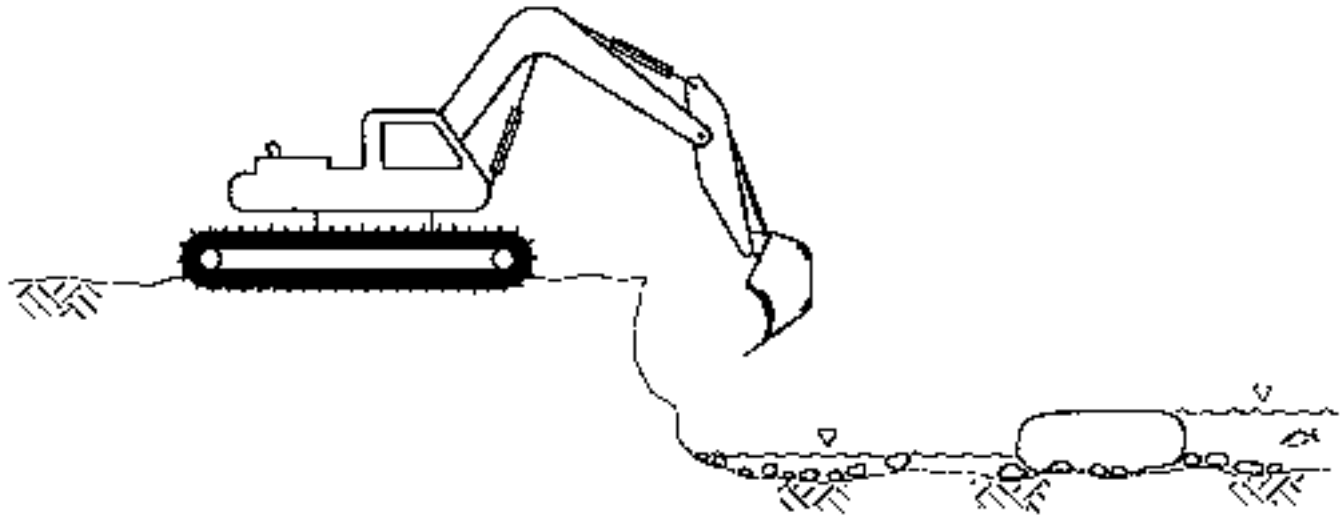
© 2001 John McCullah

BENEFITS/LIMITATIONS
- *Allows full dewatering*
- *Relatively expensive*
- *Useful in large rivers, lakes, high velocity*
- *Not really appropriate for small streams*
- *Requires staging and heavy equipment access areas*



SHEET PILE ENCLOSURES

BENEFITS/LIMITATIONS
- *Allows partial dewatering*
- *Moderately expensive*
- *Ease of installation and removal unknown*
- *Can be designed for small streams to large rivers*

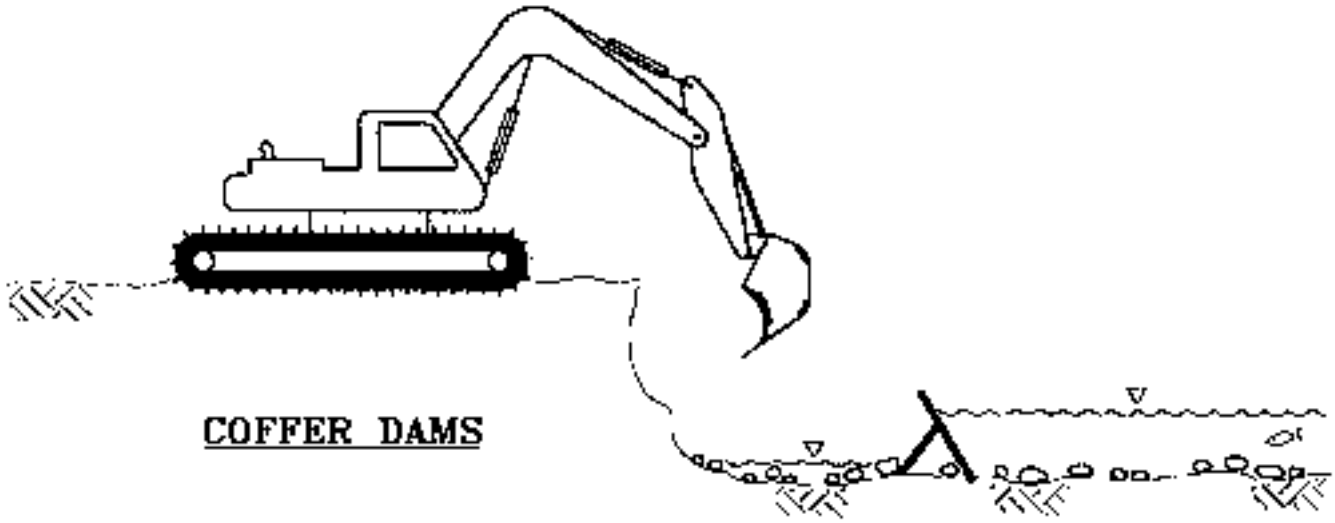


WATER-FILLED GEOTEXTILE (AQUA DAM)

INSTREAM EROSION AND SEDIMENT CONTROL ISOLATION TECHNIQUES

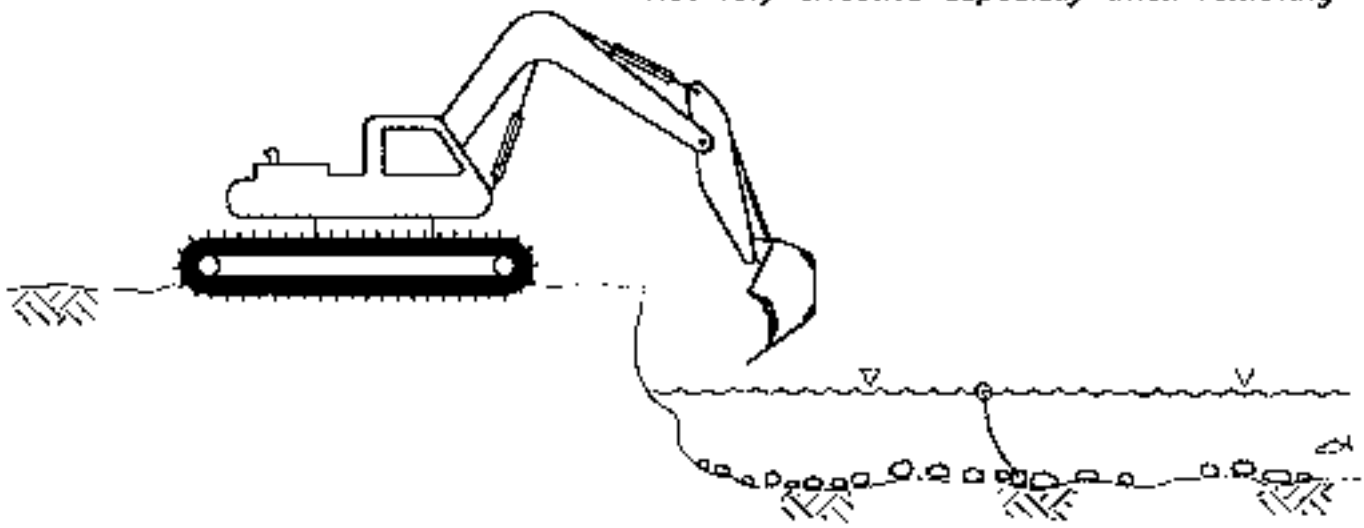
© 2001 J. McCULLAH

BENEFITS/LIMITATIONS
- Allows partial dewatering
- Many different types available
- Relatively expensive
- Can be designed for large and small streams
- Ease of installation and removal unknown



COFFER DAMS

BENEFITS/LIMITATIONS
- Does not allow dewatering
- Inexpensive
- Used in slow water or lakes only
- Not very effective especially when removing

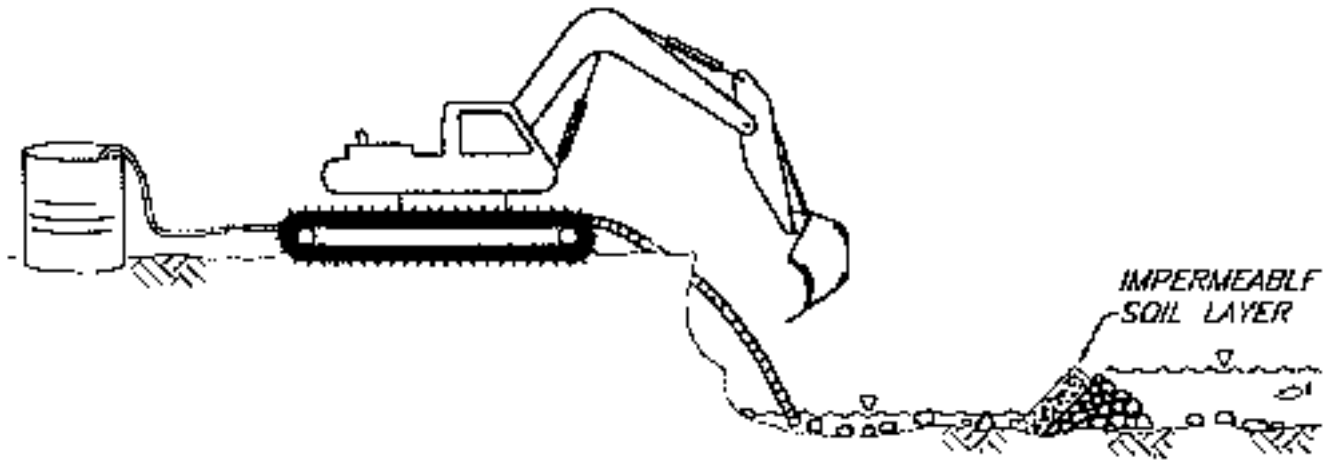


GEOTEXTILES, SILT BARRIERS, CURTAINS

INSTREAM EROSION AND SEDIMENT CONTROL ISOLATION TECHNIQUES

© 2001 JL McCULLAH

BENEFITS/LIMITATIONS
- Allows partial dewatering
- Relatively inexpensive
- Useful for small streams
- Minimal TSS when removed



NOTES:

Step 1. Install clean gravel

Step 2. Place impermeable soil

Step 3. Do work

Step 4. Decommission berm by removing soil layer first

Step 5. Pump work area. Head differential will cause turbid water to flow into work area through gravel

Step 6. Remove or spread gravel

GRAVEL/SOIL BERM INSTREAM ISOLATION TECHNIQUE

© 2001 - McCULLAH

Large Woody Debris Management and Removal

Large woody debris (LWD) in streams has many positive benefits to the aquatic environment, including increased habitat complexity for resident trout, amphibians, and birds, as well as a host of plants and fungus. Large wood also performs geomorphic functions within stream channels such as grade control, bank stabilization, and stream bedload (cobbles and gravel) scour and sorting. The goal of large wood management is to retain as much wood as possible. Large wood is defined as logs with a diameter of 6" or greater and a length of 10' or longer, rootwads and stumps.

There are, however, situations where large wood maintenance can be in conflict with the maintenance of District infrastructure such as roads, bridges, and culverts. These conflicts arise when LWD accumulates around bridge footings, culvert inlets and outlets, and adjacent to roads or structures. Redirection of flow, and streambed elevation changes associated with the LWD accumulation, towards District facilities, can lead to the catastrophic failure of these facilities. In these limited circumstances, LWD will need to be managed or removed. Planning and Operations staff will confer regarding the specific course of action.

Management and removal will be undertaken only as a last resort to mitigate ongoing or imminent damage. Locations will be assessed for sensitive species prior to beginning any work at the site. LWD shall be managed to maintain as much LWD in the stream channel as possible. Often, smaller branches and logs accumulate on a few large key log pieces, and it is possible to pick through the smaller material maintaining the large key pieces for habitat and geomorphic function. LWD can also be rearranged or relocated within the stream channel, to decrease hazard to District infrastructure, and maintain LWD within the channel. These became sites that will need periodic maintenance and is the preferred method of LWD management on District Preserves.

There are also isolated circumstances where LWD has to be removed from the channel where the potential for catastrophic failure of District infrastructure is so great that no other alternative exists to protect the infrastructure. This option will only be employed where an evaluation has been made by Planning and Operations staff, which concludes that LWD management as described in the paragraph above is not sufficient to address the heightened level of concern. Again, the volume of LWD removed will be minimized to maintain as much LWD in channel as possible. LWD removed from the channel that cannot be immediately incorporated within the stream at a nearby location, shall be stockpiled for future use. LWD removed shall be left as large as possible for incorporation into future projects, particularly large logs and rootwads with attached bole. Smaller pieces of LWD shall be removed to above the high water mark of the channel, and can be stacked or spread for terrestrial habitat.

All work involving in-channel LWD will be completed by hand crews. No heavy equipment will be operated within the stream channel, or live flowing water. Hand crews may be aided by heavy equipment if it can be operated from an existing access road adjacent to the project site. No fueling of chain saws will occur within the stream channel, and will be done at a location where fuel can not enter the watercourse.

LWD project sites will be surveyed by a qualified biologist prior to beginning any work to determine if any sensitive species are present. Appropriate agency consultations will be conducted if listed species are identified during pre-construction surveys or encountered during construction.

Live Pole Drains

A live pole drain is a biotechnical and reclamation technique which is intended to drain excess moisture away from an unstable site. The plants used to construct the bundles (willow) will sprout and grow, with the moisture continuing to drain from the lower end. The bundles of cuttings are usually placed in shallow trenches in a manner that they intersect and collect excessive slope moisture. That excess water is then allowed to drain onto a stabilized area.

Conditions Where Practice Applies

Unstable slopes, landslides, and small slumping gullies can often be successfully treated with live pole drains. This is a good technique to initiate the process of natural healing.

Materials

Use fascine or wattle techniques to construct the bundles. Keep some of the twigs and branches on the cuttings, as this will add bulk and aid drainage. Live pole drain bundles can be constructed using branches which are longer than those typically used for wattles or fascines. Live pole drains require construction stakes and/or live stakes in order to secure them firmly to the slope. Sometimes large rocks may also be used to hold the drains down.

Advantages

If constructed from willow species, live pole drains will provide cover for the site and initial stabilization while allowing other species to invade. The pole drains will continue to grow for an extended period, while allowing drainage to occur.

David Polster, M.Sc., R.P. Bio. Plant Ecologist, British Columbia, has been extremely successful using live pole drains for landslides and gullies. He has completed projects where the pole drains have provided initial stability and then drained water for years after establishment.

Disadvantages

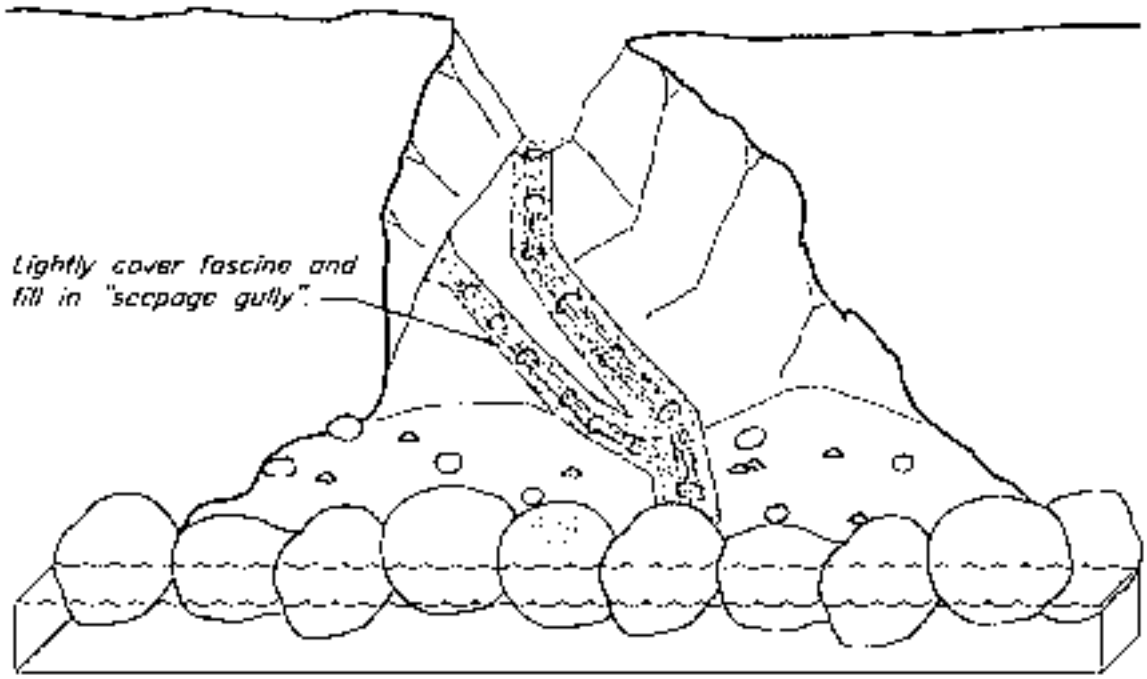
Live pole drains are not effective in larger, well defined channels with concentrated flows, as the pole drains will simply plug the channel and cause more erosion as the channel adjusts to maintain capacity. Biotechnical projects are typically conducted at times of the year when weather conditions are cool and moist and the plant material is dormant. Timing constraints can sometimes be ameliorated by irrigation, storage of plant materials, or a combination of the above. However, some reduction of plant establishment and vigor should be anticipated.

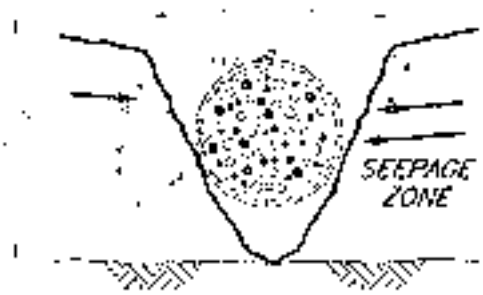
Live Pole Drains (continued)

Implementation

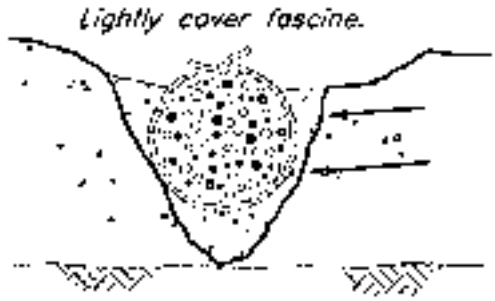
The key to successful pole drain construction is to install the drains in the areas of seepage, either by excavating a shallow trench or utilizing an existing drainage gully, so the drains intercept and control the excess moisture. Use fascine or wattle techniques to construct the bundles. The bundles should be tied tightly with twine or rope. Place the bundle of cuttings in the trench. Construct side drains as needed. It is important to key the bundles into each other by jamming the ends firmly together.

Use construction stakes and/or live stakes to hold the fascines in place. Insert the stakes adjacent to the rope ties for additional support. Stake the pole drains at 1-2 m intervals. Lightly backfill the bundles with native soil. Some twigs and branches should be left above the ground as the willow material requires some sunlight exposure to grow.





Excavate a shallow trench or utilize existing "seepage gully" (small<2ft.^{2}).



Place bundle of cuttings (fascine) in the trench and lightly backfill with native material.

NOTES:
1. Live pole drain is a biotechnical technique which drains excess moisture from the bank and provides an initial cover of woody vegetation.
2. The cuttings used to form the fascines are intended to sprout and grow while the excess moisture continues to drain from the lower end.

LIVE POLE DRAIN

© 2004 SAWA

FILE: LPD

Live Siltation

Live siltation is a revegetation technique used to secure the toe of a streambank, trap sediments, and create fish rearing habitat. The system can be constructed as a living or a non-living brushy system at the water's edge.

Conditions Where Practice Applies

Live siltation is a biotechnical technique for the edges of rivers and streams. This technique is useful along stream reaches where it is desired to encourage deposition and siltation, such as floodplains and along inner banks. It would not be an appropriate practice along an outer bend without sufficient scour or toe protection.

Materials

Natural stone, willow wattles, logs or root wad revetments are needed for toe and scour protection. The live siltation will require live branches of shrub willows of 1-1.5 m length. The branches should be dormant, and need to have the side branches still attached. Any woody plant material, such as alder, can be installed for a non-living system.

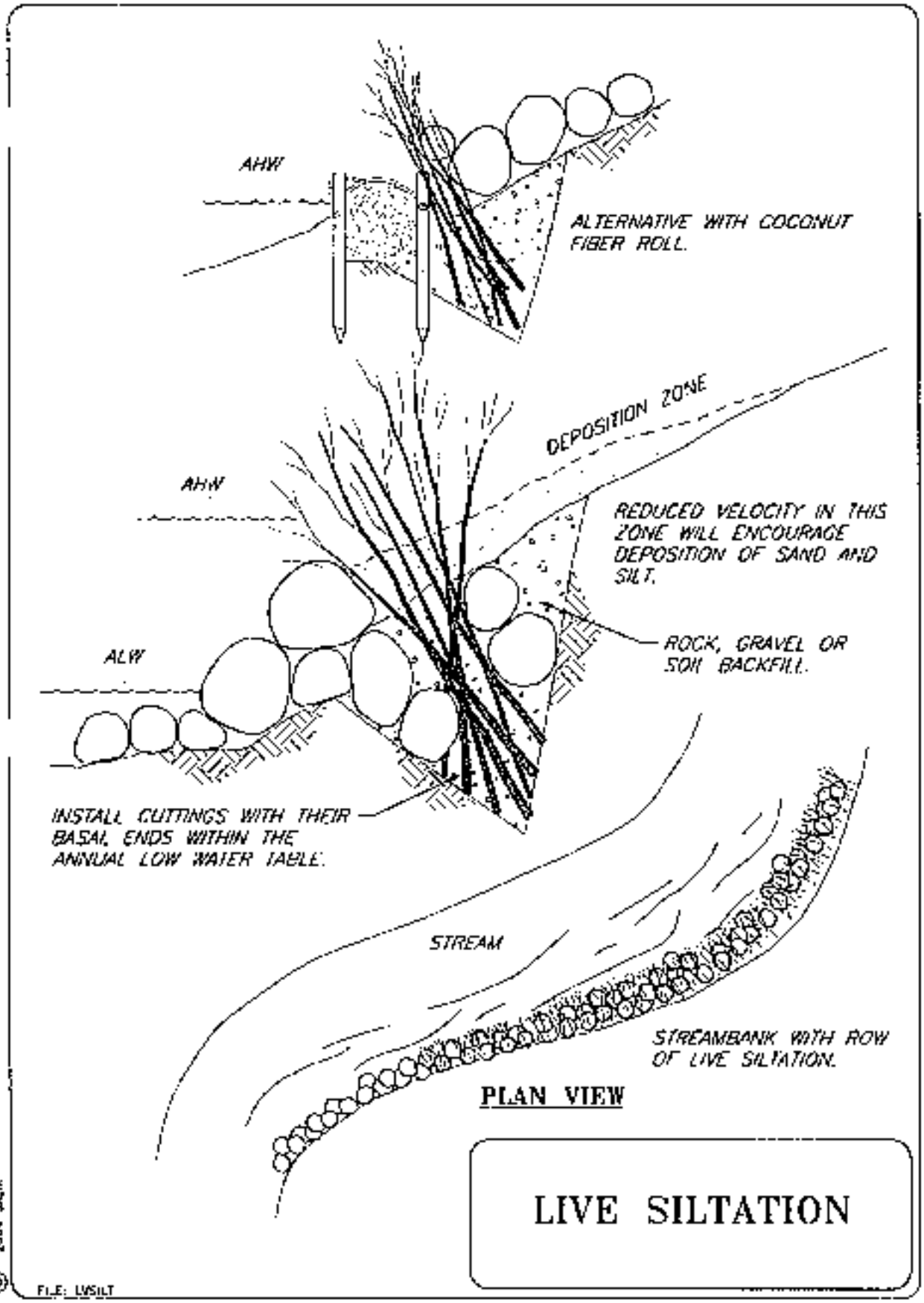
Advantages

This is a very effective and simple conservation method using local plant materials. This technique is particularly valuable for providing immediate cover and fish habitat while other revegetation plantings become established. The protruding branches provide roughness, slow velocities, and encourage deposition of sediment. The depositional areas are then available for natural recruitment of native riparian vegetation.

Implementation

Construct a V-shaped trench at the mean high water (MHW) level, with hand tools or a backhoe. Excavate a trench so that it parallels the toe of the streambank and is approximately 2 feet deep. Lay a thick layer of willow branches in the trench so that 1/3 of the length of the branches is above the trench and the branches angle out toward the stream. Place a minimum of 40 willow branches per meter in the trench.

Backfill over the branches with a gravel/soil mix and secure the top surface with large washed gravel, bundles/coir logs, or carefully placed rocks. Both the upstream and downstream ends of the live siltation construction need to transition smoothly into a stable streambank to reduce the potential for the system to wash out. More that one row of live siltation can be installed. A living and growing siltation system typically is installed at MHW. A non-living system can be constructed below MHW during low water levels. If it is impossible to dig a trench, the branches can be secured in place with logs, armor rock, bundles made from wattles, or coir logs.


AHW
ALTERNATIVE WITH COCONUT FIBER ROLL.
DEPOSITION ZONE
AHW
REDUCED VELOCITY IN THIS ZONE WILL ENCOURAGE DEPOSITION OF SAND AND SILT.
ALW
ROCK, GRAVEL OR SOIL BACKFILL.
INSTALL CUTTINGS WITH THEIR BASAL ENDS WITHIN THE ANNUAL LOW WATER TABLE.
STREAM
STREAMBANK WITH ROW OF LIVE SILTATION.
PLAN VIEW
LIVE SILTATION
© 2004 SALIX
FILE: LVSILT

Modified Live Siltation

Conditions Where Practice Applies

Use modified live siltation for the inner bends of streams or areas periodically flooded.

Modified live siltation can be placed in a manner which can direct high flows toward the center of the stream, while providing hydraulic roughness which will encourage deposition and siltation.

Materials

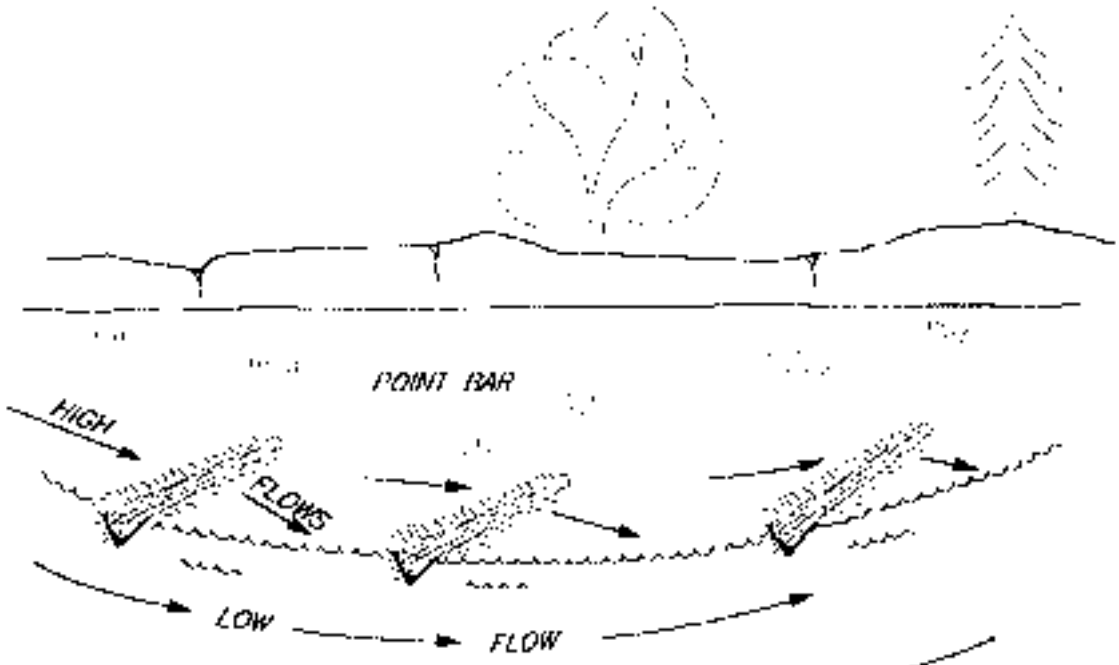
Primarily willow species are used for live siltation, however, even dead branches and non-living bundles can provide the desired hydraulic roughness. The willow species will generally thrive in depositional areas. Use willow wattles and live staking or poles. Rope will be needed for bundles, and wooden stakes will be needed to secure wattles.

Advantages

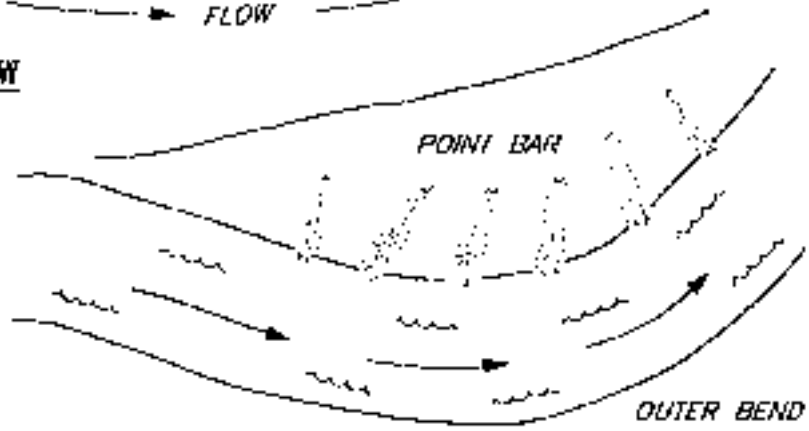
This is an inexpensive revegetation and stream stabilization technique which provides habitat enhancements and encourages deposition.

Implementation

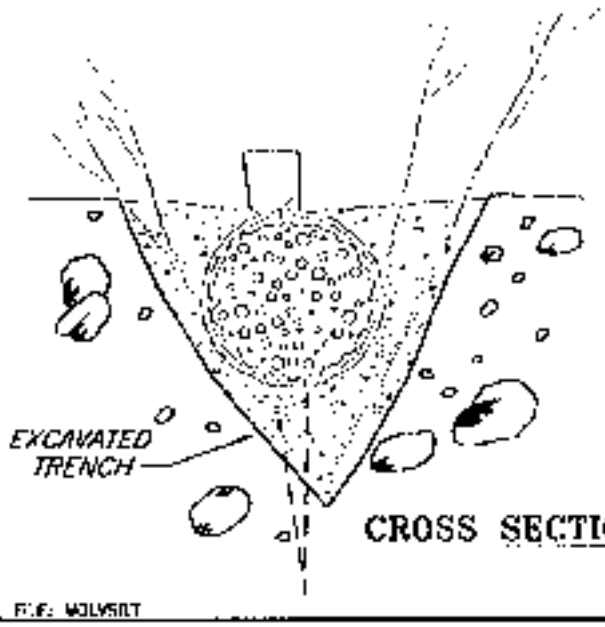
Prepare trenches. Trenches for modified live siltation should point in a slight upstream direction, no more than 20 degrees. Lay live willow bundle or dead branch bundle into trench. Secure the bundle firmly using wooden stakes. Lay in branches for live siltation. Backfill trench with soil and rock.



FRONT VIEW



PLAN VIEW



CROSS SECTION

NOTES:
1. Modified live siltation is a revegetation technique intended to encourage deposition (reduce erosion and scour) of the inner bend (point bar formation).
2. The vegetated spurs or live veins are angled slightly into the flow such that high flows will be redirected toward the center of the stream.

MODIFIED LIVE SILTATION

© 2003 JOHN McCULLAH

F.E.: WOLVSRLT

LIVE STAKING

Construction Specifications:

Harvesting:

- Stakes shall be harvested and planted when the willows, or other chosen species, are dormant. This period is generally from late fall to early spring, or before the buds start to break.
- When harvesting cuttings, select healthy, live wood that is reasonably straight.
- Use live wood at least 1 year old or older. Avoid suckers of current years growth as they lack sufficient stored energy reserves to sprout consistently. The best wood is 2-5 years old with smooth bark that is not deeply furrowed.
- Make clean cuts with unsplit ends. Trim branches from cutting as close as possible. The butt end of the cutting shall be pointed or angled and the top end shall be cut square.
- Identification of the top and bottom of cutting as accomplished by angle cutting the butt end. The top, square cut, can be painted and sealed by dipping the top 1-2 inches (25-51 mm) into a 50-50 mix of light colored latex paint and water. Sealing the top of stake will reduce the possibility of desiccation and disease caused mortality, assure the stakes are planted with the top up, and makes the stakes more visible for subsequent planting evaluations.

Diameter:

- Cuttings should generally be 3/4 inch (19 mm) or larger depending on the species. Highest survival rates are obtained from using cuttings 2-3 inches (51-76 mm) in diameter. Larger diameter cuttings are needed for planting into rock riprap.

Length:

- Cuttings of small diameter (up to 1 1/2 inches (38 mm)) shall be 18 inches (0.5 m) long minimum. Thicker cuttings should be longer.
- Cuttings should be long enough to reach into the mid-summer water table, if possible.
- No less than 1/2 total length must be into the ground.
- Stakes should be cut so that a terminal bud scar is within 1-4 inches (25-101 mm) of the top. At least 2 buds and/or bud scars shall be above the ground after planting.

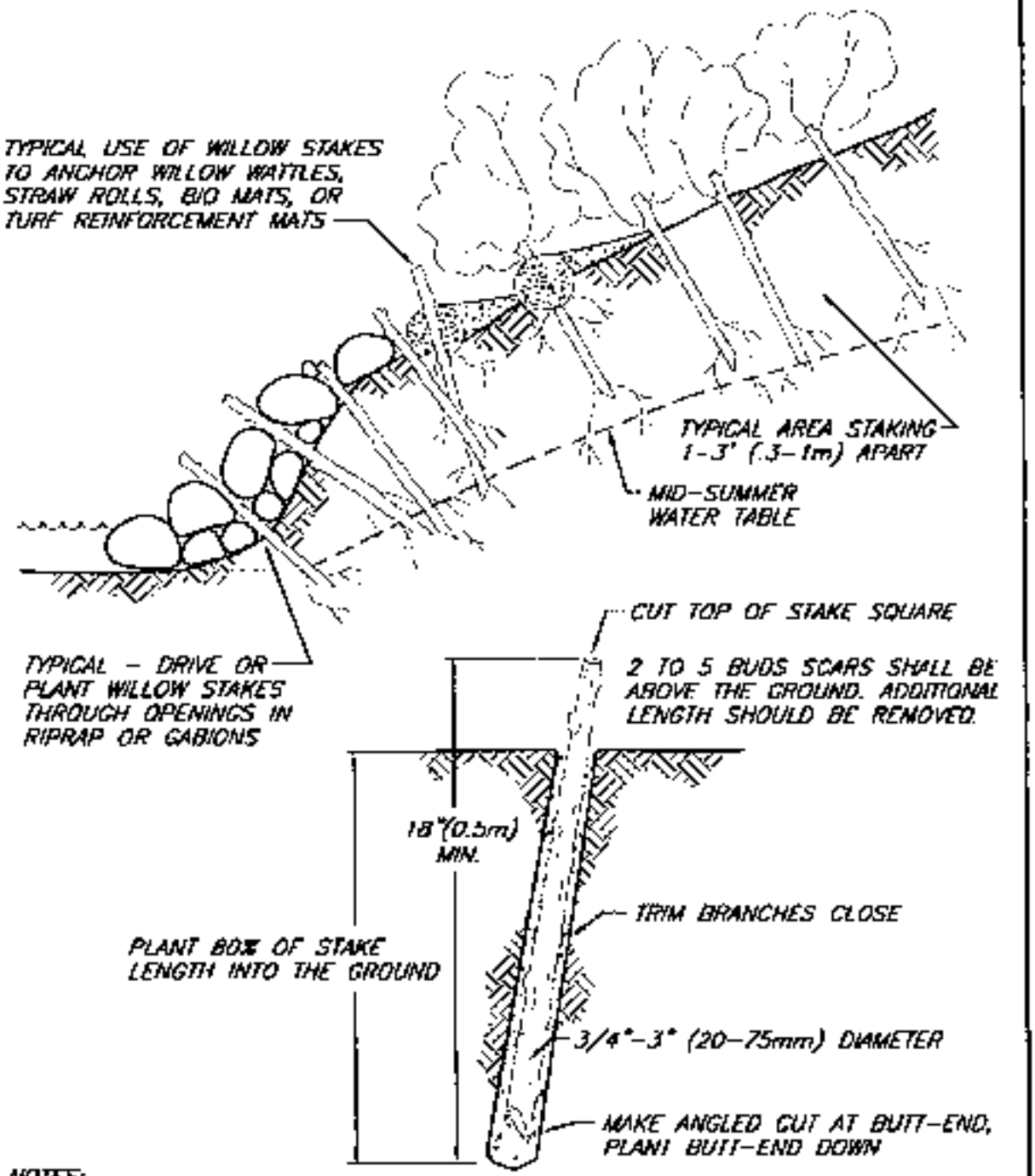
Installation:

- Stakes must be planted with butt-ends into the ground. Leaf bud scars or emerging buds should always point up.
- Stakes must not be allowed to dry out. All cuttings should be soaked in water for a minimum of 24 hours. Soaking significantly increases the survival rate of the cuttings, however they may be planted the same day they are harvested.
- Plant stakes 1-3 feet (0.3-1 m) apart.
- Set the stake as deep as possible into the soil, preferably with 80 percent of its length into the soil and in contact with mid-summer water table.
- It is essential to have good contact between the stake and soil for roots to sprout. Tamp the soil around the cutting.

- Use a iron stake or bar to make a pilot hole in firm soil.
- Do not damage the buds, strip the bark or split the stake during installation
- Split or damaged stakes shall be removed and replaced

Inspection and Maintenance:

- All temporary and permanet erosion and sediment control practices shall be maintained and repaired as needed to assure continued performance of their intended function
- Streambanks and steep slopes are highly susceptible to erosion and damage from significant storm events. Willow stakes alone provide very little initial site protection during the establishment period
- Periodic inspection, repair and maintenance will be required during the first two years or until the vegetation is established.
- All temporary or permanent erosion control practices shall be maintained and repaired as needed to assure continued performance of their intended function



NOTES:
1. HARVEST AND PLANT STAKES DURING THE DORMANT SEASON.
2. USE HEALTHY, STRAIGHT AND LIVE WOOD AT LEAST 1 YEAR OLD.
3. MAKE CLEAN CUTS AND DO NOT DAMAGE STAKES OR SPLIT ENDS DURING INSTALLATION. USE A PILOT BAR IN FIRM SOILS.
4. SOAK CUTTINGS FOR 24 HOURS (MIN.) PRIOR TO INSTALLATION.
5. TAMP THE SOIL AROUND THE STAKE.

NOT TO SCALE

LIVE STAKING

© 1995 JOHN McCULLAH

FILE: LVESTK

POLE PLANTING

Construction Specifications:

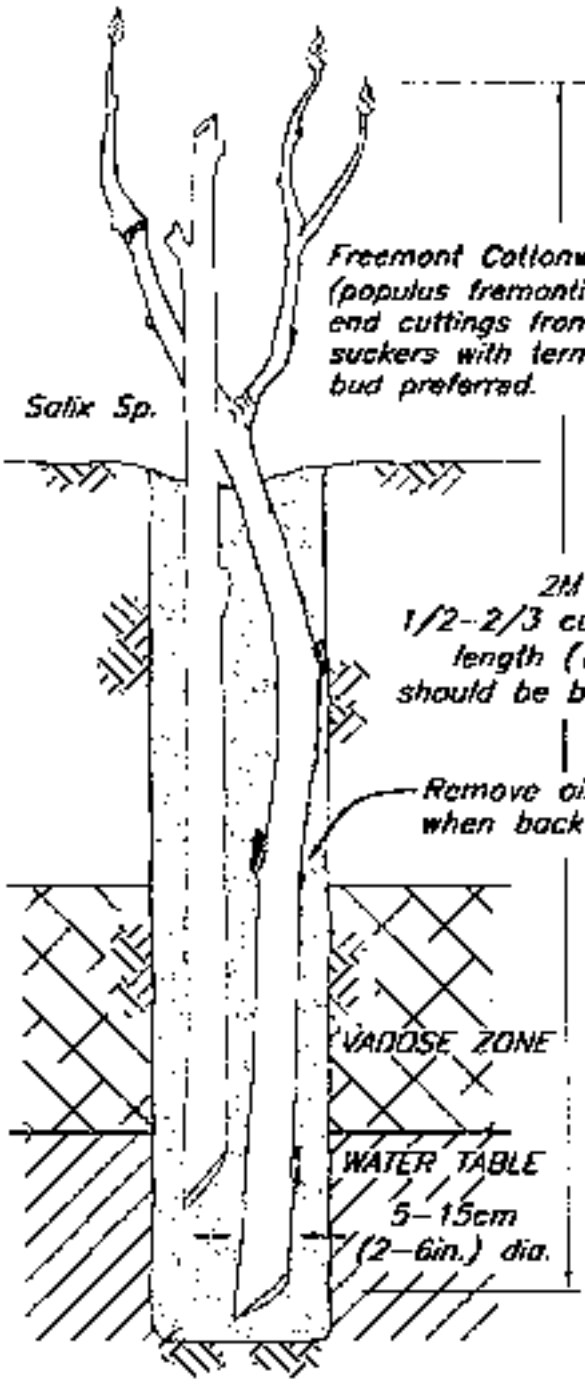
Collect and harvest cuttings (ideally during the dormant season) and then soak the poles for 5 to 7 days. Plant poles into an augered, "punched", or excavated hole. The holes should extend to approximately 1 foot above the water table and through the vadose zone. This depth can be difficult to determine in areas with reservoirs and streams with widely fluctuating seasonal water levels. In this case, ensure that the ends of the poles reach the low waterline at the time of planting if possible.

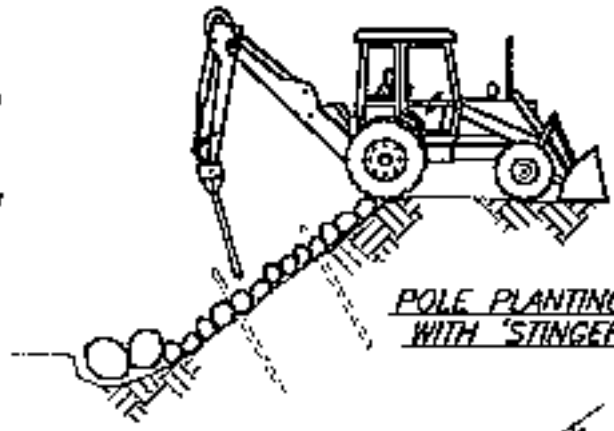
Pole plantings should ideally be installed during the construction of any structural appurtenances. For instance, plant the poles with the placement of riprap, especially into any trenches excavated for keyways or scour trenches. Another example is to plant the poles during riprap placement such that the poles extend through the riprap and backfill and into contact with the "native" bank. The backfill can be placed over and around the poles rather than having to "punch" holes through the riprap. Another method is to plant the poles during gabion construction.

The pole plantings, especially the basal ends, must have good contact with the soil. "Mudding" (filling the hole with water and then adding soil to make a mud slurry) can remove air pockets.

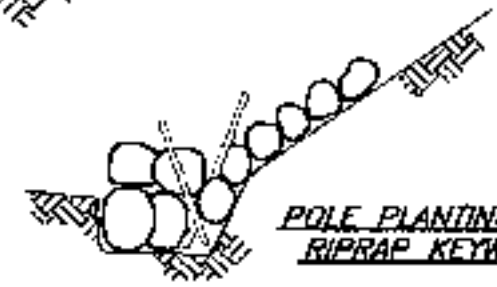
CONSTRUCTION TECHNIQUES

Plant poles deeply during construction of biotechnical streambank work.

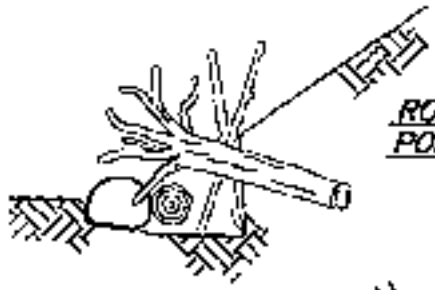




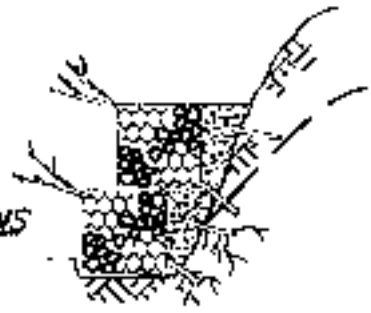
POLE PLANTING WITH 'STINGER'



POLE PLANTING IN RIPRAP KEYWAY



ROOTWAD WITH POLE PLANTING



VEGETATED GABIONS WITH POLES

NOTES:

1. Pole cuttings of willow or cottonwood are longer and have a larger diameter than branch cuttings or live stakes.
2. Larger diameter cuttings have a greater supply of stored energy (stored photosynthesis) than smaller diameter cuttings.
3. Pole cuttings are better suited for highly erodible areas and sites with fluctuating water levels.
4. The pole cuttings should extend through the vadose zone and into the permanent water table. At least 1/2 to 2/3 of the pole should be below the ground, at least 1.0m (3 ft.), and long enough to emerge above adjacent vegetation.
5. "Muddying" – filling the hole with water and then soil to make a mud slurry can remove air pockets.

POLE PLANTING

© 2000 J. McCULLAH

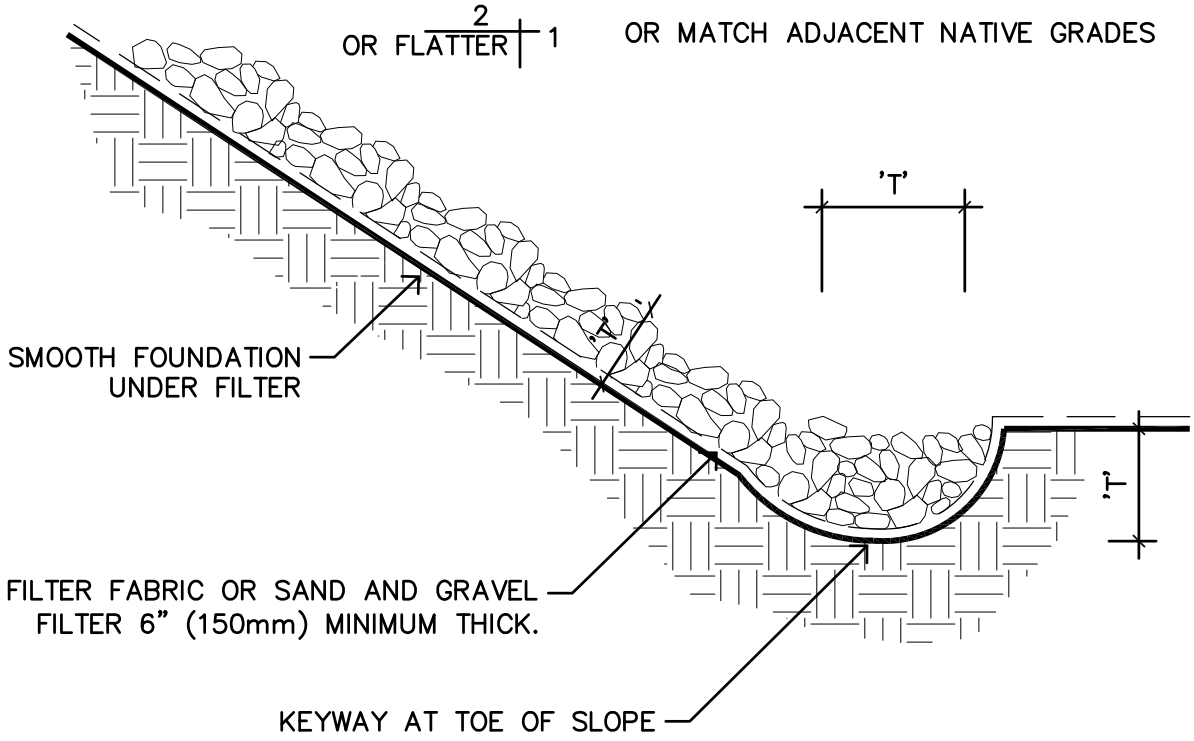
POLEPLNT

RIPRAP

Construction Specifications

- Before laying riprap and filter, prepare the subgrade to the required lines and grades shown on the plans. Compact any fill required in the subgrade to a density approximating that of the surrounding undisturbed material.
- Overfill depressions with riprap.
- Remove brush, trees, stumps, and other objectionable material.
- Cut the subgrade sufficiently deep so that the finished grade of the riprap will be at the elevation of the surrounding area. Channels should be excavated sufficiently to allow placement of the riprap in a manner such that the finished inside dimensions and grade of the riprap meet design specifications.
- Place the sand and gravel filter blanket immediately after the ground foundation is prepared. For gravel, spread filter stone in a uniform layer to the specified depth. Where more than one layer of filter material is used, spread the layers with minimal mixing.
- Place the filter fabric directly on the prepared foundation. Overlap the edges by at least 12 inches (0.3 m), and space anchor pins every 3 feet (0.9 m) along the overlap. Bury the upper and lower ends of the cloth a minimum of 12 inches (0.3 m) below ground. Take care not to damage the cloth when placing riprap. If damage occurs remove the riprap and repair the sheet by adding another layer of filter material with a minimum overlap of 12 inches (0.3 m) around the damaged area. If extensive damage is suspected, remove and replace the entire sheet.
- Where large stones are used or machine placement is difficult, a 4 inch (101 mm) layer of fine gravel or sand may be needed to protect the filter fabric.
- Placement of riprap should follow immediately after placement of the filter. Place riprap so that it forms a dense, well-graded mass of stone with a minimum of voids. The desired distribution of stones throughout the mass may be obtained by selective loading at the quarry and controlled dumping during final placement.
- Place riprap to its full thickness in one operation.
- Do not place riprap by dumping through chutes or other methods that cause segregation of stone sizes.
- Take care not to dislodge the underlying base or filter when placing the stones.
- The toe of the riprap slope should be keyed to a stable foundation at its base.
- The toe should be excavated to the depth about 1.5 times the design thickness of the riprap and should extend horizontally from the slope.
- The finished slope should be free of pockets of small stone or clusters of large stones. Hand placing may be necessary to achieve the proper distribution of stone sizes to produce a relatively smooth, uniform surface. The finished grade of riprap should be apparent.

Inspection and Maintenance. Properly designed and installed riprap requires very little maintenance. Riprap should be inspected periodically for scour or dislodged stones. Control of weed and brush growth may be needed in some locations.



TYPICAL SECTION

NOTES:

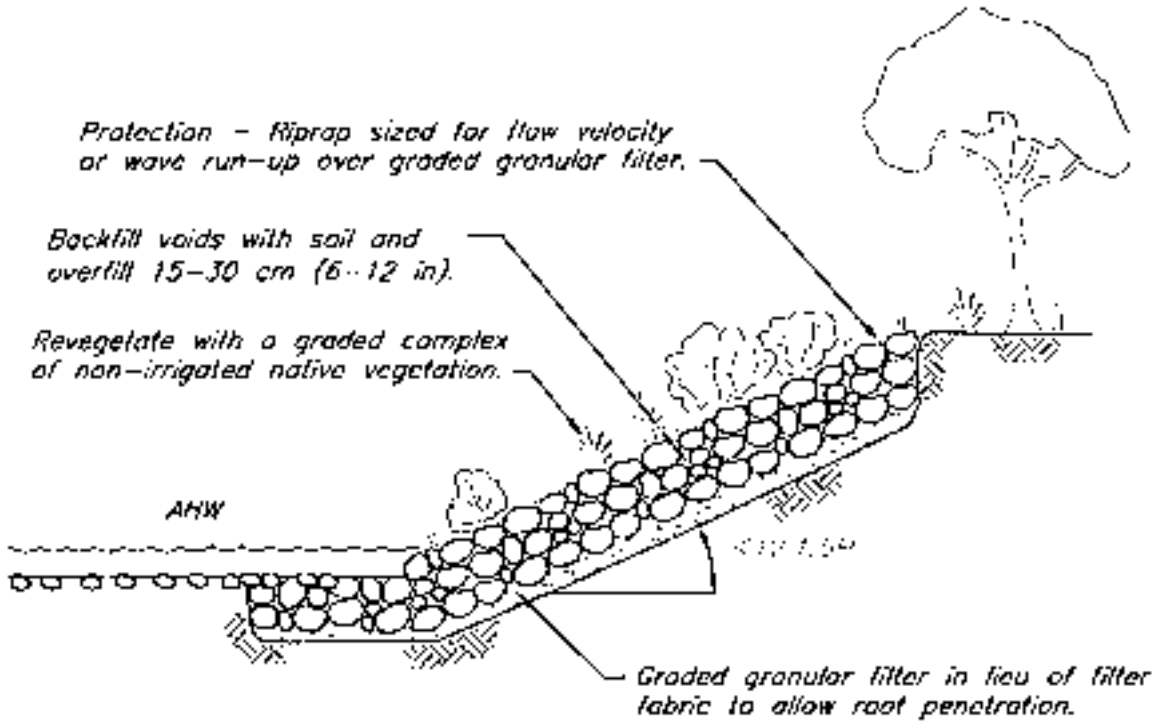
1. T=MINIMUM THICKNESS SHALL BE 1.5x THE MINIMUM STONE DIAMETER, NEVER LESS THAN 6"(150mm).
2. MIN. $\frac{1}{4}$ TON RIP–RAP OR SIZED LARGER THAN THE LARGEST BOULDERS IN STREAM.

RIPRAP PROTECTION

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 11/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\5 riprap protection.dwg

©1994 JOHN MCCULLAH



NOTES: CLASS 2 PERMEABLE MATERIAL

Permeable material for blankets or other subdrainage purposes shall consist of hard, durable, clean sand, gravel or crushed stone and shall be free from organic material, clay balls, or other deleterious substances.

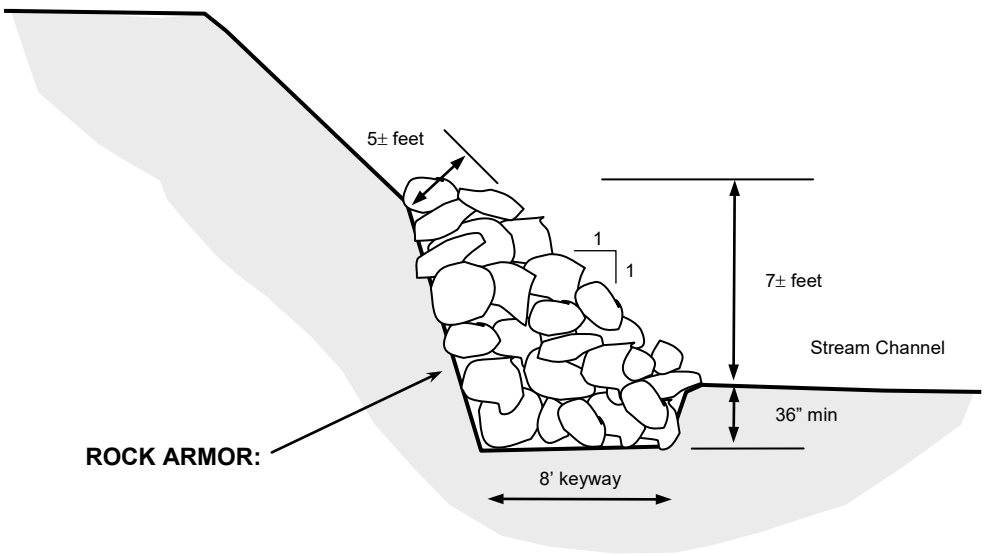
Class 2 permeable material shall have a Durability Index of not less than 40 and a Sand Equivalent value of not less than 75.

SIEVE SIZES	PERCENTAGE PASSING
1–inch	100
3/4–inch	90–100
3/8–inch	40–100
No. 4	25–40
No. 8	18–33
No. 30	5–15
No. 50	0–7
No. 200	0–3

RIPRAP
W/ SOIL AND GRASS OR GROUND COVER

© 2004 SMJK

FILE: RRSG



Notes

Keyway

- Rip rap shall be keyed a minimum of 3 feet below channel bottom and into the bank at the upstream and downstream end.
- The base keyway shall be a minimum of 8 feet wide and sloped into the hillside a minimum of 5%
- Clean keyway of loose organic debris and other unsuitable material prior to placing rock
- Remove only the portions of the log jam that extend into the construction area, the remainder of the log jam shall be undisturbed unless otherwise approved b DFG

Rock

- Rip rap shall consist of angular sound durable rock free of fracture or joint plans.
- Rock shall be graded (mix of sizes) with 50% of the rock (D50) greater than 30 inches minimum diameter.

Rock Placement

- Rock shall be carefully placed to optimize strength
- Rock shall be placed a minimum of 2 layers thick (5 feet).
- Rock shall extend 7 vertical feet above the channel bottom and be inclined no stepper than 1:1 slope
- Voids shall be filled with earth and smaller rocks to facilitate vegetation growth between the rocks. Earth may be placed at the time of construction or flushed in after construction if approved by DFG.

Earthwork

- Slope above the riprap revetment structure shall be laid back to a 1:1 of gentler slope

Revegetation

- Bare ground above the rip rap revetment structure shall be planted with redwood sprouts
- Earth fill voids in the rip rap revetment structure shall be planted with redwood, willow or other approved plants
- RPF shall provide planting instructions at the time of operations

Erosion control

- A temporary silt fence shall be installed at the base of the construction area to minimize the amount of sediment that enters the stream
- Exposed soils shall be mulched and covered with approved erosion control blanket or netting.

7E **RIP RAP (Typical)**
NTS

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

RIP RAP REVETMENT
TYPICAL SPECIFICATIONS

Standard Detail 7E

Date: May 3, 2009

Rootwad Revetment with Vegetated Riprap

Native material revetments are viable alternatives to riprap armoring and gabion type structures. Root wads and logs are constructed to protect the streambank from erosion, provide in-stream and overhead cover for fish. The practice discussed here combines root wads with a layer of stones and/or boulder armoring, generally referred to as riprap revetment. The root wads and riprap are placed along a streambank and will be vegetated with pole planting, brushlayering, and live staking (joint planting).

Conditions Where Practice Applies

The implementations of root wad revetments are beneficial if these type of structures are naturally-occurring in adjacent stream reaches or in similar stream types. Analysis of channel morphology and stream type should be performed to determine if natural material revetments will achieve the desired results.

Vegetated riprap techniques should be considered with project in streams with fishery resources. See Vegetated Riprap. The inclusion of root wads and other large woody debris will enhance the fishery habitat. The root wads are intended to produce scour pools while the overhanging wood and vegetation will provide cover and shade.

Materials

The root wad should have the bole (trunk) attached to allow anchoring into the bank. The length of the bole is dependent on site conditions, however, it should be a 2-m (6 foot) minimum.

For the riprap component, the size and weight is dependant on design velocity or slope stability analysis. A filter layer, either graded aggregate or filter fabric, placed under the riprap will prevent the washout (piping) of fines through the armor layer.

Willow material for brushlayers and pole planting will be required. The length of the cuttings will depend on the depth through the riprap and filter layer to the native soil. Live cuttings can be included and should consist of relatively straight willow branches, 25-40 mm (1-1.5 inches) diameter and long enough to reach beyond the riprap and filter layer and into native ground.

Advantages

By combining boulders, logs and live plant materials to armor a streambank fish habitat is enhanced, in addition to creating a natural looking stabilization structure. Root wad revetments can be used for a wide range of fishery enhancement structures for various stream types. Vegetated rootwads combined with vegetated riprap can protect the streambank, provide in-stream and overhead cover for fish, provide shade, provide detritus and terrestrial insect habitat, look natural, and provide habitat diversity.

Rootwad Revetment with Vegetated Riprap (continued)

Disadvantages

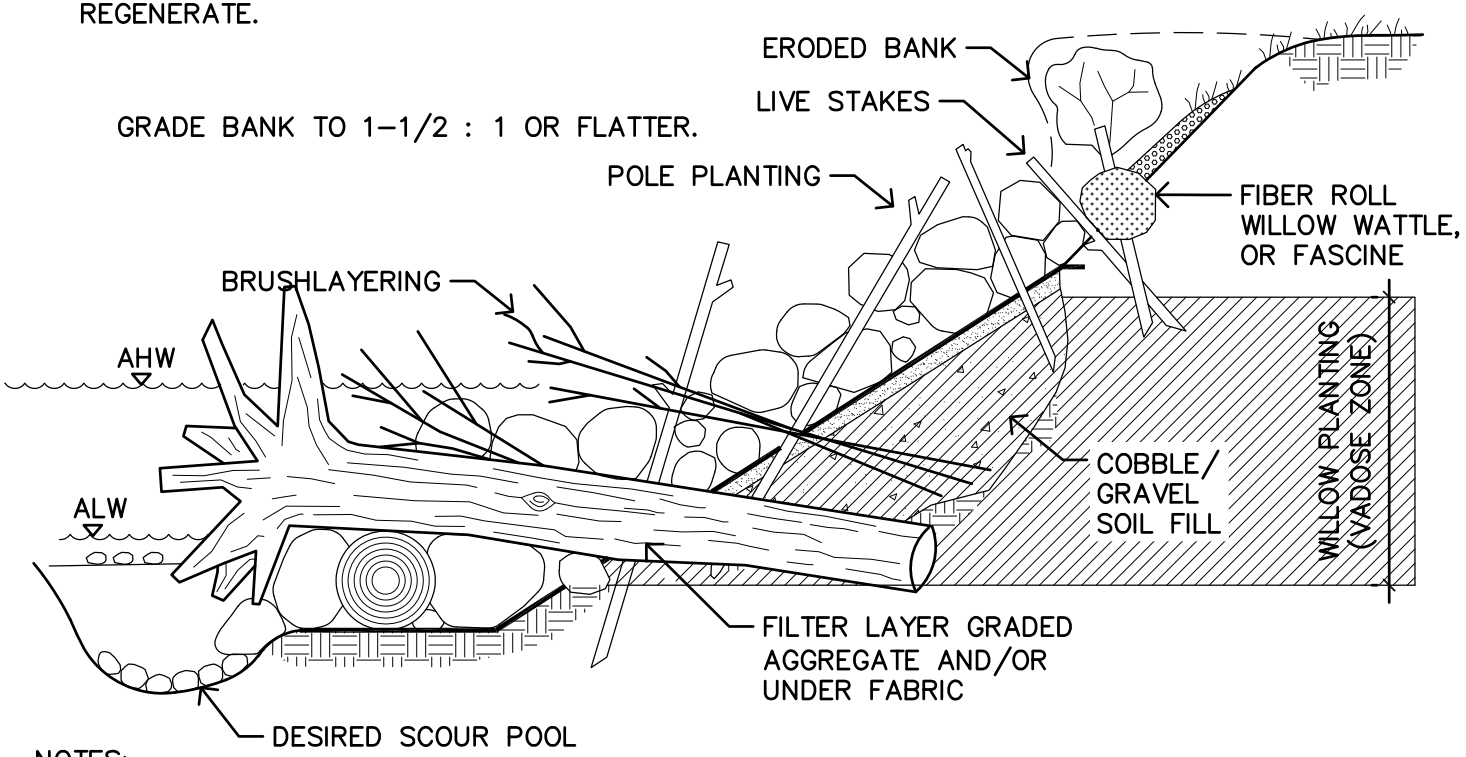
The woody materials will probably not have the durability of other structural components. However, the inclusion of live woody vegetation, along with the accompanying root reinforcement, may make these structures stronger and more durable.

Implementation

Use a backhoe or excavator to set a "footer" log in a trench excavated below the thalweg (lowest point in the channel), running roughly parallel with the bank. A second log with the root wad attached is set on top of the footer log diagonally, forming an "X". The root wad end is set pointing upstream into the flow and the butt end lying downstream 45-60° degrees. The butt end of the root wad should be set in a trench excavated into the bank. Large boulders and willow poles should be used to secure the root wad, especially at the apex. Placement of the willow poles into the excavations will ensure they are deeply embedded and able to contact the water table. Further incorporation of live woody cuttings (brushlayering and pole planting) will enhance the structure.

NOTES:

1. WILLOW POLE PLANTING AND BRUSHLAYERING SHALL BE INSTALLED DURING BANK GRADING AND RIPRAP PLACEMENT TO ENSURE GOOD CONTACT WITH 'NATIVE GROUND' AND SOIL FILL.
2. WILLOW POLES AND BRUSH LAYERS SHALL EXTEND DOWN INTO EXPECTED SOIL MOISTURE ZONES (VADOSE).
3. CUT SMALL HOLES OR SLITS IN FILTER FABRIC AS NECESSARY.
4. PLACE SOIL FILL (COBBLES, GRAVEL, SOIL) AROUND CUTTINGS.
5. PLACE RIPRAP CAREFULLY, DO NOT END DUMP. SOME DAMAGE TO BRUSH LAYERS AND WILLOW POLES IS UNAVOIDABLE AND ACCEPTABLE. DEEPLY PLANTED WILLOW MATERIAL WILL REGENERATE.

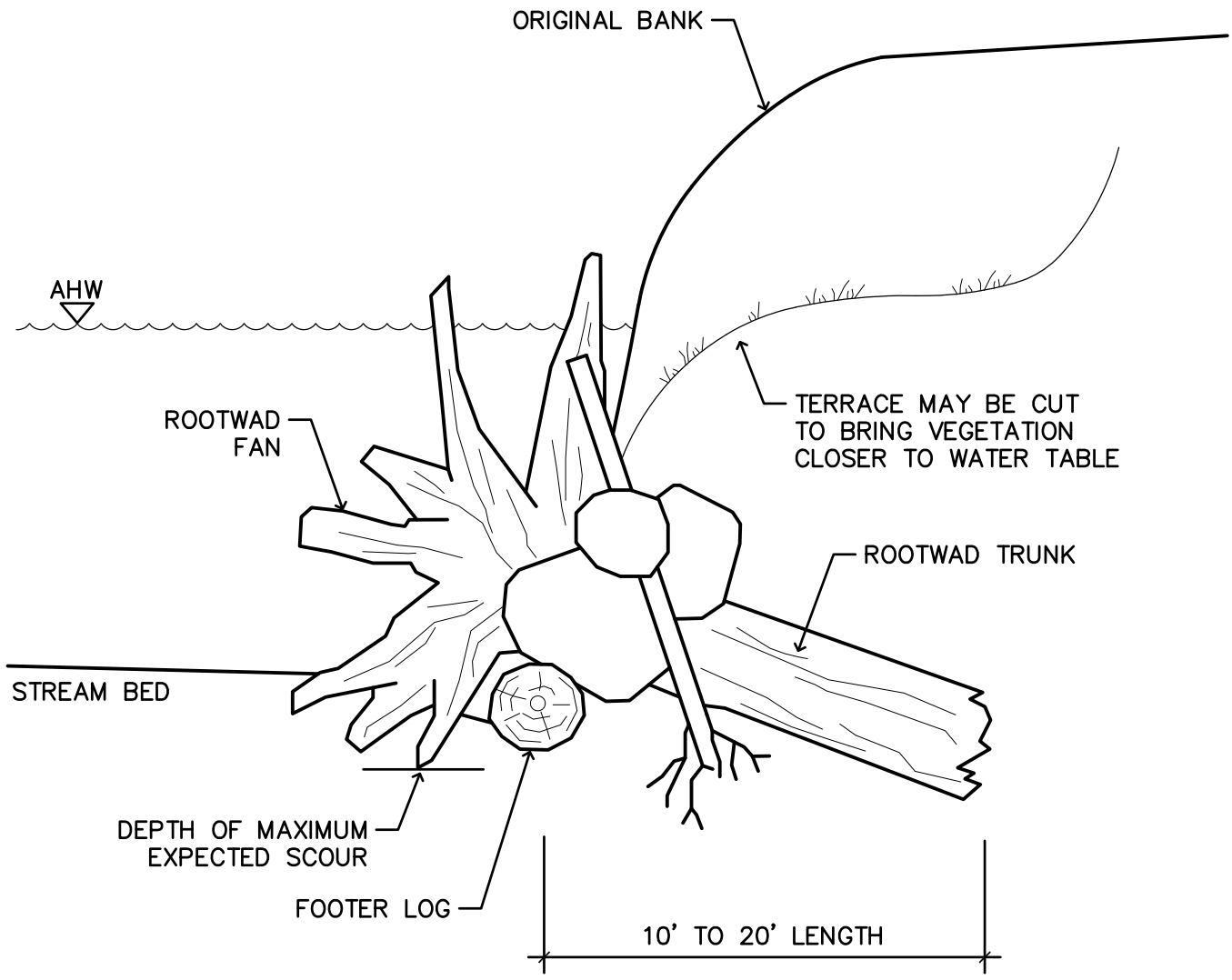


NOTES:

1. EXCAVATE TRENCH BELOW LOWEST STREAM BED GRADE, PARALLEL WITH BANK TO SET FOOTER LOG.
2. SET ROOT WAD WITH MIN. OF 6' OF BOLE ON TOP OF FOOTER LOG DIAGONALLY FORMING AN 'X'.
3. ROOTWAD PIECE SHOULD BE ANGLED UPSTREAM AT 45–60 DEGREE ANGLE, WITH BOLE SET INTO TRENCH IN BANK.
4. PLACE WILLOW POLES AND BOULDERS TO SECURE, ESPECIALLY AT APEX AND IN TRENCHES.

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		ROOTWAD REVETMENT WITH VEGETATED RIPRAP
SCALE: NTS	DATE: 11/2019	

©JOHN MCCHULLAH



ROOTWAD REVETMENT CROSS SECTION

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\5 rootwad revetment cross section.dwg

©2004 SALIX

Effective Silt Fence Installation

Definition

A silt fence is a temporary sediment barrier consisting of filter fabric entrenched into the soil and attached to supporting posts. Silt fence installed with a trencher or by slicing is the most effective installation method to ensure against common silt fence failures.

Purpose

Silt fence is a sediment control practice. Silt fence is intended to be installed where sediment-laden water can pond, thus allowing the sediment to fall out of suspension and separate from the runoff. It is not intended to be an erosion control practice.

Design Considerations

Typical silt fence specifications were written 25 years ago and have changed little since. Some states have recognized some of the inherent problems, such as inadequate trench depth, and implemented minor changes to improve efficacy. Time and experience has shown that the outdated construction specifications, combined with the improper application and incorrect installation of silt fences, has resulted in it being one of the most ineffective storm water pollution controls in use.

Do not install silt fences across streams, channels, or drainage ways. Silt fences cannot"filter" the volumes generated by channel flows. When installed across a concentrated flow path, undercutting or "end cutting" of the fence often occurs. Silt fences should not be designed to impound sediment or water more than 18 inches (0.5 m) high.

Construction Specifications

Silt fences have a useful life of one season. Their principal mode of action is to slow and pond the water and allow soil particles to settle. Silt fences are not designed to withstand high heads of water, and therefore should be located where only shallow pools can form. Their use is limited to situations in which sheet or overland flows are expected.

- Install silt fence material into a trench, 4” wide and at least 6” deep, with vertical sides. A preferred installation technique involves static slicing with an implement such as the "Tommy Silt Fence Machine" or equivalent. The soil should be sliced and the fabric mechanically installed into the soil.
- The trench must be backfilled and compacted.
- Install silt fences with 'smiles' or J-hooks to reduce the drainage area that any segment will impound

Effective Silt Fence Installation (continued)

- Silt fences placed at the toe of a slope shall be set at least 6 feet (1.8 m) from the toe in order to increase ponding volume.
- The soil should be sliced and the fabric mechanically installed into the soil.
- The height of a silt fence shall not exceed 36 inches (0.9 m). Storage height and ponding height shall never exceed 18 inches (0.5 m).
- The ends of the fence should be turned uphill.
- Steel support posts should be utilized, properly spaced and driven into compacted soil. Place the posts on the downstream side of the fabric/
- Post spacing shall not exceed 6 feet (1.8 m).
- The filter fabric is wire-tied directly to the posts with three diagonal ties. Filter fabric shall not be stapled to existing trees.

Inspection and Maintenance

- Inspect fence for proper installation and compaction by pulling up on the fence while kicking the toe of the fabric. If the fence comes out of the ground, do not "accept" the installation.
- If there are long, linear runs of silt fence without J-hooks or "smiles", do not "accept" the installation.
- Sediment shall be cleaned from behind the fence when it reaches 50% of the designed impoundment height (9 inch (0.2 m).

- Silt fences and filter barriers shall be inspected weekly after each significant storm (1 inch (25.4 mm) in 24 hour). Any required repairs shall be made immediately.
- Sediment should be removed when it reaches 1/3 height of the fence or 9 inches (0.3 m) maximum.
- The removed sediment shall conform with the existing grade and be vegetated or otherwise stabilized.
- Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized and any sediment stored behind the silt fence has been removed.

EFFECTIVE SILT FENCE INSTALLATION WITH SMILES

Construction Specifications:

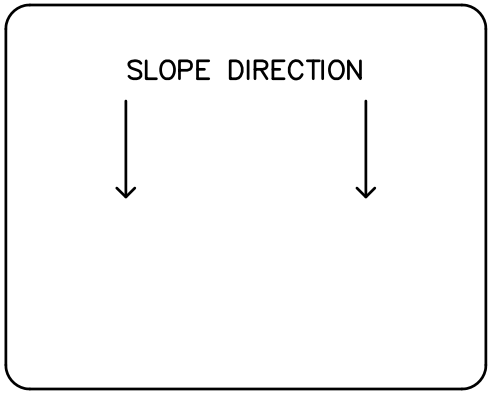
Typical silt fence specifications were written 25 years ago and have changed little since. Some states have recognized some of the inherent problems, such as inadequate trench depth, and implemented minor changes to improve efficacy. The 25 year-old specifications, referred to as the trenching method, have never been tested for efficacy and proven worthwhile. A trencher was simply the only piece of equipment available at the time capable of securing the fabric into the soil, regardless of efficacy.

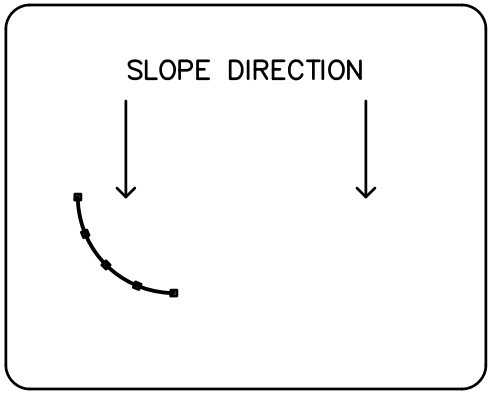
Today, many contractors just open a furrow with a blade and backfill onto the fabric with the crumbs. Loose soil, both from the trencher or the blade, absorbs water quickly and becomes saturated, easily washing out under the fabric.

- The soil should be sliced and the fabric mechanically installed into the soil.
- The height of a silt fence shall not exceed 36 inches (0.9 m). Storage height and ponding height shall never exceed 18 inches (0.5 m).
- To minimize erosion, install silt fence at the head of a slope to slow velocity and to create a large storage area.
- The fence line shall follow the contour as closely as possible.
- The ends of the fence should be turned uphill.
- Steel support posts should be utilized, properly spaced and driven into compacted soil.
- Post spacing shall not exceed 6 feet (1.8 m).
- The filter fabric is stapled or wired directly to the posts. Filter fabric shall not be stapled to existing trees.
- Fabric should be attached to the posts with three diagonal ties.
- Silt fences placed at the toe of a slope shall be set at least 6 feet (1.8 m) from the toe in order to increase ponding volume.

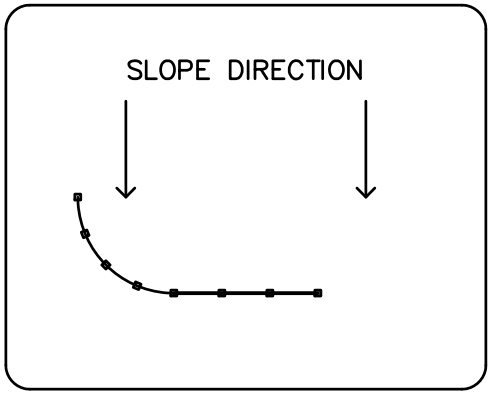
Inspection and Maintenance:

- Silt fences and filter barriers shall be inspected weekly after each significant storm (1 inch (25.4 mm) in 24 hours). Any required repairs shall be made immediately.
- Sediment should be removed when it reaches 1/3 height of the fence or 9 inches (0.3 m) maximum.
- The removed sediment shall conform to the existing grade and be vegetated or otherwise stabilized.
- Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized and any sediment stored behind the silt fence has been removed.

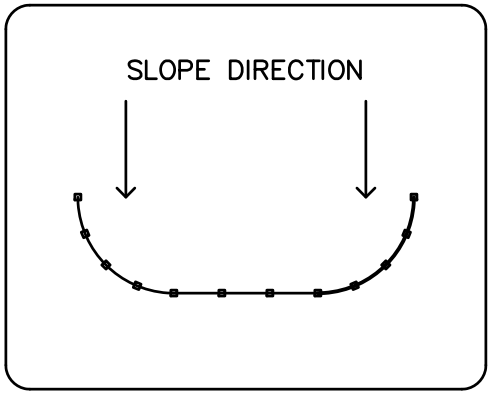




STEP 1 – CONSTRUCT LEG 1



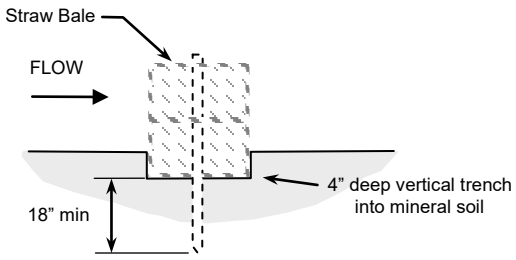
STEP 2 – CONSTRUCT DAM



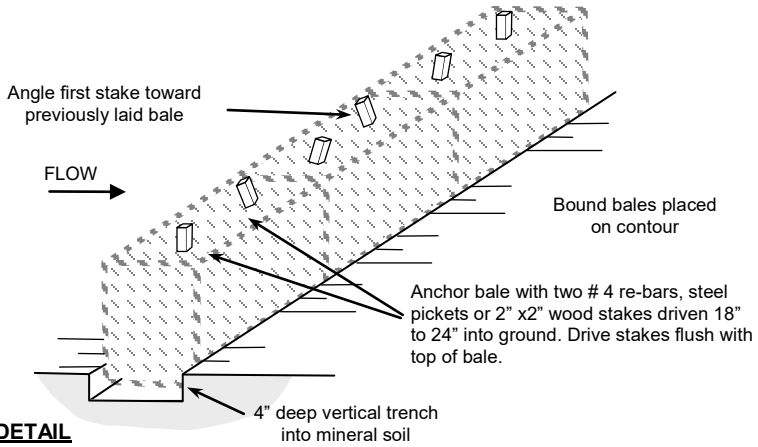
STEP 3 – CONSTRUCT LEG 2

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		SILT FENCE TYPICAL PLACEMENT ON SLOPE "SMILES"
SCALE: 1/2" = 1'-0"	DATE: 10/2019	

\\fileserv\shareall\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\1B Fence-Silt_SlopePlacementSmiles.dwg



BEDDING DETAILS



ANCHOR DETAIL

NOTES:

1. Bales shall be placed at contour locations as specified for slope erosion control
2. Bales shall be placed in ditches at designated locations for sediment reduction as specified.
3. Each bale shall be imbedded a minimum of 4" \.
4. Each bale shall be securely anchored in placed by either two # 4 re-bars, steel pickets or 2" x 2" wood stakes driven through the bales. The first stake in each bale shall be driven at an angle to force the bales together.
5. For bales placed on slope, stakes shall be driven a minimum of 18" into firm soils. For bales placed in inside ditches, stakes shall be driven a minimum of 6" into firm native soils.
6. Inspection shall be frequent and repair replacement shall be made promptly as needed
7. Bales shall be removed as directed

8C **STRAW SILT FENCE (Typical)**
NTS

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

STRAW SILT FENCE
TYPICAL SPECIFICATIONS

Standard Detail 8C

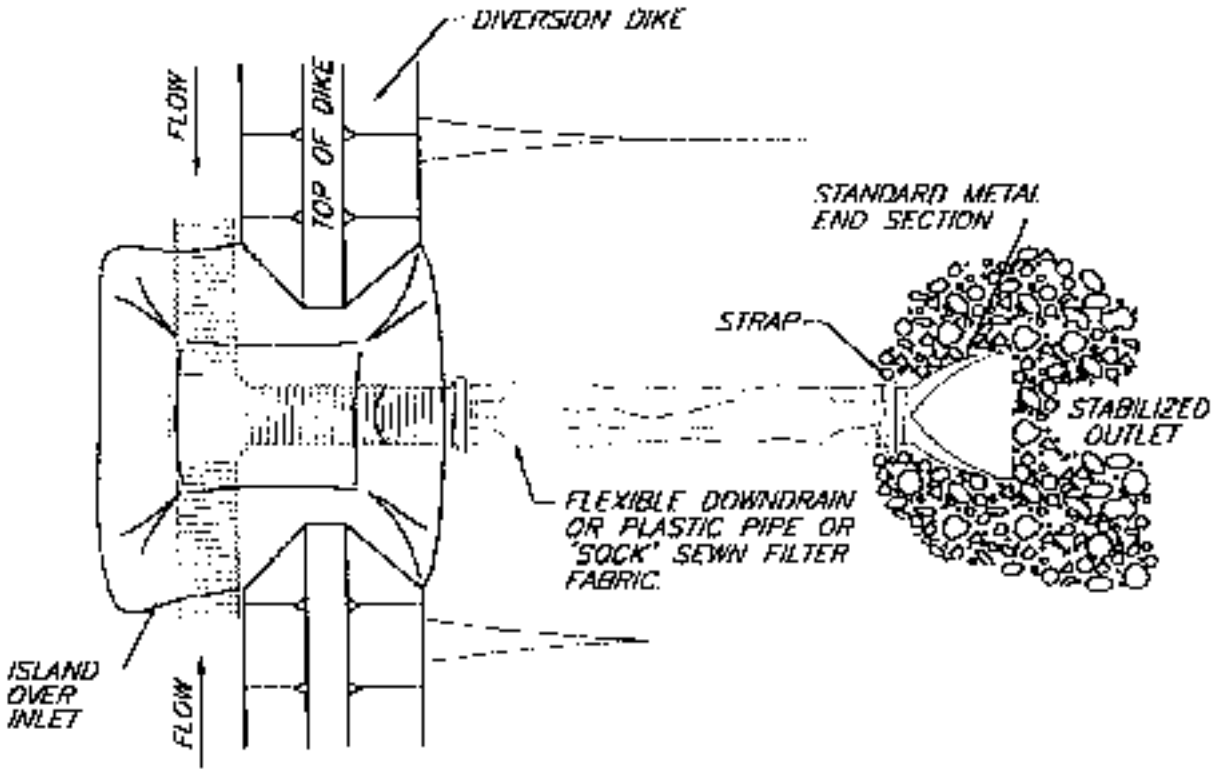
Date: May 3, 2009

SLOPE DRAIN

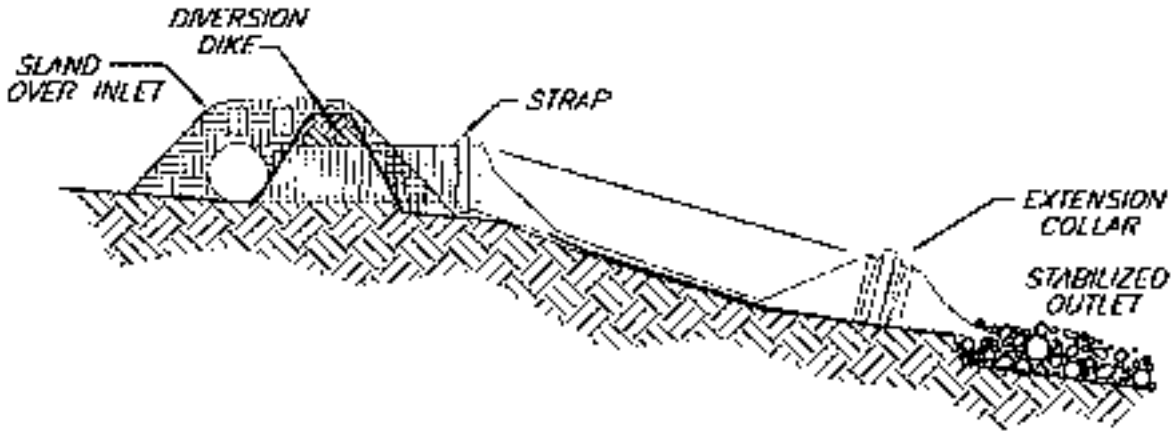
Construction Specifications: A common failure of slope drains is caused by water saturating the soil and seeping along the pipe. Proper backfilling around and under the pipe haunches with stable soil material and hand compacting in 6 inch (.2 m) lifts to achieve first contact between the pipe and the soil at all points will reduce this type of failure

- Place slope drains on undisturbed soil or well compacted fill at locations and elevations shown on the plans
- Slightly slope the section of pipe under the dike toward its outlet.
- Compact the soil under and around the entrance section in lifts not to exceed 6 inches
- Ensure that fill over the drain at the top of the slope has a minimum depth of 1.5 feet (0.5 m) and a minimum top width of 4 feet (1.2 m). The sides should have a 3:1 slope
- Ensure that all slope drain connections are water-tight
- Ensure that all fill material is well-compacted. Securely fasten the exposed section of the drain with grommets or stakes spaced no more than 10 feet (3.1 m) apart
- Extend the drain beyond the toe of the slope and adequately protect the outlet from erosion
- Make the settled, compacted dike ridge no less than 1 foot (0.3 m) higher than the top of the pipe inlet
- Immediately stabilize all disturbed areas following construction

Maintenance: Inspect the slope drain and supporting diversions after every significant rainfall and promptly make necessary repairs. When the protected area has been permanently stabilized, temporary measures may be removed, materials disposed of properly, and all disturbed areas stabilized appropriately



PLAN VIEW



SECTION

SLOPE DRAIN

© 1994 JOHN McCULLAH

FILE: SLOPEDRN

Straw Rolls

Straw rolls are manufactured from straw that is wrapped in black plastic netting. They are approximately 200 mm (8 inches) in diameter by 8-9 m (25-30 feet) long. Rolls are placed and staked along the contour of newly constructed or disturbed slopes, in shallow trenches.

Conditions Where Practice Applies

Sites appropriate for straw rolls are slopes susceptible to sheet and rill erosion, slopes producing dry ravel, slopes susceptible to freeze/thaw activity, or slopes difficult to vegetate because of soil movement. Straw rolls are not intended for use in concentrated flow situations. Straw rolls will last an average of one to two years. This is an important factor when planning the optimum length of time the slope will need mechanical stabilization. Straw rolls can be staked with live stakes if site conditions warrant. The moisture retained by the straw roll will encourage cutting establishment.

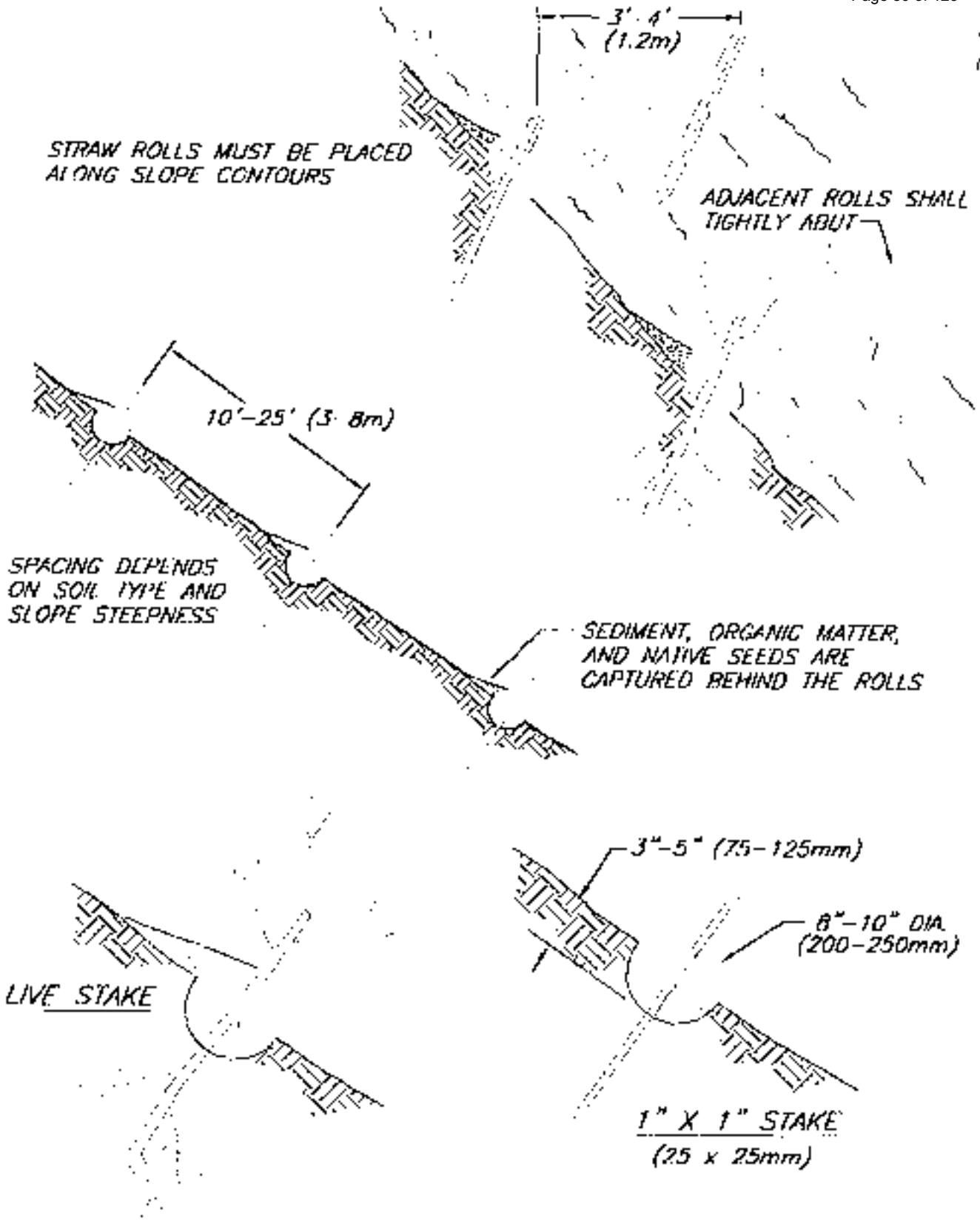
Advantages

Straw rolls are a relatively low-cost solution to sheet and rill erosion problems. They better suited than silt fences or straw bales for placement on steep slopes. Straw Rolls help establish native vegetation as rolls store moisture for vegetation planted immediately upslope. The moisture retention can help in the establishment of willows from live cuttings. The plastic netting will eventually photodegrade, eliminating the need for retrieval of materials after the straw has broken down. The straw will become incorporated into the soil with time, adding organic material to the soil and retaining moisture for vegetation.

Implementation

Prepare the slope before the installation procedure is started. Shallow gullies should be smoothed as work progresses. Dig small trenches across the slope on contour to place the rolls in. The trench should be deep enough to accommodate half the thickness of the roll. When the soil is loose and uncompacted, the trench should be deep enough to bury the roll 2/3 of its thickness because the ground will settle.

Start building trenches and install rolls from the bottom of the slope and work up. Construct trenches at contour intervals of 3-12 feet (1-4 m) apart depending on steepness of slope. The steeper the slope, the closer together the trenches. Make sure no gaps exist between the soil and the straw wattle. Use a straight bar to drive holes through the wattle and into the soil for the willow or wooden stakes. Drive the stake through prepared hole into the soil. Leave only 25-50 mm (1-2 inches) of stake exposed above roll. Install stakes at least every 1.2 m (4 feet) apart. Use straight willow stakes, 20-mm (3/4 inch) diameter in addition to wooden stakes.



NOT TO SCALE

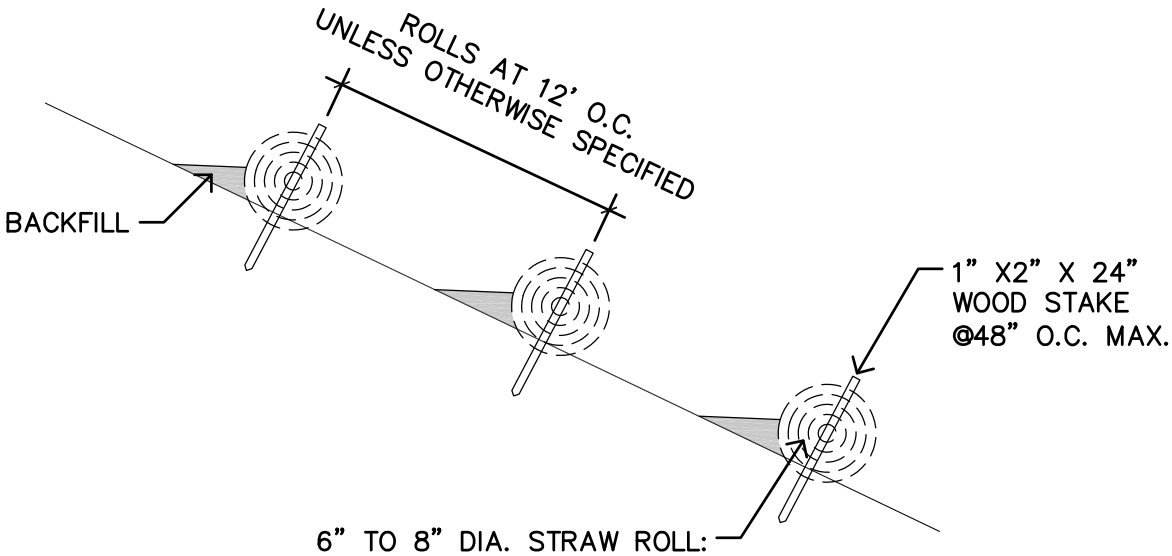
NOTE:

1. STRAW ROLL INSTALLATION REQUIRES THE PLACEMENT AND SECURE STAKING OF THE ROLL IN A TRENCH, 3"-5" (75-125mm) DEEP, DUG ON CONTOUR. RUNOFF MUST NOT BE ALLOWED TO RUN UNDER OR AROUND ROLL.

STRAW ROLLS

© 1998 J. McCULLAH

FILE: STRAWROLL



6" TO 8" DIA. STRAW ROLL:

- STRAW ROLLS SHALL BE MANUFACTURED FROM RICE STRAW AND WRAPPED IN BURLAP
- BIO-12 STRAW WATTLES BY CALIFORNIA STRAW WORKS OR EQUIVALENT;
- INSTALL PER MANUFACTURES RECOMMENDATIONS.

NOTES:

- LOCATION
  1) INSTALL AT BASE OF DISTURBED AREAS AND AT OUTLETS OF NEW OR RECONSTRUCTED REVERSE GRADES/ROLLING DIPS UNLESS OTHERWISE SPECIFIC;
  2) ROLLS TO EXTEND ACROSS ENTIRE WIDTH OF DISTURBED AREA UNLESS OTHERWISE SPECIFIED OR DIRECTED.
- PLACEMENT
  1) INSTALL PER MANUFACTURES RECOMMENDATIONS.
  2) ROLLS TO BE PLACED ON SLOPE CONTOUR;
  3) ADJACENT ROLLS TO OVERLAP; TURN ENDS OF ROLLS UP;
  4) RUNOFF MUST NOT BE ALLOWED TO RUN UNDER OR AROUND THE ROLL.

STRAW ROLL PLACEMENT

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\1B Straw roll placement.dwg

©TIMOTHY C. BEST, CEG

STRUCTURAL STREAMBANK STABILIZATION

Construction Specifications:

Riprap Riprap is the most commonly used structural material for stabilizing streambanks. When possible, slope banks to 2:1 or flatter, and place a gravel filter or filter fabric on the smoothed slopes before installing riprap. Place the toe of the riprap at least 1 foot (0.3 m) below the stream channel bottom or below the anticipated depth of channel degradation. Where necessary, riprap the entire stream cross section. It is important to extend the upstream and downstream edges of riprap well into the bank and bottom. Extend riprap sections the entire length between well-stabilized points of the stream channel.

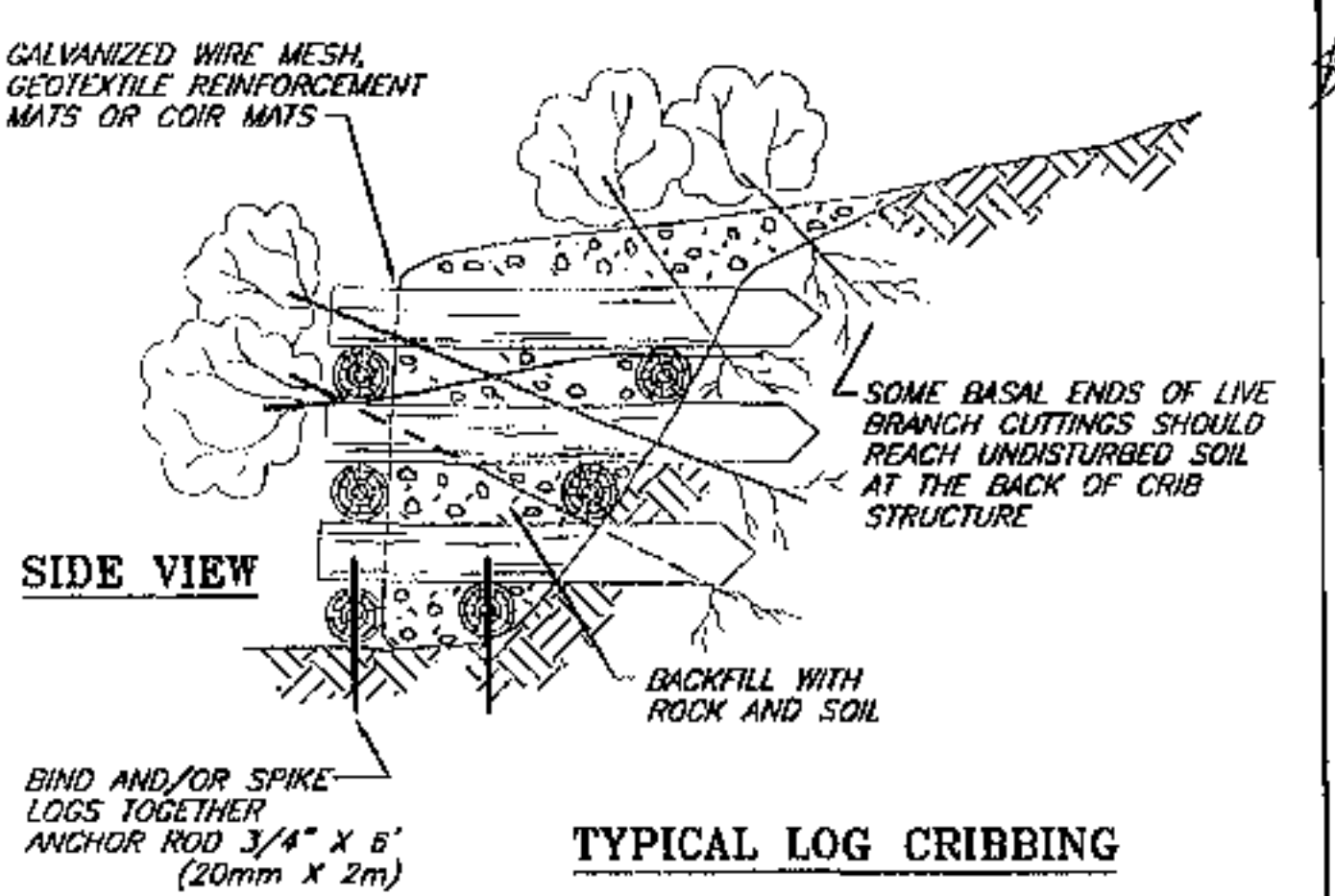
Deflectors: Deflectors are structural barriers, in the form of groins or jetties which project into the stream to divert flow away from eroding streambank sections. Stone and rock deflectors, used as instream structures, may also be useful for environmental and habitat enhancement

- Live willow (or other riparian species) staking may be incorporated into the construction of the rock deflectors
- The deflectors should be shaped in a 30-60-90 degree triangle with the 30 degree angle upstream and against the bank.
- The deflectors are generally spaced 3-5 times the length of its groin.
- Single wing deflectors should extend 1/4 to 1/2 of the way across the stream.
- Double wing deflectors will extend no more than 1/4 of the way across the stream, opposite each other. The narrowest point between deflector will be 1/2 of the stream width
- In general, the first and last deflectors should be double wing deflectors and the general deflector pattern will alternate between double wing and single wing, unless structures are intended to protect an outer bend. Then non-alternating, consecutive single wings may be required.
- The rock deflector should be constructed with a 1.5 foot (0.5 m) minimum diameter rock. Larger channels will require larger rock.
- Rock deflector should be keyed into the stream bottom a minimum of 1 foot (0.3 m).
- The top of the rock should extend 1 foot (0.3m) above normal stream flow (near bank) and slope down to a height of 0.5 feet (0.2 m) above stream flow at apex.
- The deflectors should be contiguous with riprap or other streambank protection measures.

Log Cribbing is a retaining structure built of logs to protect streambanks from erosion. Log cribbing is normally built on the outside of stream bends to protect the streambank from the impinging flow of the stream. Log cribbing can have live willow (or other riparian species)

stakes be planted between the logs, behind the structure and immediately adjacent to the cribbing.

Inspection and Maintenance: All structures should be maintained in an "as built" condition. Structural damage caused by storm events should be repaired as soon as possible to prevent further damage to the structure or erosion of the streambank.



TYPICAL LOG CRIBBING

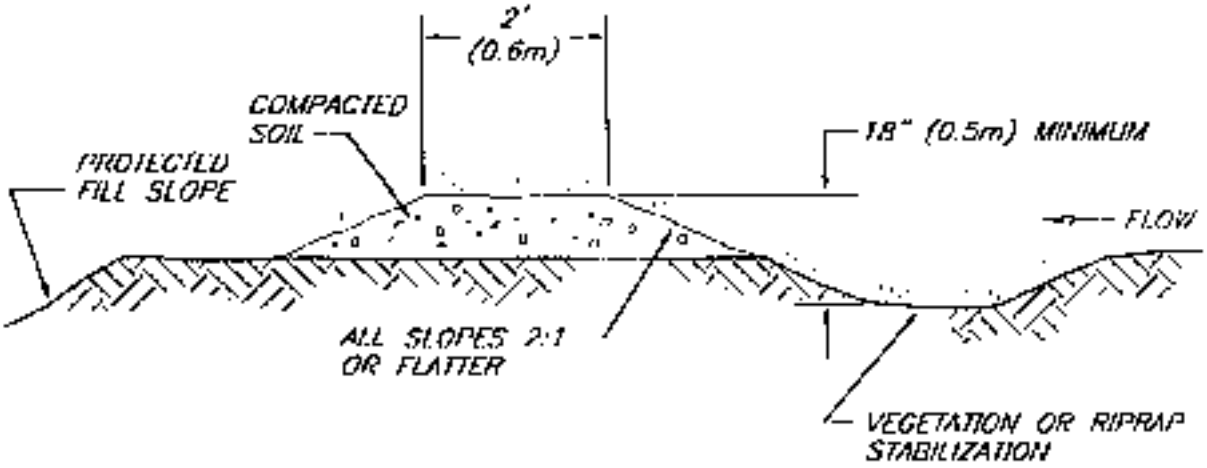
TEMPORARY DIVERSION DIKE

Construction Specifications:

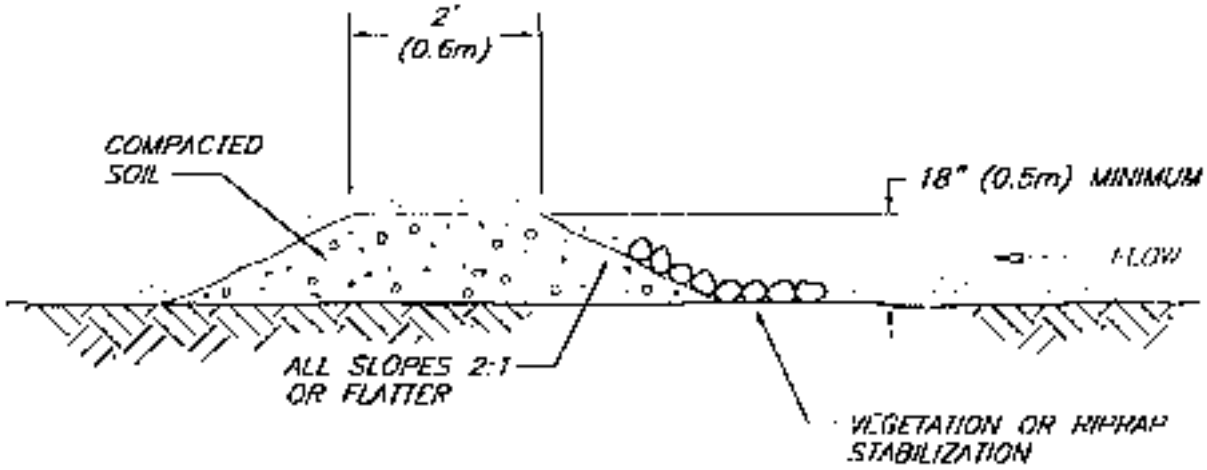
- Temporary diversion dikes must be installed as a first step in the land-disturbing activity and must be functional prior to upslope land disturbance
- The dike should be adequately compacted to prevent failure
- Temporary or permanent seeding and mulch shall be applied to the dike immediately following its construction
- The dike should be located to minimize damages by construction operations and traffic.

Inspection and Maintenance:

- The measure shall be inspected after every storm and repairs made to the dike, flow channel, outlet or sediment trapping facility, as necessary.
- Once every two weeks, whether a storm event has occurred or not, the measure shall be inspected and repairs made if needed
- Diversion Dikes used to trap sediment shall be inspected and cleaned out after every significant storm
- Damages caused by construction traffic or other activity must be repaired before the end of each working day
- If vegetation has not been established, reseed damaged and sparse areas immediately.



TYPICAL FILL DIVERSION



TYPICAL TEMPORARY DIVERSION DIKE

NOTES:
1. THE CHANNEL BEHIND THE DIKE SHALL HAVE POSITIVE GRADE TO A STABILIZED OUTLET.
2. THE DIKE SHALL BE ADEQUATELY COMPACTED TO PREVENT FAILURE.
3. THE DIKE SHALL BE STABILIZED WITH TEMPORARY OR PERMANENT SEEDING OR RIPRAP.

TEMPORARY DIVERSION DIKE

©1996 JOHN McCULLAH

FILE: TEMPDIKE

Vegetated Mechanically Stabilized Earth

Description:

This technique consists of live cut branches (brushlayers) interspersed between lifts of soil wrapped in natural fabric, e.g., coir, or synthetic geotextiles or geogrids. The live brush is placed in a criss-cross or overlapping pattern atop each wrapped soil lift in a manner similar to conventional brushlayering. The fabric wrapping provides the primary reinforcement in a manner similar to that of conventional mechanically-stabilized earth (Koerner, 1998; Mitchell & Villet, 1987). The live, cut branches eventually root and leaf out, providing vegetative cover and secondary reinforcement as well. In some cases, the vegetative treatment may consist of using a coarse netting for the soil wraps and establishing an herbaceous or grass cover by simply hydroseeding through the openings in the fabric.

Purpose:

Vegetated Mechanically Stabilized Earth (VMSE) can be viewed as a union between conventional, mechanically stabilized earth methods that utilize inert, tensile inclusions, and brushlayering, a soil bioengineering technique that utilizes live, cut branches as the tensile soil inclusions. The treatments complement one another. Fabric wraps provide the primary reinforcement and mechanical stabilization, permitting much steeper slopes to be constructed than would be possible with live brushlayers alone. The vegetation shields the fabric against damaging UV radiation and provides visual and habitat benefits.

Conditions Where Practice Applies:

VMSE can be used to stabilize slopes as steep as 1V:0.5H. This technique provides an alternative to vertical retaining structures, e.g., timber pile walls, and to techniques that require slope flattening or bank lay back, which results in excessive right-of-way encroachment at the top of bank. The use of synthetic geotextiles or geogrids provides greater long-term durability and security. The fabric or geotextile wrap also provides additional protection to upper portions of streambanks that are subject to periodic scour or tractive stresses. If either steady, long term seepage or temporary bank return flows after flood events are a problem, the brushlayers act as a drainage layer or conduits that relieve internal pore water pressure, and favorably modify the groundwater flow regime within the slope to minimize slope stability problems.

Complexity:

High. VMSE is relatively complex, because it entails designing, melding together, and constructing two similar yet distinct methods, conventional MSE and live brushlayering. Both techniques are widely used and well understood, however; simultaneous use introduces complexity.

Vegetated Mechanically Stabilized Earth (continued)

Design Guidelines / Typical Drawings:

Many different types of inclusions with various shapes and properties can be used to reinforce and buttress earthen slopes. These inclusions range from imbedded metal strips, geogrids fabricated from polymeric nets, and natural or synthetic geotextiles or fabrics. Earthen slopes, embankments, or structural fills that are stabilized or reinforced with such tensile inclusions are referred to as "mechanically stabilized earth." Shear stresses that develop in the soil matrix are transferred into tensile resistance in the imbedded inclusions via friction along the soil-inclusion interface.

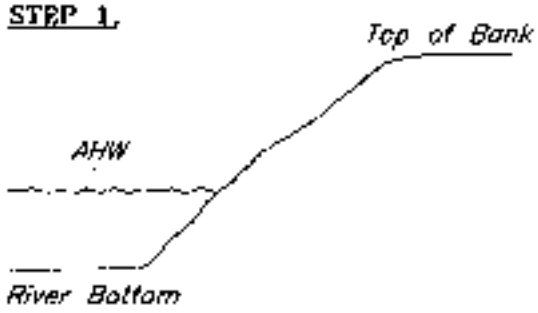
Mechanically stabilized earth retaining structures must satisfy external stability requirements, i.e., have adequate resistance to sliding, overturning, and bearing capacity failure. Internal stability requirements are also important in reinforced earth and mechanically stabilized earth structures. The tensile inclusions or reinforcements in these structures must have a sufficient unit tensile resistance and/or be placed in sufficient numbers to resist breaking in tension. The inclusions must also be sufficiently long and "frictional" enough to resist failure by pullout.

Synthetic geogrids fabricated from high-tensile strength polymeric materials are widely used in reinforced earth embankments and retaining walls. Geogrids tend to have superior pullout resistance compared to geotextile or fabric sheets because of passive resistance mobilized along the transverse elements in a mesh or geogrid. They can be used either in a wrap-around fashion to provide both backfill reinforcement and containment at the front face. This approach permits the insertion of live cuttings or branches between successive lifts of "wrapped soil" as shown schematically in Figure 1.

Live cuttings inserted in the above manner also act as tensile inclusions and help to stabilize a slope, embankment, or structural fill. Live brushlayers behave exactly in this fashion. Gray & Sotir (1992) discuss how brushlayers can be analyzed and their contribution to slope stability determined in a rational, quantitative manner. This contribution could be included as well when inert reinforcements are used in conjunction with live brushlayers such as in VMSE. In this combined approach, however, the contribution to mechanical reinforcement from the live cuttings is simply treated as a bonus, and the design analysis is focused on the fabric or geogrid reinforcements themselves.

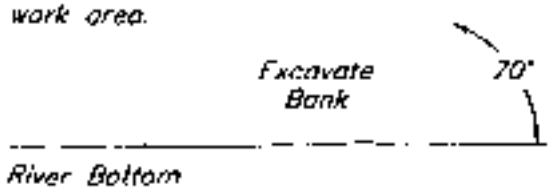
The main considerations in the design of geogrid or geotextile reinforced earthen slopes and embankment fills is the required vertical spacing (d) and total length (L) of the reinforcing layers. The total length (L) is comprised of a length or distance required to reach the expected failure surface in the backfill and an additional length, the effective or imbedment length (L_E), extending beyond the failure surface required to prevent pullout. The reader should consult with a geotechnical engineer as necessary.

STEP 1.

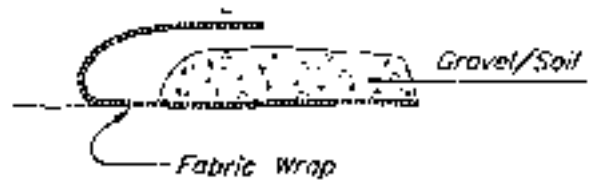


STEP 2.

Construct during periods of low water or isolate work area.



STEP 3.

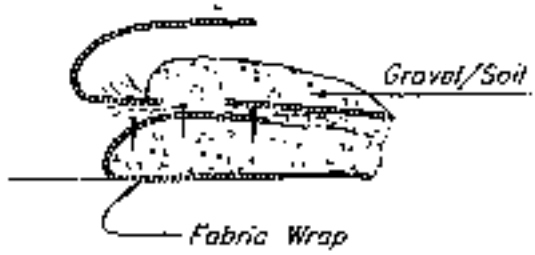


STEP 4.

Crisscross layers of dormant cuttings and/or transplants.

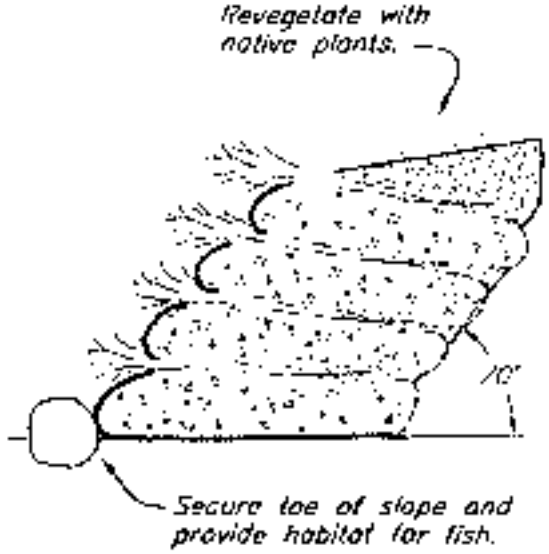
STEP 5.

Wrap second layer of soil/gravel with fabric.



STEP 6.

Repeat steps 3, 4, 5 until desired height of bank is reached.



VEGETATED MECHANICALLY STABILIZED EARTH
STEP BY STEP

© 2004 SAUK

FILE: WSE

Vegetated Riprap

A layer of stones and/or boulder armoring, generally referred to as riprap revetment, placed along a streambank and designed to be vegetated with pole planting, brushlayering, and live staking (joint planting).

Conditions Where Practice Applies

Rock riprap is the most common and effective form of streambank protection. Rock can settle and conform if some scour should occur. Conventional riprap placement, however, does not increase wildlife habitat nor is it aesthetically pleasing. It often takes many years for riprap to become vegetated if revegetation is not planned in advance and integrated with construction. The agencies whose task it is to ensure fish habitat recognize that the continued use of riprap, gabions, and other inert streambank structures have long-term negative impacts on aquatic habitats.

This practice applies whenever there is a desire to install riprap, which is more attractive and has the potential to enhance, not degrade, fish and wildlife habitat. Additionally, woody vegetation establishment will prevent soil loss (piping) from behind the structures and increase pull out resistance. Vegetated riprap techniques should be considered with projects in streams with fishery resources.

Materials

The main elements are quarry stone or other suitable rock, the size and weight dependant on design velocity or slope stability analysis. A filter layer, either graded aggregate or filter fabric, placed under the riprap will prevent the washout (piping) of fines through the armor layer.

Willow material for brushlayering and pole planting will be required. The length of the cuttings will depend on the depth through the riprap and filter layer to the native soil. Live cuttings can be included and should consist of relatively straight willow branches, 25-40 mm (1-1.5 inches) diameter and long enough to reach beyond the riprap and filter layer and into native ground.

Vegetated Riprap (continued)

Advantages

Studies have shown that the frequency of revetment failure was lower in vegetated revetments than unvegetated sections. The vegetation's roots, particularly the fibrous willow roots, prevent washout of fines and stabilizes the native soil. Vegetation helps to anchor the armor stone to the bank and increases their lift-off resistance. In addition, vegetated revetments provide riparian benefits and wildlife habitat. Vegetated riprap has a more natural appearance and is therefore more aesthetically pleasing. Along streambanks, the vegetation will slow water velocities and encourage deposition and sedimentation. Experience has shown that environmental clearances and permits are easier to obtain if the project has biotechnical, habitat enhancement, elements incorporated into the design.

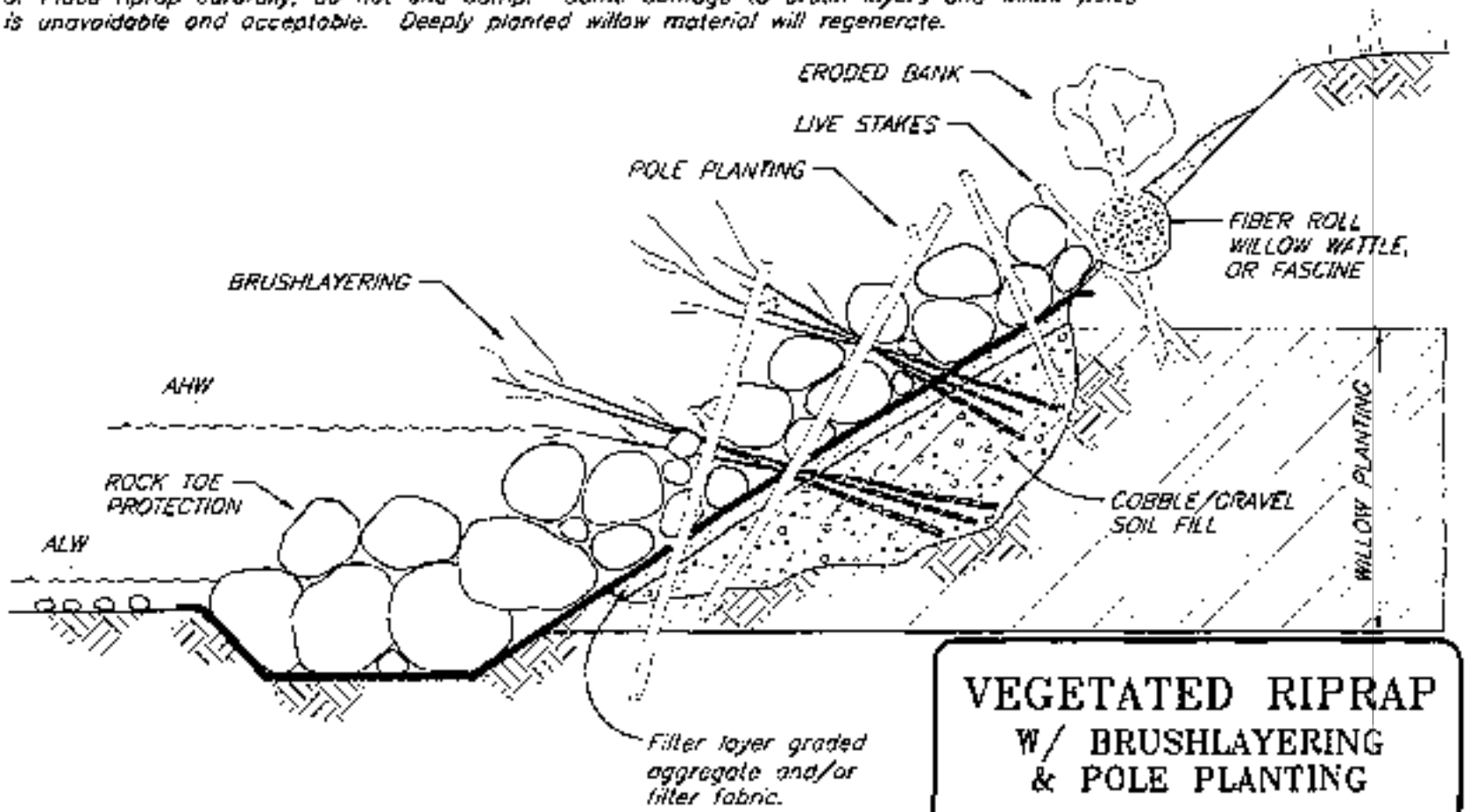
Disadvantages

It is sometimes difficult to drive the willow stakes between the rock joints, through filter fabric and into the native soil. The cuttings, brushlayering and pole planting, should be installed while the revetment is being constructed. Installation of the vegetative practices during construction will facilitate the planting but it will requires additional care when placing the rock (end dumping may damage to the cuttings).

Implementation

The branches are inserted during construction in crushed stone or riprap so that the butt ends are imbedded in the soil behind the cover to a depth of 0.3-0.5 m or into the seasonal water table or capillary fringe. The branch tips should protrude for approximately 0.5 m from the stone layer and face at an oblique angle downstream. The lowest branches are below the level of the mean summer flow and well wedged amongst the stone to prevent them from being washed out.

NOTES:
1. Install willow pole planting and brushlayering during bank grading and riprap placement to ensure good contact with 'native ground' and/or soil fill.
2. Willow poles and brush layers should extend down into expected soil moisture zones (vadose).
3. Cut small holes or slits in filter fabric as necessary.
4. Place soil fill (cobbles, gravel, soil) around cuttings.
5. Place riprap carefully, do not end dump. Some damage to brush layers and willow poles is unavoidable and acceptable. Deeply planted willow material will regenerate.

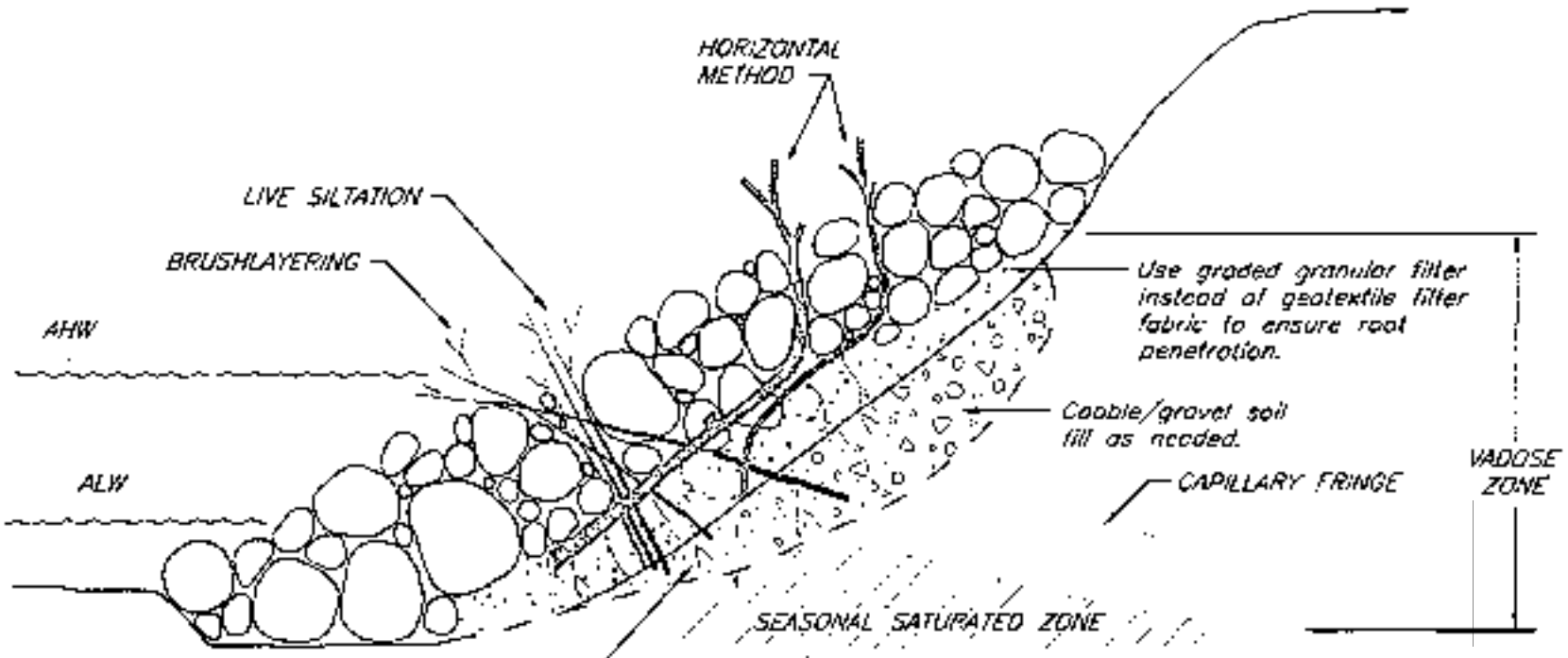


VEGETATED RIPRAP
W/ BRUSHLAYERING & POLE PLANTING

FILE: VRFA.PP

© 2004 WSDOE

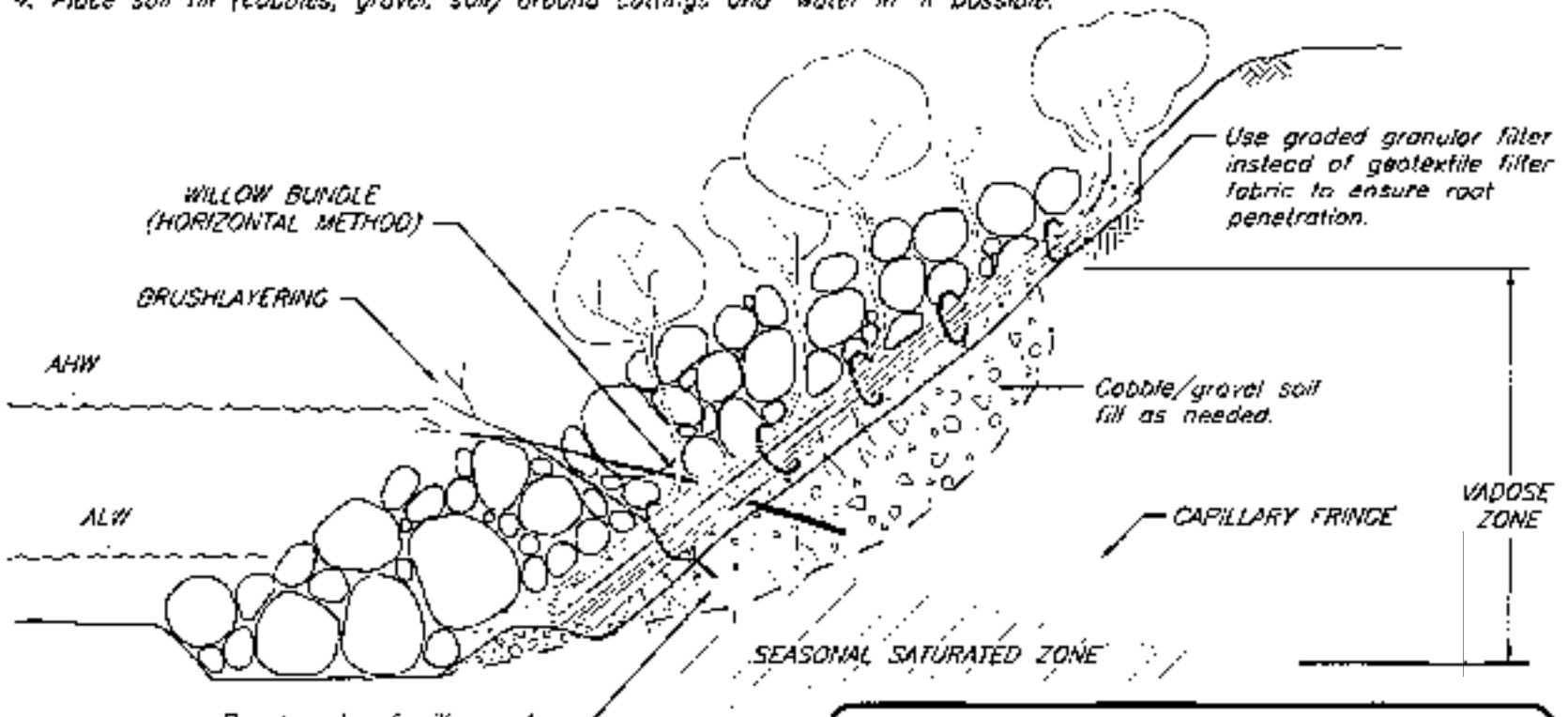
NOTES:
1. Integrate brushlayering, pole planting and live siltation techniques during rock placement to ensure contact with native ground. Laying poles "horizontally" is an efficient and cost-effective way to maximize rooting.
2. As a general rule, place basal ends of the cuttings 15 cm (6") into the capillary fringe or seasonal saturated zone.
3. Graded, granular filter is preferable to filter fabric to improve root penetration or slip poles through slits cut into fabric.
4. Place soil fill (cobbles, gravel, soil) around cuttings and 'water in' if possible.



VEGETATED RIPRAP
BENT POLE METHOD (HORIZONTAL)

© NRCS 2004

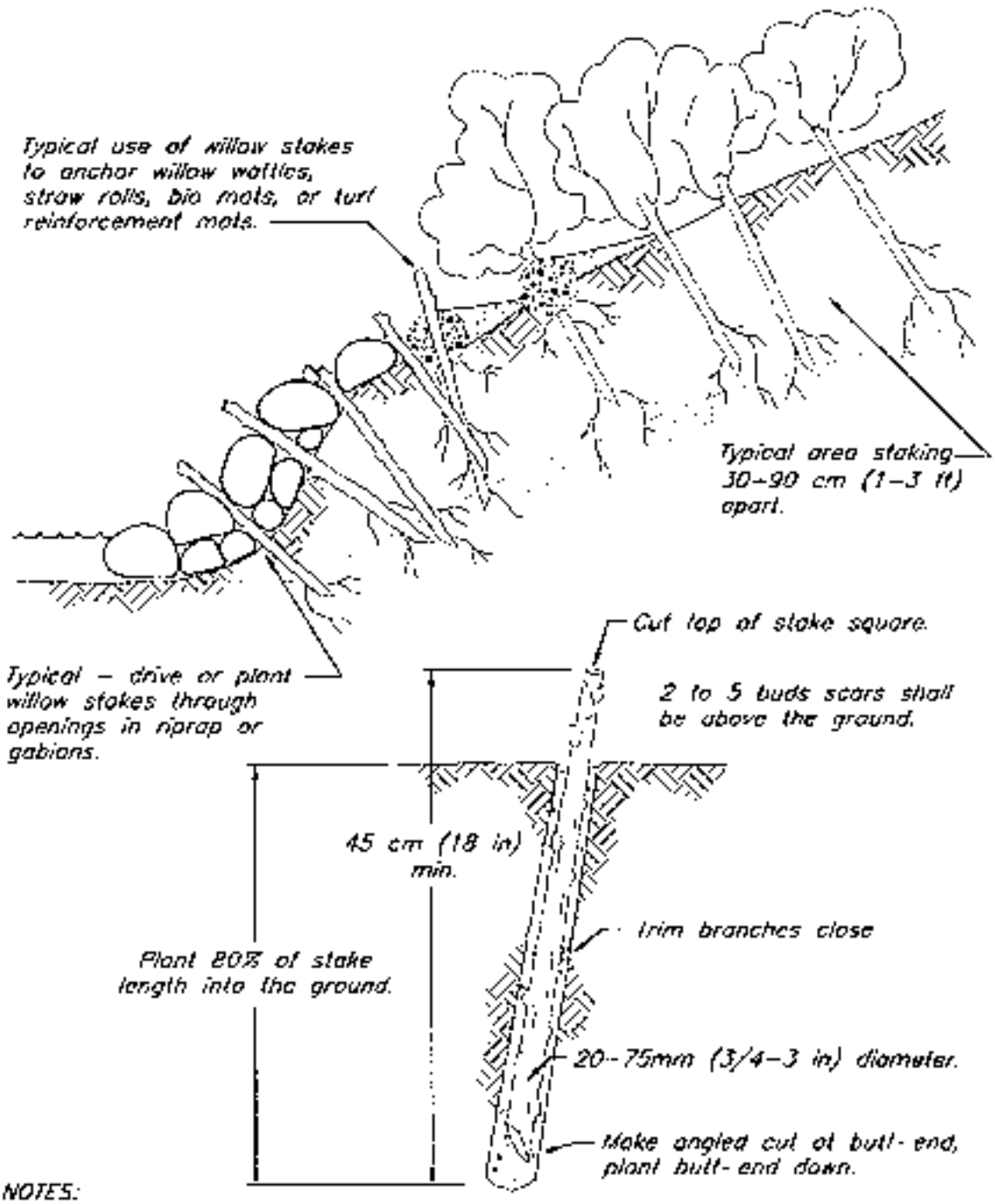
NOTES:
1. As a general rule, place basal ends of the cuttings 15 cm (6") into the capillary fringe or seasonal saturated zone.
2. Bend individual poles up through the riprap during placement while ensuring contact of the stem with native ground. Laying poles "horizontally" is an efficient and cost-effective way to maximize rooting.
3. Graded, granular filter is preferable to filter fabric to improve root penetration or slip poles through slits cut into fabric.
4. Place soil fill (cobbles, gravel, soil) around cuttings and "water in" if possible.



VEGETATED RIPRAP
WILLOW BUNDLE METHOD (HORIZONTAL)

F.J.C. VRBANO

© 2004 SALIX



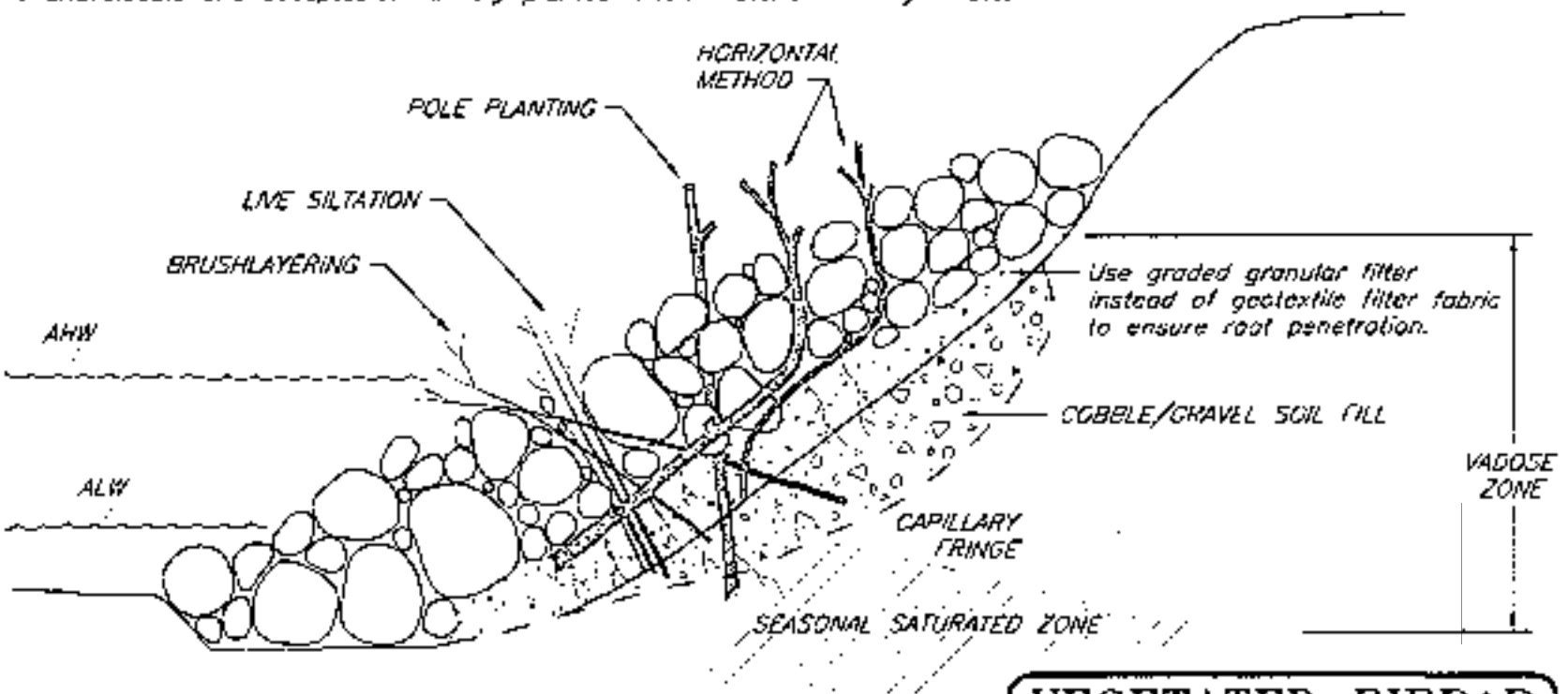
NOTES:
1. Harvest and plant stakes during the dormant season.
2. Use healthy, straight and live wood of least 1 year old.
3. Make clean cuts and do not damage stakes or split ends during installation, use a pilot bar in firm soils.
4. Soak cuttings for 24 hours (min.) prior to installation.
5. Tamp the soil around the stake.

VEGETATED RIPRAP
W/ JOINT PLANTING
(LIVE STAKING)

© 2004 SCLIV

tjr: vrup

NOTES:
1. Integrate brushlayering, pole planting and live siltation techniques during rock placement to ensure contact with native ground.
2. Plant deeply if possible. Place cuttings deeply into vadose zone, into the capillary fringe or 15 cm (6") into the seasonal saturated zone (water table).
3. Graded, granular filter is preferable to filter fabric to improve root penetration or slip poles through slits cut into fabric.
4. Place soil fill (cobbles, gravel, soil) around cuttings and 'water in' if possible.
5. Place riprap carefully, do not end dump. Some damage to brush layers and willow poles is unavoidable and acceptable. Deeply planted willow material will regenerate.



VEGETATED RIPRAP
DURING CONSTRUCTION
SUMMARY OF TECHNIQUES

Date of last revision: 12/20/2012

WATTLES (LIVE FASCINES)

Construction Specifications:

Wattle Preparation:

- Cuttings shall be harvested and planted when the willows, or other chosen species, are dormant. This period is generally from late fall to early spring.
- Choose plant materials that are adapted to the site conditions from species that root easily. A portion (up to 50%) of the bundle may be of material that does not root easily or dead material.
- The cuttings should be long (3 feet (1 m) minimum), straight branches up to 1 1/2 inches (4 cm) in diameter. Trimmings of young suckers and some leafy branches may be included in the bundles to aid filtration. The number of stems varies with the size and kind of plant material.
- Cuttings shall be tied together to form bundles, tapered at each end, 6-30 feet (2-10 m) in length, depending on site conditions or limitations in handling.
- The completed bundles should be 6-12 inches (152-305 mm) in diameter, with the growing tips and butt ends oriented in alternating directions.
- Stagger the cuttings in the bundles so that the tips are evenly distributed throughout the length of the wattle bundle.
- Wattle bundles shall be compressed and tightly tied with rope or twine of sufficient strength and durability. Polypropylene "tree rope" approximately a 3/16 inch (0.5 cm) diameter provides the necessary strength and durability.
- Wattle bundles shall be tied 12-15 inches (305-381 mm) apart.
- For optimum success wattles should be pre-soaked for 24 hours or installed on the same day they are harvested and prepared. The wattles should be installed within 2 days after harvest unless pre-soaked. Wattles must be stored in the shade and under cover or under water. They are live material and should be treated as such.

Installation:

- Work shall progress from the bottom to the top of the slope.
- Install wattles into trenches dug into the slope on contour.
- Spacing of contour trenches (wattles) is determined by soil type, potential for erosion and slope steepness.
- Perform any slope repairs, such as gully repair, slope scaling, diversion dike, gabion, or toe wall construction, prior to wattle installation.
- Beginning at the base of the slope, dig a trench on contour. The trench shall be shallow, about 1/2 the diameter of the wattle. The trench width will vary from 12-18 inches (305-457 mm) depending on the slope angle.
- Place the wattles immediately after trenching to reduce desiccation of the soil.
- Wattles shall be staked firmly in place with one row of construction stakes on the downhill side of the wattling, not more than 3 feet (1m) apart. A second row of stakes shall be placed through the wattles, near the ties, or not more than 5 feet. (1.5 m) apart.

- Overlap the tapered ends of adjacent wattles so the overall wattle thickness of the wattle is uniform. Two stakes shall be used at each bundle overlap such that a stake may be driven between the last two ties of each wattle.

- Live stakes, if specified, are generally installed on the downslope side of the bundle. Drive the live stakes below and against the bundle between the previously installed construction stakes.

- Proper backfilling is essential to the successful rooting of the wattles. Backfill wattles with soil from the slope or trench above. The backfill shall be worked into the wattle interstices and compacted behind and below the bundle by walking on and working from its wattling terrace.

- Repeat the proceeding steps to the top of the slope.

- Place moist soil along the sides of the live bundle. The top of the bundle should be slightly visible when the installation is completed.

- Plant the slope as specified.

- Seed and mulch slope. Shallow slopes, generally 3:1 or flatter may be seeded and mulched by hand. Steeper slopes should have seed applied hydraulically and the mulch shall be anchored with tackifier or other approved methods.

Inspection and Maintenance:

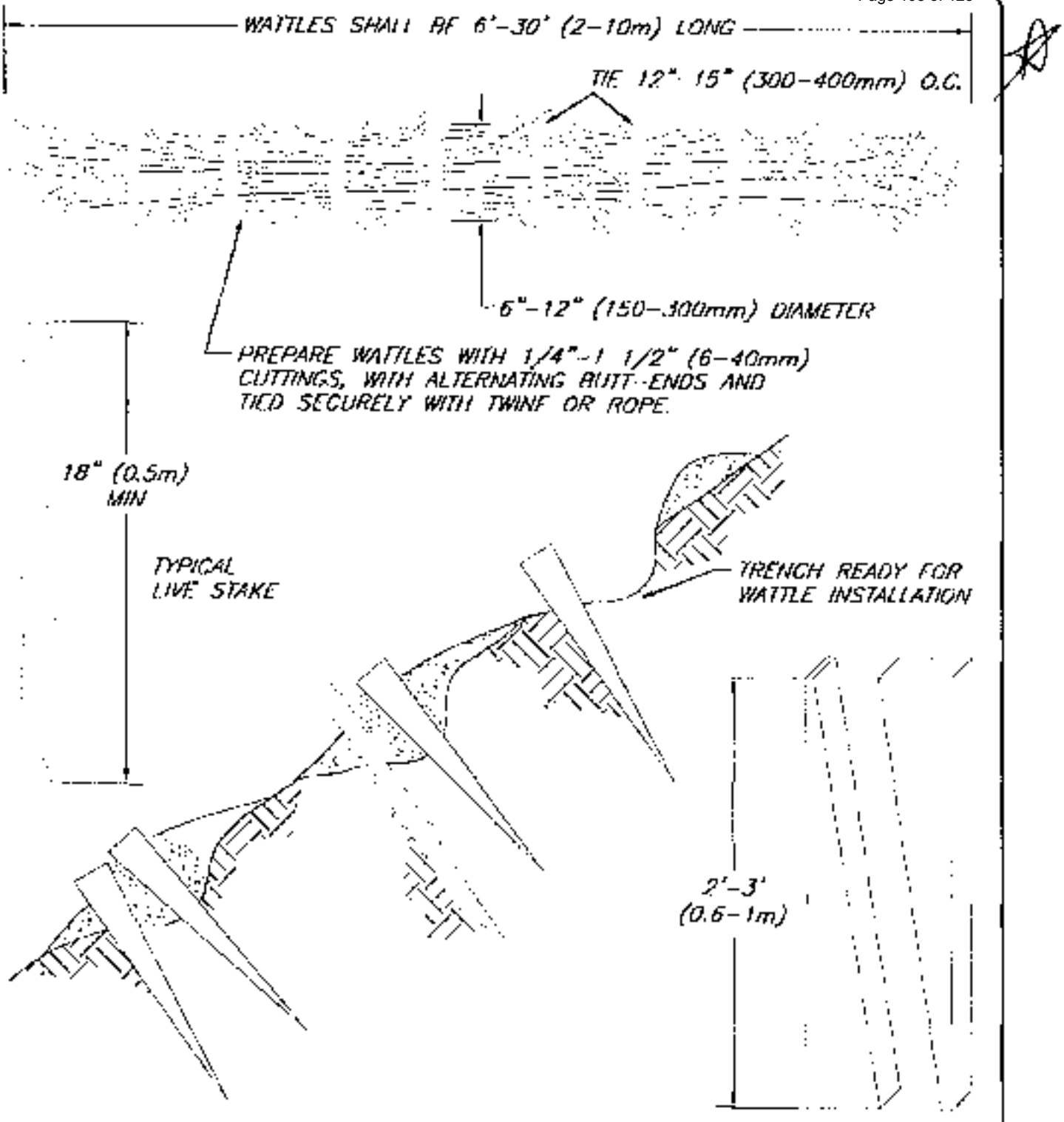
- Regular inspection and maintenance of wattle installations should be conducted, particularly during the first year.

- Repairs shall be made promptly. Stakes that loosen because of saturation of the slope or frost action shall be re-installed.

- Rills and gullies around or under wattles shall be repaired. Perform slope scaling and brushpacking as necessary.

- Repairs to vegetative practices shall be conducted promptly.

- All temporary and permanent erosion and sediment control practices shall be maintained and repaired as needed to assure continued performance of their intended function.



TYPICAL CONSTRUCTION STAKE SAW 2X4 (100X50mm) LUMBER ON DIAGONAL

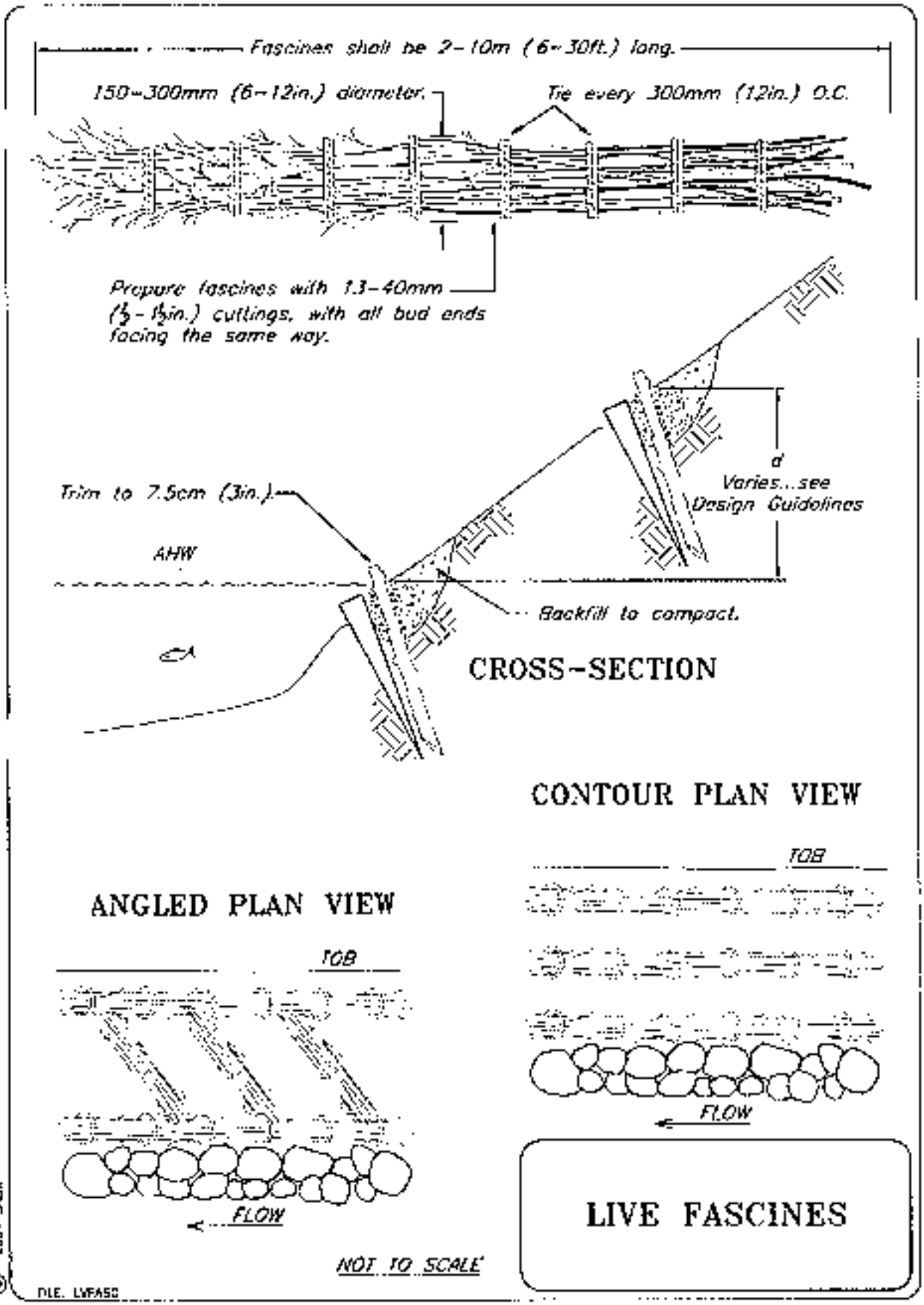
NOT TO SCALE

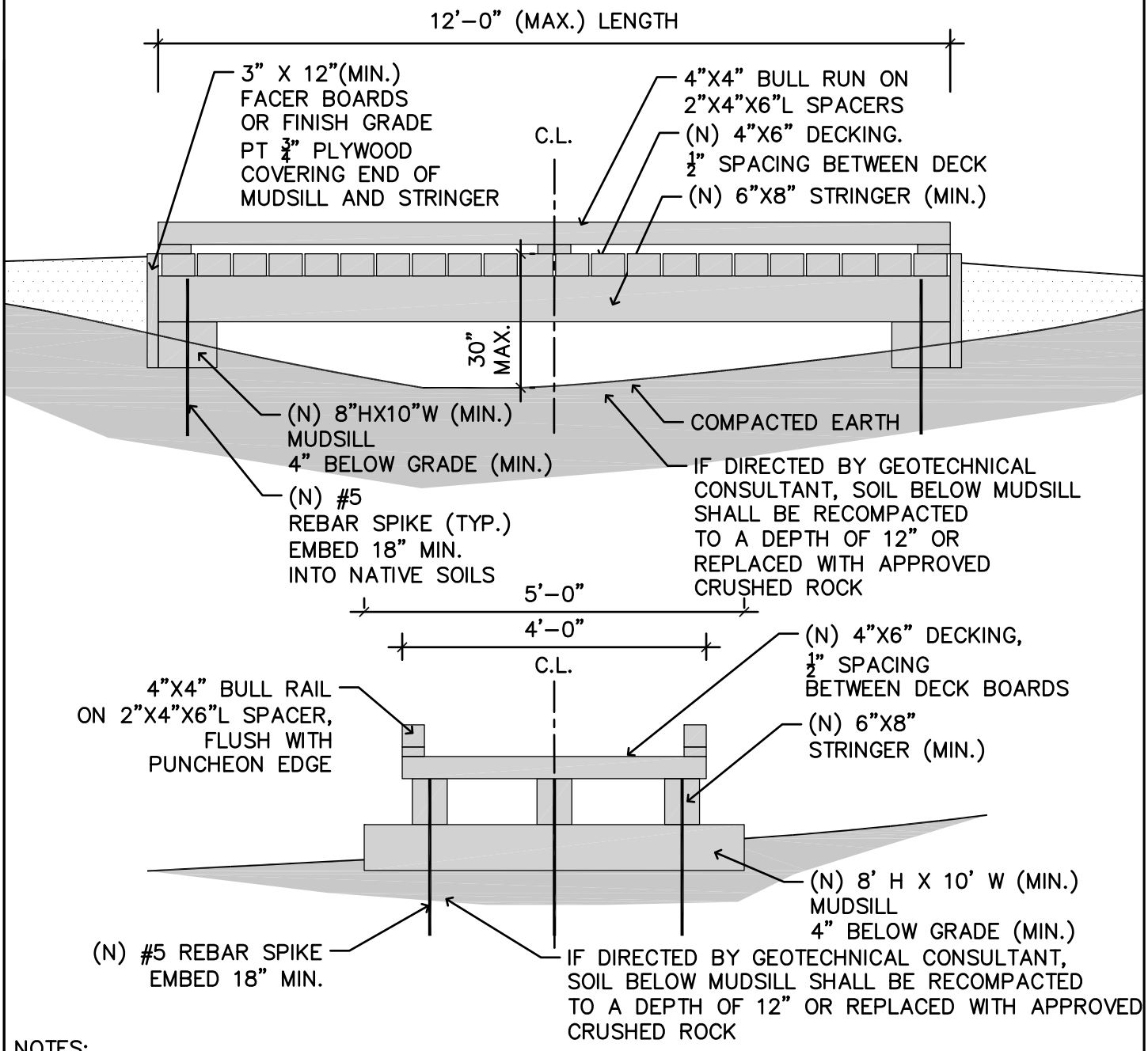
NOTES:
1. HARVEST AND INSTALL WATTLES DURING DORMANT SEASON.
2. INSTALL WATTLES ON SLOPE CONTOURS.
3. ALL WORK PROCEEDS FROM THE BOTTOM OF THE SLOPE TO THE TOP.
4. FILL OR PARTIALLY COVER WATTLE WITH SOIL FROM SLOPE OR TRENCH ABOVE.
5. COMPACT AND WORK SOIL INTO COMPLETED WATTLES.

WATTLE
(LIVE FASCINE)

© 1996 J. McCULLAH

FILE: WATTLE


Fascines shall be 2-10m (6-30ft.) long.
150-300mm (6-12in.) diameter.
Tie every 300mm (12in.) O.C.
Prepare fascines with 1.3-40mm (½-1½in.) cuttings, with all bud ends facing the same way.
d
Varies...see Design Guidelines
Trim to 7.5cm (3in.)
AHW
Backfill to compact.
CROSS-SECTION
CONTOUR PLAN VIEW
TOB
FLOW
ANGLED PLAN VIEW
TOB
FLOW
NOT TO SCALE
LIVE FASCINES
© 2004 SNJV
FILE: LVFASC



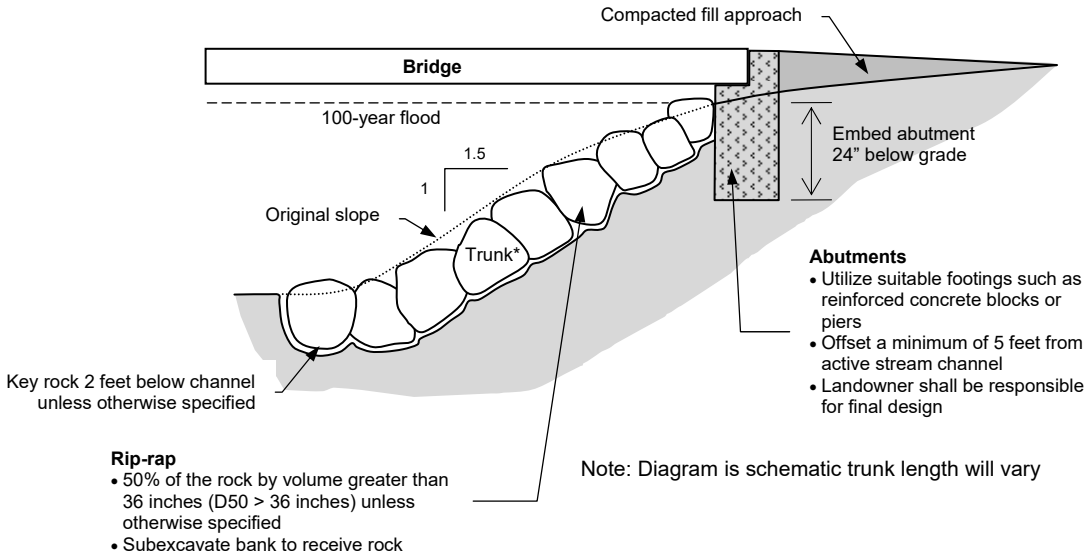
NOTES:

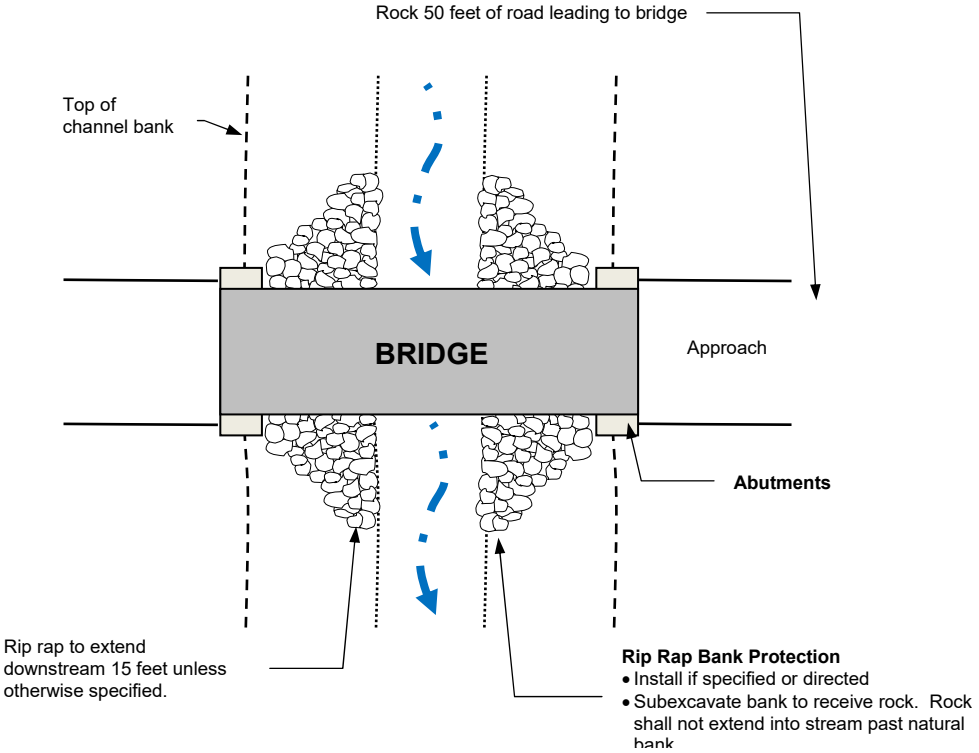
1. STANDARD PUNCHEON WIDTH SHALL BE 4 FEET. REFER TO SITE PLAN IF NARROWER PUNCHEON IS PROPOSED.
2. ALL DECKING, BEAMS, MUDSILLS AND WOOD IN CONTACT WITH EARTH OR WITHIN 1 FOOT OF EARTH SHALL BE CONSTRUCTION HEART REDWOOD OR APPROVED PLASTIC.
3. IF DIRECTED BY GEOTECHNICAL CONSULTANT, SOIL BELOW MUDSILL SHALL BE RECOMPACTED TO A DEPTH OF 12" OR REPLACED WITH APPROVED CRUSHED ROCK.
4. ALL HARDWARE SHALL BE GALVANIZED.
5. ANCHOR DECKING WITH (2) 3/8"X 8" GALVANIZED WIRE SPIKES (TYP.); PREDRILL HOLES FOR SPIKES.
6. ANCHOR BULL RAIL WITH (2) 3X8"X 10" GALVANZIED WIRE SPIKES (TYP.); PREDRILL HOLES FOR SPIKES.
7. MAINTAIN 2% MAXIMUM SLOPE ON PUNCHEON.
8. THIS DETAIL IS TYPICAL AND INTENDED FOR USE AS A GUIDELINE. ADJUSTMENTS TO THE ACTUAL DESIGN MAY NEED TO OCCUR IN FIELD DURING TIME OF CONSTRUCTION DUE TO LOCAL SITE CONDITIONS, AS DIRECTED BY AN ENGINEER OR OTHERWISE QUALIFIED PERSON.

LOW PUNCHEON (BOARDWALK)

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 03/2020

©TIMOTHY C. BEST, CEG





NOTES

- Rock rip rap shall be placed as, specified in plan and as approved in DFG 1600 agreement
- Conform to requirements of the Department of Fish and Game 1600 agreement where applicable
- Bridge placement to be supervised by project engineer

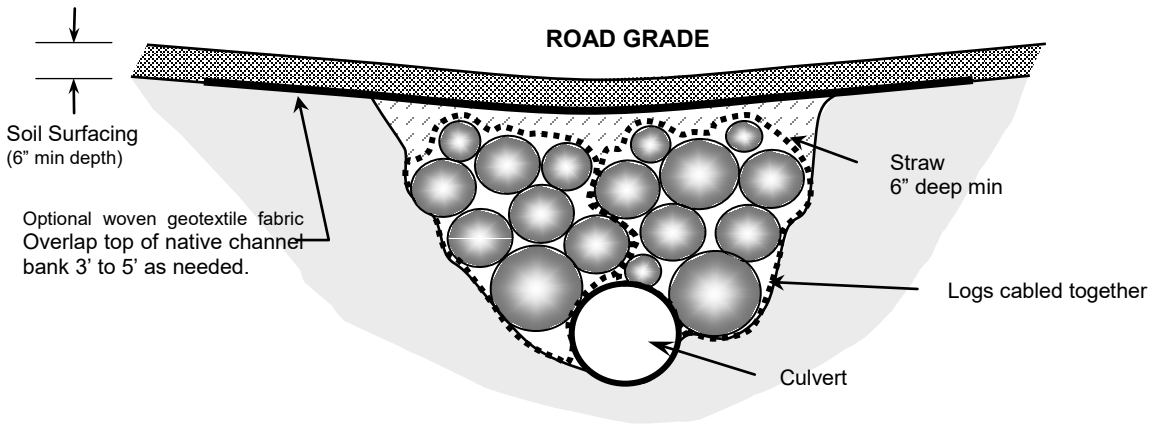
5F **BRIDGE ABUTMENT ARMOR**
NTS

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

BRIDGE ABUTMENT ARMOR
STANDARD PLAN

Standard Detail 5F

Date: March 1, 2009



NOTES

1. If there is flow in channel install 12" diameter culvert at stream grade (unless otherwise specified). This may require moving rocks or wood debris in channel. Minimize the amount of disturbance to channel banks. Pipe is not required if there is no flow at time of operations

2. Groups of logs cabled together shall be carefully placed in the axis of the channel to raise the road surface to grade. Placement of the cable logs should be done in a manner to minimize the amount of ground disturbance to the channel banks. The length of fill logs or culvert shall be 20' or greater (unless otherwise specified).

3. Equipment shall avoid operations in the channel.

4. Cables may be used to choke logs in bundles in the channel if necessary

5. Place 6" minimum layer of straw over the logs and then capped by a minimum of 6" of compacted earth to create a stable running surface. Woven geotextile fabric may be required to separate fill from straw.

6. At the conclusion of operations, first remove any soil, then straw, and finally logs and the culvert.

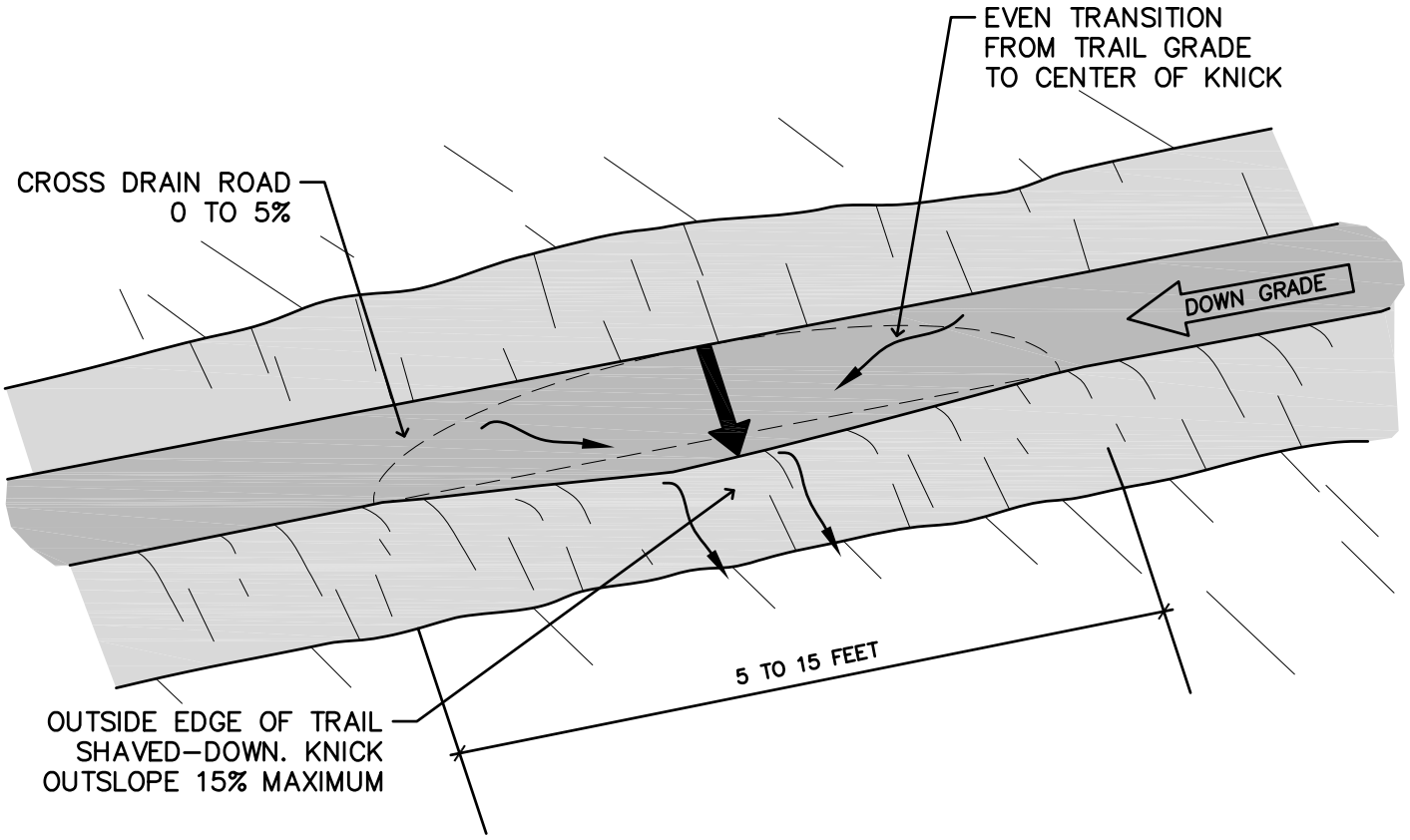
7. Remove soil from channel and taper channel banks if specified. Mulch disturbed ground with straw or native materials.

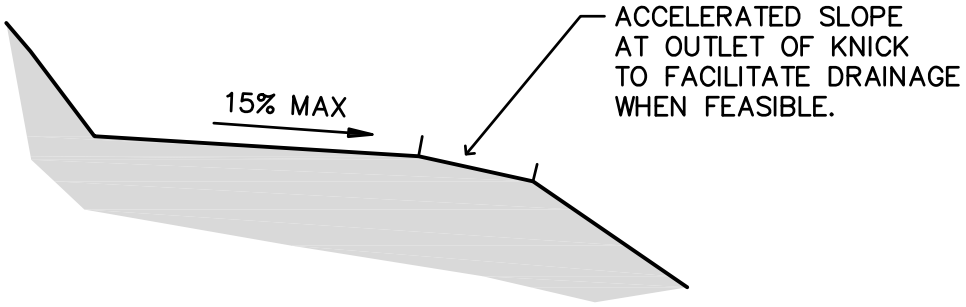
TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

TEMPORARY "SPITTLER" STREAM CROSSING

Standard Detail 5K

Date: October 3, 2010





NOTES

1. A KNICK IS A SEMI-CIRCULAR, SHAVED-DOWN SECTION OF THE OUTSIDE EDGE OF THE TRAIL.
2. THE CENTER OF THE NICK IS OUTSLOPED 15% MAX. WHICH DRAWS WATER OFF OF THE TRAIL.
3. DIP OUTLETS SHOULD BE LOCATED TO DRAIN INTO AREAS WITH ADEQUATE SEDIMENT FILTER QUALITY AND NON-ERODIBLE MATERIAL SUCH AS ROCK, SLASH, BRUSH, ETC.

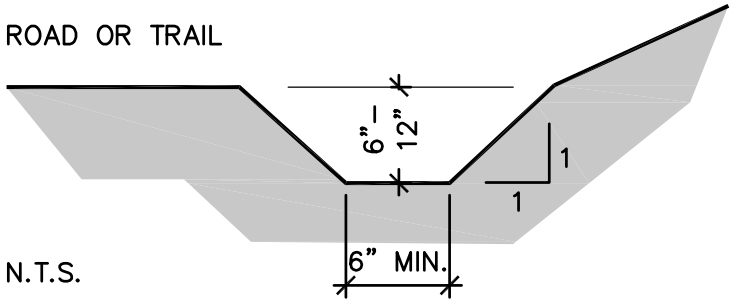
KNICK

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

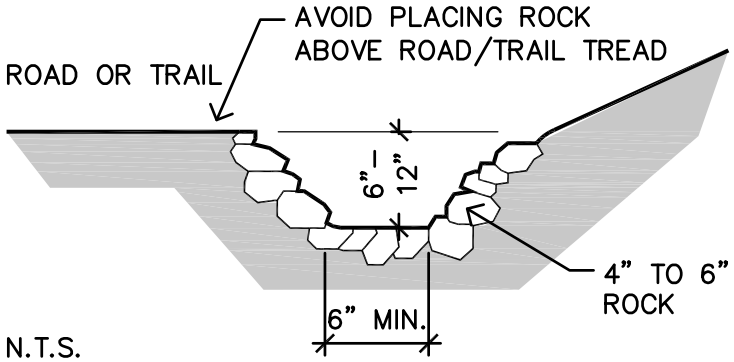
S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 knick.dwg

©TIMOTHY C. BEST, CEG

INSIDE DITCH (NATIVE)



INSIDE DITCH (ROCK LINED)



NOTES:
1. SLOPE DITCH TO DRAIN 3% MIN.
2. ARMOR DITCH WHERE SPECIFIED.
3. DRAIN DITCH TO DITCH RELIEF CULVERT INLET AS SPECIFIED.

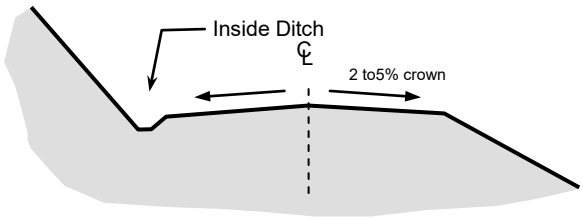
INSIDE ROAD DITCH

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

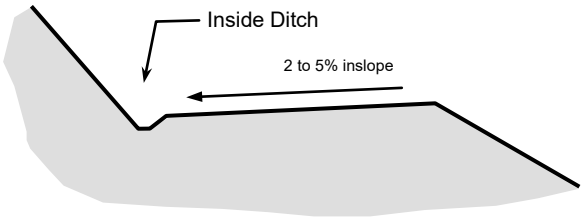
S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\4 inside road ditch.dwg

©TIMOTHY C. BEST, CEG

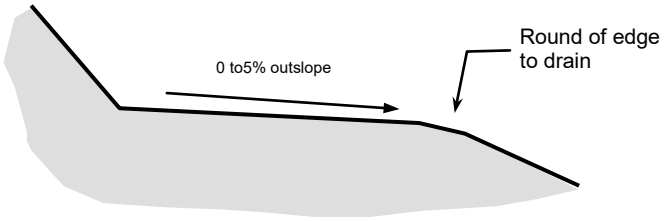
CROWNED



INSLOPED WITH DITCH



OUTSLOPED



Crowned road carries surface runoff to both sides of the road. Inslope roads carry water to the inboard (uphill) side of the roadway and therefore are constructed with a ditch and ditch relief culverts to channel runoff under the roadway. Outsloped roads shed water to the outside of the road and generally do not have a ditch on the inside edge.

NOTES:

- Crowned and insloped roads shall drained to insideditch per typical 6E.
- Ditch shall have positive flow to outlet or ditch relief culvert. See 6D Ditch Relief Culvert typical design specifications
- Drainage on outsloped roads shall be complimented with Reverse Grade Dips unless otherwise specified

6F **TRAIL CROSS SLOPES (Typical)**
NTS

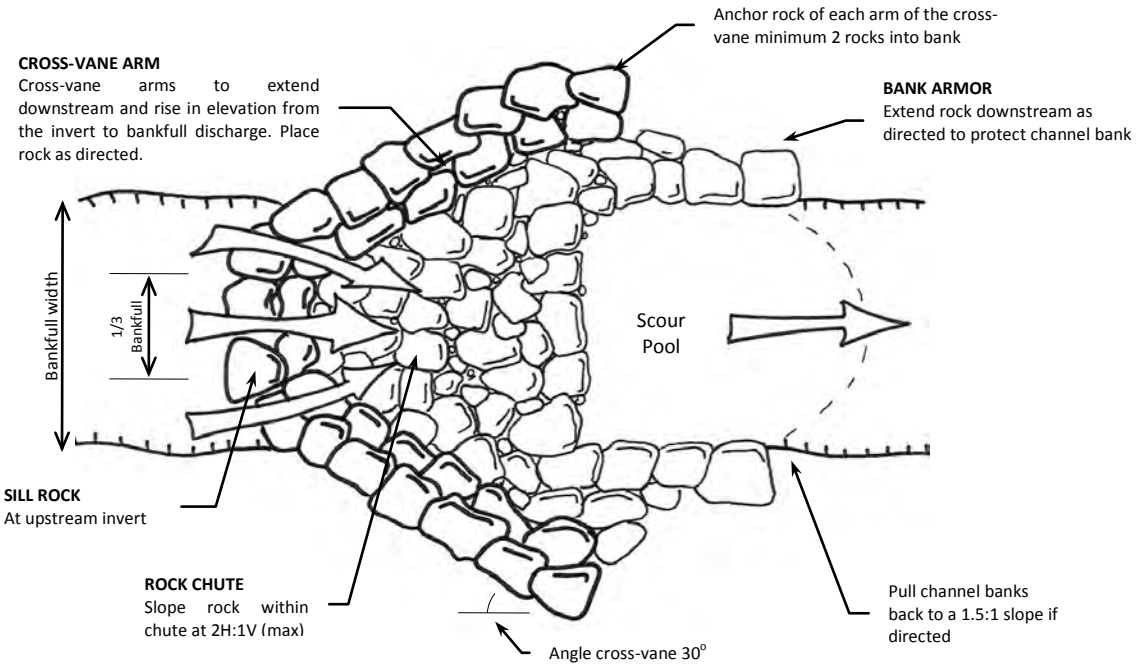
TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

TRAIL CROSS SLOPES
TYPICAL SPECIFICATIONS

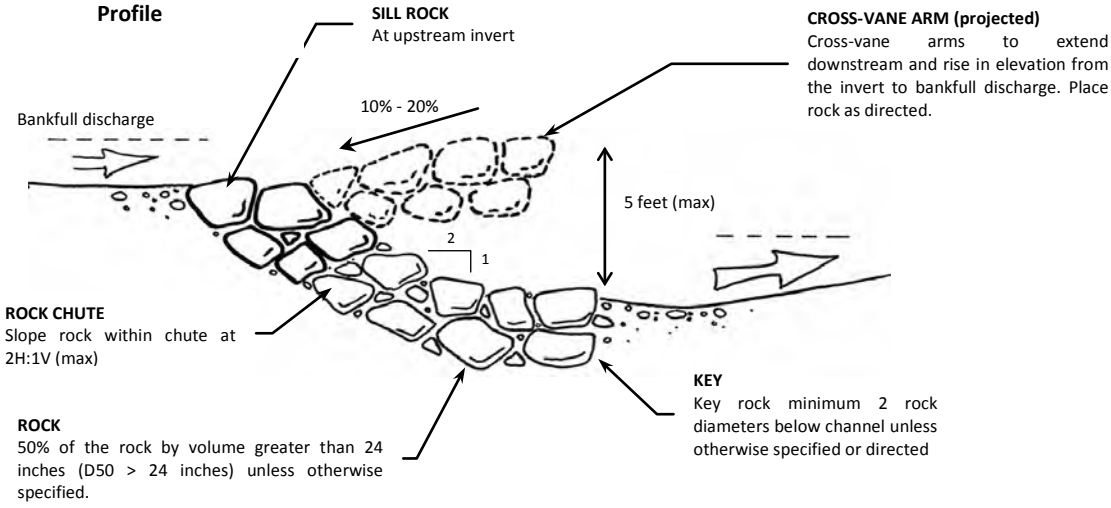
Standard Detail 6F

Date: June 6, 2009

CROSS-VANE
Plan View



CROSS-VANE
Profile



DESCRIPTION

Cross vanes are in-stream structures constructed as grade control for the streambed. The cross vane consists of a rock sill perpendicular to the stream flow located at the invert elevation of the stream. Two arms of the sill extend downstream along the banks, rising in elevation to the bankfull height as they extend downstream. The center portion of the structure is referred to as a "Rock chute"

7F **CROSS-VANE INSTREAM STRUCTURE (Typical)**
NTS

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

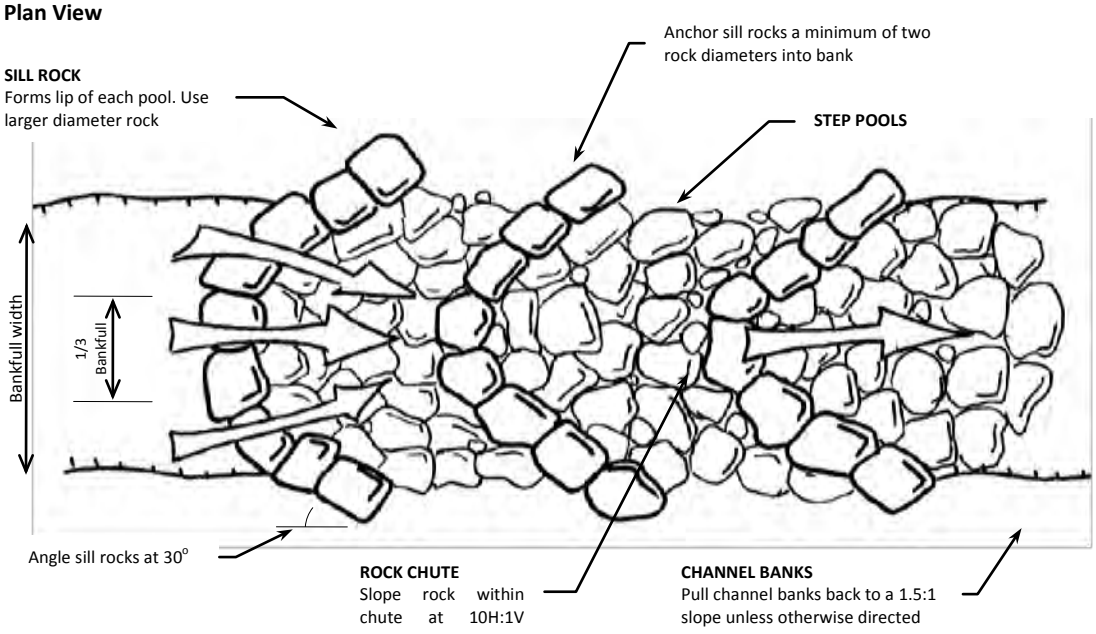
CROSS VANE STRUCTURE
TYPICAL SPECIFICATIONS

Standard Detail 7F-1

Date: August 31, 2009

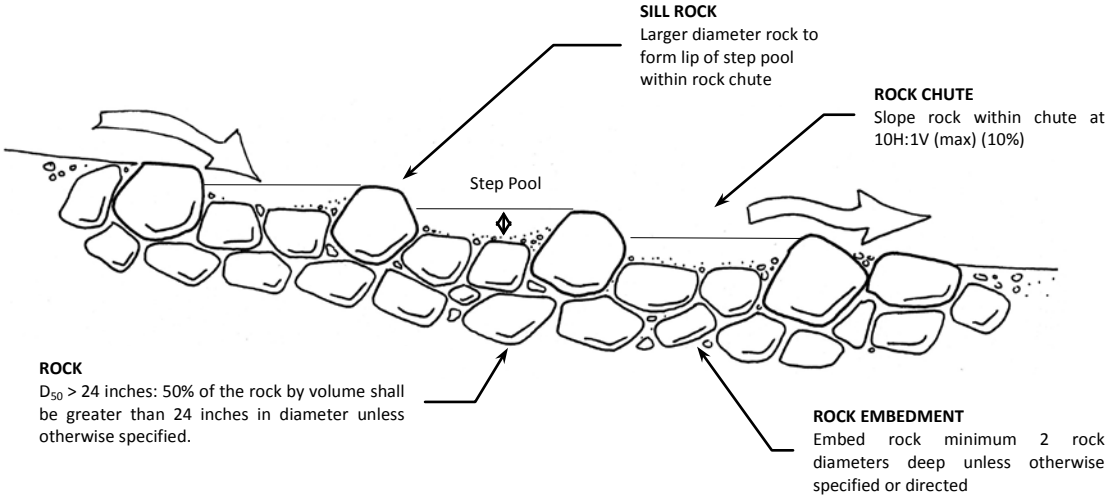
ROCK CHUTE / STEP POOL STRUCTURE

Plan View



ROCK CHUTE / STEP POOL STRUCTURE

Profile



DESCRIPTION

Rock chute and step pool structures are in-stream structures constructed as grade control for the streambed. They are permanent structures which stabilize grades in natural or artificial channels by carrying runoff from one grade to another. "V" shaped rock banks or sills form the upstream end of each step pool. The "V" should point upstream with both limbs rising in elevation to force flow to the center of the channel.

7G **ROCK CHUTE / STEP POOL STRUCTURE (Typical)**

NTS

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

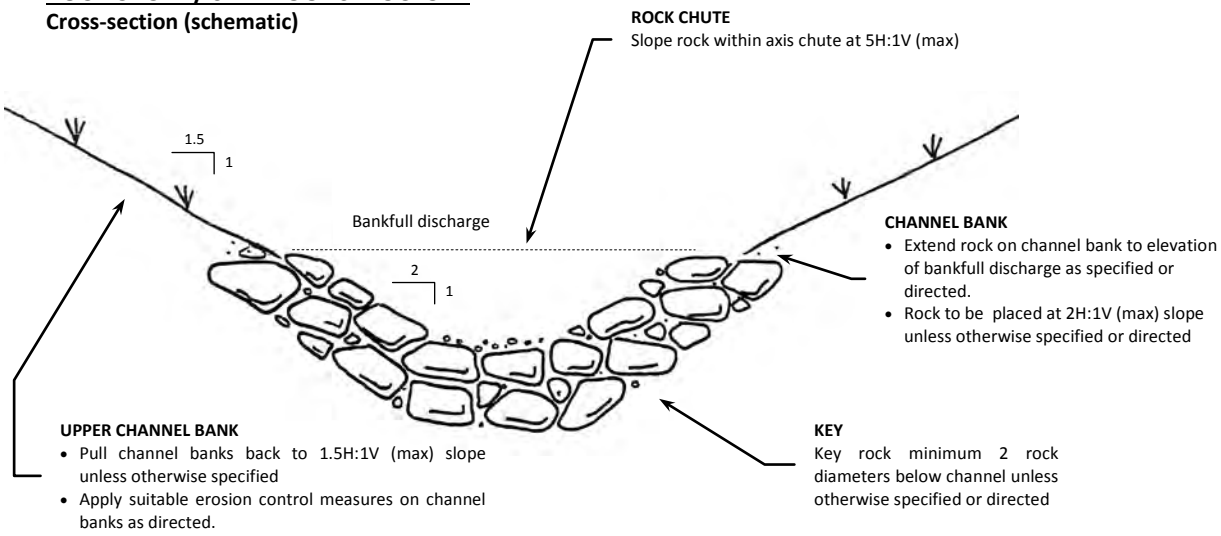
ROCK CHUTE / STEP POOL TYPICAL SPECIFICATIONS

Standard Detail 7G-1

Date: October 3, 2009

ROCK CHUTE / STEP POOL STRUCTURE

Cross-section (schematic)



NOTES

Layout

- Project geotechnical consultant or designee shall clearly layout the location and limits of the rock vane prior to construction. The structure shall be installed under direction and supervision of the project geotechnical or designee

Excavation

- The channel shall be excavated at specified with maximum channel gradient of 10H:1V (10%). Excavated slopes above the rock armor shall be no steeper than 1.5H:1V (H:V) unless otherwise specified or directed. Areas to receive rock shall be subexcavated to accommodate rock placement.

Rock

- Rock shall be graded (mix of sizes) with 50% of the rock (D_{50}) greater than 24 inches minimum diameter. Ideally, the bigger the rock, the better since big rocks are less likely to shift or become dislodged.
- Rip rap shall consist of angular sound durable rock free of fracture or joint planes. The best rock is rectangular with flat surfaces on all sides. Round river rock is the worst.
- Rock shall be carefully placed to optimize strength and be a minimum of 2 layers thick and be placed so as to have no significant gap between adjoining rock. Voids shall be chinked with small boulders, cobble or rock fragments.

Rock Chute

- Rock chute shall have a maximum channel gradient of 10H:1V (10%). The chute shall consist of a flat channel bottom (as specified) with bank laid back to a 2H:1V (50%) slope. Rock shall extend up to the elevation of bankfull discharge as specified. Step pools shall be constructed into the rock chute as specified below and to the extent feasible.

Step pools

- Rock shall be placed to form a series of shallow step pools within the axis of the rock chute. Each step shall have a maximum 18 inch drop and be spaced 2 to 3 times channel width apart.
- The steps shall be constructed from of largest diameter rock to form sills at the head of each pool. The sill rocks shall be placed to in an upstream "V"-shaped configuration with the downstream limb of each rock band/sill rising in elevation to concentrate low flow into the axis of the channel. Sill rocks shall be keyed two rock diameters into the channel bank.

Inspection

- Conform to DFG 1600 agreement
- Specifications are indented only as guideline, modifications may need to be made in the field as necessary

References

CDFG (2009). California Salmonid Stream Habitat Restoration Manual: Part XII Fish Passage Design and Implementation, California Department of Fish and Game, http://www.dfg.ca.gov/fish/Resources/HabitatManual.asp: 174.

Robinson, K. M., C. E. Rice, et al. (1998). "Design of rock chutes." ASAE **41**(3): 621 - 626

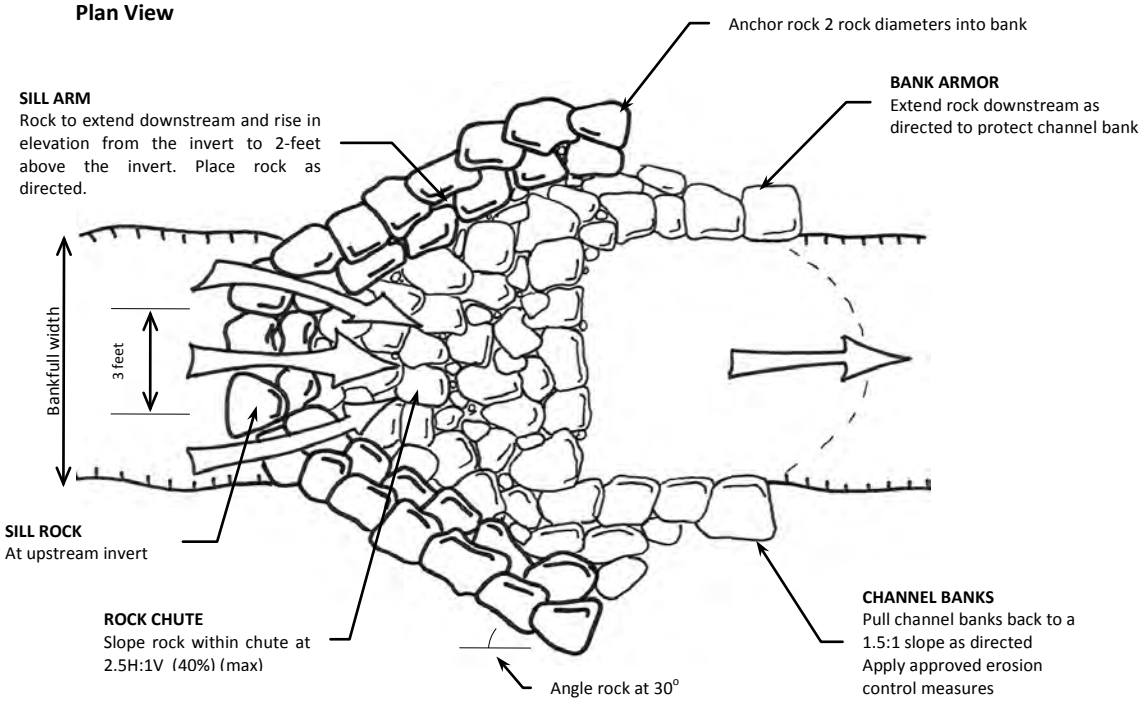
TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

ROCK CHUTE / STEP POOL TYPICAL SPECIFICATIONS

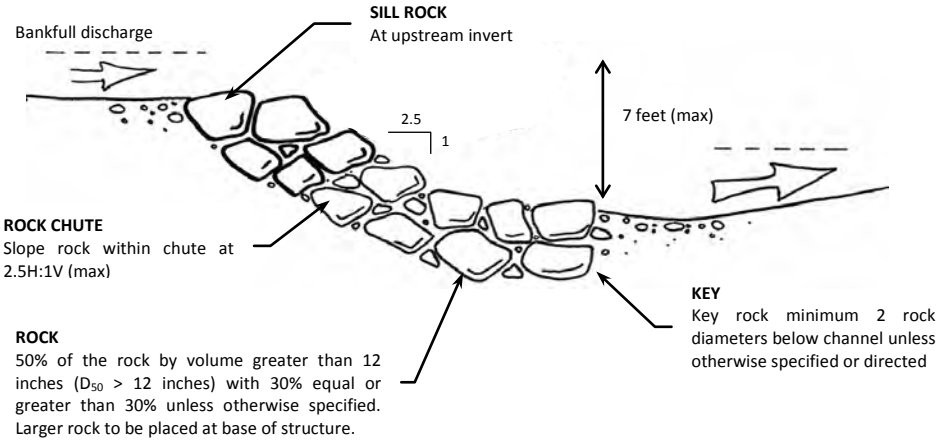
Standard Detail 7G-2

Date: October 3, 2009

ROCK CHUTE
Plan View



ROCK CHUTE
Profile



DESCRIPTION

Rock chute structures are in-stream structures constructed as grade control for the streambed. "V" shaped rock banks or sills form the upstream end of the structure. The "V" should point upstream with both limbs rising in elevation to force flow to the center of the channel.

7H **ROCK CHUTE STRUCTURE (Typical)**
NTS

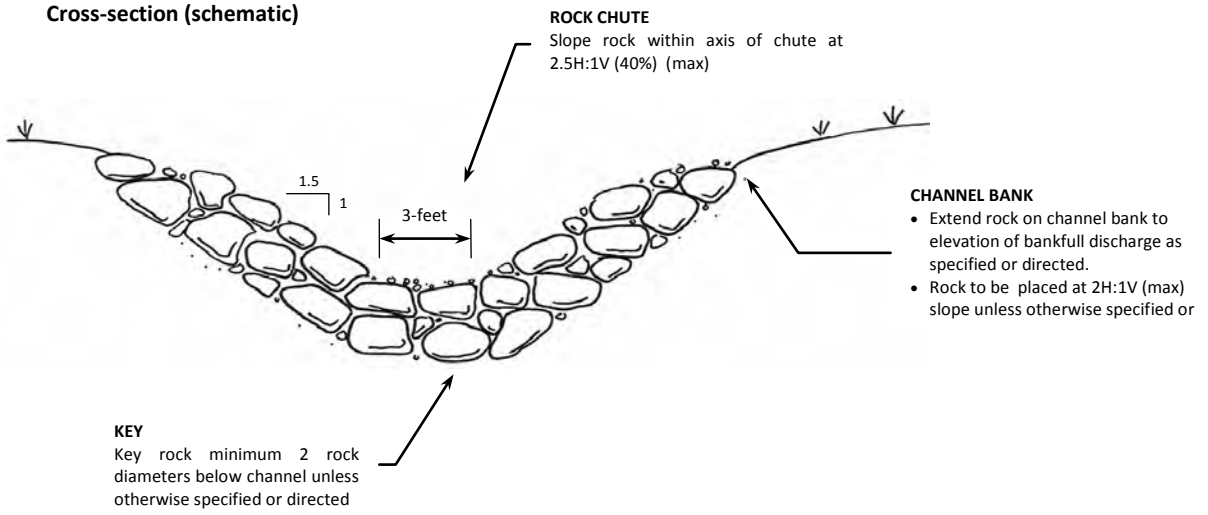
TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

ROCK CHUTE
TYPICAL SPECIFICATIONS

Standard Detail 7H-1

Date: October 24, 2009

ROCK CHUTE
Cross-section (schematic)



NOTES

Layout

- Project geotechnical consultant or designee shall clearly layout the location and limits of the rock structure prior to construction. The structure shall be installed under direction and supervision of the project geotechnical consultant or designee.

Excavation

- The channel shall be excavated at specified with maximum channel gradient of 2.5H:1V (40%). Excavated slopes above the rock armor shall be no steeper than 1.5H:1V (H:V) unless otherwise specified or directed. Areas to receive rock shall be subexcavated to accommodate rock placement.

Rock

- Rock shall be graded (mix of sizes) with 50% of the rock (D_{50}) **greater** than 12 inches minimum diameter and 30% equal or greater than 18 inches. Ideally, the bigger the rock, the better since big rocks are less likely to shift or become dislodged. The contractor shall consult with the project geotechnical consultant prior to obtaining any rock.
- Rock shall consist of angular sound durable rock free of fracture or joint planes. The best rock is rectangular with flat surfaces on all sides. Round river rock is the worst.
- Rock shall be carefully placed to optimize strength and be a minimum of 2 layers thick and be placed so as to have no significant gap between adjoining rock. Voids shall be chinked with small boulders, cobble or rock fragments.

Rock Chute

- Rock chute shall have a maximum channel gradient of 2.5H:1V (40%). The chute shall consist of a flat channel bottom (as specified) with bank laid back to a 1.5H:1V (65%) slope. Rock shall extend a minimum of two vertical feet up from the channel bottom unless otherwise specified or directed.

Inspection

- Conform to DFG 1600 agreement
- Project geotechnical consultant or designee shall supervise work
- Specifications are indented only as guideline, modifications may need to be made in the field as necessary

References

CDFG (2009). California Salmonid Stream Habitat Restoration Manual: Part XII Fish Passage Design and Implementation, California Department of Fish and Game, http://www.dfg.ca.gov/fish/Resources/HabitatManual.asp: 174.

Robinson, K. M., C. E. Rice, et al. (1998). "Design of rock chutes." ASAE **41**(3): 621 - 626

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

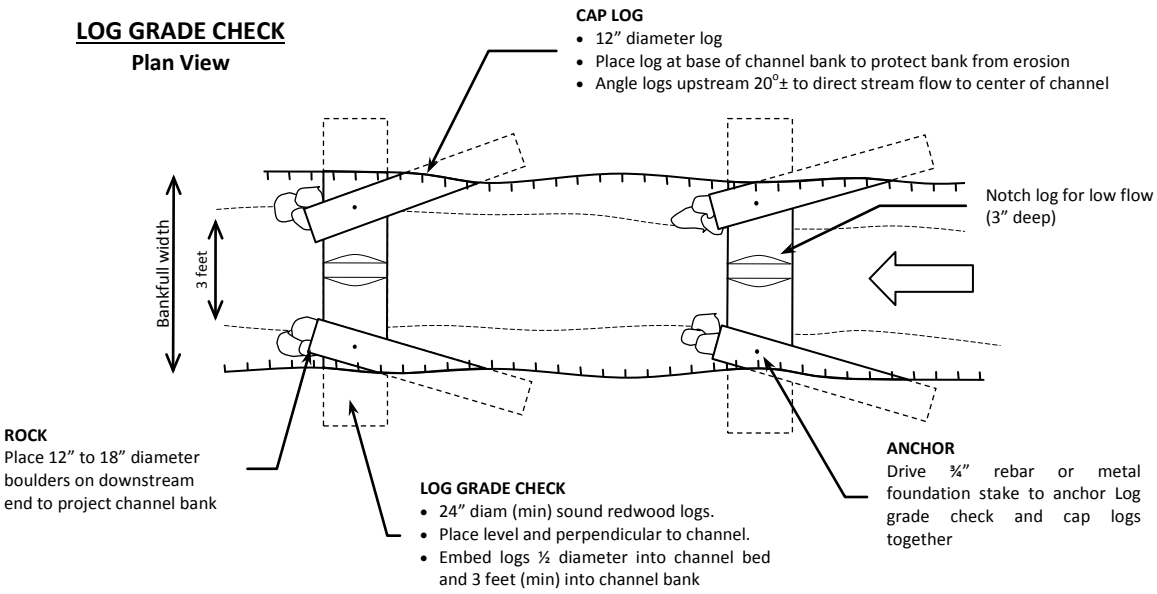
ROCK CHUTE
TYPICAL SPECIFICATIONS

Standard Detail 7H-2

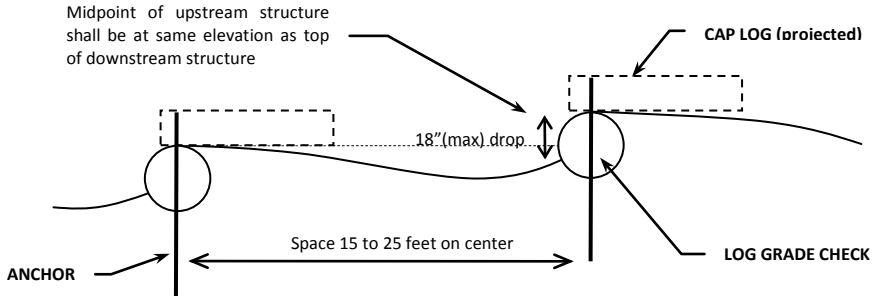
Date: October 24, 2009

LOG GRADE CHECK

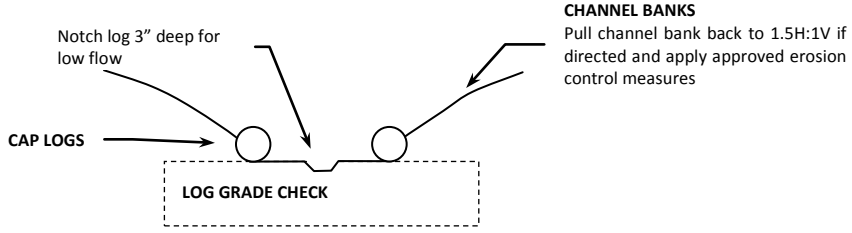
Plan View



Profile



Cross-section



DESCRIPTION

Log grade checks are in-stream structures constructed as grade control for the streambed. They consist of a large diameter log placed perpendicular to the stream and embedded into both channel banks. A cap log is placed on top of the log along both channel banks to protect both banks from erosion and to direct lower flows to the center of the channel.

NOTES

- Project geotechnical consultant or designee shall clearly layout the location and limits check dams prior to construction. The structure shall be installed under direction and supervision of the project geotechnical consultant or designee.
- Length and number of grade checks to be specified in plans or determined in the field
- Conform to DFG 1600 agreement
- Specifications are indented only as guideline, modifications may need to be made in the field as necessary

7I **LOG CHECK DAM STRUCTURE (Typical)**

NTS

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

LOG GRADE CHECK
TYPICAL SPECIFICATIONS

Standard Detail 7I

Date: October 24, 2009

EROSION CONTROL

- During project construction, the Contractor shall be responsible for implementing appropriate and necessary erosion control measures to minimize storm water runoff from the construction site, pursuant to applicable regulations and permits. The following strategies to ensure that storm water pollution is prevented shall be employed:
  - o Minimize erosion and sedimentation during construction.
  - o Eliminate pollution of storm runoff by chemicals and materials used in the construction process

- Exposed mineral soils greater than 50 square feet (sf) with less than 80% ground coverage of natural vegetation shall be seeded and mulched in order to reduce the potential for short term sheet and rill erosion.
  - o Seeding
    - Broadcast approved seed mix
  - o Mulch:
  - o Use native much were feasible
    - Where native much is unavailable and/or as directed by the geotechnical consultant or designee, mulch using 1 1/2" to 2" of approved certified weed-free straw mulch. Exposed slopes steeper than 1:1 may be covered with "Bon Terra, C2" or similar approved fabric placed in accordance with the manufacturer's recommendations and as directed by geotechnical consultant or designee.
    - If available and directed by project geotechnical consultant or designee, disturbed ground may be slash mulched using six-inch minus woody debris with 90% coverage. Slash should be packed using a dozer or the bucket of the excavator.
    - Apply mulch after seed

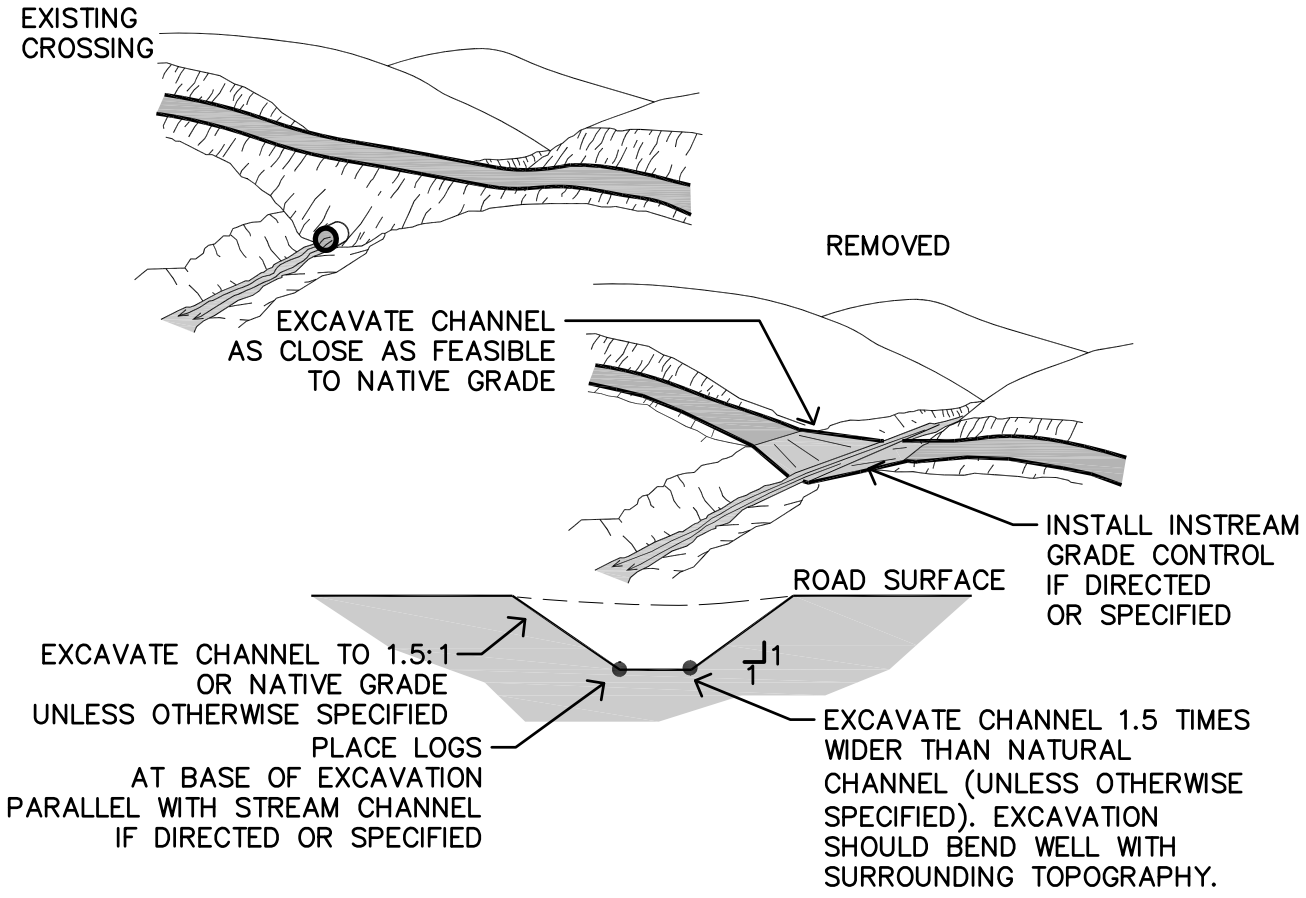
- Install a straw rolls across bare slopes and/or at base of disturbed areas if directed by CEG, RPF and/or designees or specifically called out in recommendations.

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

EROSION CONTROL NOTES

Standard Detail 8A

Date: May 3, 2009



NOTES:

- EXCAVATE A CHANNEL THAT IS 1.5 TIMES WIDER THAN THE NATURAL CHANNEL (UNLESS OTHERWISE SPECIFIED).
  - EXCAVATED CHANNEL SHALL BE AS CLOSE AS FEASIBLE TO THE GRADE AND ORIENTATION OF THE NATURAL CHANNEL.
  - CHANNEL BANKS SHALL BE EXCAVATED TO A 1.5:1 SLOPE OR NATIVE GRADE (WHICHEVER IS STEEPEST) UNLESS OTHERWISE SPECIFIED IN THE PLAN OR DIRECTED.
  - EXCAVATION SHOULD BLEND WELL WITH SURROUNDING NATURAL TOPOGRAPHY.
  - SPOILS SHALL BE PLACED AND COMPACTED ALONG A STABLE PORTION OF THE INBOARD EDGE OF THE ROAD, UNLESS OTHERWISE SPECIFIED. FILL SHALL BE PLACED IN A MANNER TO PREVENT FUTURE EROSION. FILL SHALL BE COMPACTED TO 85% RELATIVE COMPACTION UNLESS OTHERWISE SPECIFIED OR DIRECTED.
- INSTALL INSTREAM GRADE CONTROL IF SPECIFIED IN THE PLAN OR DIRECTED. GRADE CONTROL SHALL CONSIST OF LARGE WOOD OR ROCK AND IS INTENDED TO PREVENT STREAM DOWN CUTTING. SEE GENERAL SPECIFICATIONS.
- PLACE LOGS AT BASE OF EXCAVATED CHANNEL IF DIRECTED. LOGS TO BE PLACED PARALLEL WITH STREAM WITH UPSTREAM LOG OVERLAPPING DOWNSTREAM LOG. LOGS TO BE EMBEDDED INTO CHANNEL BANK TO MINIMIZE STREAM BANK EROSION. LOG DIAMETER TO BE DETERMINED BY PROJECT GEOTECHNICAL CONSULTANT OR DESIGNEE.
- MULCH DISTURBED GROUND
  - IF AVAILABLE AND DIRECTED BY PROJECT GEOTECHNICAL CONSULTANT, THE EXCAVATED CHANNEL BANKS AND SPOIL SITES MAY BE SLASH MULCHED USING 6–INCH MINUS WOODY DEBRIS WITH 90% COVERAGE. SLASH SHOULD BE PACKED USING A DOZER OR THE BUCKET OF THE EXCAVATOR.
- INSTALL A STRAW ROLL AT BASE OF DISTURBED AREAS AS DIRECTED BY GEOTECHNICAL CONSULTANT AND/OR DISTRICT REPRESENTATIVE.
- CONFORM TO REQUIREMENTS DEPARTMENT OF FISH AND GAME 1600 AGREEMENTS WHERE APPLICABLE.
- SPECIFICATIONS ARE INDENTED ONLY AS GUIDELINE, MODIFICATIONS MAY BE MADE IN THE FIELD BY GEOTECHNICAL CONSULTANT OR DESIGNEE.

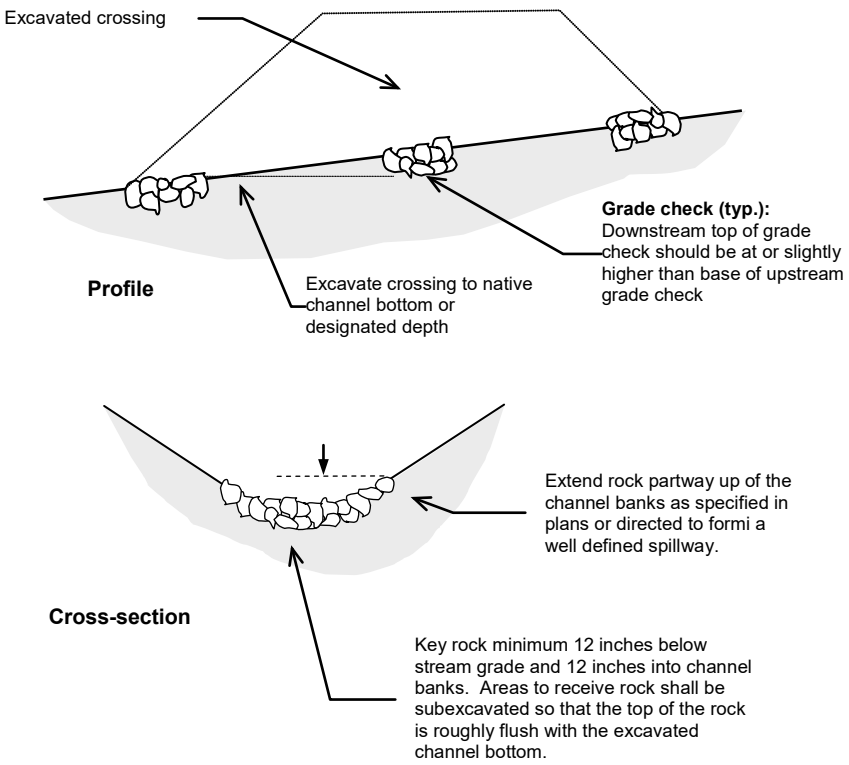
STREAM CROSSING REMOVAL

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT	SCALE: NTS	DATE: 10/2019

S:\DetailsAndSpecsCommittee\Details\Details from District\CAD Details_2020\3A stream crossing removal.dwg

©TIMOTHY C. BEST, CEG

PRELIMINARY



NOTES

- Grade check shall consist of large wood or rock rip rap as specified in plans or directed by project geotechnical consultant.
- Rock to be keyed minimum 12 inches below stream grade and 12 inches into channel banks.
- Areas to receive rock shall be subexcavated so that the top of the rock is roughly flush with the excavated channel bottom
- Rock shall extend partway up of the channel banks forming a well defined spillway to confine stream flow.
- Downstream top of grade check should be at or slightly higher than base of upstream grade check
- Length and number of grade checks to be specified in plans or determined in the field
- Specifications are indented only as guideline, modifications may be made in the field by geotechnical consultant or designee

ROCK GRADE CHECK PRELIMINARY
NTS

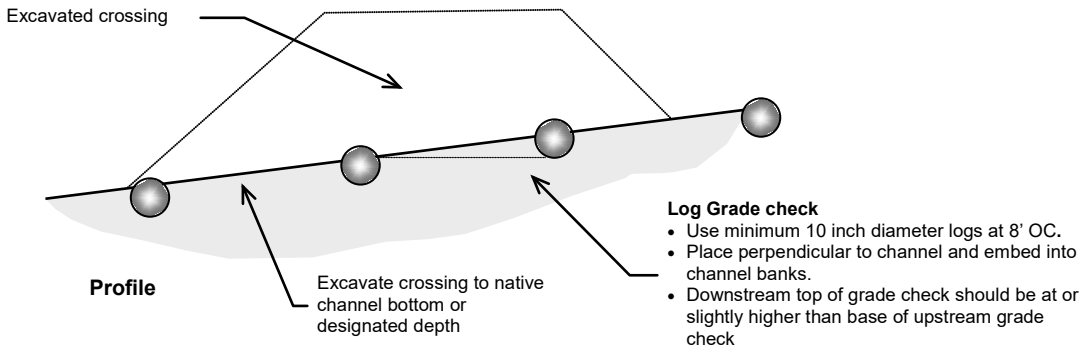
TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

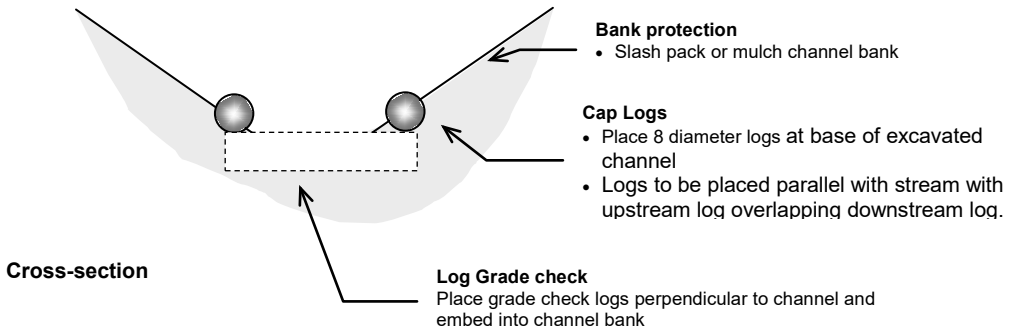
ROCK GRADE CHECK
TYPICAL SPECIFICATIONS

Standard Detail 9C

Date: May 3, 2009

PRELIMINARY





NOTES

- Grade check shall consist of large wood as specified in plans or as directed by project geotechnical consultant.
- Downstream top of grade check should be at or slightly higher than base of upstream grade check
- Length and number of grade checks to be specified in plans or determined in the field
- Specifications are indented only as guideline, modifications may be made in the field by geotechnical consultant or designee

9D **WOOD GRADE CHECK PRELIMINARY**
NTS

TIMOTHY C. BEST, CEG
ENGINEERING GEOLOGY AND HYDROLOGY
1002 Columbia Street, Santa Cruz, CA 95060
(831) 425-5832 (831) 425 5830 fax.

WOOD GRADE CHECK
TYPICAL SPECIFICATIONS

Standard Detail 9D

Date: May 3, 2009

C4.2 Revegetation Plans

I. Purpose

Revegetation Plans provide the goals, design, maintenance, monitoring and reporting requirements for installing plants and erosion control on a site to be planted after construction or some other type of disturbance. Revegetation is often a requirement of an environmental review or permits for a construction project (e.g. trail construction, demolition of buildings).

The term revegetation is often used interchangeably with the phrase ecological restoration. The first has an emphasis on initial planting of a site while the later incorporates longer term progress of a site towards self-sustaining native plants and animals interacting with ecological processes. This procedure primarily addresses the actions taken in initial revegetation with the longterm goal of ecological restoration to be kept in mind during all stages.

II. Policy

The District's Resource Management Policies (December 2014) include an overall Vegetation Management Goal and specific policies that address revegetation (only relevant sections cited below, pp. 9-10):

> **Goal VM- Sustain and promote viable and diverse native plant communities characteristic of the region**
>
> Policy VM-1 Maintain the diversity of native plant communities.
>
> - ♦ Identify appropriate areas for restoring lost or altered native plant communities and **restore** them to a natural condition. This is often best done by restoring natural processes and controlling invasive plants, rather than by planting.
> - ♦ Manage native grassland sites to encourage reestablishment and perpetuation of California native grasses.
> - ♦ Manage oak woodland to encourage reestablishment and perpetuation of California native oaks.
>
> Policy VM-2 Use native species occurring naturally on similar sites in ecological restoration projects.
>
> - ♦ Use seed and cuttings collected from the same geographic area to revegetate or **enhance** degraded areas. One source of native seed is topsoil or mulch taken from adjacent intact habitat and applied thinly.
> - ♦ Use fill, mulch, and seed mixtures that are as free as possible of non-native plants in ecological restoration projects. Know where such materials come from. (See GS-2 for possible exception.)
> - ♦ Work with nurseries to grow native plants needed for ecological restoration projects.
> - ♦ Avoid seeding with rye grass (unless sterile), "Zorro" fescue, Harding grass, or other non-native aggressive plants after fires to control erosion.
> - ♦ Use plant material that is biologically and visually appropriate to the surrounding wild landscape and appropriate to the stage of plant community development at the site.
> - ♦ Encourage District tenants to use native plants for landscaping to provide natural habitat.

The Resource Management Policies include a glossary of terms. Those most relevant to revegetation are included below; refer to that glossary for more terms related to plants and revegetation (pp. 85 – 99).

Native – Those elements of the natural world occurring within an ecosystem prior to disturbance from an outside event.

Performance Measure(s) – Parameter(s) used to measure project success tied to project goals and objectives.

Restoration – The process of returning land that has been degraded and disturbed into functional habitat.

Restore – To bring back to or put back into a former or original state.

Revegetation – The process of replacing existing vegetation on a site with desired vegetation.

Vegetation Management – The maintenance, establishment, or restoration of target vegetation that meets a preserve's management objectives.

III. Procedure

A. Contents of a Revegetation Plan

A revegetation plan generally will have the following outline and each of these sections are described in more detail below:

- Project Background
- Revegetation Design
- Planting Specifications
- Maintenance
- Monitoring
- Reporting

B. Project Background

Explain purpose of the revegetation plan. If it is mitigation for project impacts, describe impact types and quantify impacts by type (e.g. area of impact by vegetation type, number and size of trees removed by species). Describe site conditions including soils, slope, aspect, existing vegetation including weeds, water, visual quality, rare or sensitive plant or animal species, adjacent land, prior land uses, trails and roads, and other factors that might influence success of the revegetation plan. If revegetation project is to restore or protect habitat for special status species, describe site conditions that would best support the target species.

Describe requirements of the project's environmental review under the California Environmental Quality Act (CEQA) and permit conditions such as those from required city/county tree removal and grading permits, streambed alteration agreement from the California Department of Fish and Wildlife, permits from the Corps of Engineers, State or Regional Water Quality Control Boards, Coastal Commission, and San Francisco Bay Conservation and Development Commission. A staff biologist or biological consultant with revegetation expertise should be involved in the development of avoidance, best management practices, and mitigation measures during the design phase of the core project for which revegetation is required, and should also be involved in negotiations for permits which might require revegetation. A biologist can assist in developing practical revegetation approaches that will restore the site to sustainable natural conditions. Ideally, the revegetation plan is developed during the project planning phase and

requires no or minor revisions during the permit and CEQA review processes.

Attach or reference prior reports or surveys describing conditions on-site or other relevant reports.

C. Revegetation Design

Describe location, size, reference site, types of vegetation communities to be created (e.g. riparian forest, perennial grassland, mixed evergreen broadleaf forest), grading work required, drainage considerations, and other relevant design elements.

A nearby undisturbed location may be used as a reference site to determine target plant community types, plant species, plant associations, and densities by species.

The design will usually include some type of performance criteria. See monitoring section below for details.

Determine schedule for all phases of revegetation including surveys, design, collection of propagules, growth of plants at nursery, site preparation, plant installation, maintenance and monitoring. Information on when these activities should be scheduled is provided below.

Surveys usually occur in the spring to determine what annual native and nonnative plants occur at the site especially to detect rare species and breeding activities of wildlife that need to be avoided. Flowering and breeding of many species occur in the spring so surveys at this time make it easier to detect these resources. Special conditions at a proposed revegetation site may require surveys at another time of year or more than one survey. Surveys may need to be repeated closer to or during construction of the project and prior to installation of the plants. Refer to Midpen's rare species GIS layers (which incorporate the California Natural Diversity Database) to determine which rare species may occur in the vicinity of the site and then determine when is the best time and method to survey for them. See Sections C3.1 Wildlife Surveys and C4.2 Rare Plant Surveys for procedures on how and when to conduct surveys for rare species.

Collection of seeds and cuttings from the local area of the revegetation site usually needs to occur over a 1 to 1.5-year period before planting. This is because the seeds and cuttings often only can be collected at specific times of year and then it takes a minimum of 8 months to grow the plants to a suitable size for planting. Native grass seed is harvested in late summer/early fall and due to limited supply, seed is often bought out quickly so pre-orders for native grass seed are often necessary. Natural Resources staff often request plant orders be provided to them by the February (20 months) in the year before the scheduled Fall planting date, and native grass seed orders be provided to them by the February (8 months) before the scheduled Fall planting date.

Midpen is committed to collecting only seeds and cuttings from locally-derived native plants rather than importing seeds and cuttings of the same species from another part of California. This is because locally collected propagules are generally better adapted to the local climate and soils, and they and their progeny will do better surviving under local conditions. For example, if a tree species from a mild climate is planted at a higher

elevation or more interior location, its buds may break open and release delicate leaves in late winter when a freeze may still occur at the colder location, and this could severely damage or kill the young plants.

The appropriate local collecting area should be determined by biologists familiar with the future planting site. If the surrounding natural lands of the proposed planting site are a vegetation type common in the Santa Cruz Mountains (e.g. redwood-tanoak forest, chamise chaparral) with common soil types, then propagules from other locations in San Mateo and Santa Clara Counties are preferred and from throughout the San Francisco Bay Area may be suitable. For sites with serpentine soils or species at the limits of their range, propagules should be collected from the same watershed, similar elevation and soils. The summit of Mt. Umunhum is a location where many of the plant species are unusual (such as not occurring elsewhere in the Santa Cruz Mountains with closest known locations in the Diablo Range), so all propagules for revegetation sites at Mt. Umunhum are being only collected in a very localized area at the summit and its shoulders.

When highly disturbed sites are being restored, control of weeds should often start one to two years ahead of planting. This allows more effective methods of weed control (mowing, tilling, herbicide spraying) and repeat treatments without the concern of disturbing installed native plants, and reduces the amount of weed seeds in the soil bank once planting begins.

Native plants for revegetation projects are usually installed in the September-November period in the Mediterranean climate of central coastal California where rain falls in the cool winter and spring periods, and the summers are hot with no or very little rain occurring from May through September. Plants native to this region put on a growth spurt in the Fall as the days get shorter but air and soil temperatures are still warm. When small native plants are installed in the ground with some irrigation or early rains in the Fall, they will start to grow their roots into the soil and be well established before they go dormant in the coldest part of winter. Then in the following spring when temperatures warms up again, their roots will grow rapidly for a few months until the annual summer drought sets in. Plans should be made as to who will install the plants, typically volunteers or revegetation contractors. Scheduling of volunteer days to install plants need to be coordinated with the Volunteer Program Manager at least 6 months ahead of planting date. Hiring a revegetation contractor to install plants will usually require that a public bid process is started at least 6 months ahead of planting date.

Maintenance of a site (watering and weeding) often needs to be scheduled for 3 to 5 years after the initial planting in order for installed plants to survive dry summers without irrigation and not be crowded out by faster-growing weedy plants. Maintenance is often done by a revegetation contractor and requires that a public bid process is started at least 6 months ahead of planting date.

An annual monitoring of the plants at the end of the summer for 3 to 5 years will determine survival and help determine if replanting is necessary in subsequent Falls.

D. Planting Specifications

Describe number of plants by species, pot size, propagule type, spacing, and procedures for installing container plants, cuttings or seed. A location map should show the boundaries of the site within the preserve or property and access roads. A site map should show the different vegetation communities to be installed, and location of roads, trails, fences, irrigation, and staging areas. A plant list is often provided as quantitative information in a table and split into sections by vegetation community. If seeding is included as part of the project, the amount of seed by species can be provided in a separate seed list or added as a detail on plans.

Removal of tree species may or may not require replacement with the same or similar species, especially for restoration projects. Projects objectives are often in direct conflict with mandatory tree replacement. Examples include: opening the tree canopy to promote growth of rare and/or native species such as Kings Mountain manzanita, and reducing fire risk and fuel loading at overstocked sites. Care should be taken to determine the desired successional stage of the project, the current fire risk and fuel loading of the site, the surrounding vegetative community health, presence of any pathogens/disease, and the habitat values provided. If it is determined that tree replacement is <u>not</u> suitable to meet project objectives, then alternative mitigation should be considered. Alternative mitigation may include:

- Leaving removed trees on site as downed woody material to provide refugia
- Mulching on site to prevent growth of weed species and erosion of soils
- Removal of invasive species within (and in some cases beyond) the project area
- Planting a wider diversity of native (non-tree) species to promote the desired project outcomes and to increase overall habitat values at the site
- Offsite mitigation if a reasonable and suitable site is available

When tree replacement is considered feasible, care should be taken to prevent overplanting sites that would become overstocked or change the overall site conditions in an unfavorable manner.

A materials list will help determine what products need to be acquired beforehand (e.g. browse protectors, wire, T-posts, Blue-X Tubes, stakes, staples, zipties, erosion control mats or wattles, straw, mulch), and what equipment is required during site preparation and planting (e.g. dozers, graders, shovels, trowels, buckets, tarps, post pounders, gloves, pliers, staplers, water, and water storage and delivery). Details can be included on plans showing how the plants are to be installed and whether planting basins, mulch and browse protectors should be included.

Sanitary practices should be followed during site preparation, installation or maintenance when bringing tools or equipment onto the site, importing materials, or bringing in and storing plants and seed. Refer to Section C4.5b Soil Phytophthoras of this procedure manual for details.

Identify water sources for irrigation. Most often, maintenance staff (Midpen staff, contractor, or volunteers) will haul water from a field office to the project site and apply it by either hoses and pumps for larger sites or by buckets for very small sites. Sometimes, such as for acorn planting, shady sites or small remote sites, no irrigation is

provided and germination and growth of plants is dependent on rainfall. Be specific about location of offsite or onsite water tanks and fittings and who is responsible for filling up tanks.

Identify access to site and if there are any limitations on vehicles that can be used to access site and carry in equipment during both the installation and maintenance phases. In particular, note if there are any locked gates, bridges with narrow clearance or weight limits, or other trail limitations (width of gate, width of trail, trail surfaces that limit or prevent certain size equipment at all times or during seasonal conditions). For locked gates, make sure combination locks are installed for contractors to access as needed.

Site preparation may include removal of structures or non-native vegetation; grading; ripping of compacted soils; and installation of irrigation or water storage equipment, perimeter fencing, access roads, and soil amendment. If it is a weedy site, control of weeds and reduction of weedy seeds in the soil bank can start two or more years ahead of installation of native plants. Mark and, as necessary, put temporary constructing fencing around native vegetation to remain or sensitive aquatic, wetland, rare plant, rare animal or nesting birds. Is testing of site soils for Phytophthoras required? Sometimes during the site preparation phase, equipment operators need training on how to avoid impacting sensitive biological resources.

Consider when to phase erosion control and seeding – before or after planting. Usually, installation of erosion control is undertaken after major grading and building work as a final part of the construction phase to make sure all bare soils are covered to prevent erosion during the rainy season. However, seeding is best done in the late fall period just before the start of seasonal rains. Seeding should also be phased so that major disruption of the sown soil will not occur such as by running equipment or walking across the site. Subsections of the project site for which seeding is the only restoration activity can be seeded directly after construction in the fall period. Seeding that occurs in the same area as planting should occur after the installation of all plants to minimize disturbance of shallowly-sown seeds.

Typical native seed mixes are based on site conditions as shown in the tables below. A 40-pound bag of grass seed covers approximately 1 acre of bare soil. Seeded areas should be covered with weed-free straw, native grass straw, or duff from nearby forest to keep soil moist while seeds are germinating, and to help mask the seed from birds and rodents. A no-till drill seeder can be used to plant grass seed on relatively flat areas on which a tractor can operate and will only require a seeding rate of approximately 30 lbs per acre.

Sunny Seed Mix

Species Name	Common Name	Percent in 40 lb. bag
Stipa pulchra	purple needle grass	20%
Bromus carinatus	California brome	40%
Elymus glaucus	blue wild rye	40%

Shade Seed Mix

Species Name	Common Name	Percent in 40 lb. bag
Bromus carinatus	California brome	37.5%
Regreen™	sterile wheatgrass seed	62.5%

Regreen™ is the product name for sterile wheatgrass that germinates quickly and thickly to help stabilize bare soil. Within one to two growing seasons, it will no longer have viable seed and will stop germinating which will allow other grasses and plants to occupy the stabilized soil. It is particularly helpful in shady sites which might not have good conditions for other grasses to germinate.

Wet Seed Mix

Species Name	Common Name	Percent in 40 lb. bag
Bromus carinatus	California brome	20%
Stipa pulchra	purple needle grass	20%
Elymus glaucus	blue wild rye	60%

If available, meadow barley (Hordeum brachyanterum) seed does well in moist locations. Plugs of beardless wildrye (Elymus triticoides) can also be transplanted from one wet site to another.

Browse damage to the plantings from wildlife can be severe if protective measures are not taken. Plant species deemed palatable to deer, rabbits and rodents can be caged with a browse protection. Browse protection (cages) are often a minimum of 30 inches in diameter, stand 48 inches in height, and are constructed out of number 14-gauge or 16-gauge welded-wire fencing (12-gauge only required where there is cattle in the revegetation site) with a 2-inch by 4-inch grid pattern and each cage needs to be anchored into the ground using 2 medium duty (heavy duty in cattle areas) steel T-posts, each 5 feet in length. Cages are attached to the T-posts using a small amount of fence wire or zip ties or any other method that is easy to remove/replace during maintenance weeding.

Acorns are planted (1-3 per planting basin), covered with 1-2 inches of soil with a plastic Blue-X® tree shelter (or equivalent) installed in each acorn basin to reduce moisture loss from the soil and protect seedlings from wildlife browse. Stakes anchoring the Blue-X tree shelters should be in a sleeve formed by the Blue-X film or on the interior of the shelter to avoid lizards and rodents from crawling up a stake on the outside and then jumping into and getting stuck in the shelter. Plastic netting can be placed over the top of shelters to keep butterflies from getting stuck in them.

Refer to these department files for more details:

- How To Broadcast Seed
- Planting Notes: Acorns
- Planting Notes: Container Stock

E. Maintenance

Maintenance is expected to be necessary at regular intervals for the first few years and will decrease over time. Maintenance includes the removal of invasive, non-native vegetation, such as yellow star thistle; replacement of dead plants (only if survivorship drops below accepted thresholds); watering; checking of acorn seedlings, and removal of browse protectors. Monitoring data (see following section) will be used to evaluate the need to adjust maintenance activities to ensure the success of the revegetation project.

The plantings will require watering during the plant establishment period which is generally three years but may be as long as five years during drought years or if the site is very sunny and dry. In Year 1, the plantings are irrigated approximately 2 times per month from May through October. Each watering should provide a significant amount of water to encourage the development of taproots (approximately 2 gallons per planting basin).

The watering schedule in Year 2 will be similar to Year 1; in Year 3, watering is expected to be reduced to one deep watering per month. The watering schedule may be modified based on natural rainfall patterns to ensure plant survival. Watering will be performed by hand and basins will be filled slowly to allow the water to seep into the ground rather than spilling outside the basin. In exceptionally dry years, watering may be extended additional months and may occur more frequently.

Weeds within the revegetation site will be controlled throughout the site as a whole, but particularly within each planting basin during the plant establishment period. Weed control methods shall be by mulching, pulling by hand, mowing, and herbicide spraying depending on the site conditions and should be consistent with the District's Integrated Pest Management Program.

The planting basin consisting of 36-inch diameter around each installed tree and shrub will be kept free of target invasive plants by maintaining the wood chip or rock mulch layer and manually removing the weeds that become established in the mulch. The remainder of the revegetation site (between basins) will be maintained at less than 10% cover of target invasive plants. Weeds throughout the site (between planting basins) will be kept to a maximum height of 30-61cm (1-2 feet) year round usually by mowing. Weed control activities will occur before seed set, to the extent possible. Care will be taken to avoid impacting any native woody species that colonize the gaps between plantings.
Maintenance staff shall work to avoid disturbing wildlife in the project area while mowing or brush-cutting including but not limited to equipment modifications, mowing patterns and buffer strips.

Check the acorn basins in the early spring and every few months thereafter to determine if more than one acorn germinated per basin. Only the most vigorous acorn seedling should be left in each basin and any extra oak seedlings in the same planting basin should be clipped below ground. Note that in dry years, some acorns may not germinate until the subsequent year so check again for duplicate acorn germination and do not remove plastic tree shelters or install replacement plants or acorns until germination conditions are evaluated at the beginning of the second summer. Watering of acorn basins is not always necessary; at remote locations, acorns can be planted without watering but at greater densities or over several years.

The revegetation site's browse protectors will be maintained in good working order during the plant establishment period. Following Year 3, the conditions of the browse protectors and the plants will be evaluated and the protectors removed, if appropriate. At a minimum, the browse protectors will be removed and disposed at the end of the plant establishment period and cessation of annual monitoring. In general, once a plant reaches the top of the browse protector, and especially if it has additionally developed a canopy that spreads to the outside edge of the protector, that is a good time to remove the protector because deer tend to not browse too far inwards and rabbits and rodents cannot reach the top of the plant where the active growing points are located for shrubs and trees.

During the first three years of the five-year Plant Establishment Period, dead plants will be replaced if the average plant survival for all installed species combined falls below the 80% plant survival criterion outlined in the next section. An adaptive management approach towards plant replacement will be instituted. Thus, the plant species chosen for replacement will be based upon a critical evaluation of the vigor and growth of the plantings installed. Those species that are well adapted to the plantings sites and are rapidly establishing will generally be used to replace dead plants.

Care will be taken to avoid damaging naturally recruiting native species during maintenance and weeding activities. Maintenance personnel will be trained to differentiate between native and non-native species. Fostering natural recruitment will aid in rapid habitat development.

F. Monitoring

Monitoring of the mitigation site by a qualified biologist will be conducted throughout the plant establishment period, and monitoring reports will be prepared annually. Monitoring will take place quarterly, with the first monitoring to occur three months following site installation. By the final year of monitoring, native habitat should be sufficiently well established to determine if the site will eventually achieve the long-term goals of increasing native plant cover and less than 10% cover of invasive species. The following elements will be monitored to evaluate the site's progression towards this goal.

Plant survival and health are often monitored in April, June and September. Survival will be assessed by a full plant count, recording survivorship by species. Each plant basin will be inspected to determine whether the plant therein is alive or dead. Vigor (overall plant health) shall be monitored several times per year. Note that 80% plant survival criterion is frequently used but other percentages can be used based on site design and goals.

A qualitative assessment of the vigor of each plant shall be made by considering such factors as leaf and stem color, bud development, new growth, herbivory, drought stress, fungal/insect infestation and physical damage. Particular note should be made of patterns of symptoms that appear to be persistent among certain species or in particular sections of the planting area.

In addition to monitoring the survival of installed plants, monitoring of percent cover across a revegetation site is an optional indicator of revegetation success and is suitable for some sites where the eventual development of dense cover is required such as for erosion

control, replacement of sprawling vegetation types, or dense wildlife habitat. Percent cover will be assessed on an annual basis. The goal for monitoring percent cover is to determine if a steady increase in native cover occurs over time. Percent cover can be visually estimated or can be determined using the line intercept method employed along fixed transects that cross the site and is calculated by species and for the entire site. Percent cover of both the installed and the naturally recruited native plants will be measured. Percent cover of woody species will be monitored in Years 3, 4, and 5; cover values are expected to be negligible in Years 1 and 2 because the woody plants are initially small. On a successful site on which trees or shrubs have been planted, percent cover should be in the range of 10% absolute cover in Year 3 and increase to 20% absolute cover in Year 5.

Plant health and vigor can also be assessed along the permanent transects established for percent cover monitoring. Plants within a 1.5 meter band along each transect will be observed and monitored qualitatively for health and vigor.

G. Reporting

The annual report during maintenance of revegetation sites will include at minimum: a summary of the year's monitoring data, a summary of invasive plant control efforts and watering activities, an assessment of progress towards success survivorship requirements, and any recommendations, including a tally of any replacement plants required (refer to a table if relevant). The annual report is usually finalized and submitted to regulatory agencies as required by December 31.

The details of new revegetation sites shall be documented for Midpen's GIS layers. See the metadata for the revegetation layer for details on the type of information to be collected.

H. Costs

In 2017, the costs for contract growing of native plants at a nursery generally were $8-15/plant. Costs for maintenance of plants generally were about $10/plant/month and the maintenance period is usually 3 to 5 years after planting.

A breakdown of typical maintenance costs is in table below.

Watering 3X/mo	plant or acorn basin/month	$6.00
Watering 2X/mo	plant or acorn basin/month	$4.00
Weeding 1X/mo	ft2/mo	$0.10

Mulch replacement 1X/yr	site/year	$300.00
Plant protection devices - maintain & remove	device/yr	$10.00
Acorn basins - maintain & remove	basin/yr	$10.00
Replacement of dead plants per plant	plant/yr	$30.00
Monitoring 1X/year	plant or acorn basin/yr	$10.00
Reporting per month	report/mo	$60.00
Reporting 1x/yr per annual report	report/yr	$2,000.00

I. References

The Society for Ecological Restoration and the Society for Ecological Restoration - California organizations have publications and trainings that guide revegetation and ecological restoration practices such as:

- International Standards for the Practice of Ecological Restoration, December 2016
- Ecological Restoration for Protected Areas: Principles, Guidelines and Best Practices, 2012
- Guidelines for Developing and Managing Ecological Restoration Projects, December 2005
- SER International Primer on Ecological Restoration, 2004

Major Watersheds

Midpeninsula Regional Open Space District

A. Hébert January 2018

Miles 0 5 10

San Pedro Creek
San Mateo Creek
Cordilleras Creek
Pilarcitos Creek
Purisima Creek
Lobitos Creek
Tunitas Creek
San Gregorio Creek
San Francisquito Creek
Adobe Creek
Permanente Creek
Stevens Creek
Calabazas Creek
Pomponio Creek
Pescadero Creek
Butano Creek
Saratoga Creek
San Tomas Aquinas Creek
Gazos Creek
Guadalupe River
Los Gatos Creek
Waddell Creek
San Lorenzo River
Scott Creek
Uvas Creek
Soquel Creek

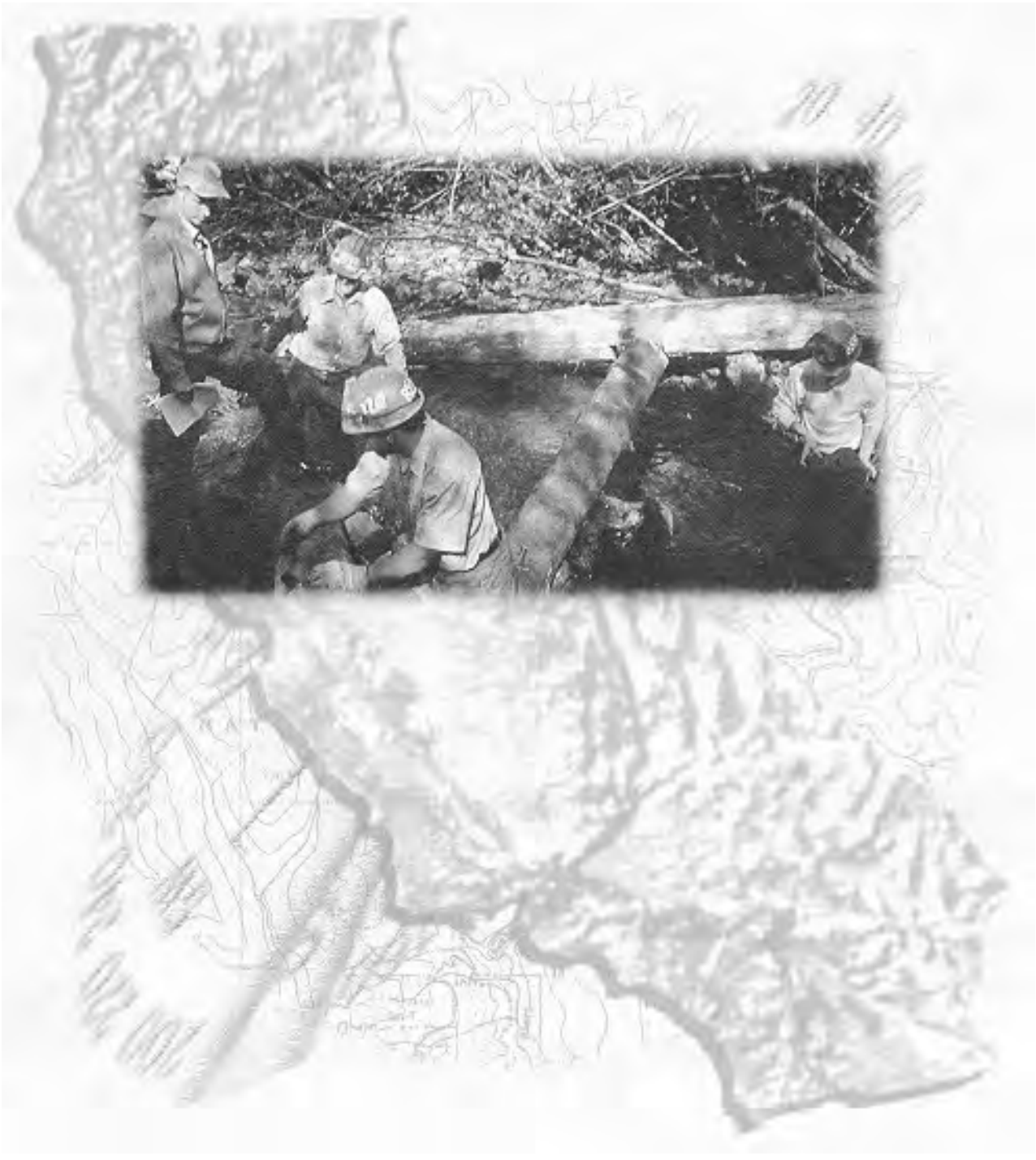
Midpen Boundary
Watershed Boundary
MROSD Preserves
Coho Distribution
Steelhead Distribution
Streams

N

CALIFORNIA SALMONID STREAM HABITAT RESTORATION MANUAL

PART VII

PROJECT IMPLEMENTATION



PART VII PROJECT IMPLEMENTATION

When critical habitat has been determined to be lacking, placement of suitable structures or other remedial actions may be appropriate. If structural options are selected, some essential physical parameters must be considered. Project location and access, available structural materials, stream flow volume and velocity, current and expected land use practices, watershed stability, stream channel and bank stability, and bedload and debris transport are basic parameters that must be considered before instream improvement structures are installed. Hydraulic cross sectional analysis should always be performed to assure passage of bankfull flows.

Kinetic energy of a stream determines its ability to move materials. Maximum kinetic energy is generated during bankfull flow, usually related to storms. Bankfull flows may also occur because of released storage in regulated streams. It is during these bankfull flow events that maximum bedload transport and channel formation occurs. As flows subside, deposition and additional stream channel forming processes occur.

Numerous factors including watershed condition, channel configuration, and instream structure regulate bedload transport through a system. The coupling of water energy and bedload limits the opportunities for placement of stable fish habitat structures.

SELECTION OF STABLE SITES

Stable habitat restoration sites with appropriate hydrologic channel characteristics afford the greatest opportunity for successful structure installation. Review of site suitability for project work must incorporate an assessment of natural features of the stream. For example, observation of deposition and scour areas on stream banks will reveal the range of flows in the stream. At each potential structure site, the following factors should be analyzed to determine if a structure will be suitable, stable, and effective.

Gradient

For many structures, sites with gradients less than 0.5 percent or greater than four percent are poor candidates. Stream reaches with gradients of less than 0.5 percent are frequently depositional areas. Partial channel spanning structures that constrict flow such as single and opposing wing deflectors or constricting weirs, can be used to increase water velocities, creating habitat by deepening channels.

High gradient stream reaches greater than four percent are difficult to control. The substrate in these streams is often bedrock or boulder and usually lacks spawning gravel. Full channel spanning structures designed to trap gravel must be placed very close together to reduce the flushing effect of high stream flow velocity. Hydraulic forces present in excessively high gradient streams increase stress and the probability of structural failure, and reduces the number of alternative treatments and the chance of a project succeeding.

Stream Width

Sites in reaches that are slightly wider than mean stream width are the best candidates for successful channel spanning structures. Velocities in these areas will be lower than more constricted reaches, providing a natural energy control. However, overly wide channels will typically be areas of deposition and are unsuitable for other than channel constricting structures.

Substrate

Bedload deposition tends to occur in areas of mean stream width or wider. These areas provide the greatest opportunity for placement of substrate scour or deposition structures. Channel spanning structures may be placed to capture gravel or other bedload materials on the upstream side of the structure, and create scour downstream. A series of structures can redistribute bedload and create reaches containing gravel deposition, cover, and scoured pools. Free-standing structures are typically unstable because of periodic bedload movement associated with high flows.

Highly compacted substrate creates special construction problems for placement of instream fish habitat structures. Heavy equipment or specialized techniques may be required to securely anchor structures at these sites. For this reason, construction costs are often prohibitive and long term stability is uncertain.

Bedrock substrate provides a good anchor for instream structures using cable or rebar and polyester resin adhesive. The bedrock foundation for a stable structure must be un-fractured and durable.

Stream Order

Lower order streams, at appropriate sites, can usually be controlled with standard habitat restoration structures. Higher order streams typically have high stream power and require large construction materials and larger or more complex structures, making site selection even more critical.

Reach Length

Generally, a reach should be long enough so that structures can be placed in a series. When structures are placed in a series, the most upstream and downstream structures create velocity control points. These controls can be particularly important in areas where deposition of gravel is the purpose of the structure.

Channel Sinuosity

Sinuous stream reaches are areas of scour and deposition. To be effective in these reaches, a structure must be fitted to the bend in the stream. For example, diagonal weirs located on a bend will trap gravel while downstream-V weirs at the same site generally will not. Generally, sinuous stream reaches are not desirable locations for structures built in a series.

Bank Stability

The choice of suitable structures is limited by the stability of stream banks at the site. For example, structures that direct flow into unstable banks will result in bank erosion and possible structural failure. Stable banks are essential to structural integrity in channel spanning structures.

Bank Morphology

Stability of habitat structures will be affected by stream bank morphology. Especially steep banks will result in rapidly rising stream surface elevation with increased flows overtopping installed structures. Unconfined stream banks will result in rapid widening of the stream, with increased flows potentially relocating the stream channel and circumventing the structure. Bedrock or well consolidated stream banks provide a stable base for structure placement, whereas poorly consolidated stream banks require riprap or other durable material for protection.

The extent to which boulders and woody structures protrude from the stream bank into the channel will provide a reasonably good guideline for placement of stream bank associated habitat structures. For comparative purposes, look at natural channel features that presently produce habitat similar to that which needs to be increased. Projects should use successful natural features as guidelines for design and location of structures whenever possible.

HYDRAULIC IMPACTS

A familiarity with the principles of stream hydraulics is important when designing site specific instream habitat enhancement structures because it is necessary to predict hydraulic impacts of each project to ensure that it will achieve the desired result. Inter-Fluve Inc. has developed a method for predicting hydraulic impacts, "Using Basic Hydraulic Analysis for In-Channel Design" (G. Koonce and M. Kiesse, Inter-Fluve Inc., personal communication). However, due to the myriad of factors affecting streams it remains difficult to measure and predict the precise outcome of a new structure to a stream. Evaluation of each project site for successes, failures, and causes is useful for developing skills of selection, design, and construction of habitat improvement structures.

For any single structure such as a diagonal log weir, the location of stream scour and deposition is relatively predictable. As structures become more complex, or a series of structures is developed, scour and deposition becomes more difficult to predict.

Scour is predictable at four locations in a stream: on the outside of bends, below waterfalls or cascades, at a constriction, or at a steepened gradient. The amount of scour generated by a structure has built-in limitations controlled by the kinetic energy budget of the stream.

Similarly, deposition can be predicted at three locations in a stream: on the inside of bends, in quiet water areas such as eddies where stream energy has been dissipated, and on the upstream side of natural sills or structures where flow is obstructed.

Height of a structure or relative radius of a bend influences the amount of scour or deposition. For example, stream flow and energy gradient, combined with effective height of a structure will dictate the depth of scour. In general, the higher the structure the deeper the plunge, up to the point of energy limitations (Figure VII-1). The need for upstream migration of adults or juveniles is a very important consideration when deciding how high to build a structure. Jumps in excess of 12 inches are to be avoided. If the gradient of the stream dictates a structure of over 12 inches in height, a low-flow notch at the thalweg is required to improve upstream migration for juveniles.

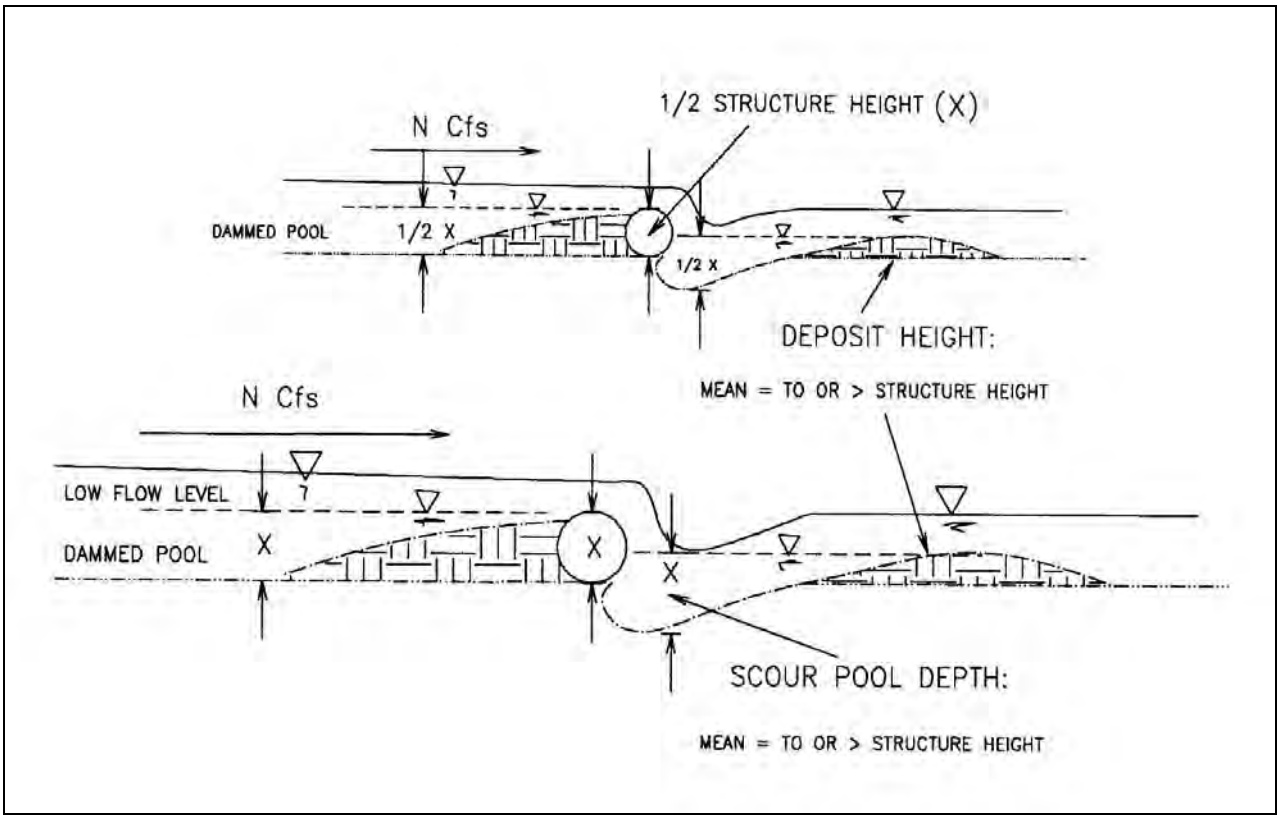


Figure VII-1. Typical structures of variable height in the same stream reach create pool depths and deposition heights directly related to structural heights (Anderson, 1988).

Without attempting formal hydraulic engineering analysis, observation of an existing structure in a stream will give a good indication of the scour that can be expected for a similar structure. Structures that obstruct flow tend to produce bars downstream that are nearly as tall as the structure.

Where water overtops a structure, the vertical angle of the downstream face strongly influences potential stability of the structure by directing the impact of the plunge flow. A vertical face will result in scour directly at the toe and may undercut the structure. With some designs of log structures this may be desirable but for boulder structures in deep alluvial streams this may result in structure failure. Undercutting can be avoided by placement of downstream rows of successively deeper boulders to provide a sloping face (Figure VII-2) that directs plunge flow away from the structure.

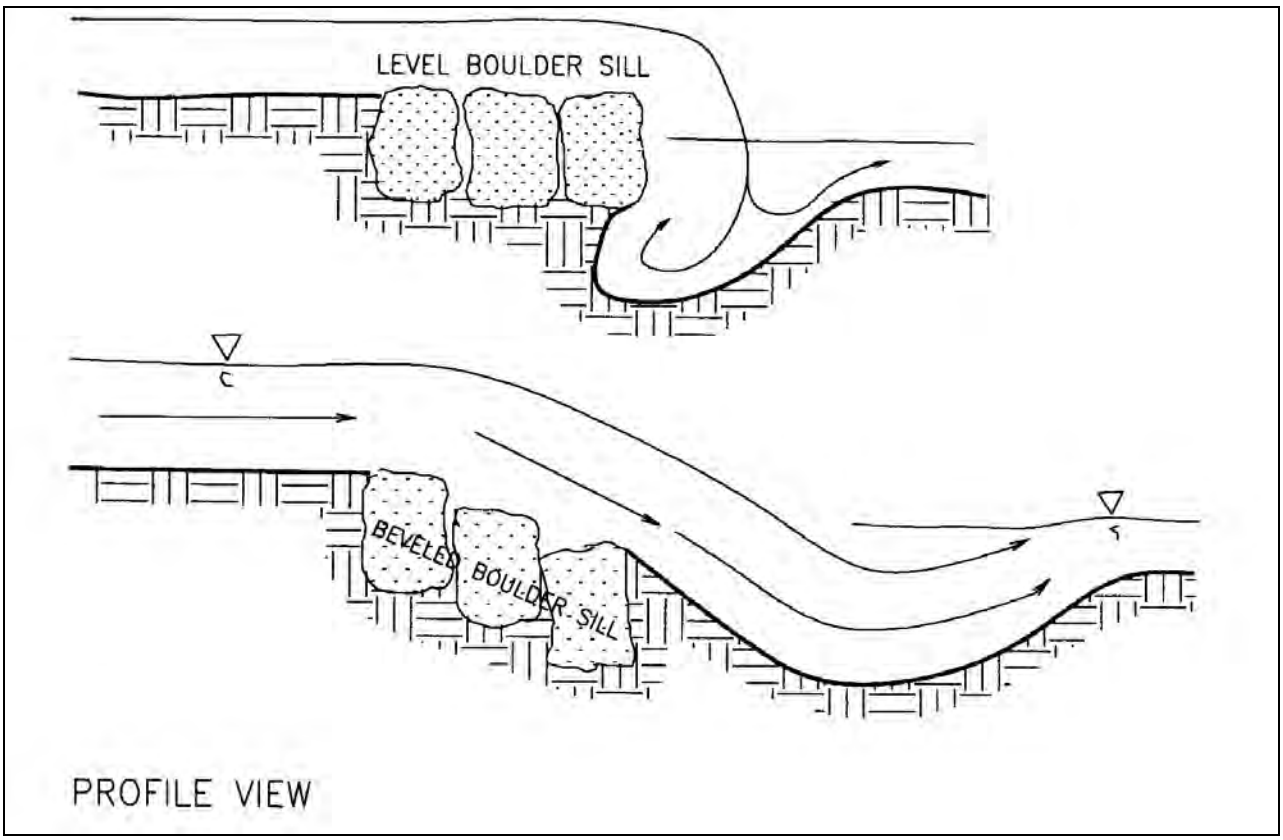


Figure VII-2. Comparison of level and sloping boulder face affect on flow into plunge pool (Overton, 1987).

Length of a full-spanning structure relative to the perpendicular stream width affects the stream's energy budget above and below the structure. Structures perpendicular to flow, such as straight log weirs, generally increase velocities because they narrow the high-flow channel. This happens because of the constriction created by the anchoring structures required to protect the ends of the weir. Structures such as diagonal log weirs that are two to three times the mean stream width will widen the hydraulic cross section, thus decreasing velocities.

Structures placed level on stream grade will produce even cross-sectional flows with very predictable deposition areas above and below the structure. Structures of irregular heights will break up these even flows and produce irregular scour and deposition areas. Although structures of irregular height are not as stable as those placed level, they can enhance salmonid spawning and rearing by increasing diversity of cover in the form of turbulence and scoured pools. The simpler the design the more likely it will be that hydraulic impacts can be forecast. It is more difficult to reliably predict the outcome of complex structural arrangements largely because of multiple and unequal flow vectors generated.

Channel constrictions are common natural occurrences and can be easily duplicated with structures. Bedload is moved through the constricted area and scour is created and maintained within the constraints of the available kinetic energy budget. Structures such as upstream-V weirs, and single and opposing wing-deflectors are examples of channel constrictors. A channel can also be widened to spread out the flow and diminish concentration of energy. This usually will result in

channel aggradation. Downstream-V weirs and diagonal weirs are common structures for this purpose.

Multiple structures placed in a stream reach or complex structures such as log, root wad, and boulder combinations can create complex habitat with a wide variety of habitat niches.

SELECTION OF MATERIALS

The site often dictates which types of materials and which techniques must be used to successfully accomplish a stream habitat enhancement project. Selection of materials should come only after considering all factors. Factors to consider include:

- What are project objectives?
- What are funding limitations?
- What is expected life of the structure?
- What materials are on-site or nearby?
- If materials must be imported, are they economically available in adequate quality and quantity?
- Can the material of choice successfully be held in place during a major hydrological event?
- Will placement of enhancement structures require mechanized equipment, a large work crew or a combination?
- Are there access roads to the project site or a feasible way to get equipment and materials to the stream?
- Are the materials of choice aesthetically acceptable?

These considerations, together with the following information should be useful for choosing appropriate materials for fish habitat improvement structures.

Basic Structural Materials

Gabions

Gabions are heavy wire-mesh baskets that are filled with rocks or other hard material. They have been used to build instream structures such as weirs and wing deflectors. After several years, the wire mesh typically deteriorates due to abrasion, leaving broken and protruding wire from the disintegrating baskets. This creates a hazard to fish and humans. DFG recommends that gabions never be used within the flood prone area. Gabions can be useful as buried dead man anchors.

Gabion wire baskets are formed using the wire ties provided with the gabions. The empty gabions are firmly anchored and filled with rock. It is best to use angular, durable, un-fractured rock with a flat side facing the exterior of the gabion. When more than one gabion is used, secure the gabions together with heavy wire.

Logs

Logs can be used individually, or in combination with other logs, root wads, or boulders. Longevity is highly dependent on the tree species and percentage of time that the log is saturated. Redwood, western red cedar, Port Orford cedar, and Douglas fir can be expected to last the longest. Spruce, hemlock, white fir, pine, and hardwoods are least durable. The longevity of most logs can also be increased by removing their bark. Logs are buoyant and will float if not secured or weighted down adequately.

Logs can be used for a variety of applications: weirs, wing-deflectors, digger logs, cover structures, cribbing, and bank armor. Full-channel log structures are susceptible to washout or destabilization during periods of high stream flow if not adequately secured.

Root Wads

A root wad with an extensive root network can provide complex fish habitat throughout the year depending on where it is placed. Root wads can be anchored in a variety of locations including mid-channel, at the stream margins, or in pools, to enhance summer and winter habitat. Root wads with a long section of log intact are most valuable since they are easier to secure in place. Root wads must be well secured, preferably to bedrock, boulders, or stable logs.

Boulders

Competent boulders can be used in a variety of applications. They are especially suited for instream structures including weirs, wing-deflectors, and boulder clusters. Boulders are used extensively as riprap to stabilize failing stream banks. Logs, root wads, and boulders are often used in combination to form cover structures.

Boulders are among the most aesthetically pleasing of all stream enhancement structural materials. It is often difficult to tell whether their presence or arrangement is natural, or the product of habitat improvement efforts. Stream size does not limit their suitability. In wide stream channels, boulder weirs are more stable than log weirs because of the tendency for logs to float and disassemble.

The ideal situation is to locate a source of boulders close to the work site. The boulders must be of appropriate size, only use boulders that are as large or larger than those already in the stream channel. They must also be available in adequate quantity, and be un-fractured so they will withstand rough treatment during loading, unloading, and placement. Highly durable boulders are essential if cable and polyester resin adhesive are used to secure the boulders.

Angular quarry boulders are more stable under high stream flow conditions than round stream boulders. Burying approximately one-third of a rounded boulder into the substrate can help compensate for this drawback. Boulders should not be taken from the streambed if their removal decreases existing suitable habitat.

Boulder weights can be estimated by the size of the boulder. The following table estimates the weight of a boulder as approximately 150 pounds per cubic foot.

Diameter (feet)	Volume (cubic feet)	Weight (lbs)
2.0	4.2	627
2.5	8.2	1224
3.0	14.1	2115
3.5	22.4	3359
4.0	33.4	5014
4.5	47.6	7139
5.0	65.3	9793

Heavy equipment is usually required for transporting and positioning boulders. If access to the project site is unsuitable for a dump truck, cost per boulder will increase because of the additional time necessary for a front end loader or bulldozer to deliver individual boulders. Under some circumstances it may be most cost effective to transport and place boulders by helicopter.

At remote sites, boulders may be moved a short distance with hand tools such as a griphoist. An effective method for preparing to move a boulder is to drill a hole in the boulder and secure a short section of cable to the boulder using polyester resin adhesive (Figure VII-3). The griphoist cable is secured to the cable in the boulder with cable clamps. In some cases, chokers or rock nets are also used to move boulders. Griphoists must be secured to an anchor that is either found or created and should be in-line with the boulder and the final desired location. If anchoring to a live tree, measures must be taken to protect the tree. An anchor can be made by drilling a hole in bedrock or in a large boulder and securing a section of cable with polyester resin adhesive.

An effective technique is for one person to operate the griphoist while a second person works behind the boulder with a pinch bar to help guide the boulder and to prevent binding. Snatch blocks can be used to increase the pulling capacity of the griphoist, or to change the angle of pull. A griphoist is equally effective in moving large logs.

Miscellaneous Structural Materials

Geotextile fabric and woven-wire fencing material are often used together on log bank stabilization structures before back-filling with cobble and boulders. The material serves to retain bedload or fill material and help establish and maintain the integrity of the habitat structure.

Geotextile Fabric

Geotextile fabric is available in a variety of textural weaves, strengths, and pore sizes. It is not easily punctured or torn and is available in UV-resistant form for applications where it may be exposed to sunlight. Regardless of pore size, it appears that accumulations of fine sediment and sand eventually prevent movement of water through it. It can also be used effectively as a silt trap during construction of instream structures.

Wire Fencing

High quality wire fencing is woven rather than welded and must be galvanized to ensure longevity. Some types of fencing are PVC-coated and generally have excellent longevity, especially if covered with rock.

Geotextile fabric and wire fencing are often used together on log bank stabilization structures. The geotextile fabric prevents the fine sediment from flowing under the logs and the wire fencing adds structural stability. When using wire fence to add structural stability to a log bank stabilization structure, care must be taken to ensure the wire is properly anchored down and back-filled.

It was once common practice to install geotextile fabric and wire fencing on the upstream side of log channel-spanning structures to prevent water from flowing under the log. This practice has been discontinued. Often, the fabric and wire are lifted over the log structure by the hydraulic force of the water. This can result in the wire posing a potential hazard to people and fish.

Concrete

Concrete is a building material made by mixing cement, sand and gravel with water. Concrete is used to build walls and floors in projects such as fishways and culverts. Concrete cures under water. However, care must be taken to prevent concrete from leaking into the stream, since it is toxic to fish (pH shock) until set and cured. Broken concrete has been used in some areas as riprap. This is not recommended, since its density and resistance to scour are less than that of most rock and it usually does not stay in place or last long.

Wire Rope

Wire rope or cable comes in a variety of diameters and types. Stainless steel cable has the longest life, but is very expensive. Galvanized wire rope is coated with zinc to improve rust resistance. It is relatively free of grease coating, making it suitable for polyester resin adhesive applications. Its longevity is probably greater than non-galvanized steel wire rope. Non-galvanized steel wire rope is lubricated to alleviate abrasion between wire strands when the cable is in motion and under stress. The grease also helps to retard rusting.

There are several ways to cut wire rope in the field. Guillotine type cable cutters are commonly used. These work well but tend to fray the end of the cable making it difficult to push the end of the cable into a hole drilled in a boulder or bedrock using polyester resin adhesive. A skill saw equipped with a metal cutting blade makes a clean cut of the cable, leaving no frayed ends.

ANCHORING TECHNIQUES

The failure of an anchor is probable unless the structure is properly constructed following these recommended techniques. Steel rebar, wire rope, and expansion bolts are the most commonly used materials for anchoring systems. All have several varied applications. Trenching and the use of a deadman are techniques used to stabilize and hold structures in place.

Cabling to Boulders or Bedrock Using Polyester Resin Adhesive

When dealing with durable, un-fractured boulders or bedrock, the cable and polyester resin adhesive technique is a cost effective method of anchoring stream enhancement structures (Figure VII-3). The technique can be used to secure boulders in sequence, or to secure logs or root wads to boulders or bedrock. This anchoring technique can be accomplished using rock drills capable of drilling holes up to one inch in diameter, at a variety of angles.

Before using polyester resin adhesives, read and follow all manufacturer's labels concerning use of this product. Polyester resin adhesives can be used in wet or dry conditions. The hole diameter drilled must be no more than one-eighth inch larger than the cable to be used and should be approximately 10 inches deep. Clean the hole using water or air and a brush to remove all debris. All the rock dust must be removed from the hole or the polyester resin adhesive will adhere to the dust and not to the rock. Use clear, clean water to thoroughly clean drilled holes and ensure the polyester resin adhesive will adhere to the rock, not the dust or silt. Cut the cable to the proper length, keeping cable slack to a minimum between the fastening points. Clean the cable using acetone or muriatic acid. Galvanized wire rope is relatively free of grease and requires much less cleaning than lubricated wire rope. The cable must be absolutely free of oil to get a good bond with the polyester resin adhesive. It is important when using acetone or muriatic acid that precautions are taken to protect the person doing the cleaning, and that it is accomplished away from the stream in case of an accidental spill. Fill the hole approximately two-thirds full with polyester resin adhesive. Insert the cable, turning slowly when possible, until the cable hits the bottom of the hole. Air pockets left at the bottom of the hole reduces bonding strength. Polyester resin adhesive must be used prior to the indicated expiration date.

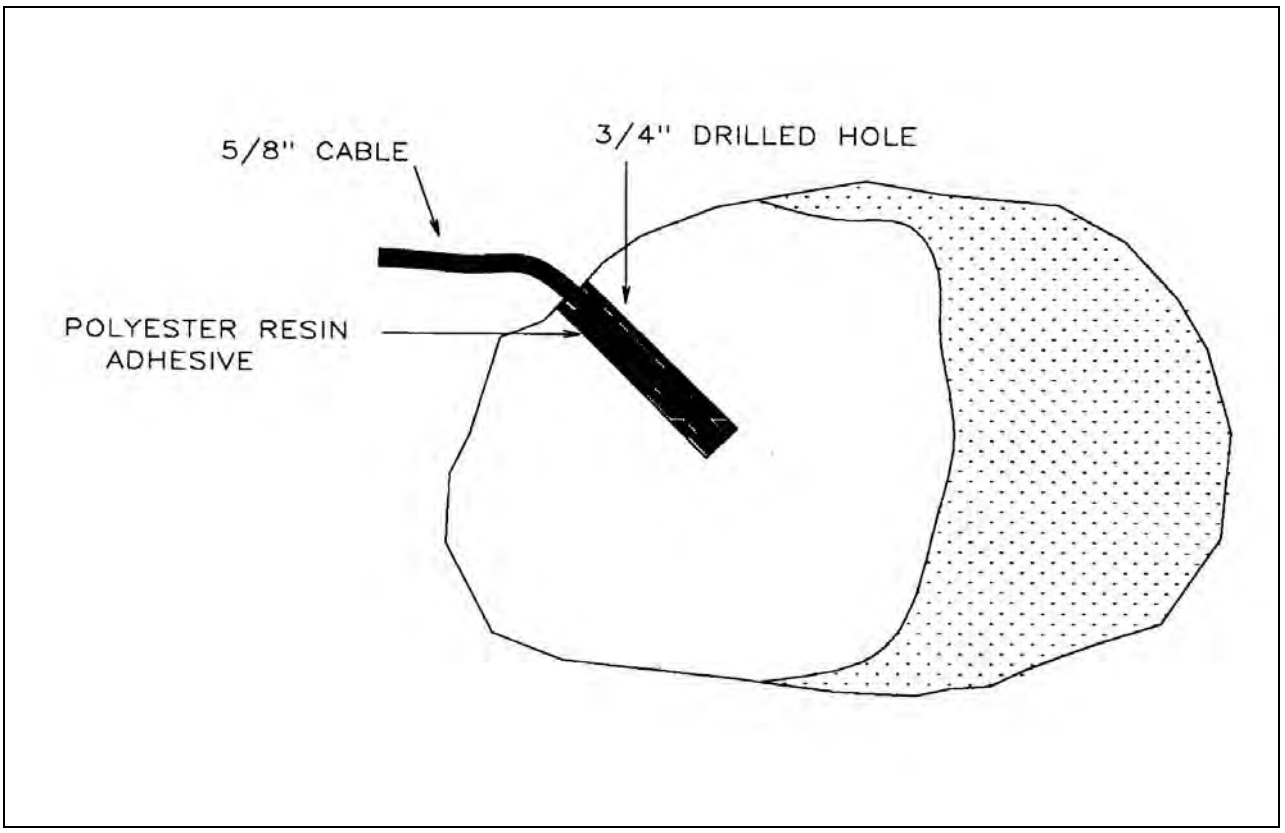


Figure VII-3. Cable secured to boulder using polyester resin adhesive.

Cabling to Logs and Root Wads

Woody material should be secured by inserting the cable through the log or root wad. Where this is not possible, notching the material to recess the cable is necessary. Always remove bark at the point of contact between the cable and the log or root wad because bark will rot, resulting in slack in the anchoring cable. When threading cable through augured holes, or wrapping it around logs or root wads, cable clamps should be used to fasten the cable. A minimum of two clamps is required to prevent slippage. The cable should be looped through the hole, and around the material and clamped back to itself. Simply placing a clamp on the end of the cable will not suffice because it can be pulled off, or pulled through (Figure VII-4).

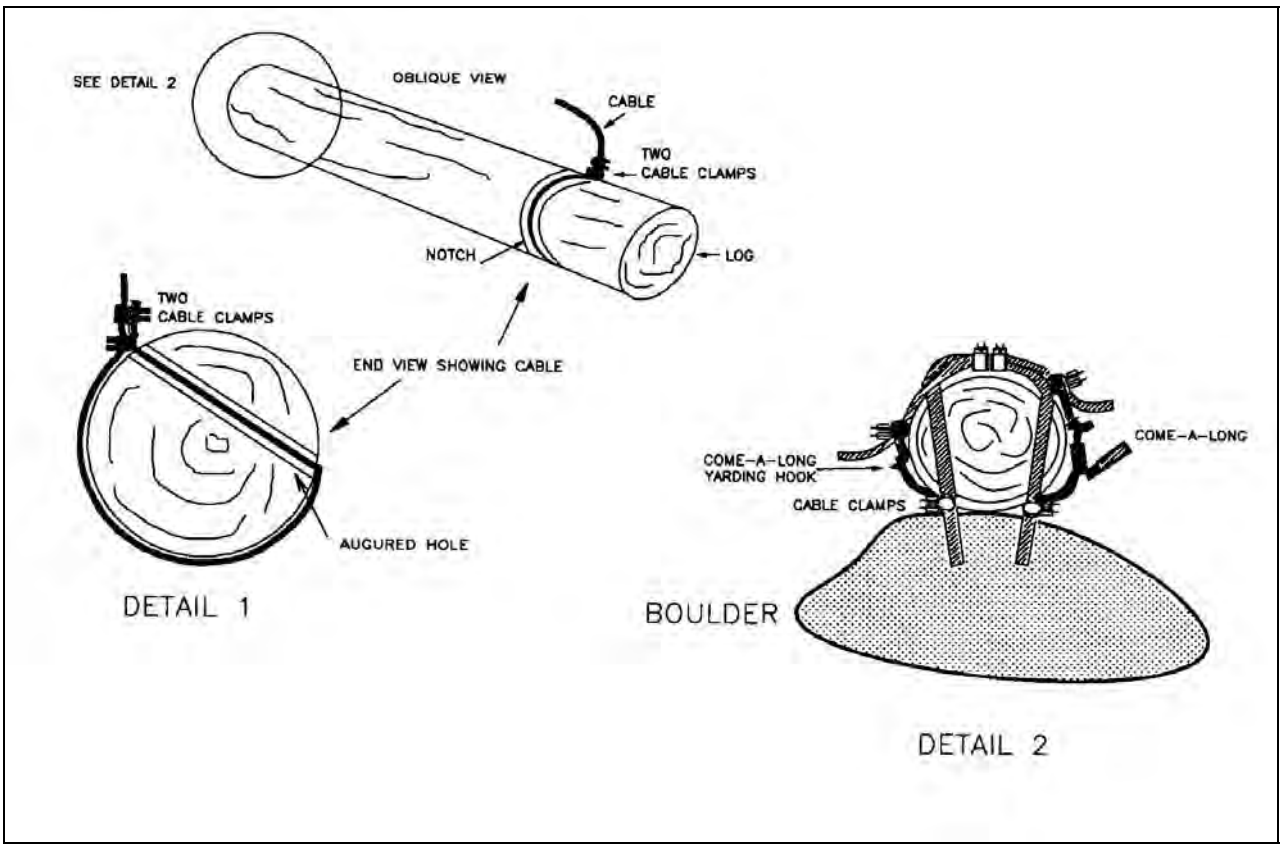


Figure VII-4. Cabling to log.

Cabling Logs and/or Root Wads to Boulders or Bedrock

Logs or root wads to be secured instream must be anchored tightly so they do not float or move. A procedure has been developed called the "two-cable method" for anchoring logs to boulders or bedrock. Two griphoists are used to pull the cables tight using this method. Commercially available cable grips, or a special tool called a cable-hook clamp can be used to facilitate tightening of cables with a griphoist.

To construct a cable-hook clamp, saw off the eye of a slip hook and weld it to a cable clamp base. Use a cable clamp one size smaller than the cable to be used (example 1/2-inch cable clamp for 5/8-inch cable). It may also be necessary to use welding rod to build up mounds in the cable cradle to aid in holding the cable ends (Figure VII-5).

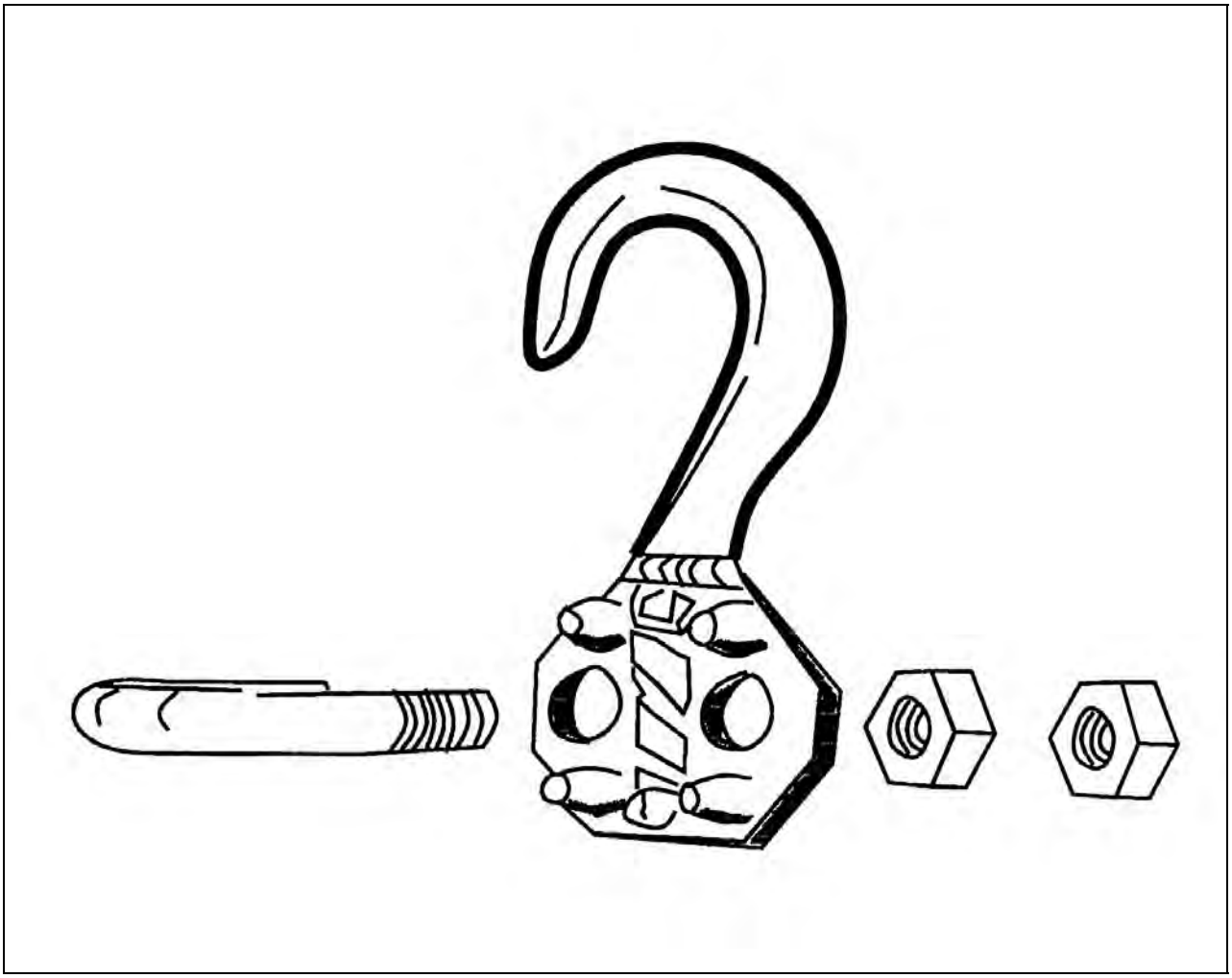


Figure VII-5. Cable hook clamp.

To cable a log to a boulder or bedrock using the two-cable method, drill two holes to a minimum depth of 10 inches. The angle of the holes should match the direction the cable will be pulled to prevent excessive bending at the rock face. The layout of the griphoist anchors must be arranged to set up opposing pulls in alignment with the log structure to be secured. Follow directions for use of the cable and polyester resin adhesive. Allow the adhesive to set up overnight. Drill holes for the cable through the log. Using the hook clamps, attach cable ends to the griphoist (Figure VII-6). Loosely attach a minimum of two cable clamps to the cables before tightening the cables with the griphoist. Pull both cable ends with the griphoist, avoiding binding as the cables move past each other. When cables are at maximum tension, tighten the cable clamps. Remove griphoists. Check cable tension. If cables are not tight, loosen the cable clamps and repeat the process. Secure the loose cable ends to the log with staples (Figure VII-7). Two variations of the two-cable method are shown in (Figures VII-8 and VII-9).

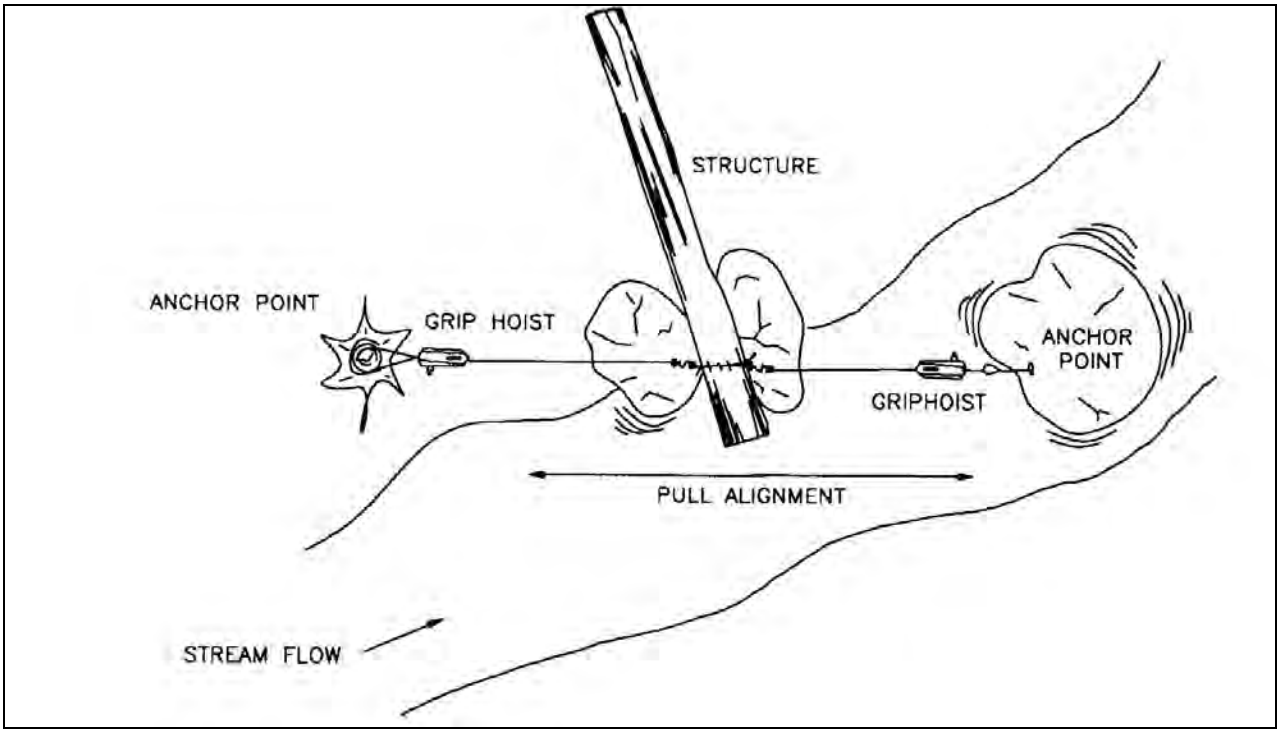


Figure VII-6. Tightening cable ends using two griphoists.

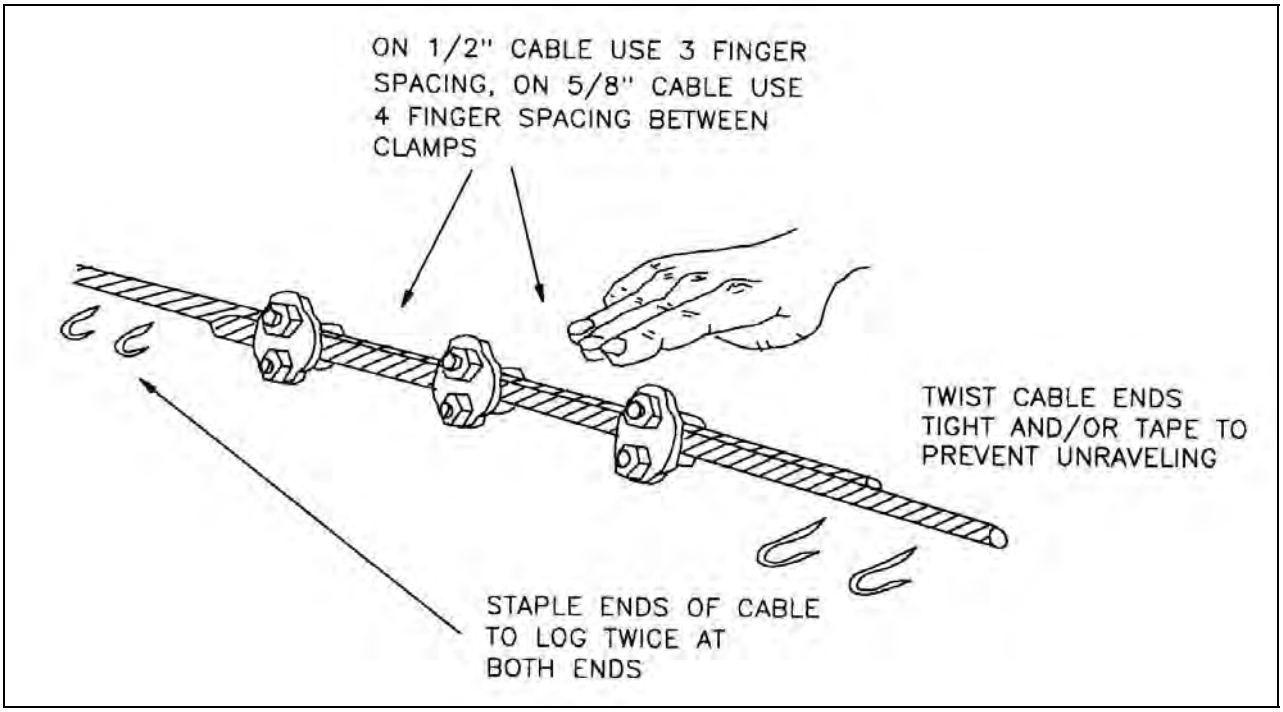


Figure VII-7. Attach cable clamps to cables.

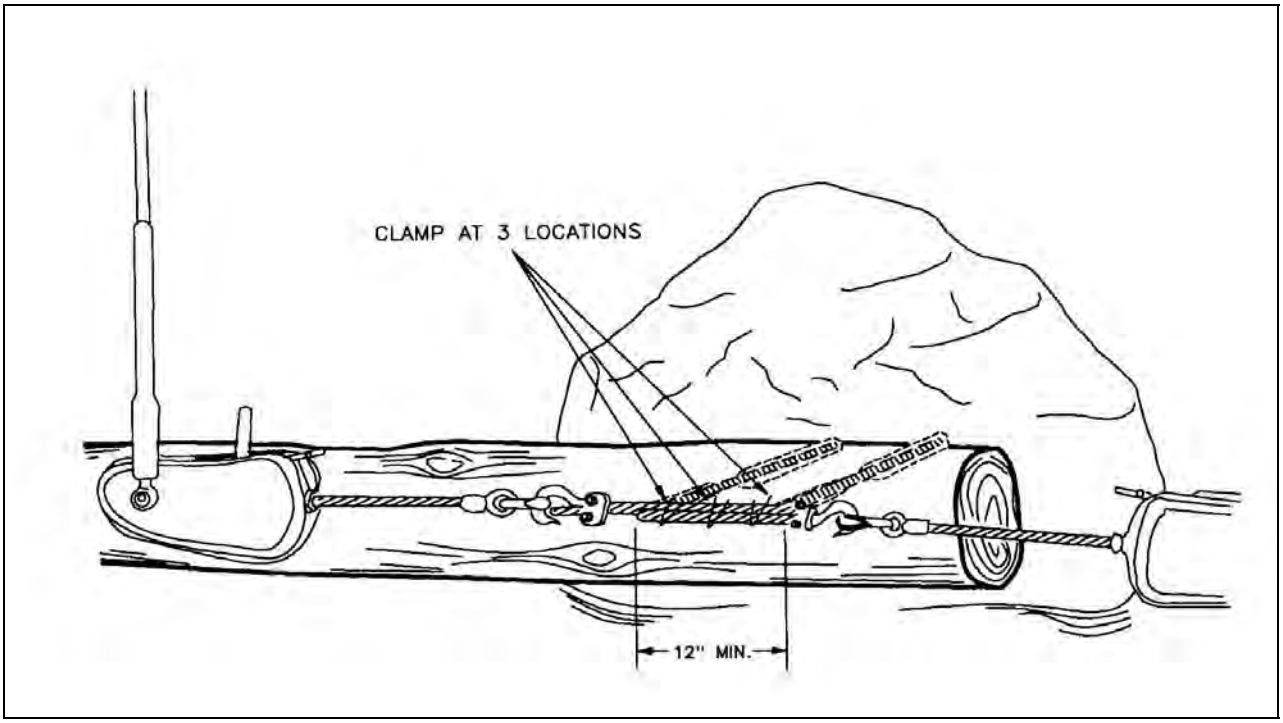


Figure VII-8. A variation of the two-cable method.

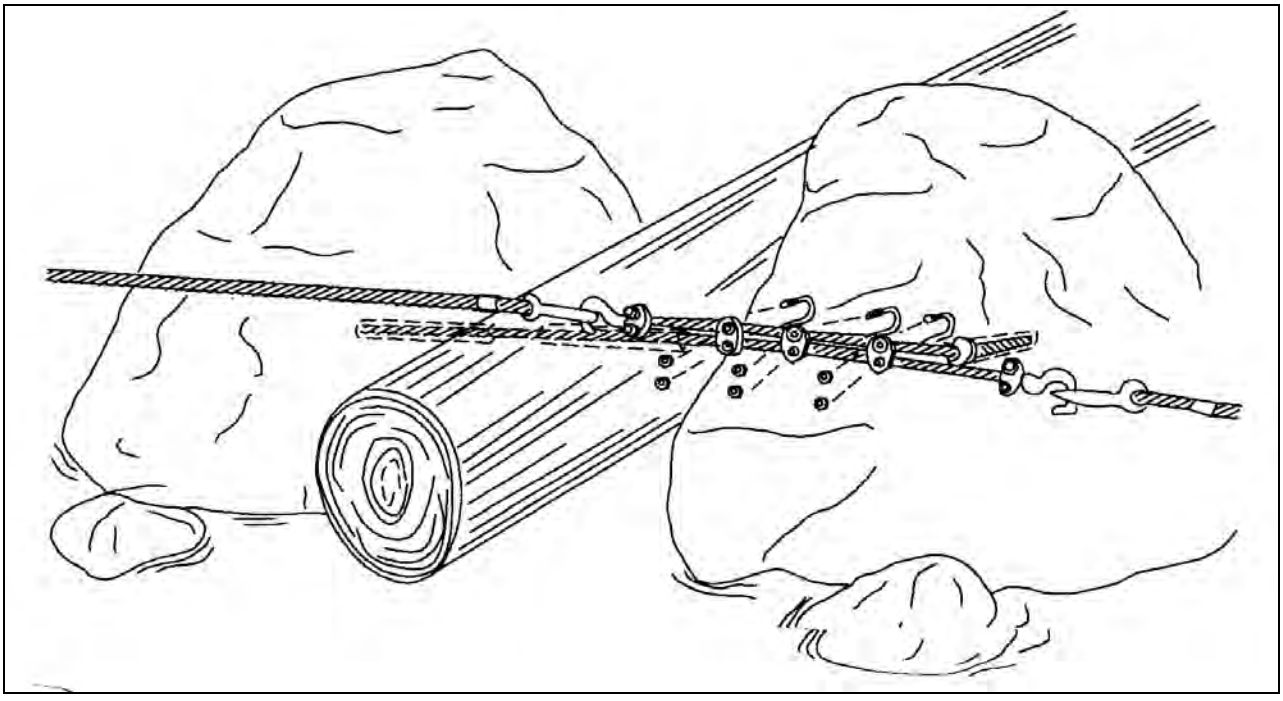


Figure VII-9. A variation of the two-cable method.

Log Pinning With Rebar

In addition to being a component of reinforced concrete, rebar can also be used in anchoring applications. To pin logs together with threaded rebar, an aligned hole is augered through both logs. A length of threaded rebar is inserted through the holes, a steel-plate washer and nut are then placed on both ends of the rebar and tightened to secure the logs. Before driving in threaded rebar, a nut must be threaded on the impact end of the rebar to protect the threads from being damaged (Figure VII-10). After the nut has been tightened, the end of the threaded rebar must be mushroomed to prevent the nuts from backing off. Minimum recommended size of threaded rebar is one-inch. The minimum size steel-plate washer recommended is three-inches square, by one-quarter inch thick.

If standard non-threaded rebar is used, a pilot hole slightly smaller than the diameter of the rebar should be drilled through the log(s). The rebar is then driven in far as possible using a metal fence post driver, then a sledge hammer is used to drive it the rest of the way. It is important to bend over the ends on the rebar at least at a right angle so logs will not lift off.

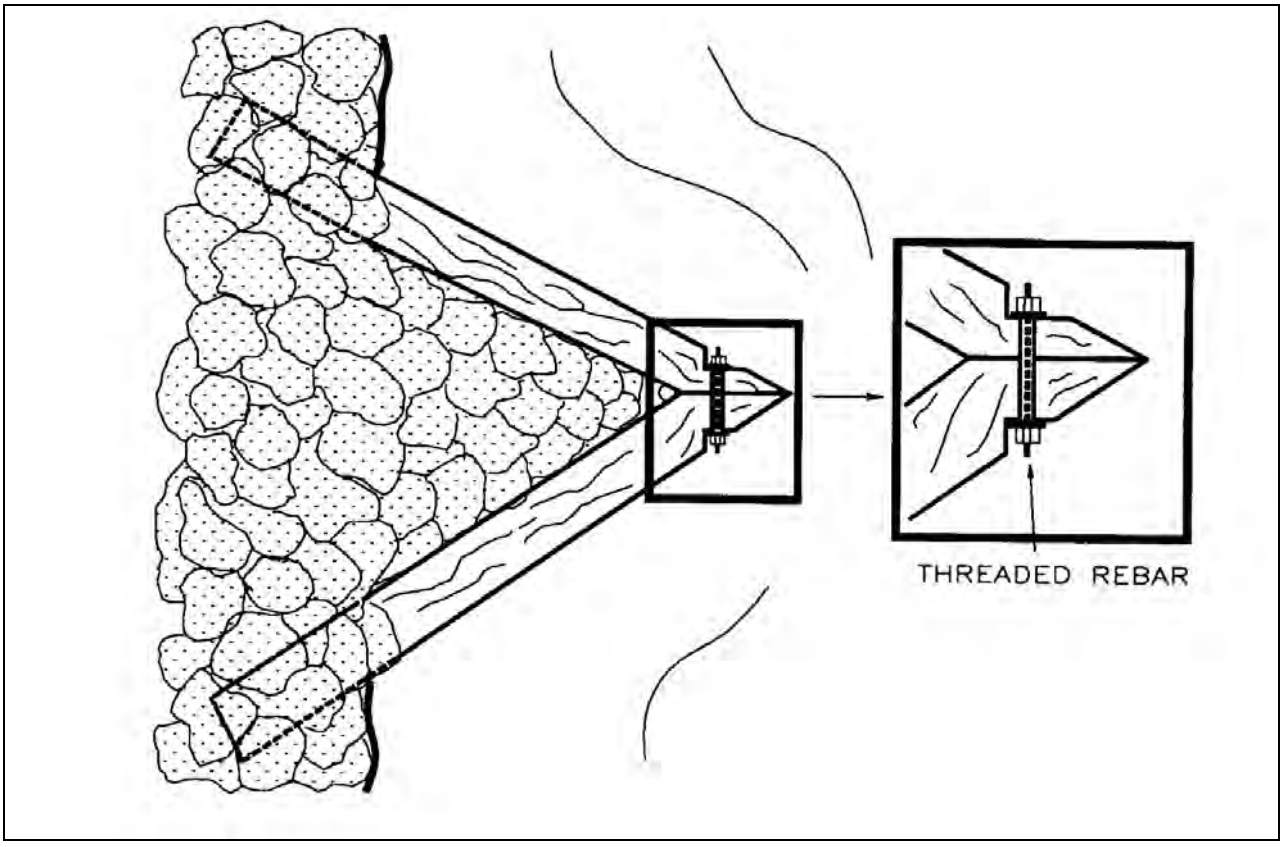


Figure VII-10. Threaded rebar used to secure two logs together.

Stream Bank Anchors Using Rebar

Steel rebar can be driven into the stream bank to hold log structures in place. This technique is only to be used in conjunction with additional anchoring techniques such as a deadman, cable secured with polyester resin adhesive to a boulder or bedrock, or with threaded rebar to a stable or embedded log (Figure VII-11). Logs are very buoyant and will float away if not securely anchored.

A post driver or sledge hammer are best suited to driving rebar. Rebar anchors must be at least 10 feet in length, to ensure that they are not uncovered by high stream flows. The rebar can be trimmed to create a point. The pointed end will help penetrate hard ground or buried woody debris. If scour is expected at the end of a structure, the ends should be anchored by other means.

Often, rebar cannot be driven into a heavily armored stream bank. It frequently bends at cobble and boulder obstructions, or reaches impenetrable bedrock. However, an increased number of rebar anchors may be able to compensate for shallow penetration.

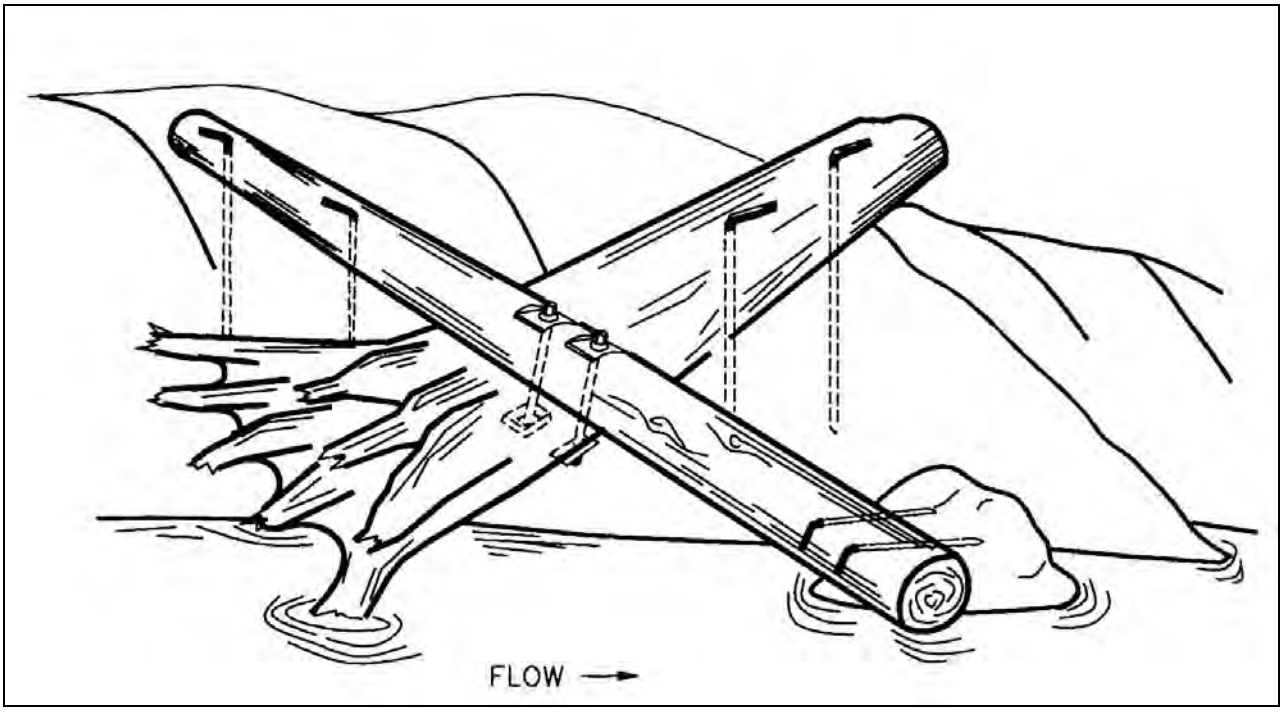


Figure VII-11. Rebar anchoring application.

Bedrock and Boulder Anchors Using Threaded Rebar

Threaded rebar can be secured to bedrock using polyester resin adhesive (Figure VII-12). Hole depth must be sufficient to reach competent, un-fractured rock in order to obtain maximum bonding strength. A minimum of 10 inches is recommended. Setting rebar into fractured rock or into a hole that has not been cleansed of rock dust may not produce a reliable bond.

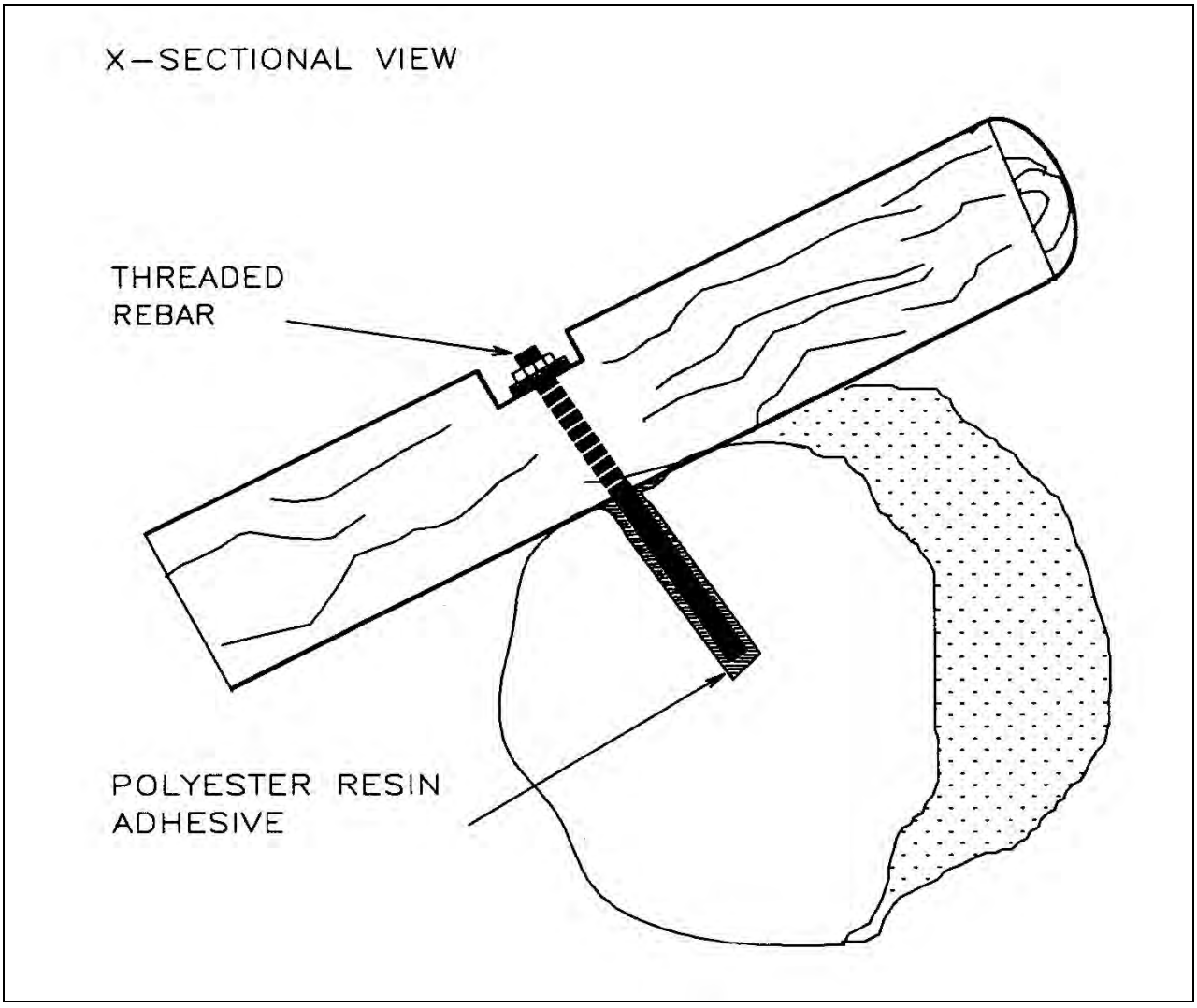


Figure VII-12. Threaded rebar anchoring log to boulder, using polyester resin adhesive.

Threaded Rebar and Cable Anchor to Boulder or Bedrock

North Coast Fisheries has developed an anchoring technique using threaded rebar, cable and polyester resin adhesive to secure logs or root wads to boulder or bedrock. The log is moved into position. Holes are drilled into the boulder or bedrock after the log is in-place. The cable is secured to the bedrock or boulder using polyester resin adhesive. The adhesive is allowed to cure overnight. A hole is drilled through the log in line with the cables. The bark and cambium layer of the log are removed so the plate will fit against the heartwood of the log. Threaded rebar is driven through the hole leaving three to four inches of rebar sticking out on each side. A loop is formed on the end of the cable using two cable clamps. The loop is tightly threaded over the rebar leaving as little slack as possible. The cable clamps used to form the loop in the cable are tightened down. The metal plate and nut are threaded on the rebar and tightened down (Figure VII-13).

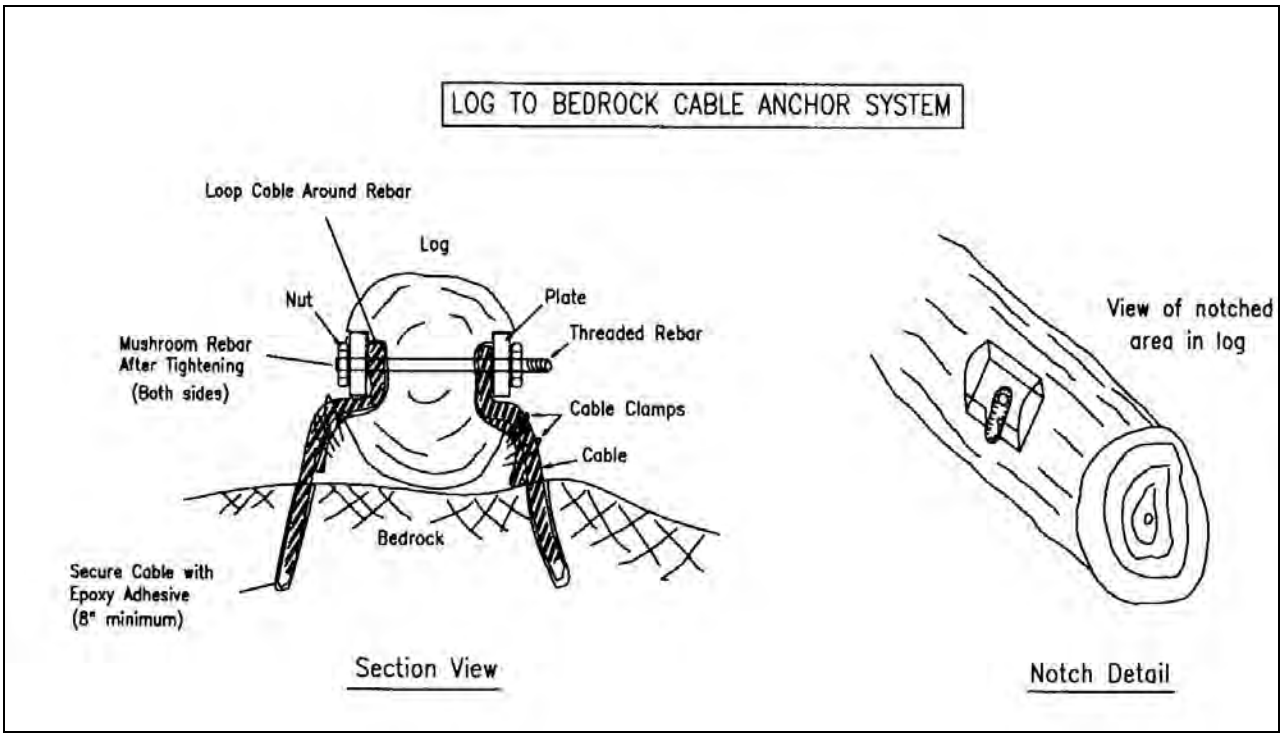


Figure VII-13. Threaded rebar and cable anchor to boulder or bedrock.

Expansion Bolts

Steel expansion bolts provide a means for establishing an anchor point in concrete. This method is commonly used when anchoring steel Washington baffles in concrete box culverts. There are a wide variety of commercially available anchors suitable for fish habitat construction purposes. Typically, a series of ridges on drop-in anchors are embedded in the sides of a drilled hole as the anchor is expanded by insertion of a threaded bolt; or a clip is expanded and wedged into the sides of a hole when a nut is tightened to compress it against the opposite end of the bolt (Figure VII-14).

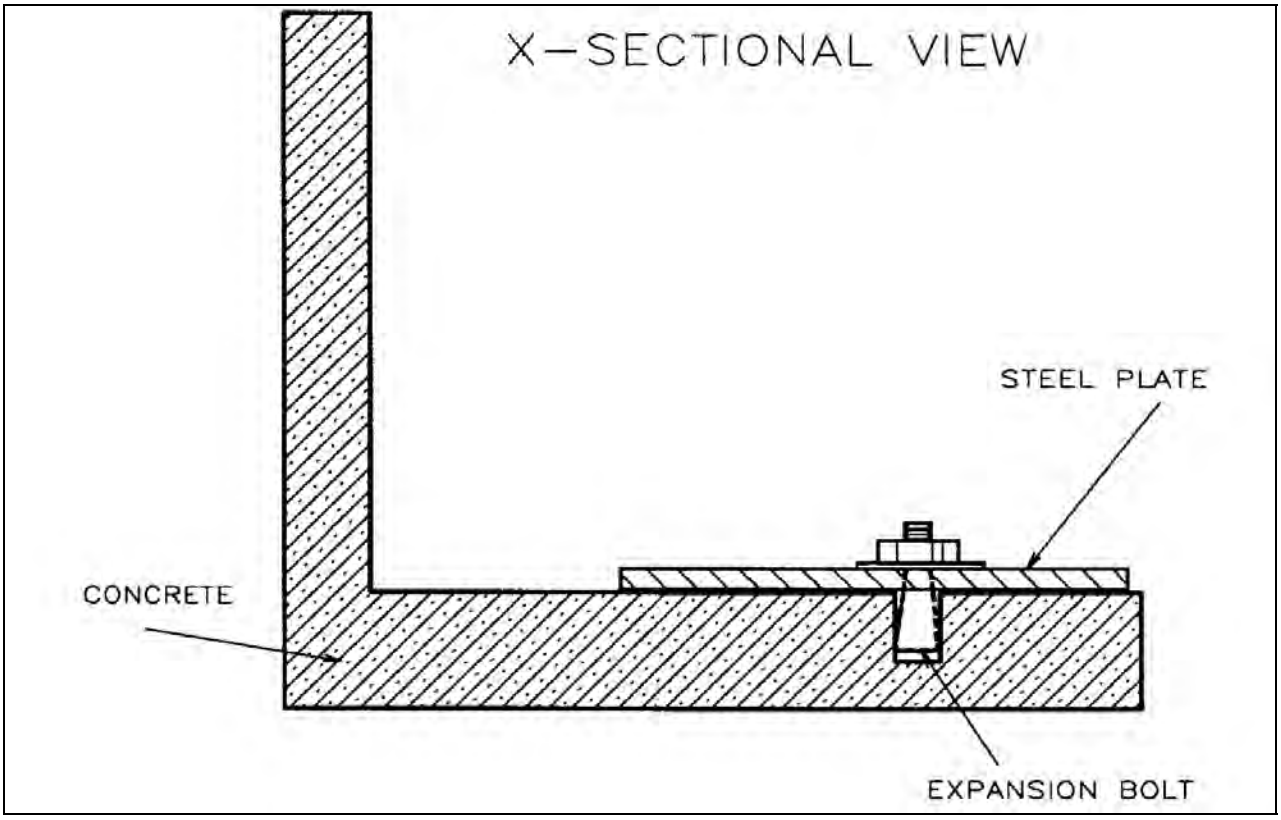


Figure VII-14. Expansion bolt into concrete.

Trenching

Trenching is an anchoring technique that is used to "key-in" or recess structures. Recessing a log or boulder into trenches excavated in the substrate or the bank reduces the chances of high stream flows undermining the structure or cutting around the structure's ends. Trenching stream banks to key in structures can only be accomplished where suitable, stable banks are present. Trenching can be performed either with heavy equipment or by hand (Figure VII-15).

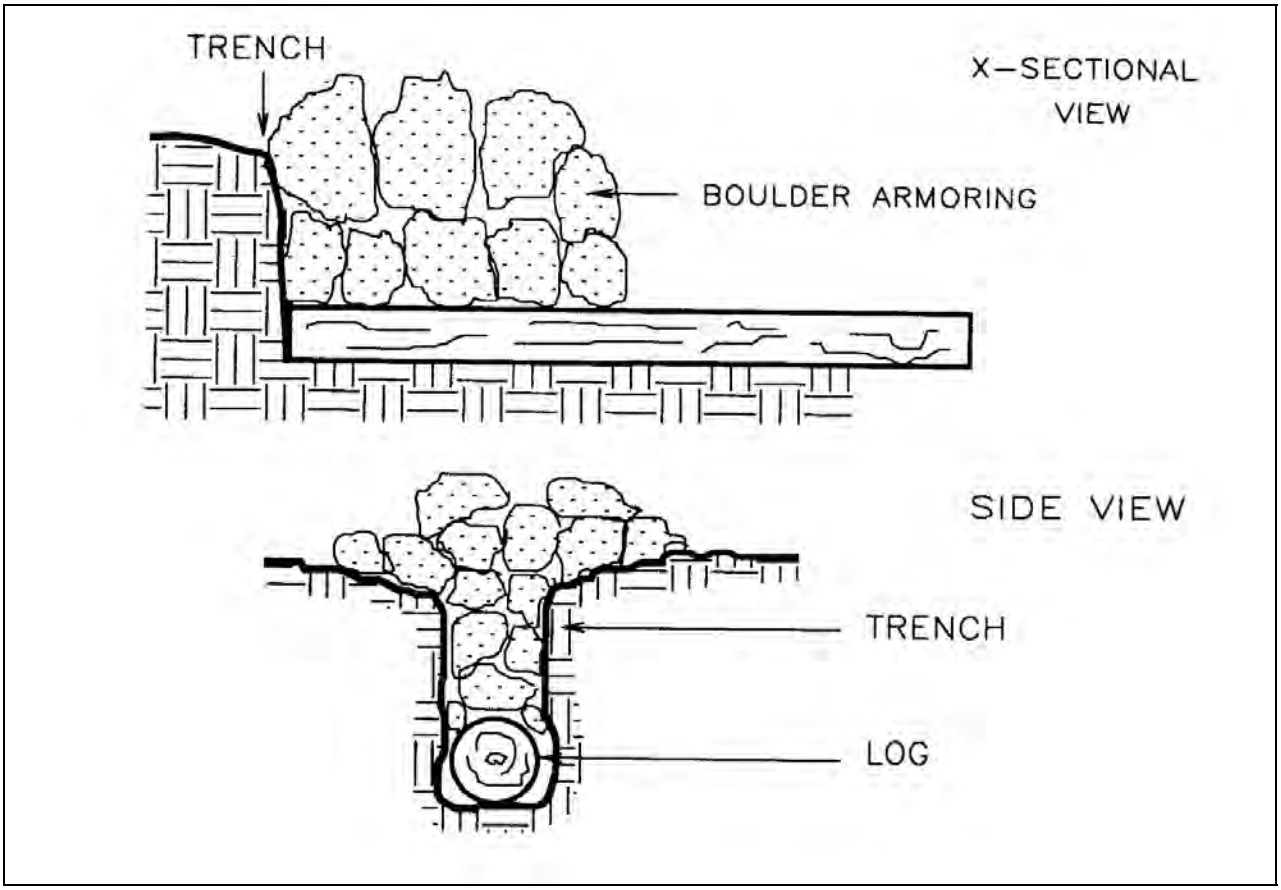


Figure VII-15. Trenching.

Deadman

Where no natural anchors, such as trees, stumps, or boulders are present, an anchor point must be constructed. This is possible using a "deadman". A log, boulder, gabion, or other structurally sound object can serve as a deadman. The deadman is buried in the stream bank, and becomes a stable substrate fixture.

The deadman must be buried at least 3-feet deep on the stream bank above bankfull flow. The deadman, with several attached anchoring cables, is placed in the pit. The cables extending from the deadman are placed in narrow trenches dug down to the instream structure. After attaching the cables to the habitat structure, the cables are tightened, and the pit and trenches are back-filled and compacted (Figure VII-16).

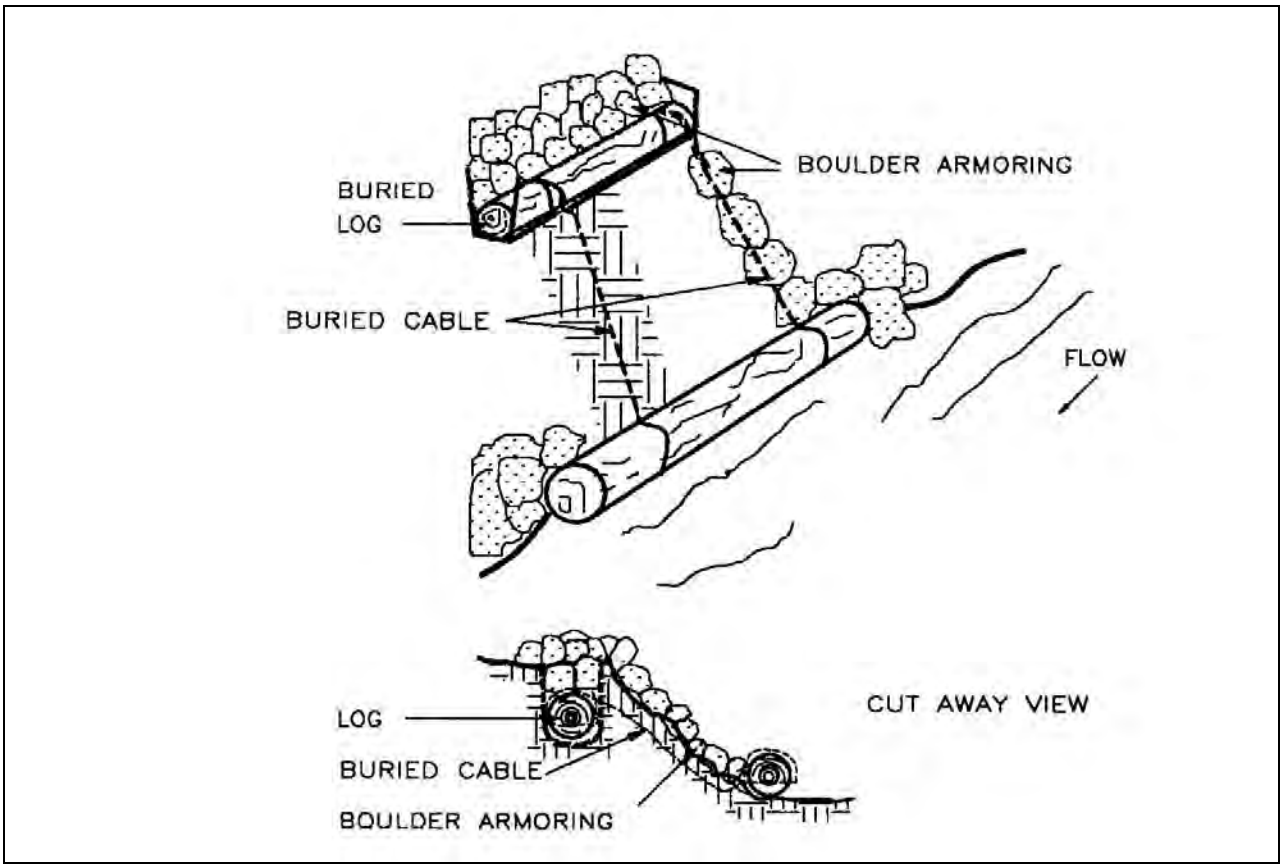


Figure VII-16. Deadman.

Unanchored Large Woody Debris

Most instream habitat enhancement structures require some type of anchoring technique to ensure they will remain in place during high flow events and to prevent high flows from altering their configuration and intended function. However, in particular cases the addition of unanchored large woody material may be beneficially used to enhance some streams and stream reaches. In small streams, large woody debris (LWD) is often the structural agent in pool formation or a key element associated with the habitat quality of a pool. The effect LWD has on channel morphology is influenced by its size, orientation, spacing, and association with other structural elements as well as a number of other variables including stream-flow energy, sinuosity, substrate, bank composition, and channel width. First through third order streams are generally best suited for unanchored LWD placement projects. Where appropriate, the placement of unanchored LWD requires no maintenance and are free to adjust naturally to the stream=s hydraulic regime.

In unanchored applications, logs selected for placement should have a minimum diameter of twelve inches and a minimum length 1.5 times the mean bankfull width of the stream channel type reach and the deployment site. A root wad should be selected with care and have a minimum root bole diameter of five feet and a minimum length of fifteen feet and at least half the channel type bankfull width. Regardless, a DFG Fish Habitat Specialist must be consulted prior to initiating these projects and obtaining necessary DFG permits.

INSTREAM HABITAT IMPROVEMENTS

There are three general categories of the most commonly used instream structures: 1) cover structures; 2) boulder structures; and 3) log structures. Often a single structure or combination of structures will provide for rearing, spawning, and cover. It is important that instream structures be monitored after high flows have occurred to determine if the desired habitat condition has been met (Part VIII, Project Monitoring and Evaluation). Often, maintenance or modification is needed to make the structure perform properly.

Cover Structures

Quality of a pool can be increased by adding cover structures. Amount of effective cover and the complexity of habitat is at least as important as the physical amount of pool created. Strategically placed cover can help keep pools scoured, while improperly placed cover will cause deposition of sediment.

A study on the effectiveness of placing tree bundles of fir, alder, maple, and myrtlewood was conducted on five different Oregon streams. Juvenile coho and steelhead populations were sampled in 16 pools before and after tree bundles were added. Before the tree bundles were added the pools sampled were holding 12 percent of their summer coho population during the winter. The following year, after tree bundles were added, these same pools contained 74 percent of their summer coho population during the winter sampling. The sampling showed an increase in steelhead populations between the summer and winter populations, the winter after tree bundles were added.

Riparian vegetation is a highly important source of cover. Overhanging vegetation or undercut banks, along with the associated roots, provide excellent, effective cover.

Logs, root wads, tree bundles, and boulders are the primary cover elements added to pools. Some guidelines concerning construction and installation of cover structures in a stream are:

- Cover should be incorporated with other stream enhancement structures such as log and boulder weirs, boulder clusters, and single and opposing wing-deflectors.
- Cover structures are often placed in pools, backwater areas, or along meanders to provide protection.
- Logs, tree bundles, or root wads can be cabled against the banks. Secure logs or root wads to a stump, a live tree, a bedrock outcropping, large boulders, or use a deadman. Cover can also be cabled to instream boulders using polyester resin adhesive.
- Cable all log and root wad cover structures tightly.
- Protect the upstream end of logs from direct flow of the stream.

Examples of cover structures are divide logs; digger logs; spider logs; and log, root wad and boulder combinations.

Divide Logs

Divide logs are installed mid-channel in spawning riffles to provide a visual barrier between adjacent spawning areas. This can increase spawner use of a riffle area and provide escape cover (Figure VII-17).

Divide logs require suitable substrate for anchoring. Such substrate consists of boulders or bedrock. Length and diameter of the log used will be dictated by length of the spawning channel and depth of flow. In general, divide logs should be 18 to 36 inches in diameter.

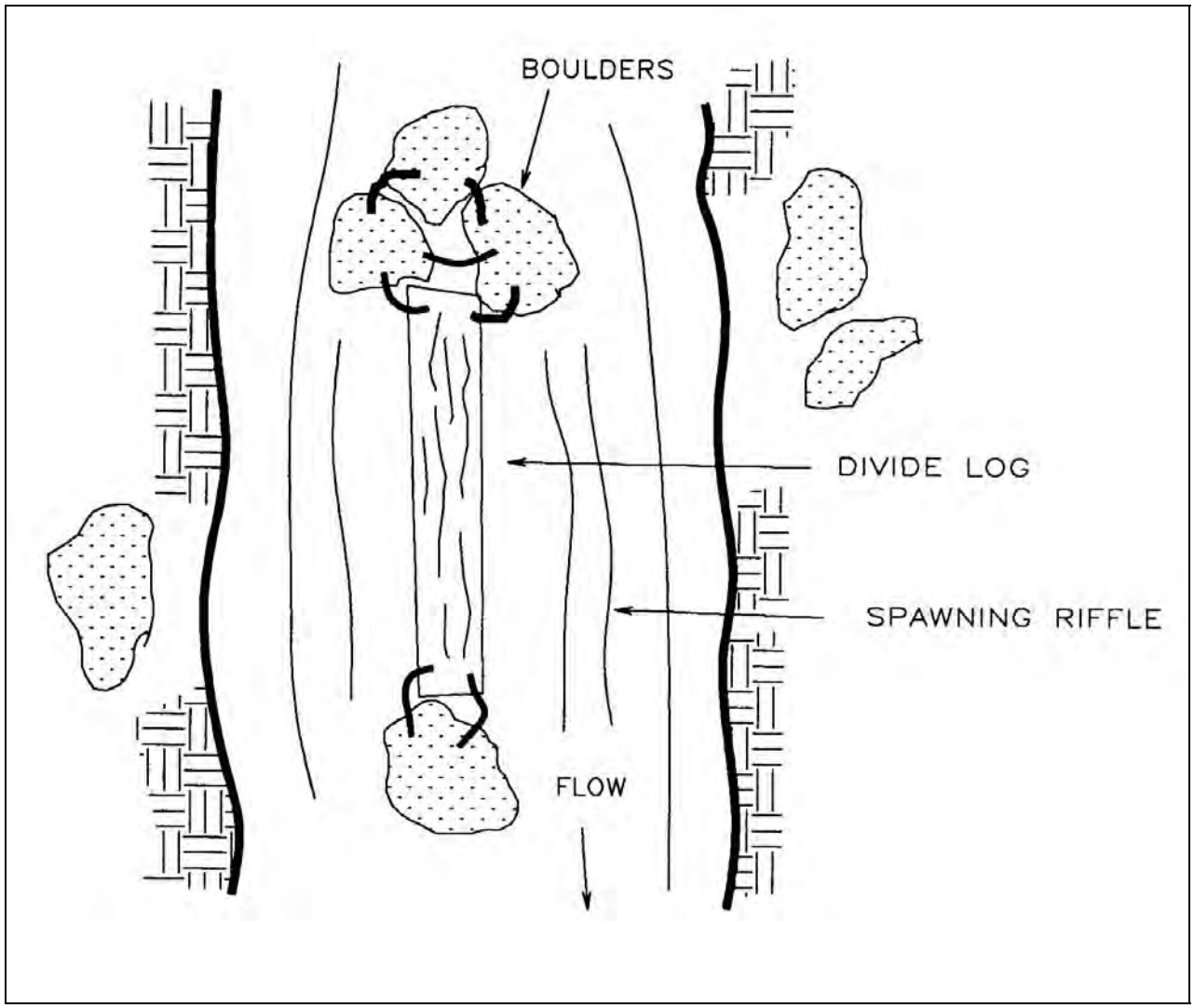


Figure VII-17. Divide log.

Digger Logs

Digger logs are placed with one end anchored securely on the bank and the other end plunging into the bottom of a pool. Primary use of digger logs is to enhance pool habitat by creating diverse cover for rearing juveniles as well as for migrating adults. They are also used to scour the channel, creating or expanding pool habitat. Logs with root wads intact should have the root wad end extending down into the pool to offer the most complexity for increasing rearing habitat and maximizing scour (Figure VII-18). Digger logs will be most secure when two-thirds of the log is on the bank and one-third of the log extends into the channel.

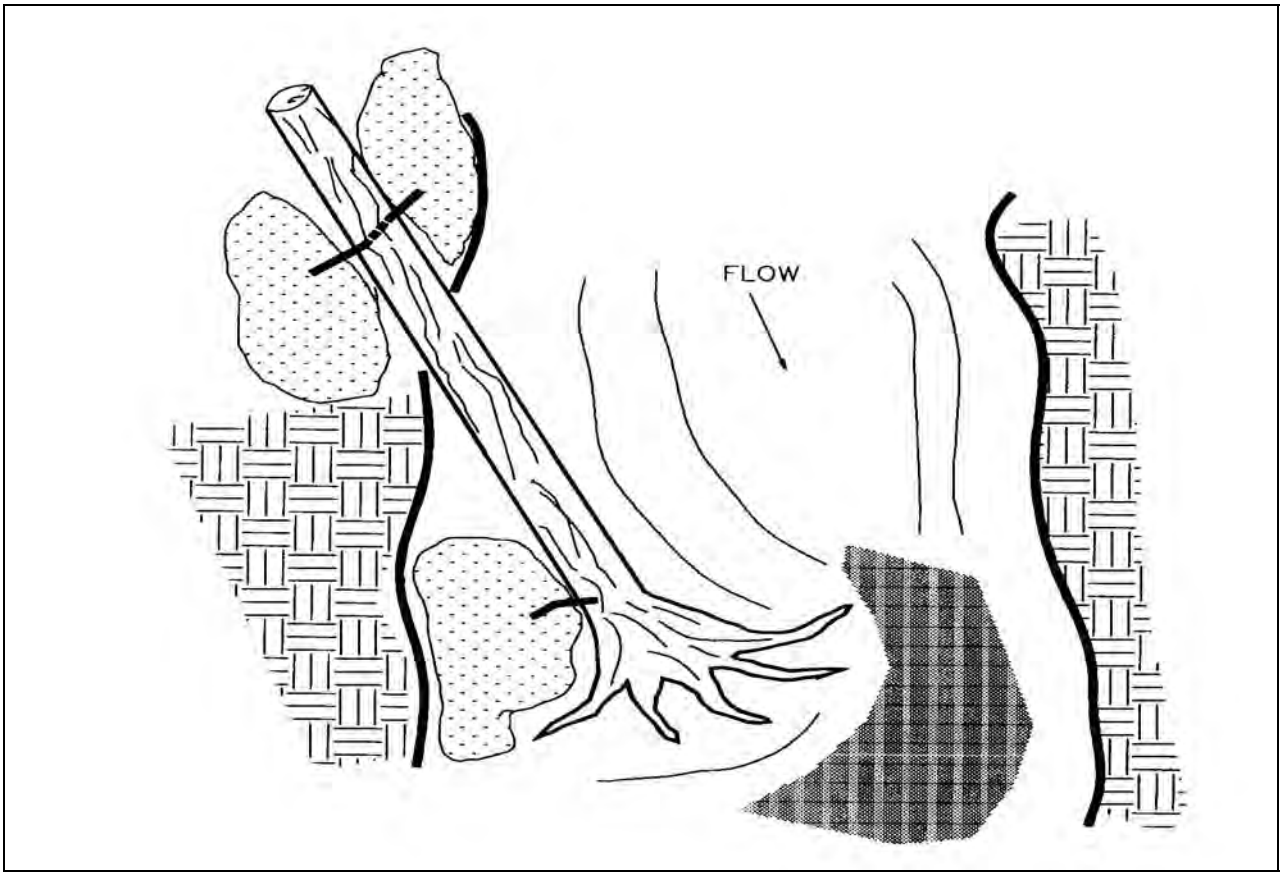


Figure VII-18. Digger log.

Digger logs are usually secured to bedrock and held in place using cable and polyester resin adhesive, or secured to live trees or downed wood with threaded rebar. The log must be anchored in at least two places, with anchors spaced as far apart on the log as possible to keep it secure during high flows. Digger logs can be set in a trench dug into the stream bank. At least one-third of the length of the log should be placed in the bank. This buried end of the log should be covered with boulders to anchor the structure. If the digger log is to successfully create scour, it is important that the end of the log in the water does not float during high flows. Digger logs will usually be positioned to point downstream, although there may be some situations where pointing them upstream would be appropriate (where the intention of the log placement is to create scour). The vertical angle of the log should usually be 30 to 45 degrees to the bank.

Spider Logs

Spider logs, also called mini log jams, are several logs placed at angles to mimic a log or debris jam. They provide cover for juvenile rearing and adult spawning and collect woody debris to increase diversity. Their use is restricted to areas where there is no danger of causing bank failure or channel migration. Pools and backwater eddy areas on the stream channel margins are the best locations for these structures (Figure VII-19).

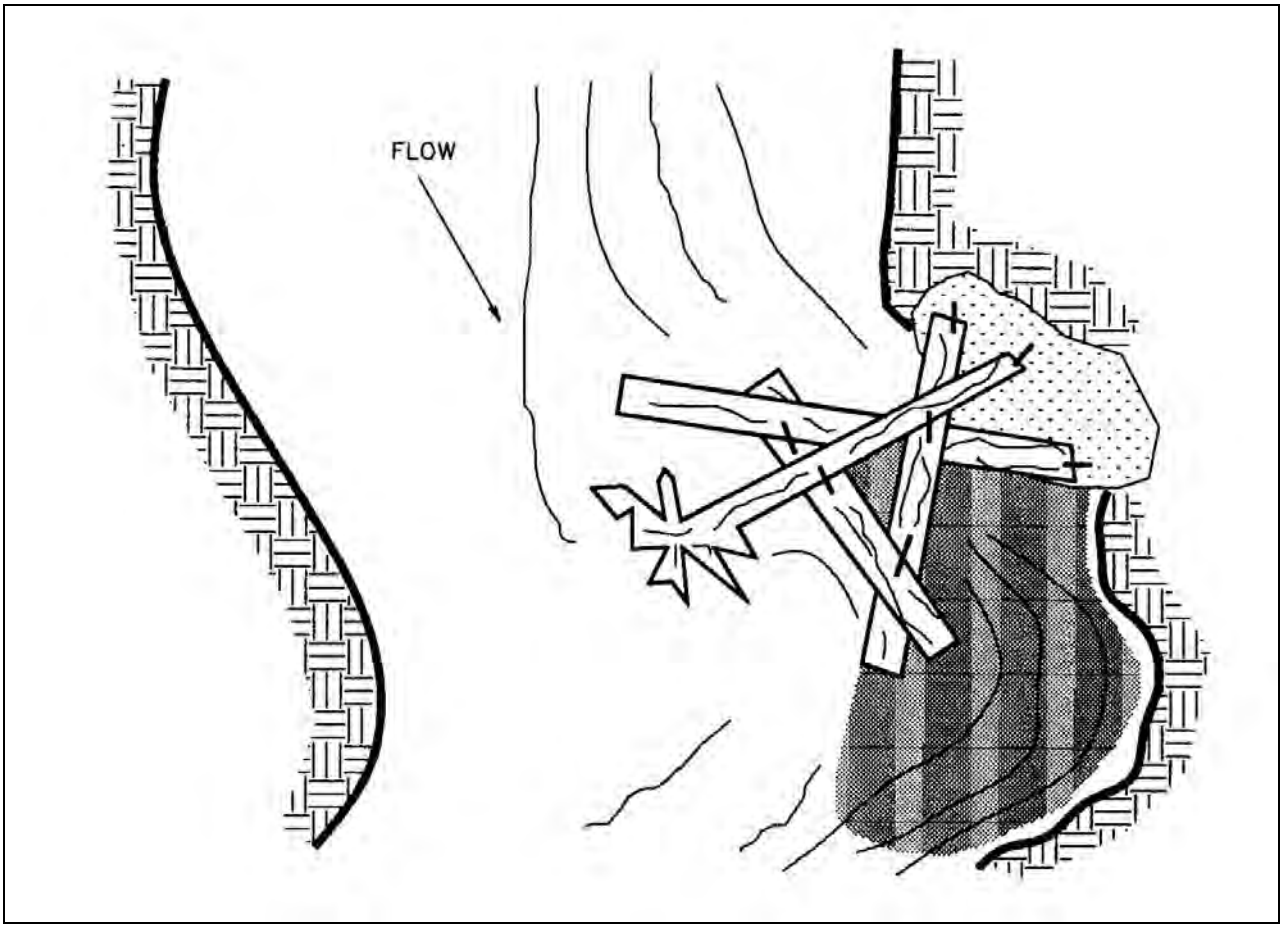


Figure VII-19. Spider logs.

The structures are composed of several logs placed across each other, in the shape of a triangle, to imitate a natural debris or log jam. Each of the logs must be secured to bedrock or large boulders in the channel with cable and polyester resin adhesive, or to live trees with threaded rebar. The logs are secured together with threaded rebar. Several other logs with branches and root wads attached are then fastened to these structure logs with cable or threaded rebar.

Caution must be used in locating these structures as the potential for an adverse effect is great. Before placing spider logs it is necessary to determine channel capacity and bankfull discharge that can be expected. Log structures should not reduce channel capacity below flood stage needs or a massive log jam and sediment trap could develop.

Log, Root Wad, and Boulder Combinations

Log, root wad, and boulder combinations combine the two main forms of structure added to a stream to enhance habitat. The longevity of boulders combined with the cover provided by logs can create habitat that is superior to that offered by either element individually.

Log, root wad, and boulder combinations are used to create cover for juvenile rearing. These structures also act as resting areas and escape cover for spawning salmonids. By creating velocity shear zones they create areas of deposition as well as scour, thereby enhancing spawning through gravel sorting (Figure VII-20).

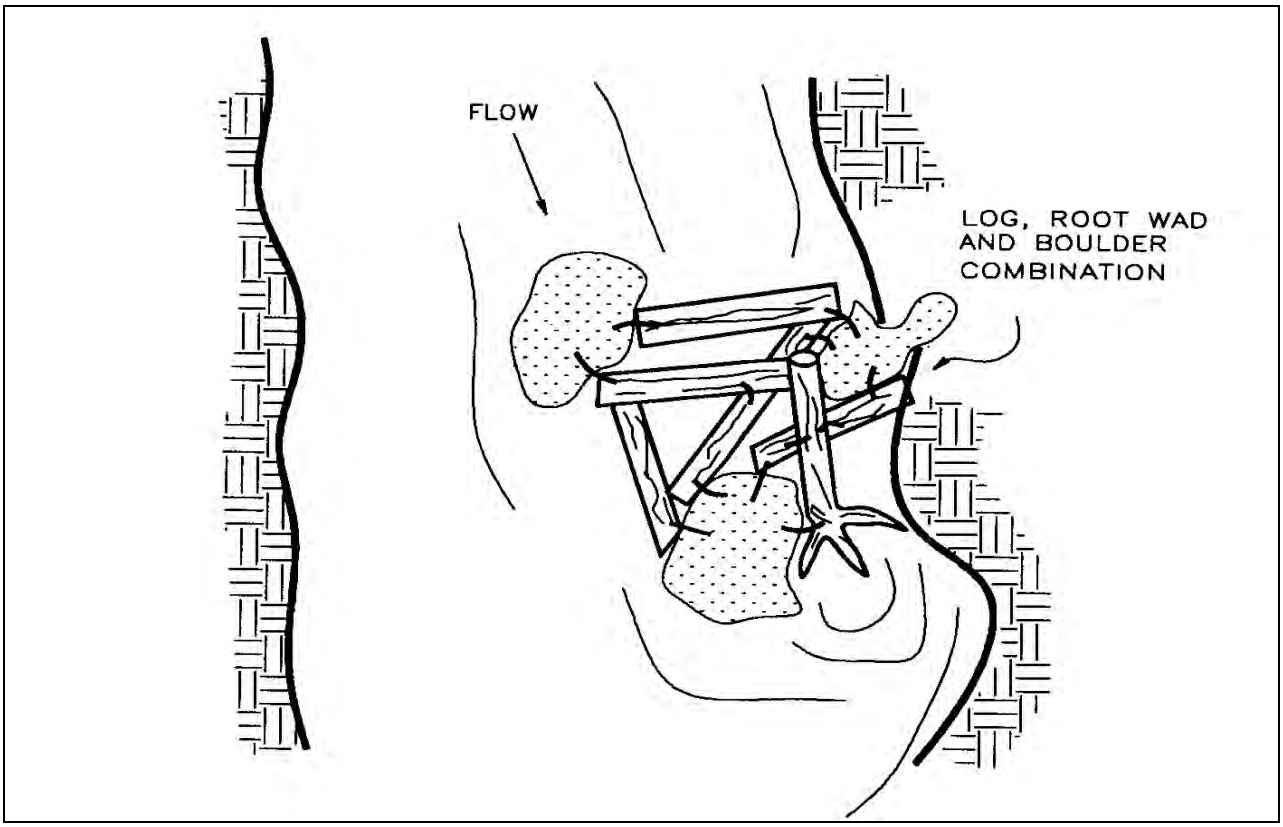


Figure VII-20. Log, root wad, and boulder combination.

Methods used to install log, root wads, boulder combination structures are the same as those used for installing log or boulder structures. The boulders used must be of sufficient size to counteract the buoyancy of the logs. Because of the potential for deflecting high flows into adjacent stream banks, it is important to make sure that banks are resistant to erosion or to take steps to increase their resistance by armoring them with boulders and/or logs.

Boulder Structures

Boulder structures are placed in the active channel and along stream banks for creating a desired habitat type. They are used to break up or diversify stream flow in a particular stream reach, to provide instream cover for juvenile salmonids and spawning adults, or to recruit spawning gravel. It is desirable to create a variety of stream flow velocities, because juvenile salmonids will select different velocities depending on whether they are feeding or resting. Different water velocities will also sort gravel and create diversity in the substrate.

Boulders are well suited for diversifying flows because they are resistant to being displaced by high flows. Because of this they can be placed mid-channel without constructing a full-channel spanning structure. The interstices in boulder clusters and between large boulders can provide escape cover for juvenile and adult salmonids. Boulders must be sized according to stream discharge and channel morphology. Whenever possible, it is best to individually select boulders for use in a project.

There are several disadvantages to using boulders. One is that boulders often must be hauled to the construction site from a quarry. If there is not a quarry nearby, the cost of buying and trucking boulders can be very high. A second problem with using boulders is that if they are placed in mobile substrate, perimeter scour may cause the boulder to bury itself. For this reason, it is necessary to use large boulders, or to secure boulders using polyester resin adhesive and cable to form a larger structure.

Design of boulder structures depends upon the primary function to be served. The range of flows to which a particular structure or series of structures may be subjected will dictate size of boulders to be used, and proper anchoring techniques to be employed.

Boulders can be used in a variety of situations and configurations to perform a desired function or fulfill a particular habitat need. Possible configurations of boulders include weirs, clusters, and single and opposing wing-deflectors.

Boulder Weirs

Boulder weirs are primarily used to collect and retain gravel for spawning habitat, or to create one or more jump pools to facilitate fish passage on marginally accessible or impassable stream reaches. Such fish barriers may be natural or human-induced.

When designing a boulder weir, the following factors must be considered. The boulders used should be larger than boulders occurring naturally in the stream. Large angular boulders are most desirable as they are least likely to roll out of place during high flows. Improper placement of downstream-V and diagonal weirs may direct flow in a manner creating undesirable erosion.

Weirs that span the full channel width can be configured in several shapes including: 1) perpendicular to the flow (if used for back-flooding); 2) diagonal; 3) downstream-oriented "V" (Figure VII-21); and 4) "U"-shaped (if used to improve spawning gravel). General construction principles are the same for all configurations; only one description of construction techniques is presented.

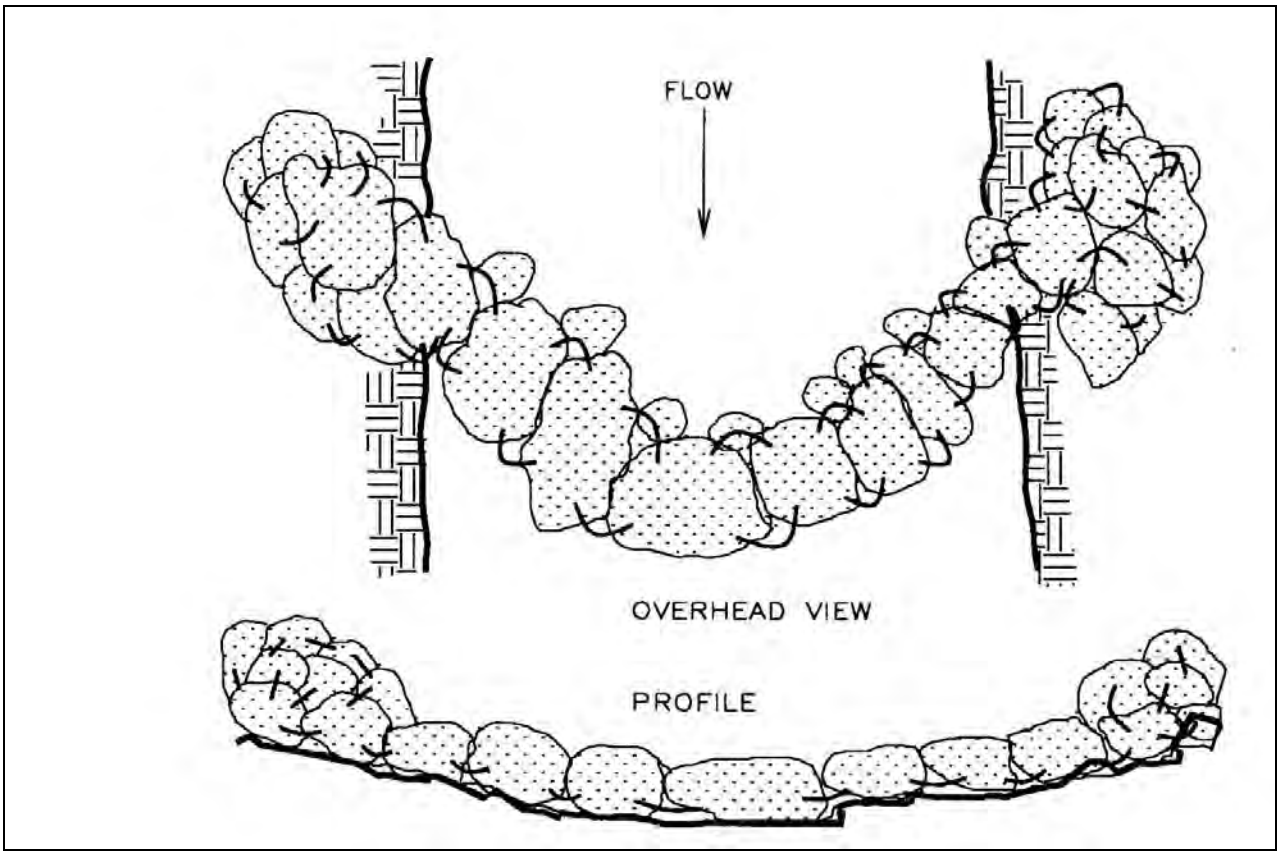


Figure VII-21. Downstream-V boulder weir.

Weirs should be keyed 4 to 6 feet horizontally into stream banks with a gradual downward slope of the weir height toward the thalweg. This slope can be adjusted to position the thalweg. The thalweg will tend to follow the low point in the weir. At the low point of the weir a "spillway" should be constructed by creating an opening one to two feet wide. This creates a notch through which flow is concentrated at low flows. The notch should be roughly triangular in shape with the apex of the triangle oriented down. Flat, broad spillways make fish passage difficult.

The weir should be sealed with smaller rock and cobble to prevent seepage flow and maintain flow over the spillway. This helps to prevent the weir from becoming a low flow barrier to juvenile salmonids.

To assure that the stream is not diverted around the end of the weir during high flows, ends of the weir should be extended to a point above normal high water level. Ends of the weir should be set in a trench dug to a depth of at least one boulder diameter. In bedrock substrate, the boulders on the ends of the weir should be cabled to bedrock. It is important that during high flows the stream does not flow around the end of the weir and cause bank erosion, or establish a new channel.

Quarry boulders will typically be more angular than stream boulders, and depending on the size of the boulders, will be fairly resistant to movement by stream flow. Therefore, they are usually considered to be superior to stream boulders for weir construction. Density of the boulder will also affect its stability in the stream, and how well it stands up to being drilled for cabling. Size of the boulder selected will depend on size available and the magnitude and velocity of stream flow. In general, the bigger the boulder the better. However, the boulder must suit the size of the channel (i.e., a 6-foot diameter boulder would not normally be placed in a 10-foot wide channel, or bank scour is likely).

Oversized boulders are seldom a problem. The opposite is more often the case. If boulders are relatively small and will be subjected to flows of such magnitude that they would not be stable in the stream, they should not be used. Even with suitably sized boulders it is often desirable to secure the boulders together using cable and polyester resin adhesive to create a stable structure. Cabling requires drilling holes into adjacent boulders and securing them with short lengths of cable. It is important that the cables are no longer than the distance between the boulders plus the depth of the holes. Drill the holes in the sides of the boulders (never the top). Any slack or flex in the cable will allow the boulders to move. By cabling adjacent boulders together, a series of boulders effectively creates a single unit which will remain stable during high flows.

Scour created on the downstream side of boulders may create a crater and cause boulders to roll into the scour hole. This is particularly true with stream boulders which tend to be rounded from abrasive action of years of high flows. Cabling boulders together will help reduce the tendency of the boulders to roll. Where possible, boulders should be imbedded into the substrate to a depth one third of their diameter to compensate for their tendency to roll downstream.

A boulder weir can be one or more rows wide. By setting the downstream row or rows of boulders at progressively lower elevations than the one above, a more gradual drop of stream elevation can be created so the energy in the plunge effect of the water flowing over the weir is dispersed over a wider area. Scour will occur slightly farther downstream and won't be as likely to undermine the boulders. Fish passage must be considered when designing weirs with wide crests.

If placed in a series, the appropriate distance between weirs depends on stream gradient and height of the weirs. In general, spacing should be such that water backed up by one weir will not affect the depth of the water in the plunge pool of the upstream weir. It is important to consider leaping abilities of the fish to be benefitted by the project. In general, no jump should be higher than 12 inches.

Vortex Boulder Weir

Vortex boulder weirs were designed by Wildland Hydrology for use in high bedload streams to maintain sediment transport capacity and low width/depth ratios (Figures VII-22, VII-23, and VII-24). These structures are most appropriate in >F= and >B= type channels. Vortex boulder weirs:

1) Provide instream cover and deepen feeding areas in riffle habitats;

2) Provide a wide range of velocities for salmonid holding water at high flow without creating backwater or sediment deposition;

3) Act as a grade control structure without upstream lateral migration, bank erosion or aggradation, characteristic of some log or boulder weir designs;

4) Maintain a low width/depth ratio to reduce sediment deposition and maintain the sediment transport capacity of the channel.

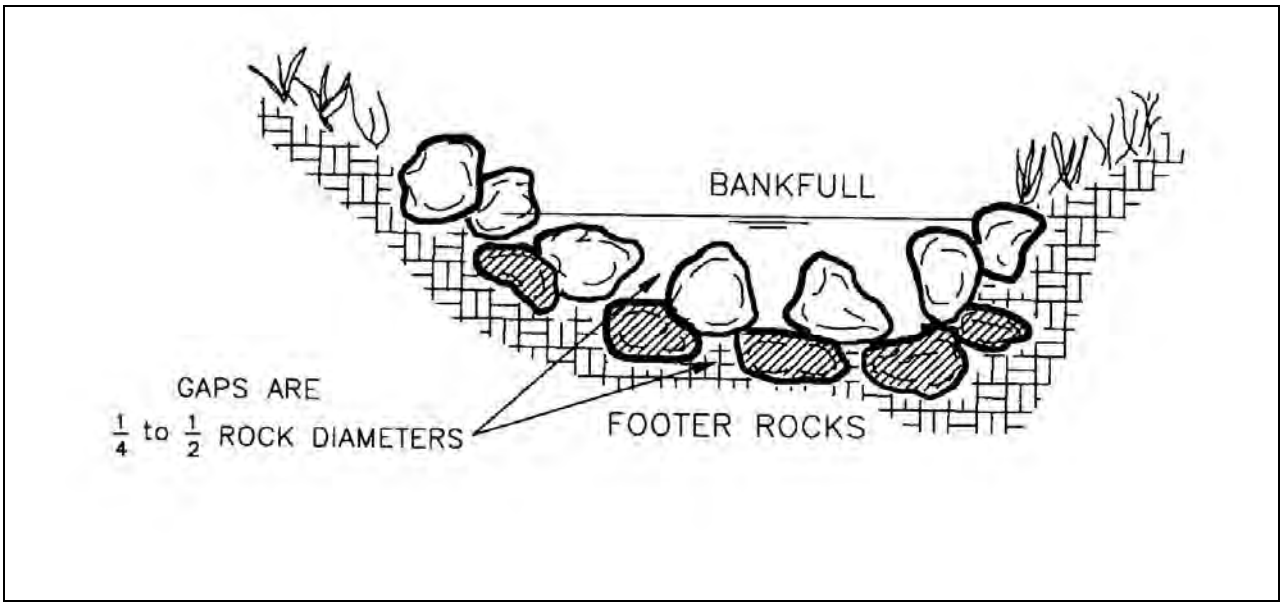


Figure VII-22. Vortex boulder weir, cross section view (Rosgen, 1993).

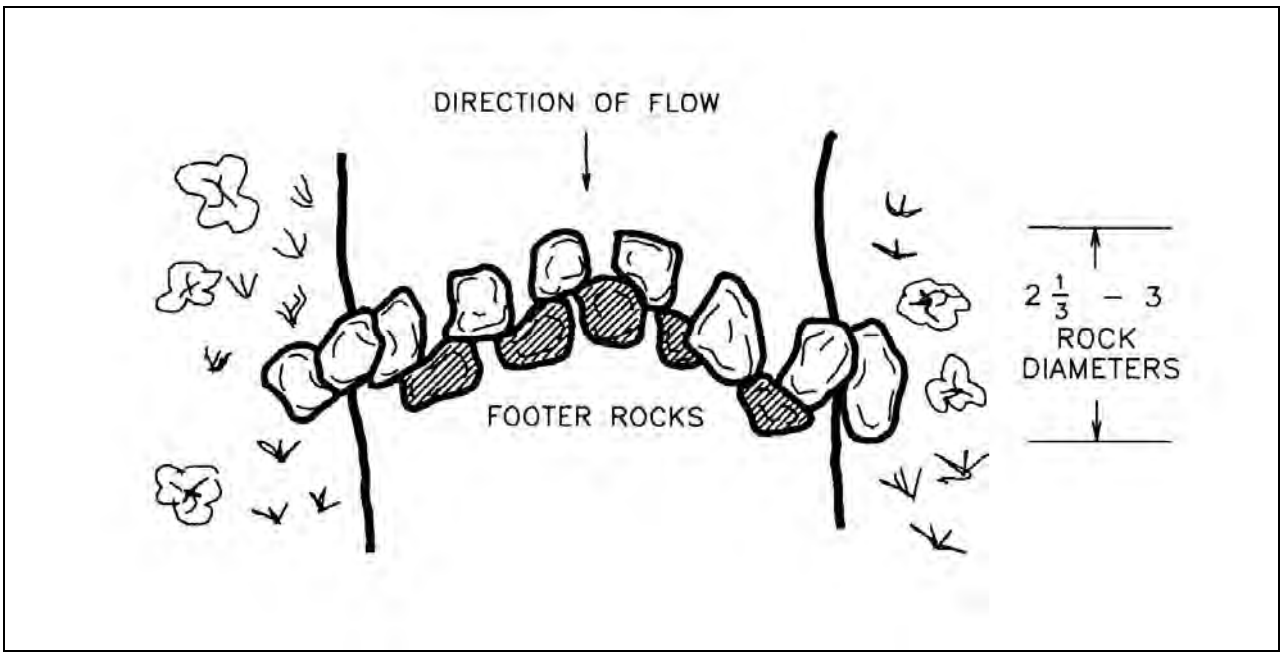


Figure VII-23. Vortex boulder weir, plan view (Rosgen, 1993).

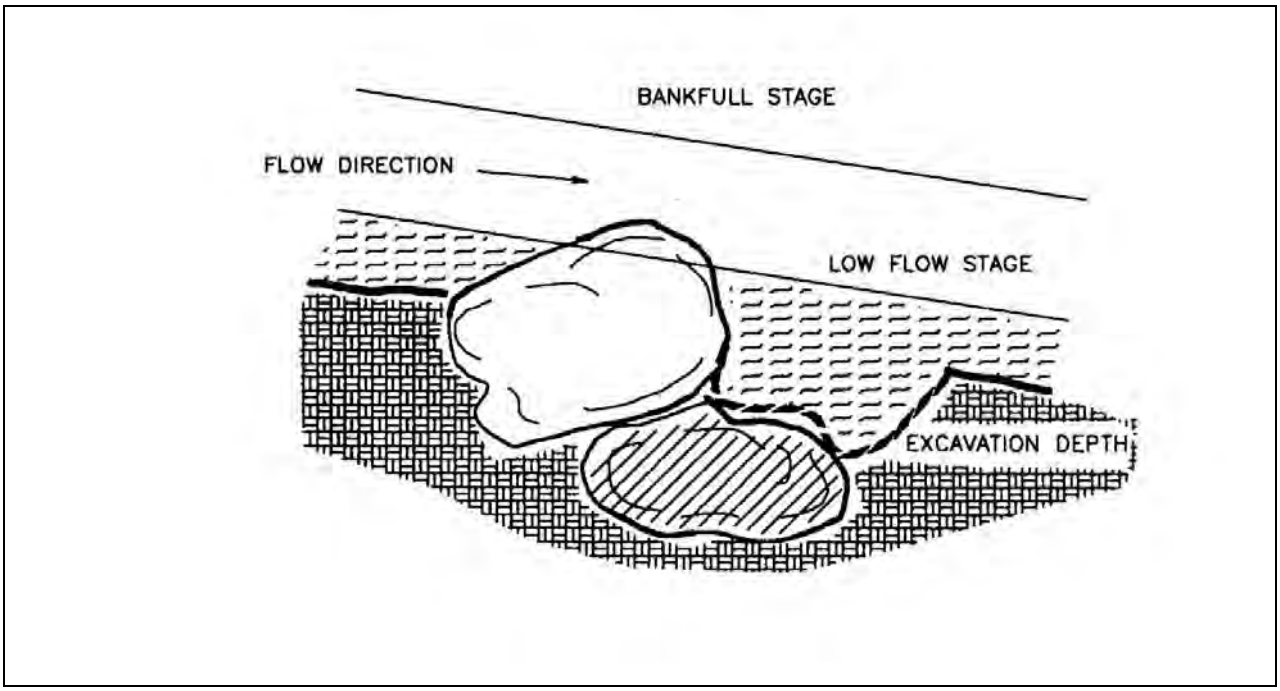


Figure VII-24. Vortex boulder weir, profile view (Rosgen, 1993).

Boulder Clusters

Boulder clusters are used to create scour pockets around boulders, to provide rearing habitat for juvenile salmonids, to build quiet water resting areas for upstream migrating spawners, and to sort spawning gravel (Figure VII-25).

Generally, clusters are located in straight, stable, moderately to well confined, low gradient riffles (0.5 to 1 percent slope) for spawning gravel enhancement; they are also placed in higher gradient riffles (1 to 4 percent slope) to improve rearing habitat and provide cover. At least 3 to 5 foot diameter boulders are recommended, except in very small streams.

To be effective in creating scour pockets and habitat niches around individual boulders, the correct distance between adjacent boulders and the configuration of the boulder clusters must be determined. In general, adjacent boulders should be 0.5 to 1 foot apart. The best configuration for boulders is usually a triangle of three boulders. Several of these clusters may be aggregated to increase scour area and create greater habitat complexity.

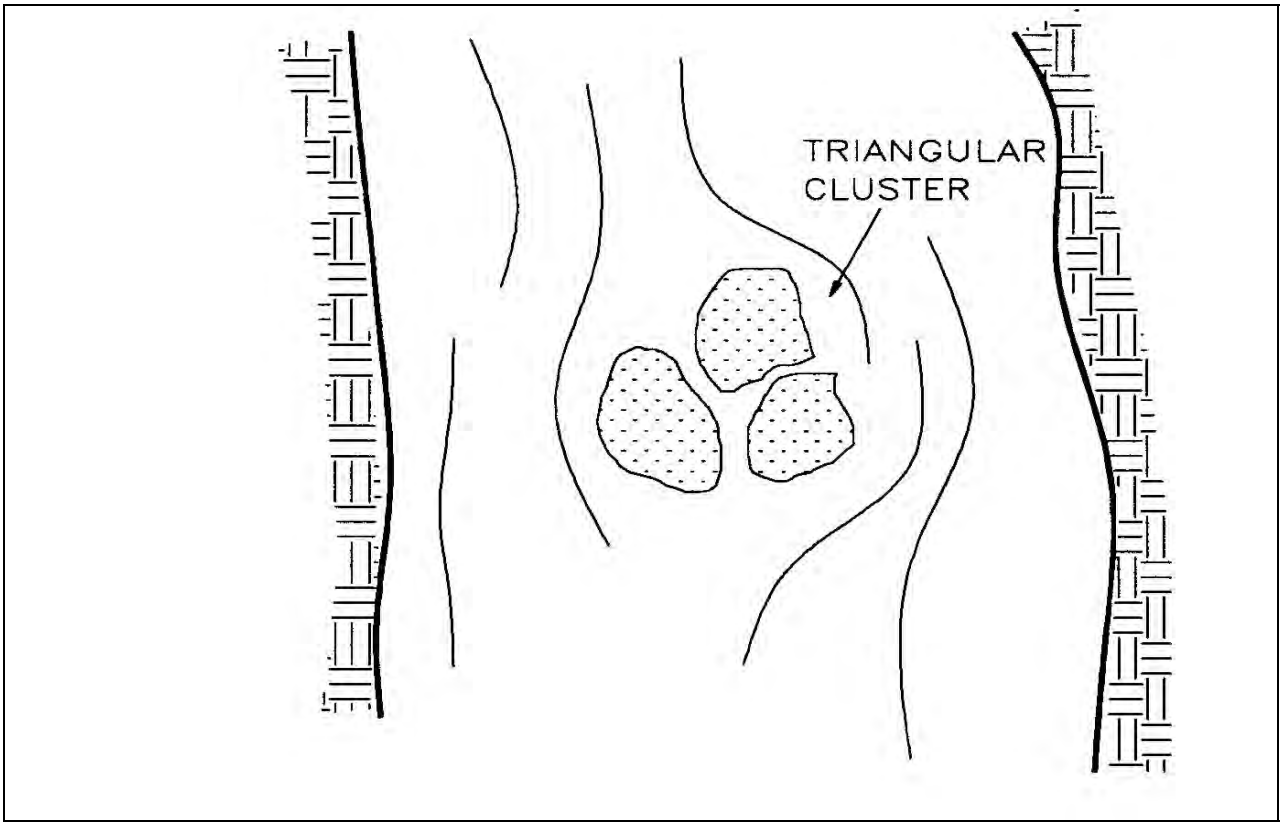


Figure VII-25. Boulder cluster.

If large angular quarry boulders are available, a single boulder can create good cover for juvenile and adult fish. Place the boulder within the middle two quarters of channel width, and not in a deposition zone. If the boulder is placed on a sand or silt bar, it may disappear into the bar. Do not use boulders that are so big that they divert the stream from its channel, or into soft stream banks.

Single and Opposing Boulder Wing-Deflectors

Single wing-deflectors are built to protect a portion of one bank, by deflecting the flow away from the bank. They are also used to create scour by constricting the channel thereby accelerating the flow (Figure VII-26). Wing-deflectors can also create quiet water resting areas for use by upstream migrating spawners.

Opposing wing-deflectors are built to constrict the flow to create a scour pool and sort spawning gravel. These structures are best installed in long, uniform glides or riffles. They create rearing habitat for juvenile salmonids as well as resting areas for upstream migrating spawners. The upstream side of the deflector will develop deposition that may become suitable spawning habitat.

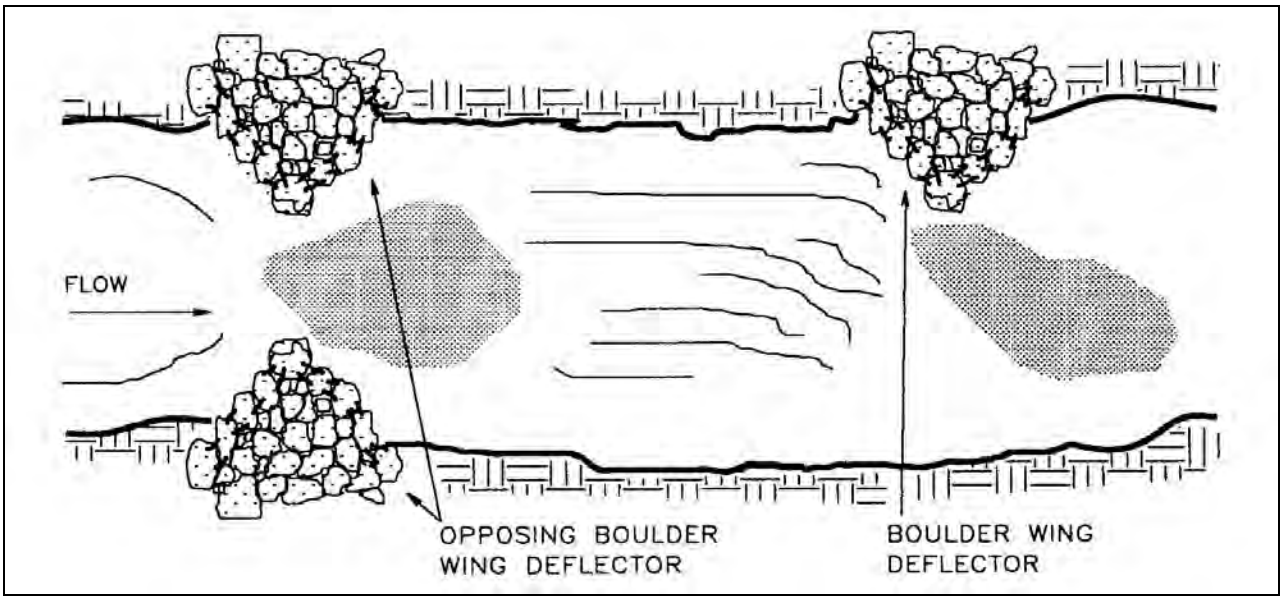


Figure VII-26. Single and opposing boulder wing-deflectors.

Wing-deflectors are similar to boulder weirs in that they are keyed into the stream banks, and slope to a low point near the center of the channel. Opposing wing-deflectors are created by constructing two single wing-deflectors opposite each other, reducing channel width by 40 to 80 percent. They should be constructed in low profile and their apexes should be equal in height.

Wing-deflectors are built in a triangular shape. This configuration will more effectively funnel flows between the apexes of opposing wing-deflectors, or to the apex of a single deflector.

Size of boulders will depend on the size of the channel, but oversized boulders are usually not a problem. To maintain the integrity of the structure it is desirable to secure the boulders with cable and polyester resin adhesive to create the perimeter of the structure. Smaller boulders or cobble can be used to fill the interior. The stream banks must either be naturally resistant to erosion or bank protection should be incorporated in construction of wing-deflectors.

Log Structures

Applications for log structures are similar to those for boulder structures. Logs may be used to provide instream cover for juvenile salmonids and spawning adults, to scour pools for rearing habitat, to recruit spawning gravel, and to stabilize eroding stream banks.

Log structures have a variety of shapes and uses. These include straight log weirs, downstream-V weirs, diagonal weirs, upstream-V weirs, upsurge weirs, wing-deflectors, divide logs, digger logs, and Hewitt ramps. The various structures have specific purposes which often dictate the specifications to which they are built. Many of these structures serve the dual purpose of trapping, sorting, and stabilizing gravel for spawning habitat as well as creating scour pools which act as rearing habitat for juvenile salmonids and escape cover or resting areas for spawning adults.

Log Weirs

As with boulder weirs, log weirs must be designed to specifications dictated by channel dimensions and range of flows that the stream may experience. It is important that log weirs are designed so that they do not become low-flow migration barriers. The maximum jump height that a log weir should create is 12 inches.

Log weirs are often placed in long, shallow riffles or runs. They may also be installed on straight reaches or meanders. The gradient should be between 1.5 and 4 percent in a moderately entrenched channel. Stream banks should be stable and composed of coarse, resistant material.

Log weirs have advantages and disadvantages compared to boulder weirs. The advantages are that logs are often available near the channel and are often obtainable at no cost other than the labor to bring them to the project site. A disadvantage of logs is that they will eventually rot, making the structure less durable than one of boulders. Redwood and cedar logs, however, can last for decades in a stream, are aesthetic, and are easy to work with.

Log weirs can be built in a variety of configurations. The type of log weir constructed is dependent on the desired habitat modification. Straight log weirs have been used extensively throughout the California coastal mountains. Constructed properly, they will trap gravel upstream and scour a pool downstream. Several problems have been associated with straight weir design. Straight log weirs can push too much water to sides, eroding fragile banks. Where there is not a proper downstream control, down-cutting immediately below the weir may create a jump in excess of 12 inches and a low-flow notch will be required (Figure VII-27). Generally, the only purpose for a straight log weir is to back-flood an area, such as a culvert. Downstream-V and diagonal weirs are more efficient at trapping gravel and upstream-V weirs are better for scouring pools.

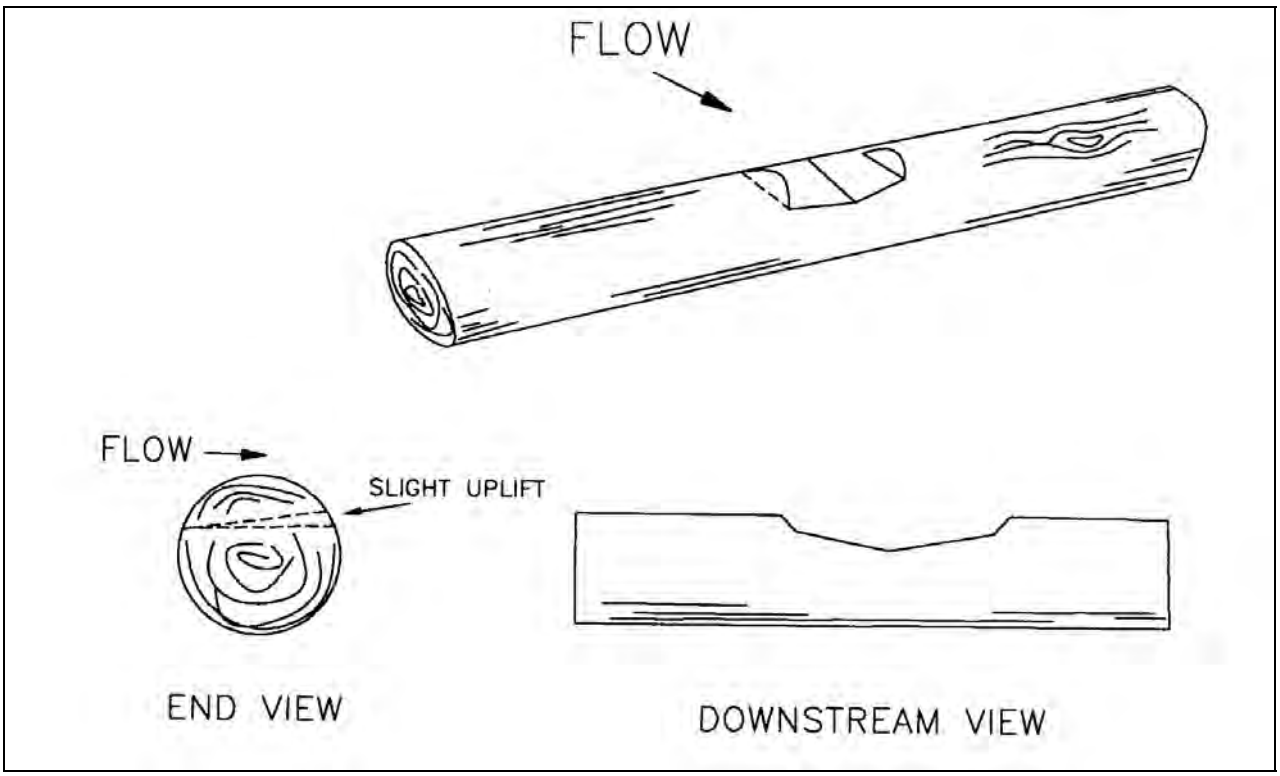


Figure VII-27. Straight log weir with low-flow notch.

Downstream-V weirs are effective in dissipating high flow energy and are used to collect spawning gravel. The downstream design forces water to the banks, therefore downstream-V weirs should only be constructed in areas of good bank stability (Figure VII-28).

Diagonal log weirs are placed diagonally to stream flow and span the full channel width. The upstream end of a diagonal log weir is set at a lower elevation than the downstream end. The drop in elevation should be approximately 6 inches in 10 feet. Diagonal log weirs cause stream flow to adjust direction so flow comes off the log at a right angle. Diagonal log weirs are good for creating lateral scour pools on river bends and for collecting spawning gravel, and they are also used to adjust direction of the stream. They can be very useful in directing flow away from unstable banks (Figure VII-29).

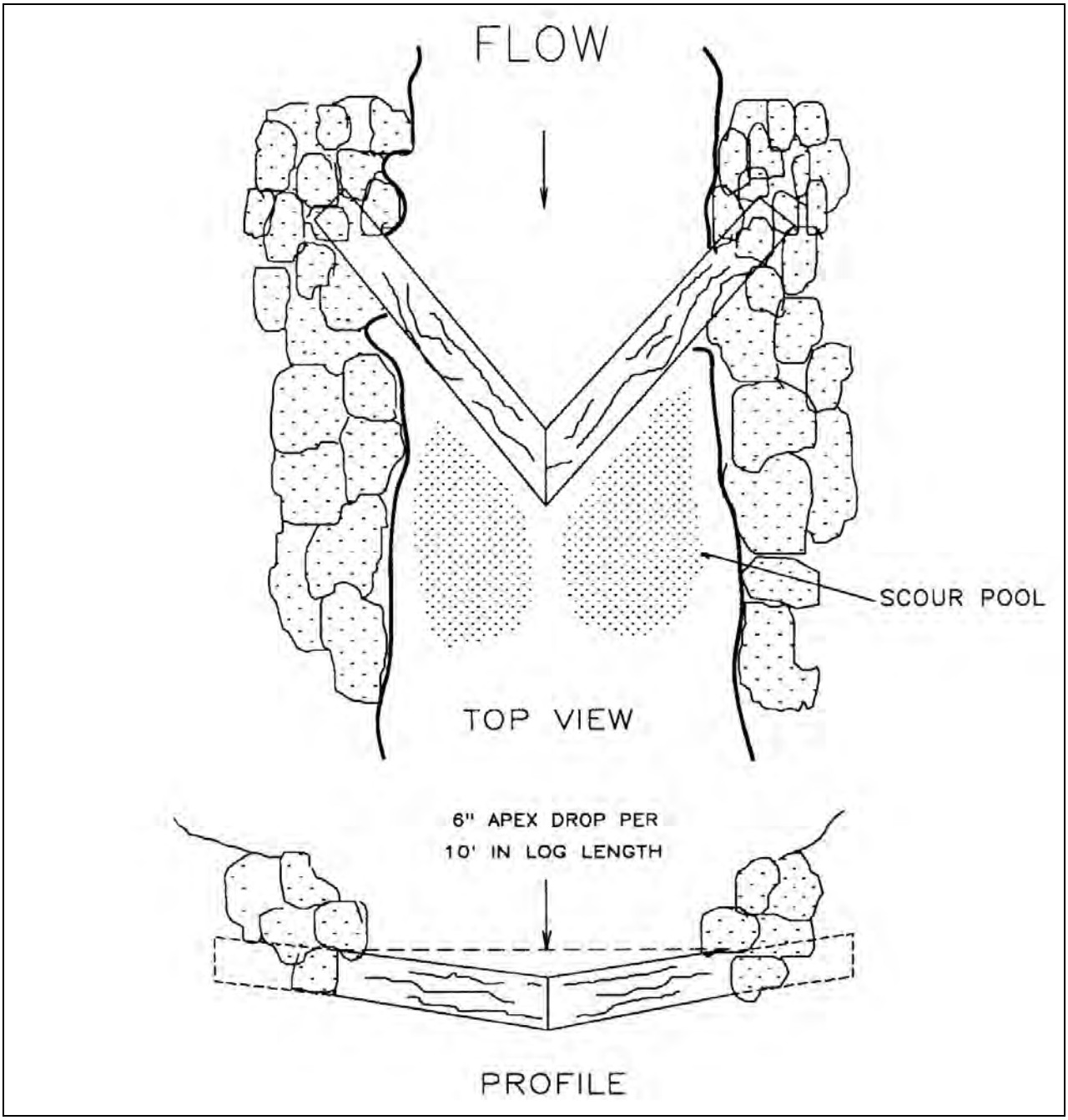


Figure VII-28. Downstream-V log weir.

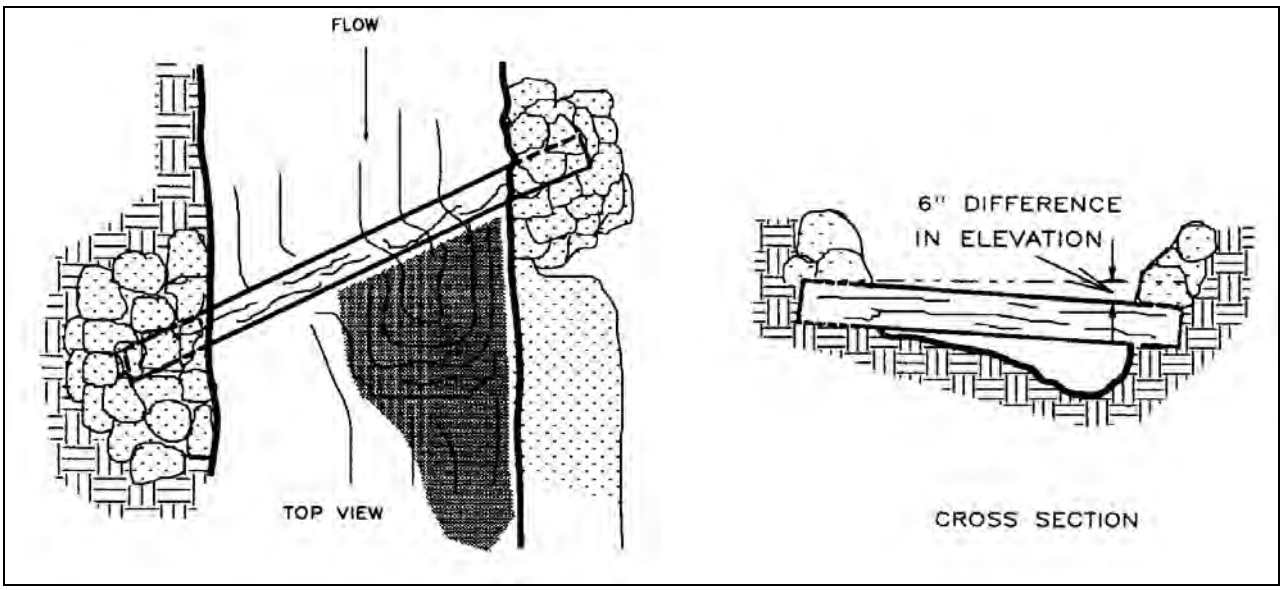


Figure VII-29. Diagonal log weir.

Upstream-V log weirs are used to scour deep pools. Principles of construction are the same for the various shapes of log weirs. Construction of an upstream-V weir will be described. These techniques of construction apply to other log weirs with some variations required to accommodate differences in configuration (Figure VII-30).

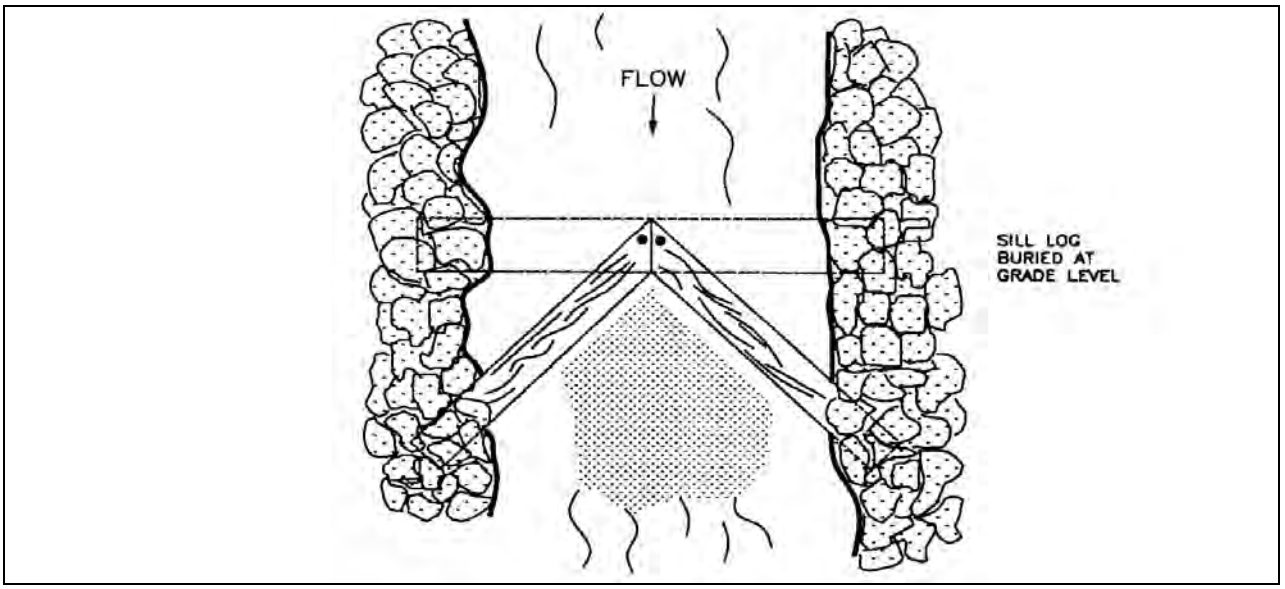


Figure VII-30. Upstream-V log weir.

Use redwood or cedar logs if available. Logs should be of appropriate size, determined by channel width, channel type, and bankfull discharge flows. Dig a trench perpendicular to the channel to bury the sill log at streambed grade. Key the ends of the sill log at least 6 feet into the bank. Place rock on keyed section of the log to prevent it from floating loose. Rock must be large enough and in sufficient quantity to protect banks.

Place the apex ends of the two logs forming the upstream "V" on top of the sill log. The two logs are placed so the apex is approximately 6 inches lower than the downstream keyed-in ends of the logs. The top of the logs at the apex should be no higher than 12 inches above the downstream water line. The apex of the logs must be shaped for a close fit. Drill through the apex ends of the two logs into the sill log, and hammer lengths of one-inch threaded rebar through both drill holes. Secure washers and nuts to the ends of the threaded rebar and tighten securely. Armor the bank ends of the logs with rock. Dig a 24-inch deep pool at the downstream apex so that fish can jump over the logs until high flows can create a scour pool.

If a series of weirs is to be installed, the downstream weir should be constructed first. Difference in elevation between lower and upper water surfaces should be 12 inches. Elevations can be determined with a hand or survey level and a stadia rod.

There are numerous variations of the upstream-V log weir. These include the upstream-V leaving a low-flow notch (Figure VII-31), the upstream-V using opposing log deflectors over a sill log (Figure VII-32), and log constrictors over a series of log planks (Figure VII-33).

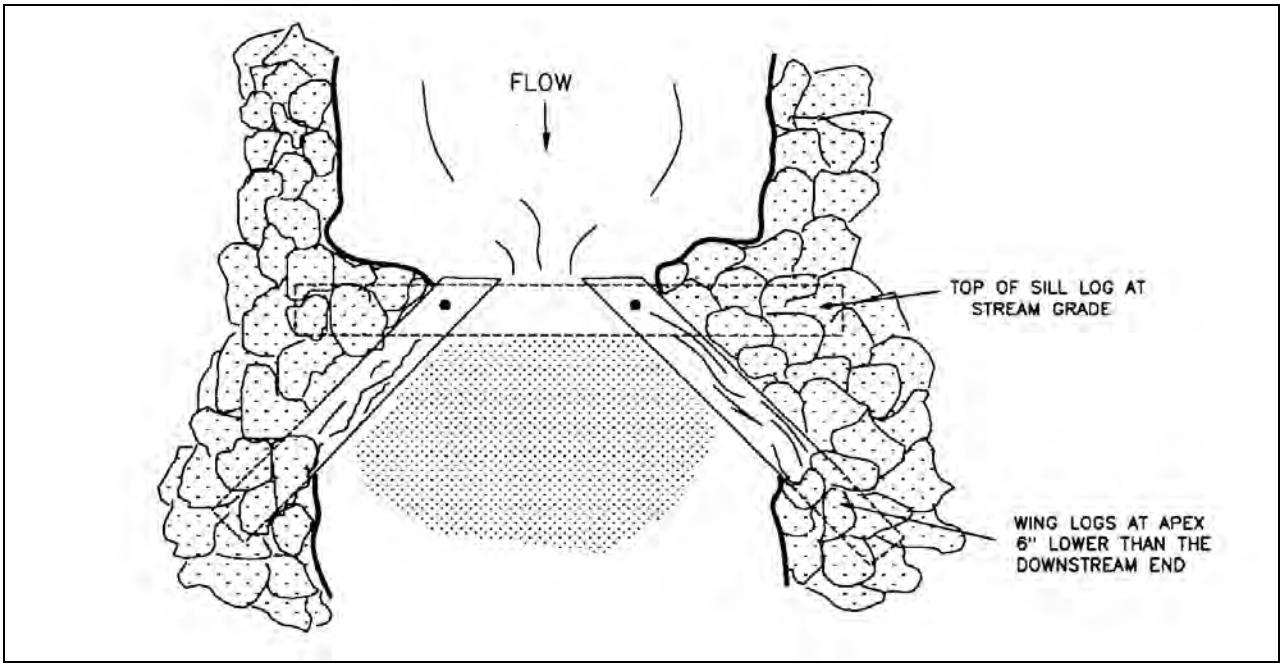


Figure VII-31. Upstream-V log weir with a low-flow notch.

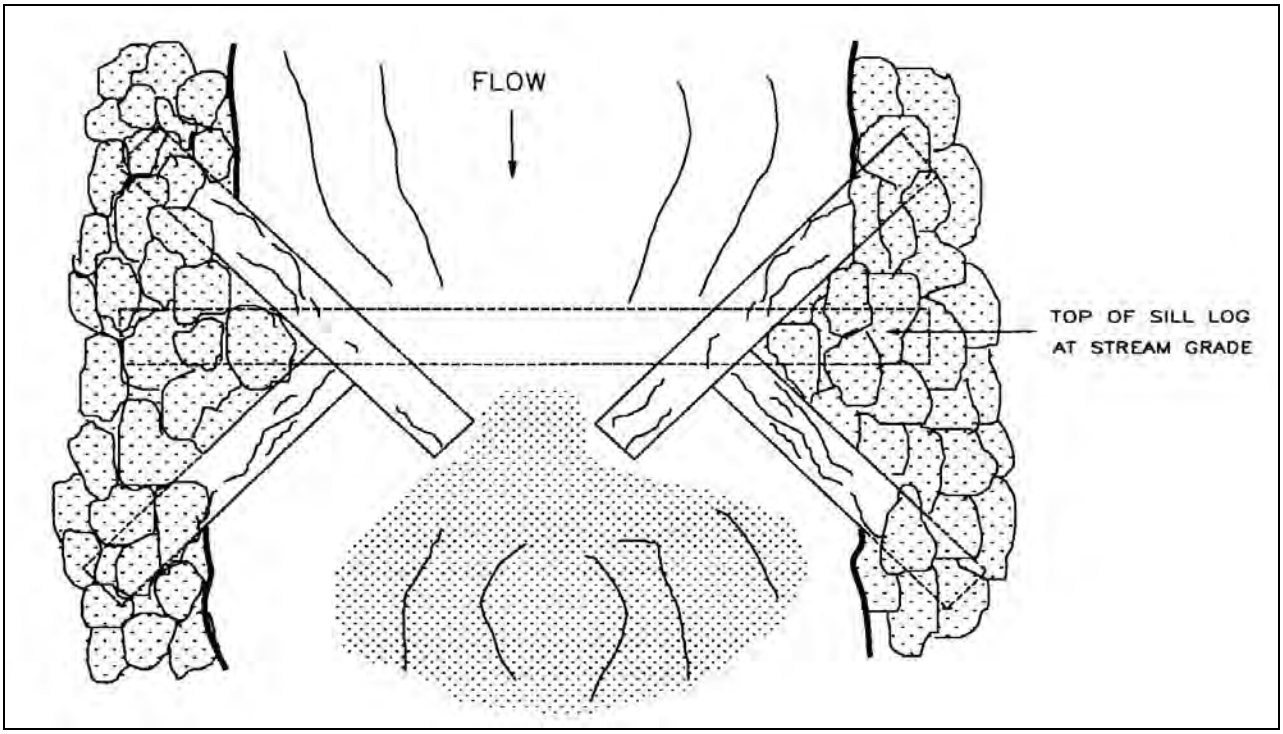


Figure VII-32. Upstream-V log weir with a low-flow notch.

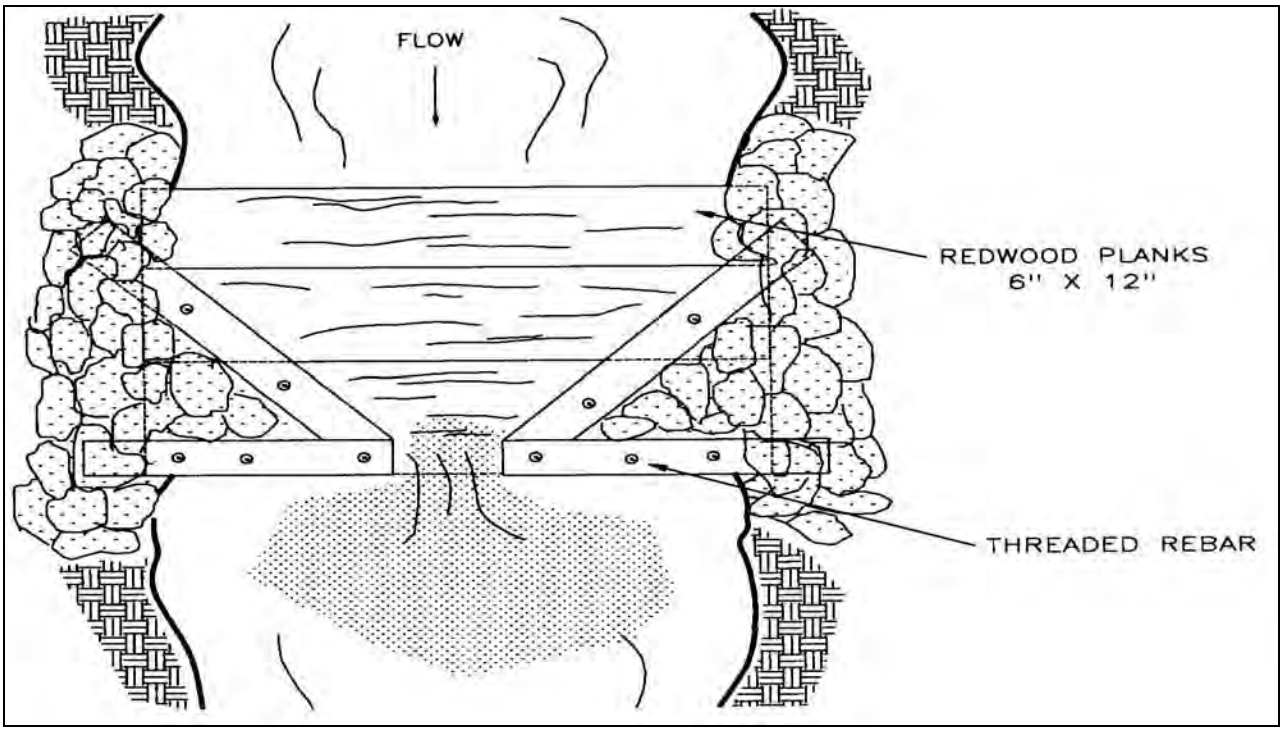


Figure VII-33. Log constrictors over planks.

Upsurge Weirs

Upsurge weirs are logs which span the full channel width. They are used to force stream flow under the log in order to scour the channel bottom to create or enhance pools for summer rearing habitat. Upsurge weirs are most effective when the bottom of the log is placed at the summer low-flow surface elevation (Figure VII-34).

Strong anchoring systems are required for upsurge weirs because of the strong hydraulic lifting force generated at scouring flows. Upsurge weirs should be anchored to stationary boulders on the banks or to bedrock. If this is not possible, both ends of the weir can be set into excavated trenches on opposite banks at the summer low-flow water level. Four to six feet of the log should be keyed into each bank. Enough weight must be placed on each log end to permanently secure it.

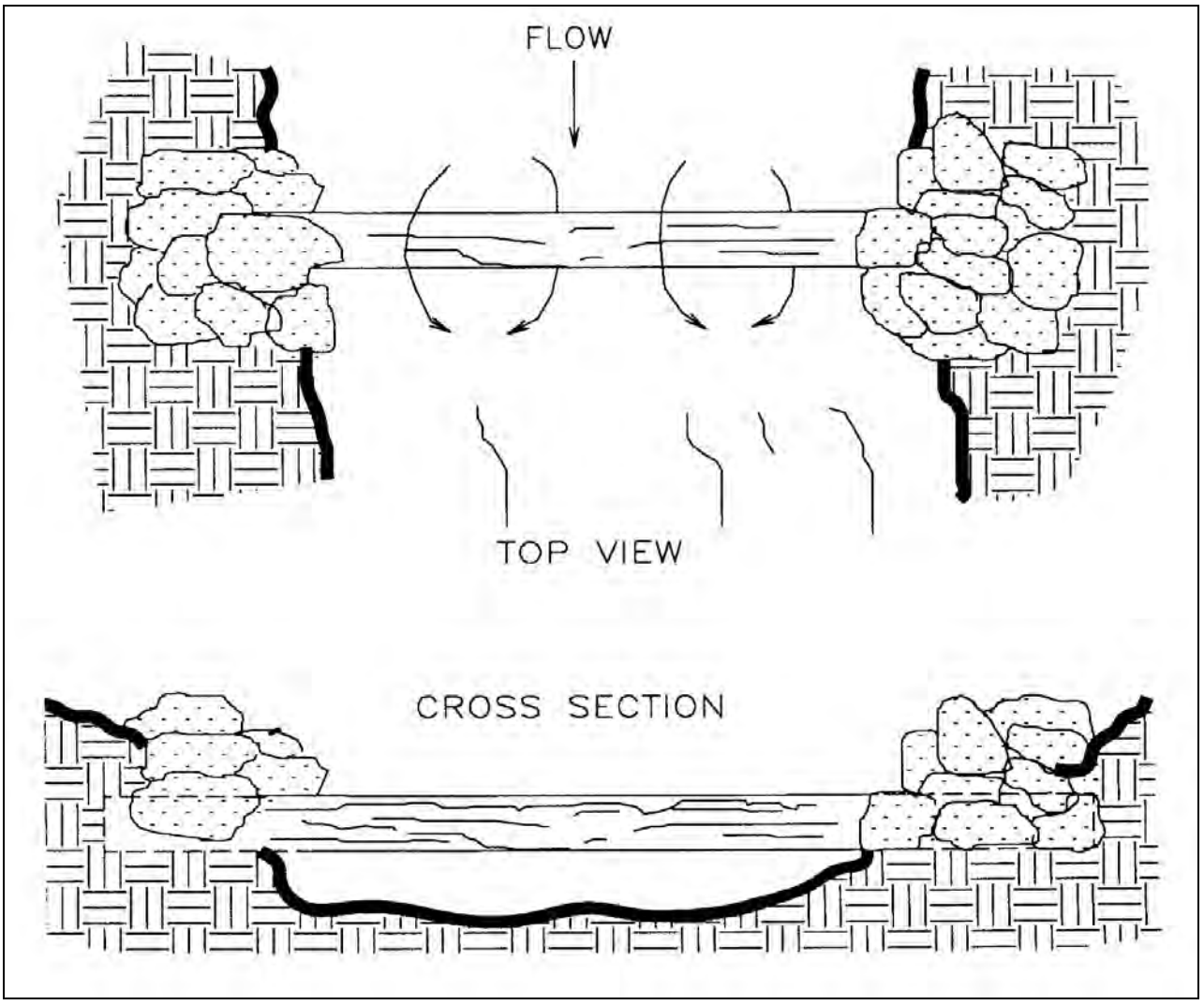


Figure VII-34. Upsurge weir.

Single and Opposing Log Wing-Deflectors

Wing-deflectors are used to concentrate the flow of water into a selected area of the channel to create scour. The scour creates a pool and the deflector(s) will act as cover and create a resting area for fish. They are primarily used in areas of long, uniform glides or riffles to diversify habitat and create velocity shear zones (Figure VII-35).

Wing-deflectors must not be placed or designed so that they create a severe channel constriction or deflect high flows into unstable or unprotected stream banks. The upstream log should extend into the summer low-flow channel so that it provides summer rearing habitat.

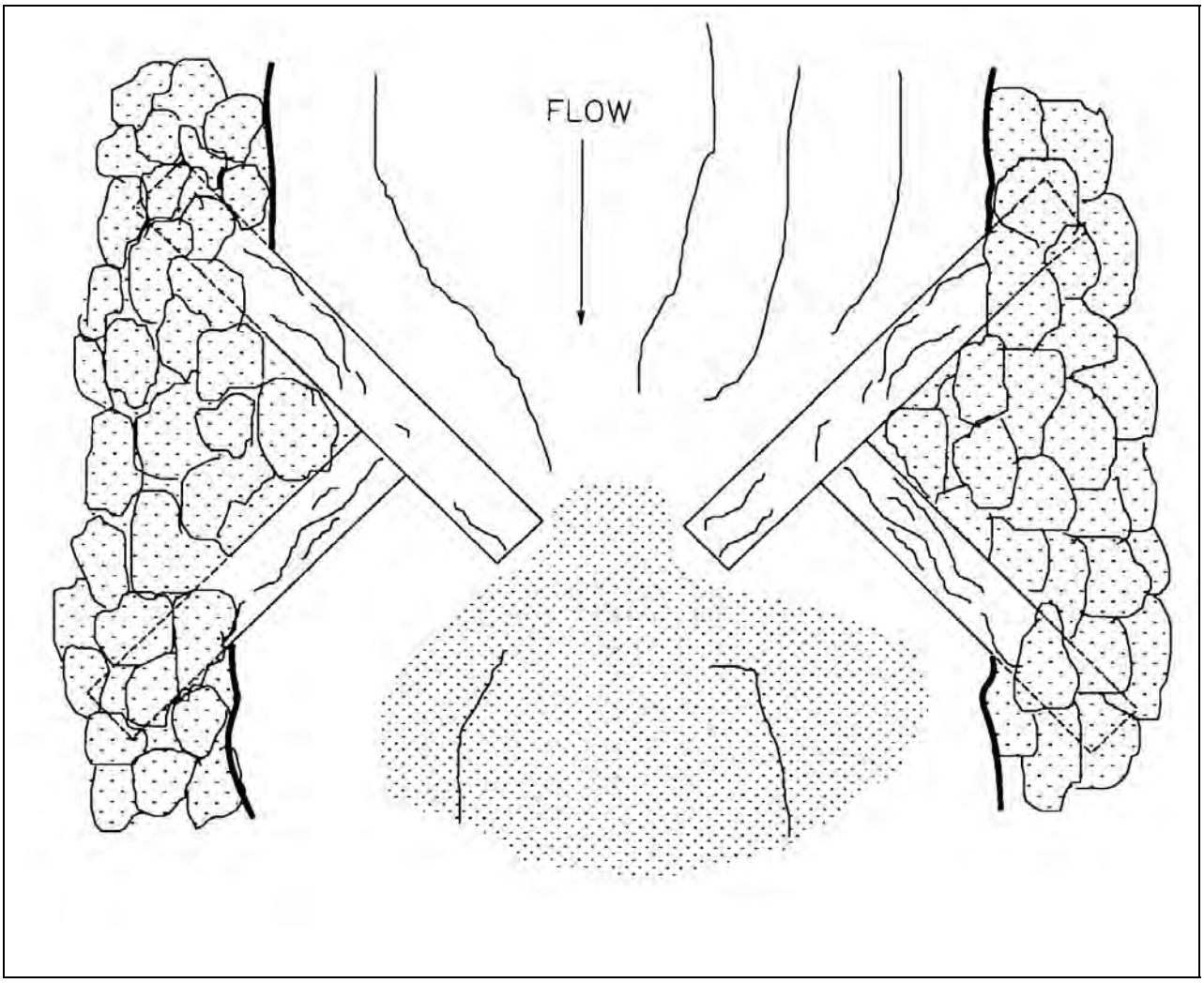


Figure VII-35. Opposing log wing-deflector.

The construction of the deflector involves making a "V" or a triangle whose base is parallel to the bank and whose two sides join to make the apex, which extends into the flow. A trench must be excavated into the bank to key-in the logs that make up the sides of the triangle. The trench must extend far enough into the bank to afford adequate anchoring for the deflector side logs. The angle of this trench will determine the angle at which the deflector sits. Orientation of the trenches will be determined by the desired apex angle. The apex angle will be 100 to 120

Julie Andersen

From: Kasteen, Terris@Wildlife <Terris.Kasteen@wildlife.ca.gov>
Sent: Thursday, January 18, 2018 2:42 PM
To: Julie Andersen
Cc: Coty Sifuentes-Winter
Subject: RE: SFDFW protocol
Attachments: 2017_SFDFW_Protocol.docx

Follow Up Flag: Follow up
Flag Status: Flagged

Julie,
I've attached your documents with my suggested edits in tracked changes. They are very minor. I've pasted Randi's comments below:

"I'm fine with this approach as long as it doesn't conflict with measures in their existing permits, e.g., their RMA. The plan doesn't have any legal status on its own. If the measures do conflict, MidPen can always submit a request to amend the permit to reflect their new protocol. Julie had a similar question recently regarding special-status amphibians. Maybe what they need is a species management plan that can be incorporated into permits by reference and updated as-needed as BMPs evolve?"

Let me know if you need any additional feedback or if you have other concerns,

Terris Kasteen
Wildlife Biologist
Santa Clara, Santa Cruz, San Mateo, San Francisco Counties
California Department of Fish and Wildlife
Bay Delta Region 3
(831) 336-8300
Terris.Kasteen@wildlife.ca.gov

From: Julie Andersen [mailto:jandersen@openspace.org]
Sent: Thursday, January 11, 2018 2:38 PM
To: Kasteen, Terris@Wildlife <Terris.Kasteen@wildlife.ca.gov>
Cc: Coty Sifuentes-Winter <csifuentes@openspace.org>
Subject: RE: SFDFW protocol

Hi Terris,

Sending a reminder to see if any updates on a Midpen SFDFW protocol and/or MOU?

We have a meeting with CalFire on January 30 and SFDFW and nests always comes up when we partner for routine fuelbreak maintenance and defensible space work. I would love to have some input so we can better speak to that issue.

Thanks!
-Julie

From: Kasteen, Terris@Wildlife [mailto:Terris.Kasteen@wildlife.ca.gov]
Sent: Friday, December 15, 2017 8:34 AM
To: Julie Andersen <jandersen@openspace.org>
Subject: RE: SFDFW protocol

Julie,
I've made some progress on this review. I've sent my changes on to a couple other staff and am waiting for replies. Randi Adair has given some good feedback on how to use the protocol in conjunction with your other permits. I will include all this when I compile and send all comments and edits to avoid multiple emails. That said, I know things may tend to fall by the wayside this time of year so please send a reminder to me at the beginning of the year. Thanks,

Terris

From: Julie Andersen [mailto:jandersen@openspace.org]
Sent: Thursday, November 02, 2017 4:50 PM
To: Kasteen, Terris@Wildlife <Terris.Kasteen@wildlife.ca.gov>
Subject: SFDFW protocol

Hi Terris,

We have had many a woodrat project this year and I anticipate they will continue. I have drafted up a suggested protocol based on what has and has not worked at our many projects. I believe the attached document will allow us to do most of our routine work and is protective of the species as well. Can you review and let me know your thoughts? I have submitted this same information for a restoration project in Santa Clara County and I plan to submit for our routine maintenance permit renewal/amendment as well.

Thanks for your review and any thoughts.

-Julie

Julie Andersen
Resource Management Specialist III
Midpeninsula Regional Open Space District
330 Distel Circle, Los Altos, CA 94022
P: (650) 691-1200 – F: (650)691-0485
jandersen@openspace.org

San Francisco Dusky-Footed Woodrat (SFDFW) Protocol

Midpeninsula Regional Open Space District Preserves provide many areas of habitat for SFDFW that is conserved as open space in perpetuity. However in some instances District projects, operations, and/or maintenance activities have the potential to impact SFDFW individuals and/or their nests.

For projects occurring in suitable SFDFW habitat, prior to project implementation, a qualified biologist shall survey the site for evidence of nesting SFDFW *(i.e.,* large stick nests). Since woodrats use their nests year round, surveys for nests may be conducted at any time of the year. If woodrats or their nests are present, a biological awareness training shall be provided by a qualified biologist prior to project implementation.For any woodrat and/or nest that are found within project boundaries, the measures listed below shall be implemented:

In natural areas:

All wood rat nests will be flagged in the field and delineated on project site maps. In all instances, every effort should be made to avoid impacts to woodrat nests. Avoidance, even with a small buffer area is considered preferable to relocation. Avoidance buffers of a minimum of 3-10 feet shall be implemented, flagged where appropriate, and avoided during project implementation. Smaller buffers allow work to occur in close proximity without displacing and relocating individuals each time these activities occur which may be on an annual or recurring basis (defensible space around structures, road and trail side brushing, invasive plant removal etc.). As evaluated by the project biologist, where appropriate to minimize impacts from project activities, fencing will be installed around the nest and include the buffer area. When removing materials from around a woodrat nest be cognizant of tree branches, fencing, or other materials that may support the nest structure. Whenever possible leave these materials in place. However, if they must be removed and the nest may become compromised, live trapping may be necessary.

For all woodrat nests that cannot be avoided by project activities (i.e. will require relocation), a qualified biologist shall live trap to determine if the nest is in use. Trapping activities should occur prior to April and after mid-July each year to prevent impacts to woodrats rearing young or young woodrats. If a nest is found to be unoccupied or not in use for 3 full days (2 nights of trapping), then it may be removed. The nest shall be relocated or a pile of replacement sticks shall be placed outside of the development footprint for future colonization or re-use. If a lactating female is trapped, project actitivies shall be postponed until young have become independent.

Trapped woodrats may be kept in captivity by a qualified biologist until their nests are relocated to suitable habitat outside of the development footprint. Every effort should be made to minimize the time the animal is held in captivity. A CNDDB form shall be filled out and submitted to CDFW for any San Francisco dusky-footed woodrats that are trapped. Once trapped, nests shall be torn down and rebuilt surrounding a log based structure, an inverted wooden planter, or similar structure having at least one entrance and exit hole that is slightly buried into the ground to anchor. Any cached food and nest material encountered shall be placed within the new structure during rebuilding. Whenever possible, the structure shall be "over-built" by adding

larger branches for predator protection to create an area for the individual to safely emerge outside of the nest. One or more persons shall remain outside the release structure for up to 10 minutes to mimic a predator. Relocated nests are intended to provide a release site and opportunity for the woodrats to relocate to another nest (most woodrats average more than one nest and may or may not remain with a relocated nest), or to colonize the new structure.

Once nests are relocated, any trapped woodrats should be released into the reconstructed nest using a "soft release," by plugging the individual into the shelter using loose dirt over the entrance.

Relocated nests are expected to eventually be re-colonized and should be monitored one year post construction using visual surveys and/or wildlife cameras to determine if a relocated nest has returned to use. A monitoring report should be submitted to CDFW to document use or non/use of relocated nests.

<u>In non-natural areas such as structures, abandoned vehicles, human debris piles or other areas:</u>

In some District locations, woodrats have colonized abandoned buildings, old vehicles, diffuse garbage piles, or other locations where nests are difficult to locate, individuals cannot be live-trapped consistently, and/or there is a lack of woody materials for nest reconstruction. In these instances, live trapping is not required (especially if there is a risk to human health) if the surrounding area provides suitable habitat or supports a healthy colony that is being avoided and/or can be enhanced. Work at these locations must occur prior to April and after mid July to prevent impacts to woodrats rearing young.

In these types of projects (cleanup, demolitions etc.) if individual rats are present, they will be encouraged to leave the area on their own which may include demolition or cleanup in phases, and/or hand removal of materials. If individual woodrats are observed during implementation, work in the immediate area shall cease until the animal leaves the area on its own. Work may continue at other locations away from the observation location. If the animal does not leave the area on its own, the project biologist or a biological monitor shall be notified. Work may proceed at the observation site, once the animal has left the area on its own or a biological monitor is present to ensure that the individual SFDFWs are not harmed.

If nests are present that cannot be trapped or removed, woody debris piles that look like woodrat houses can be constructed to provide opportunities for sheltering and colonization by displaced woodrats. Woody debris piles shall be constructed under the guidance of the project biologist or onsite biological monitor. Woody debris piles will consist of dead branches of various sizes that are collected from the surrounding area. Each pile will generally be ~3-5 feet high by 8-10 feet in diameter. A variety of stem sizes shall be used ranging from ~0.5 to 6 inches in diameter. The intent is to provide a relatively safe location for an SFDFW to build a house with respect to predators, and to provide some amount of accessible woody material to facilitate colonization.

Nest replacement ratios will be determined based on the number of woodrats and/or nests observed, as well as the size and number of undisturbed nests in the surrounding areas.

Best Management Practices for Avoiding and Minimizing Impacts to Bat Species

- In areas of suitable habitat, preconstruction surveys are required for the following bat species:
    - Pallid Bat
    - Townsend's Big-eared Bat
    - Western Red Bat

- Bat surveys should take place during the April 15 through August 31 maternity roost season whenever possible. Surveys may also take place between February 16 and April 14. Findings during spring surveys may indicate that a second summer survey is necessary
- Bats generally breed April through Aug, no building or tree work (over 16" dbh) is allowable during this time if surveys determine that special status bats or maternity roosts are present
- Bats go into a deep torpor period November 16 through February 15, no building or tree work (over 16" dbh) is allowable during this time if surveys determine that special status bats or maternity roosts are present
- If individual non breeding and non-special status bats are present, a qualified biologist may be retained to remove the bats and work may proceed year round
- If maternity roosting or special status bat species are present at any time, no work is allowed without first excluding and providing alternate roost site(s) outside of the breeding season
- Alternate roost site(s) must be determined by District Natural Resources staff or a consulting biologist and submitted to California Department of Fish and Wildlife before installation
- Whenever possible alternative roost site(s) will be provided 6 months to 1 year prior to the removal of maternity roosting habitat to allow bats adequate time to discover the new locations
- Alternative roost site(s) shall be monitored for occupancy by a qualified biologist within one year of installation
- Contractors, Midpen staff, and others working in areas known to support maternity roost site(s) and/or special status bat species will be provided biological awareness training by a qualified biologist prior to the commencement of work

Mitigation for impacts to maternity roost(s) and special status bat species:

<u>Buildings and other human structures:</u>

- To mitigate for demolition activities, fumigation, or other activities that involve the removal or disturbance of roosting bats in buildings, bridges, outbuildings, dilapidated structures, old vehicles (buses, trailers etc.), or other human created structures (including debris piles):

- If signs of bats are evident and removal or disturbance of bats is necessary, a qualified biologist will conduct surveys for roosting bats prior to beginning work. Surveys will consist of daytime pedestrian surveys to look for visual signs of bats (e.g., guano), and if determined necessary, evening emergence surveys to note the presence or absence of bats. If evidence of bat roosting is found, the number and species of roosting bats will be determined. If no evidence of bat roosts is found, then no further study will be required. Bat detectors and/or infrared detectors may be used to supplement survey efforts, but are not required.

- When bat roosting sites are located in buildings, exclusion of bats from the building will occur outside of the April through August nursery season.

- If roosts of special-status bats are determined to be present and must be removed, a bat exclusion plan will be prepared and submitted to CDFW. The exclusion plan will describe the method of exclusion, which may include the use of one-way doors at roost entrances (bats may leave but not re-enter), or sealing roost entrances when the site can be confirmed by a bat expert to contain no bats. No bats will be excluded until the plan is approved by CDFW and alternative roosting habitat is approved. The bats will be excluded from the roosting site before the site is disturbed or modified in any way.

Trees Removal:

- Avoid removal of trees greater than sixteen inches dbh during the April through August nursery season whenever possible.

- If removal of trees greater than sixteen inches dbh during the nursery season cannot be avoided, a qualified biologist will conduct surveys for roosting bats where suitable large trees are to be removed. Surveys will consist of daytime pedestrian surveys to look for visual signs of bats (e.g., guano), and if determined necessary, evening emergence surveys to note the presence or absence of bats. If evidence of roosting bats is found, the number and species of roosting bats will be determined. If no evidence of bat roosts is found, then no further study will be required. Bat detectors and/or infrared detectors may be used to supplement survey efforts, but are not required.

- If roosts of special-status bats are determined to be present and must be removed during the April through August nursery season, a bat exclusion plan shall be prepared and submitted to CDFW. The exclusion plan will describe the method of exclusion, which may include the use of one-way doors at roost entrances (bats may leave but not re-enter), or sealing roost entrances when the site can be confirmed by a bat expert to contain no bats. The use of sonic bat deterrents may also be allowed when called for by a qualified biologist. No bats will be excluded until the plan is approved by CDFW and alternative roosting habitat is approved. Exclusion efforts may be restricted during periods of sensitive activity (e.g., during hibernation or while females in maternity colonies are nursing young). The bats will be excluded from the roosting site before the site is disturbed, closed or modified in any way. When possible alternative roosting sites will be provided 6 months to a year prior to the removal of existing roosts. Once the replacement roosts are constructed and it is confirmed that bats are not present in the original roost site, the structures may be removed or sealed.

Work in or adjacent to areas known to support special status bats and/or maternity roosts:

- Whenever possible work shall take place outside of the April through August nursing season.
- Natural Resources staff shall provide and/or consult with qualified biologists having knowledge specific to the bat species present at the site. Species specific noise tolerance levels (including high frequency noise) shall be established for work taking place within a determined buffer around the maternity roost. All equipment working within the site during the nursing season must be tested for high frequency noise outputs prior to use on the site. If equipment is determined to produce any noise that is expected to cause bats to abandon a maternity roost it will not be used on the site within an biologist established buffer during the nursing season.

Relocation of bat boxes:

- Relocation requires the approval of the Natural Resources department and may be performed by a qualified biologist.
- Bat boxes may be relocated between mid-September to mid-October, or from mid-February to mid-March (during warm periods outside of the nursing season). Bat boxes may be relocated outside of these recommended time periods with sign off from a qualified biologist.
- Relocation of boxes that support special status bat species requires notification to CDFW before implementation.
- If a bat box is determined to be unoccupied by a qualified biologist, it may be relocated at any time without modification. If occupied, a one way door shall be installed on the entrance/exit of the bat box, preferably during a warm period when bats are likely to be active. The one way door shall remain in place for a period of 3-7 days. After this period a qualified biologist shall arrive on site and check the box for occupancy. If the box is still occupied then the one way door shall remain in place for an additional 3-7 days. Once the box is determined to be unoccupied then it may be relocated with direction from Natural Resources or a qualified biologist to a nearby suitable habitat. The new location will be recorded and added to the Districts' GIS database. The one way door shall then be removed to allow bats to access the box. Relocated bat boxes shall be monitored for occupancy by a qualified biologist within one year of installation.

APPENDIX D.

Biology Appendix

U.S. Fish and Wildlife Service IPaC Report

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

NOT FOR CONSULTATION

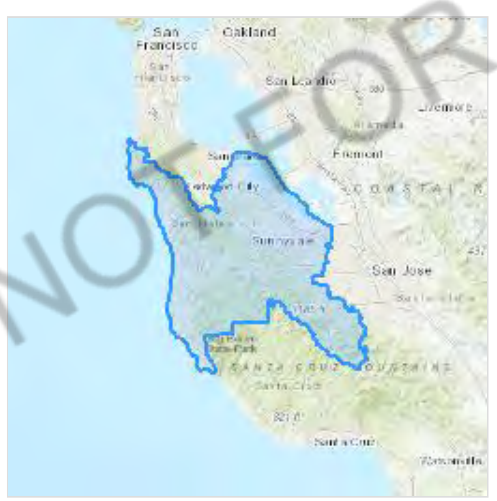
Project information

NAME

Midpeninsula Routine Maintenance and Facilities Improvements Program

LOCATION

California



DESCRIPTION

None

Local offices

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

San Francisco Bay-Delta Fish And Wildlife

(916) 930-5603
(916) 930-5654

650 Capitol Mall
Suite 8-300
Sacramento, CA 95814

http://kim_squires@fws.gov

Ventura Fish And Wildlife Office

(805) 644-1766
(805) 644-3958

2493 Portola Road, Suite B
Ventura, CA 93003-7726

NOT FOR CONSULTATION

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Log in to IPaC.
2. Go to your My Projects list.
3. Click PROJECT HOME for this project.
4. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

NOT FOR CONSULTATION

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS

Salt Marsh Harvest Mouse Reithrodontomys raviventris — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/613

San Joaquin Kit Fox Vulpes macrotis mutica — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/2873

Southern Sea Otter Enhydra lutris nereis — Threatened
Wherever found — Marine mammal
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/8560

Birds

NAME	STATUS

California Clapper Rail Rallus longirostris obsoletus — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/4240

California Least Tern Sterna antillarum browni — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/8104

Least Bell's Vireo Vireo bellii pusillus — Endangered
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/5945

Marbled Murrelet Brachyramphus marmoratus — Threatened
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/4467

Short-tailed Albatross Phoebastria (=Diomedea) albatrus — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/433

NOT FOR CONSULTATION

Southwestern Willow Flycatcher Empidonax traillii extimus — Endangered
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/6749

Western Snowy Plover Charadrius nivosus nivosus — Threatened
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/8035

Yellow-billed Cuckoo Coccyzus americanus — Threatened
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/3911

Reptiles

NAME	STATUS

Alameda Whipsnake (=striped Racer) Masticophis lateralis euryxanthus — Threatened
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/5524

Green Sea Turtle Chelonia mydas — Threatened
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/6199

San Francisco Garter Snake Thamnophis sirtalis tetrataenia — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/5956

Amphibians

NAME	STATUS

California Red-legged Frog Rana draytonii — Threatened
Wherever found
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/2891

NOT FOR CONSULTATION

California Tiger Salamander Ambystoma californiense — Threatened

There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/2076

Fishes

NAME	STATUS

Delta Smelt Hypomesus transpacificus — Threatened
Wherever found

There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/321

Tidewater Goby Eucyclogobius newberryi — Endangered
Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/57

Insects

NAME	STATUS

Bay Checkerspot Butterfly Euphydryas editha bayensis — Threatened
Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/2320

Mission Blue Butterfly Icaricia icarioides missionensis — Endangered
Wherever found

There is **proposed** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/6928

Ohlone Tiger Beetle Cicindela ohlone — Endangered
Wherever found

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/8271

San Bruno Elfin Butterfly Callophrys mossii bayensis — Endangered
Wherever found

There is **proposed** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/3394

NOT FOR CONSULTATION

Zayante Band-winged Grasshopper Trimerotropis infantilis — Endangered
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/1036

Crustaceans

NAME	STATUS

Conservancy Fairy Shrimp Branchinecta conservatio — Endangered
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/8246

Vernal Pool Fairy Shrimp Branchinecta lynchi — Threatened
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/498

Vernal Pool Tadpole Shrimp Lepidurus packardi — Endangered
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/2246

Flowering Plants

NAME	STATUS

Ben Lomond Spineflower Chorizanthe pungens var. hartwegiana — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/7498

Ben Lomond Wallflower Erysimum teretifolium — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/7429

California Seablite Suaeda californica — Endangered
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/6310

NOT FOR CONSULTATION

Contra Costa Goldfields Lasthenia conjugens — Endangered
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/7058

Coyote Ceanothus Ceanothus ferrisae — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/8440

Fountain Thistle Cirsium fontinale var. fontinale — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/7939

Hickman's Potentilla Potentilla hickmanii — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/6343

Marin Dwarf-flax Hesperolinon congestum — Threatened
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/5363

Marsh Sandwort Arenaria paludicola — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/2229

Menzies' Wallflower Erysimum menziesii — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/2935

Metcalf Canyon Jewelflower Streptanthus albidus ssp. albidus — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/4186

Robust Spineflower Chorizanthe robusta var. robusta — Endangered
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/9287

NOT FOR CONSULTATION

San Mateo Thornmint Acanthomintha obovata ssp. duttonii — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/2038

San Mateo Woolly Sunflower Eriophyllum latilobum — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/7791

Santa Clara Valley Dudleya Dudleya setchellii — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/3207

Santa Cruz Tarplant Holocarpha macradenia — Threatened
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/6832

Scotts Valley Polygonum Polygonum hickmanii — Endangered
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/3222

Scotts Valley Spineflower Chorizanthe robusta var. hartwegii — Endangered
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/7108

Showy Indian Clover Trifolium amoenum — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/6459

White-rayed Pentachaeta Pentachaeta bellidiflora — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/7782

Conifers and Cycads

NAME	STATUS

NOT FOR CONSULTATION

Santa Cruz Cypress Cupressus abramsiana Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/1678	Threatened

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

This location overlaps the critical habitat for the following species:

NAME	TYPE
Bay Checkerspot Butterfly Euphydryas editha bayensis https://ecos.fws.gov/ecp/species/2320#crithab	Final
California Red-legged Frog Rana draytonii https://ecos.fws.gov/ecp/species/2891#crithab	Final
Marbled Murrelet Brachyramphus marmoratus https://ecos.fws.gov/ecp/species/4467#crithab	Final
Tidewater Goby Eucyclogobius newberryi https://ecos.fws.gov/ecp/species/57#crithab	Final
Western Snowy Plover Charadrius nivosus nivosus https://ecos.fws.gov/ecp/species/8035#crithab	Final

NOT FOR CONSULTATION

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php

- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NOT FOR CONSULTATION

NAME	BREEDING SEASON (IF A BREEDING SEASON IS INDICATED FOR A BIRD ON YOUR LIST, THE BIRD MAY BREED IN YOUR PROJECT AREA SOMETIME WITHIN THE TIMEFRAME SPECIFIED, WHICH IS A VERY LIBERAL ESTIMATE OF THE DATES INSIDE WHICH THE BIRD BREEDS ACROSS ITS ENTIRE RANGE. "BREEDS ELSEWHERE" INDICATES THAT THE BIRD DOES NOT LIKELY BREED IN YOUR PROJECT AREA.)
Allen's Hummingbird Selasphorus sasin This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9637	Breeds Feb 1 to Jul 15
Arctic Tern Sterna paradisaea This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds May 20 to Aug 15

Ashy Storm-petrel Oceanodroma homochroa — Breeds May 1 to Jan 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/7237

Bald Eagle Haliaeetus leucocephalus — Breeds Jan 1 to Aug 31
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1626

Black Oystercatcher Haematopus bachmani — Breeds Apr 15 to Oct 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9591

Black Rail Laterallus jamaicensis — Breeds Mar 1 to Sep 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/7717

Black Scoter Melanitta nigra — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Black Skimmer Rynchops niger — Breeds May 20 to Sep 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/5234

Black Storm-petrel Oceanodroma melania — Breeds May 15 to Nov 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Black Swift Cypseloides niger — Breeds Jun 15 to Sep 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/8878

Black Turnstone Arenaria melanocephala — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

NOT FOR CONSULTATION

Black-footed Albatross Phoebastria nigripes — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/8033

Black-legged Kittiwake Rissa tridactyla — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Black-vented Shearwater Puffinus opisthomelas — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Bonaparte's Gull Chroicocephalus philadelphia — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Brown Pelican Pelecanus occidentalis — Breeds Jan 15 to Sep 30
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/6034

Burrowing Owl Athene cunicularia — Breeds Mar 15 to Aug 31
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9737

California Thrasher Toxostoma redivivum — Breeds Jan 1 to Jul 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Clark's Grebe Aechmophorus clarkii — Breeds Jan 1 to Dec 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Common Loon gavia immer — Breeds Apr 15 to Oct 31
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/4464

NOT FOR CONSULTATION

Common Murre Uria aalge — Breeds Apr 15 to Aug 15

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Common Tern Sterna hirundo — Breeds May 10 to Sep 10

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/4963

Common Yellowthroat Geothlypis trichas sinuosa — Breeds May 20 to Jul 31

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/2084

Costa's Hummingbird Calypte costae — Breeds Jan 15 to Jun 10

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9470

Double-crested Cormorant phalacrocorax auritus — Breeds Apr 20 to Aug 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/3478

Golden Eagle Aquila chrysaetos — Breeds Jan 1 to Aug 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1680

Gull-billed Tern Gelochelidon nilotica — Breeds May 1 to Jul 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9501

Herring Gull Larus argentatus — Breeds Apr 20 to Aug 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

NOT FOR CONSULTATION

Lawrence's Goldfinch Carduelis lawrencei — Breeds Mar 20 to Sep 20
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9464

Least Tern Sterna antillarum — Breeds Apr 20 to Sep 10
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Lewis's Woodpecker Melanerpes lewis — Breeds Apr 20 to Sep 30
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9408

Long-billed Curlew Numenius americanus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/5511

Long-tailed Duck Clangula hyemalis — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/7238

Marbled Godwit Limosa fedoa — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9481

Northern Fulmar Fulmarus glacialis — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Northern Gannet Morus bassanus — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

NOT FOR CONSULTATION

Nuttall's Woodpecker Picoides nuttallii — Breeds Apr 1 to Jul 20
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9410

Oak Titmouse Baeolophus inornatus — Breeds Mar 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9656

Parasitic Jaeger Stercorarius parasiticus — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Pink-footed Shearwater Puffinus creatopus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Pomarine Jaeger Stercorarius pomarinus — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Red Phalarope Phalaropus fulicarius — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Red-breasted Merganser Mergus serrator — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Red-necked Phalarope Phalaropus lobatus — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Red-throated Loon Gavia stellata — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

NOT FOR CONSULTATION

Ring-billed Gull Larus delawarensis — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Rufous Hummingbird selasphorus rufus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/8002

Scripps's Murrelet Synthliboramphus scrippsi — Breeds Feb 20 to Jul 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Short-billed Dowitcher Limnodromus griseus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Song Sparrow Melospiza melodia — Breeds Feb 20 to Sep 5
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

South Polar Skua Stercorarius maccormicki — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Spotted Towhee Pipilo maculatus clementae — Breeds Apr 15 to Jul 20
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/4243

Surf Scoter Melanitta perspicillata — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Tricolored Blackbird Agelaius tricolor — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3910

NOT FOR CONSULTATION

Whimbrel Numenius phaeopus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9483

White-winged Scoter Melanitta fusca — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Willet Tringa semipalmata — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Wilson's Storm-petrel Oceanites oceanicus — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Wrentit Chamaea fasciata — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

NOT FOR CONSULTATION

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence

across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

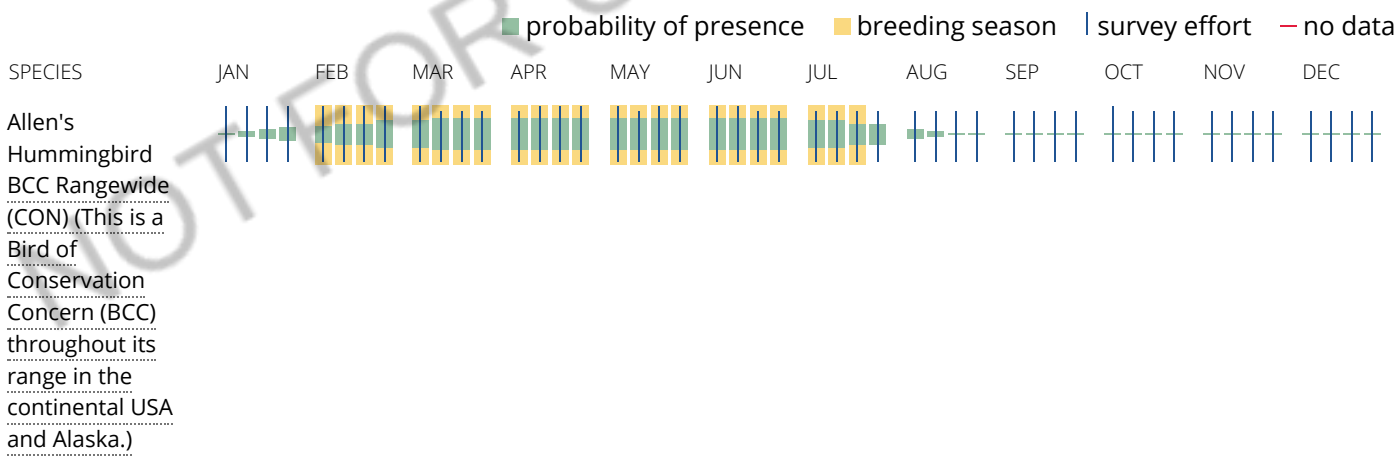
Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

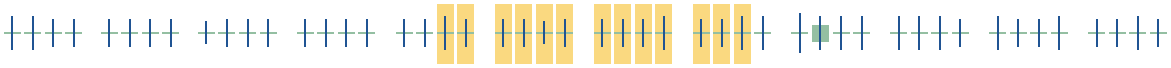
No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

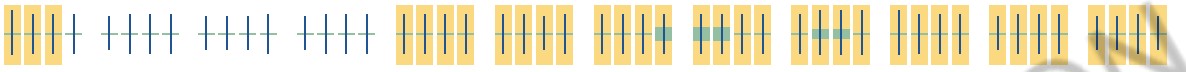


NOT FOR CONSULTATION

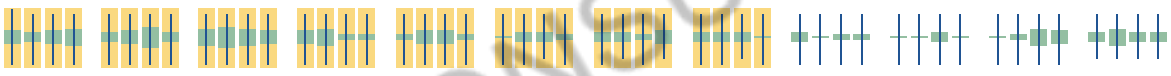
Arctic Tern Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



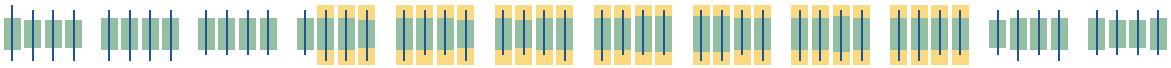
Ashy Storm-petrel BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Bald Eagle Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Black Oystercatcher BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

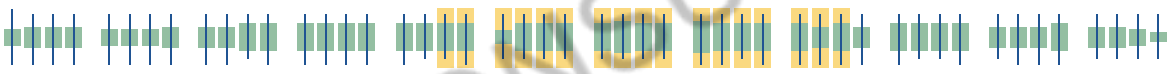


DRAFT FOR CONSULTATION

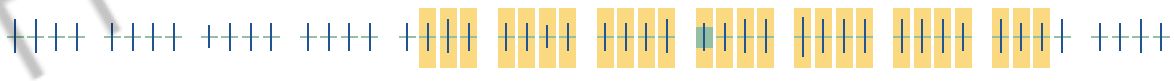
Black Rail BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Black Scoter Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

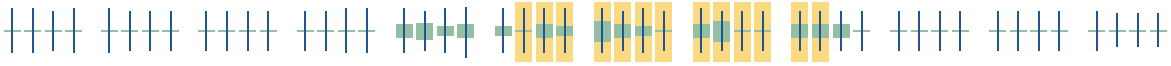
Black Skimmer BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Black Storm-petrel BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

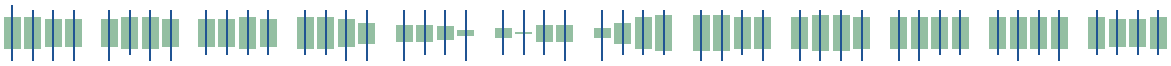


Black Swift BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



NOT FOR CONSULTATION

Black Turnstone
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Black-footed Albatross
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

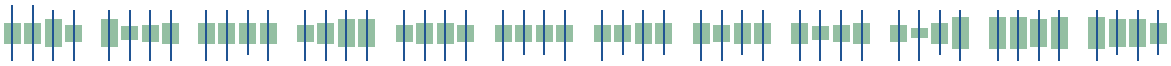
SPECIES JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

Black-legged Kittiwake
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

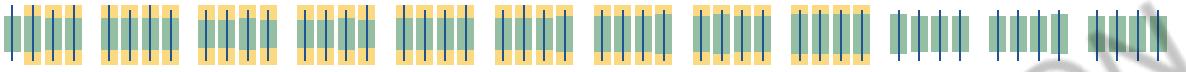
Black-vented Shearwater
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

NOT FOR CONSULTATION

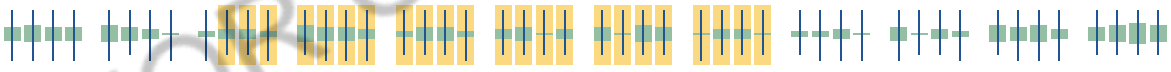
Bonaparte's Gull Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



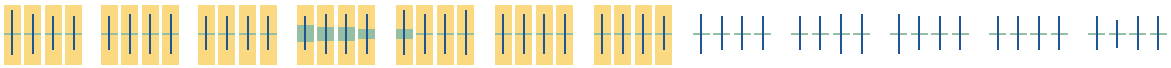
Brown Pelican Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Burrowing Owl BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)

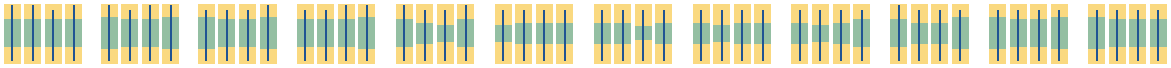


California Thrasher BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

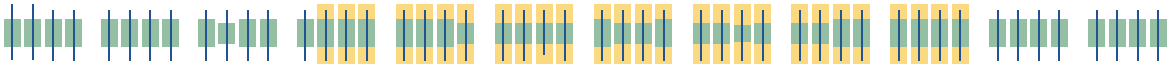


NOT FOR CONSULTATION

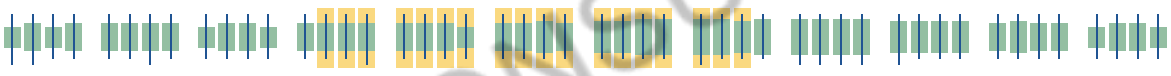
Clark's Grebe BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



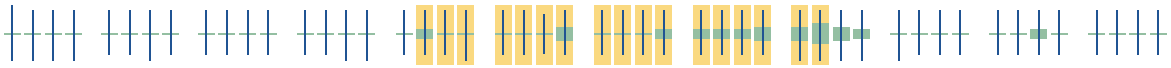
Common Loon Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



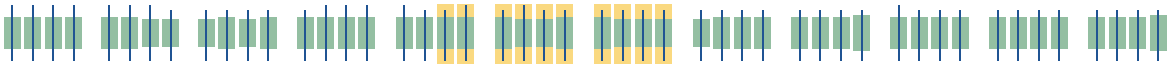
Common Murre Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Common Tern Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



DRAFT FOR CONSULTATION

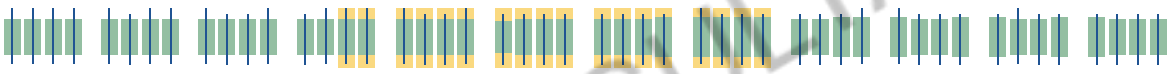


Common Yellowthroat BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)

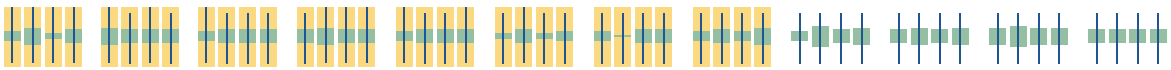
Costa's Hummingbird BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)

NOT FOR CONSULTATION

SPECIES JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

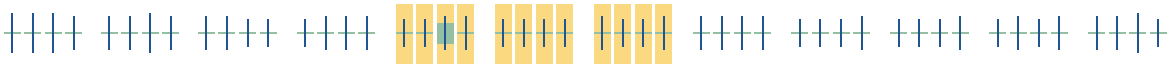


Double-crested Cormorant Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

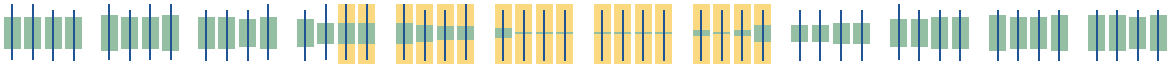


Golden Eagle Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

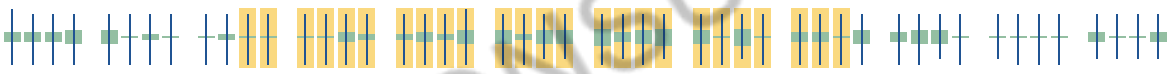
Gull-billed Tern
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



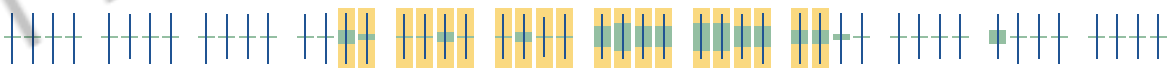
Herring Gull
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Lawrence's Goldfinch
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

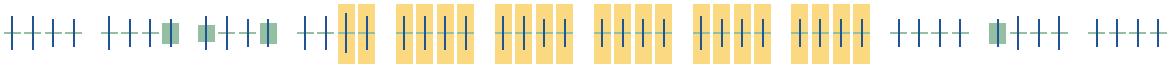


Least Tern
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

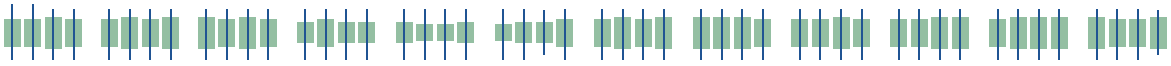


NOT FOR CONSULTATION

Lewis's Woodpecker BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

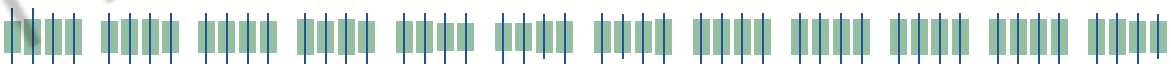


Long-billed Curlew BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Long-tailed Duck Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

Marbled Godwit BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



NOT FOR CONSULTATION

Northern Fulmar
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

Northern Gannet
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Nuttall's Woodpecker BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)												
Oak Titmouse BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)												

NOT FOR CONSULTATION

Parasitic Jaeger Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

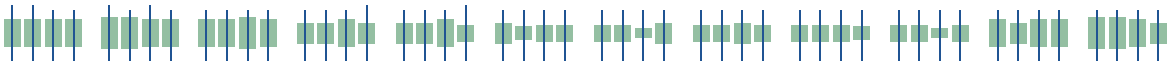
Pink-footed Shearwater BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Pomarine Jaeger Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

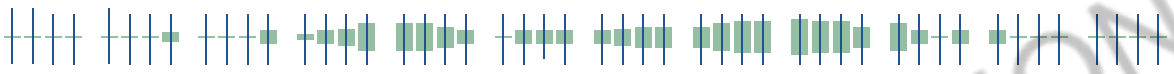
Red Phalarope Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

NOT FOR CONSULTATION

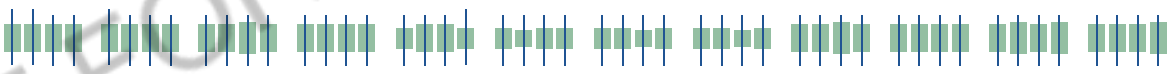
Red-breasted Merganser Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Red-necked Phalarope Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

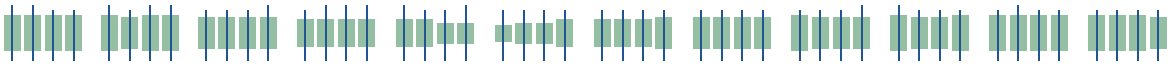


Red-throated Loon BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



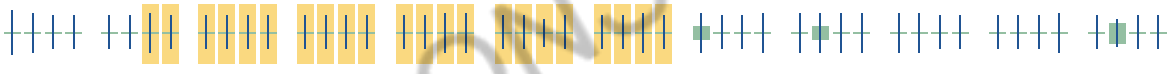
NOT FOR CONSULTATION

Ring-billed Gull Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Rufous Hummingbird BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

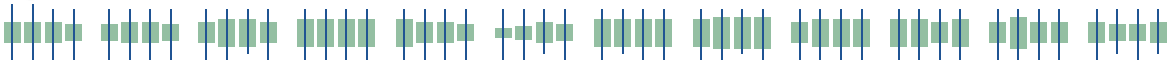
Scripps's Murrelet BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



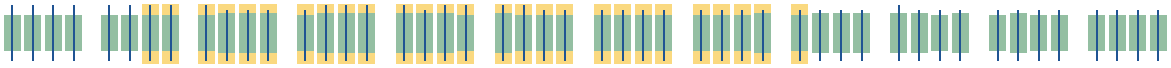
NOT FOR CONSULTATION

SPECIES JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

Short-billed Dowitcher BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

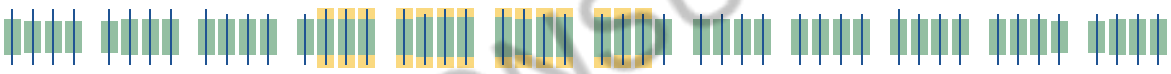


Song Sparrow BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)

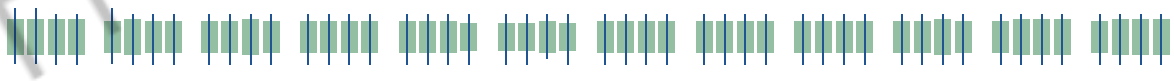


South Polar Skua Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

Spotted Towhee BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)

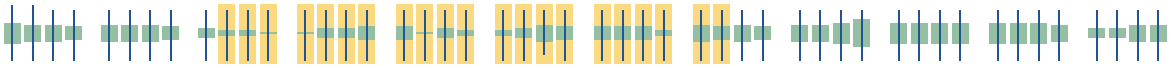


Surf Scoter Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

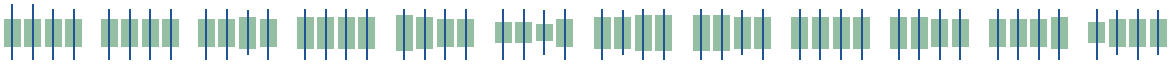


NOT FOR CONSULTATION

Tricolored Blackbird BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

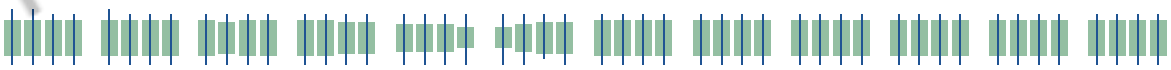


Whimbrel BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



White-winged Scoter Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

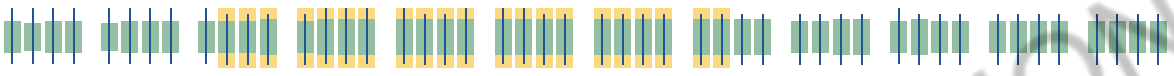
Willet BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



NOT FOR CONSULTATION

Wilson's Storm-petrel Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

Wrentit BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



NOT FOR CONSULTATION

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

NOT FOR CONSULTATION

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

NOT FOR CONSULTATION

Marine mammals

Marine mammals are protected under the Marine Mammal Protection Act. Some are also protected under the Endangered Species Act[1] and the Convention on International Trade in Endangered Species of Wild Fauna and Flora[2].

The responsibilities for the protection, conservation, and management of marine mammals are shared by the U.S. Fish and Wildlife Service [responsible for otters, walruses, polar bears, manatees, and dugongs] and NOAA Fisheries[3] [responsible for seals, sea lions, whales, dolphins, and porpoises]. Marine mammals under the responsibility of NOAA Fisheries are **not** shown on this list; for additional information on those species please visit the Marine Mammals page of the NOAA Fisheries website.

The Marine Mammal Protection Act prohibits the take (to harass, hunt, capture, kill, or attempt to harass, hunt, capture or kill) of marine mammals and further coordination may be necessary for project evaluation. Please contact the U.S. Fish and Wildlife Service Field Office shown.

1. The Endangered Species Act (ESA) of 1973.
2. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is a treaty to ensure that international trade in plants and animals does not threaten their survival in the wild.
3. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following marine mammals under the responsibility of the U.S. Fish and Wildlife Service are potentially affected by activities in this location:

NAME

Southern Sea Otter Enhydra lutris nereis
https://ecos.fws.gov/ecp/species/8560

NOT FOR CONSULTATION

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

WETLAND INFORMATION IS NOT AVAILABLE AT THIS TIME

This can happen when the National Wetlands Inventory (NWI) map service is unavailable, or for very large projects that intersect many wetland areas. Try again, or visit the NWI map to view wetlands at this location.

NOT FOR CONSULTATION

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal,

state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

NOT FOR CONSULTATION

This page intentionally left blank

California Natural Diversity Database Species List

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: County IS (San Mateo OR Santa Clara OR Santa Cruz)

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Acanthomintha duttonii San Mateo thorn-mint	PDLAM01040	Endangered	Endangered	G1	S1	1B.1
Accipiter cooperii Cooper's hawk	ABNKC12040	None	None	G5	S4	WL
Adela oplerella Opler's longhorn moth	IILEE0G040	None	None	G2	S2	
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	Threatened	G1G2	S1S2	SSC
Agrostis blasdalei Blasdale's bent grass	PMPOA04060	None	None	G2	S2	1B.2
Allium peninsulare var. franciscanum Franciscan onion	PMLIL021R1	None	None	G5T2	S2	1B.2
Allium sharsmithiae Sharsmith's onion	PMLIL02310	None	None	G2	S2	1B.3
Ambystoma californiense California tiger salamander	AAAAA01180	Threatened	Threatened	G2G3	S2S3	WL
Ambystoma macrodactylum croceum Santa Cruz long-toed salamander	AAAAA01082	Endangered	Endangered	G5T1T2	S1S2	FP
Ammodramus savannarum grasshopper sparrow	ABPBXA0020	None	None	G5	S3	SSC
Amsinckia lunaris bent-flowered fiddleneck	PDBOR01070	None	None	G3	S3	1B.2
Aneides niger Santa Cruz black salamander	AAAAD01070	None	None	G3	S3	SSC
Anniella pulchra Northern California legless lizard	ARACC01020	None	None	G3	S3	SSC
Anodonta californiensis California floater	IMBIV04220	None	None	G3Q	S2?	
Anomobryum julaceum slender silver moss	NBMUS80010	None	None	G5?	S2	4.2
Antrozous pallidus pallid bat	AMACC10010	None	None	G4	S3	SSC
Aquila chrysaetos golden eagle	ABNKC22010	None	None	G5	S3	FP
Arctostaphylos andersonii Anderson's manzanita	PDERI04030	None	None	G2	S2	1B.2
Arctostaphylos glutinosa Schreiber's manzanita	PDERI040G0	None	None	G1	S1	1B.2

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Arctostaphylos hookeri ssp. hookeri Hooker's manzanita	PDERI040J1	None	None	G3T2	S2	1B.2
Arctostaphylos imbricata San Bruno Mountain manzanita	PDERI040L0	None	Endangered	G1	S1	1B.1
Arctostaphylos montaraensis Montara manzanita	PDERI042W0	None	None	G1	S1	1B.2
Arctostaphylos ohloneana Ohlone manzanita	PDERI042Y0	None	None	G1	S1	1B.1
Arctostaphylos pacifica Pacific manzanita	PDERI040Z0	None	Endangered	G1	S1	1B.1
Arctostaphylos pajaroensis Pajaro manzanita	PDERI04100	None	None	G1	S1	1B.1
Arctostaphylos regismontana Kings Mountain manzanita	PDERI041C0	None	None	G2	S2	1B.2
Arctostaphylos silvicola Bonny Doon manzanita	PDERI041F0	None	None	G1	S1	1B.2
Ardea alba great egret	ABNGA04040	None	None	G5	S4	
Ardea herodias great blue heron	ABNGA04010	None	None	G5	S4	
Arenaria paludicola marsh sandwort	PDCAR040L0	Endangered	Endangered	G1	S1	1B.1
Arizona elegans occidentalis California glossy snake	ARADB01017	None	None	G5T2	S2	SSC
Asio flammeus short-eared owl	ABNSB13040	None	None	G5	S3	SSC
Asio otus long-eared owl	ABNSB13010	None	None	G5	S3?	SSC
Astragalus pycnostachyus var. pycnostachyus coastal marsh milk-vetch	PDFAB0F7B2	None	None	G2T2	S2	1B.2
Astragalus tener var. tener alkali milk-vetch	PDFAB0F8R1	None	None	G2T1	S1	1B.2
Athene cunicularia burrowing owl	ABNSB10010	None	None	G4	S3	SSC
Balsamorhiza macrolepis big-scale balsamroot	PDAST11061	None	None	G2	S2	1B.2
Banksula incredula incredible harvestman	ILARA14100	None	None	G1	S1	
Boechera rubicundula Mt. Day rockcress	PDBRA40100	None	None	G1	S1	1B.1
Bombus caliginosus obscure bumble bee	IIHYM24380	None	None	G4?	S1S2	

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Bombus crotchii Crotch bumble bee	IIHYM24480	None	Candidate Endangered	G3G4	S1S2	
Bombus occidentalis western bumble bee	IIHYM24250	None	Candidate Endangered	G2G3	S1	
Brachyramphus marmoratus marbled murrelet	ABNNN06010	Threatened	Endangered	G3	S2	
Buteo swainsoni Swainson's hawk	ABNKC19070	None	Threatened	G5	S3	
Caecidotea tomalensis Tomales isopod	ICMAL01220	None	None	G2	S2S3	
Calasellus californicus An isopod	ICMAL34010	None	None	G2	S2	
Calicina minor Edgewood blind harvestman	ILARA13020	None	None	G1	S1	
Callophrys mossii bayensis San Bruno elfin butterfly	IILEPE2202	Endangered	None	G4T1	S3	
Calyptridium parryi var. hesseae Santa Cruz Mountains pussypaws	PDPOR09052	None	None	G3G4T2	S2	1B.1
Campanula californica swamp harebell	PDCAM02060	None	None	G3	S3	1B.2
Campanula exigua chaparral harebell	PDCAM020A0	None	None	G2	S2	1B.2
Campanula sharsmithiae Sharsmith's harebell	PDCAM02100	None	None	G1G2	S1S2	1B.2
Carex comosa bristly sedge	PMCYP032Y0	None	None	G5	S2	2B.1
Carex saliniformis deceiving sedge	PMCYP03BY0	None	None	G2	S2	1B.2
Castilleja affinis var. neglecta Tiburon paintbrush	PDSCR0D013	Endangered	Threatened	G4G5T1T2	S1S2	1B.2
Castilleja rubicundula var. rubicundula pink creamsacs	PDSCR0D482	None	None	G5T2	S2	1B.2
Ceanothus ferrisiae Coyote ceanothus	PDRHA041N0	Endangered	None	G1	S1	1B.1
Central Dune Scrub Central Dune Scrub	CTT21320CA	None	None	G2	S2.2	
Centromadia parryi ssp. congdonii Congdon's tarplant	PDAST4R0P1	None	None	G3T1T2	S1S2	1B.1
Centromadia parryi ssp. parryi pappose tarplant	PDAST4R0P2	None	None	G3T2	S2	1B.2
Charadrius nivosus nivosus western snowy plover	ABNNB03031	Threatened	None	G3T3	S2	SSC

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Chlorogalum pomeridianum var. minus dwarf soaproot	PMLIL0G042	None	None	G5T3	S3	1B.2
Chloropyron maritimum ssp. palustre Point Reyes salty bird's-beak	PDSCR0J0C3	None	None	G4?T2	S2	1B.2
Chorizanthe cuspidata var. cuspidata San Francisco Bay spineflower	PDPGN04081	None	None	G2T1	S1	1B.2
Chorizanthe pungens var. hartwegiana Ben Lomond spineflower	PDPGN040M1	Endangered	None	G2T1	S1	1B.1
Chorizanthe pungens var. pungens Monterey spineflower	PDPGN040M2	Threatened	None	G2T2	S2	1B.2
Chorizanthe robusta var. hartwegii Scotts Valley spineflower	PDPGN040Q1	Endangered	None	G2T1	S1	1B.1
Chorizanthe robusta var. robusta robust spineflower	PDPGN040Q2	Endangered	None	G2T1	S1	1B.1
Cicindela hirticollis gravida sandy beach tiger beetle	IICOL02101	None	None	G5T2	S2	
Cicindela ohlone Ohlone tiger beetle	IICOL026L0	Endangered	None	G1	S1	
Circus hudsonius northern harrier	ABNKC11011	None	None	G5	S3	SSC
Cirsium andrewsii Franciscan thistle	PDAST2E050	None	None	G3	S3	1B.2
Cirsium fontinale var. campylon Mt. Hamilton thistle	PDAST2E163	None	None	G2T2	S2	1B.2
Cirsium fontinale var. fontinale fountain thistle	PDAST2E161	Endangered	Endangered	G2T1	S1	1B.1
Cirsium occidentale var. compactum compact cobwebby thistle	PDAST2E1Z1	None	None	G3G4T2	S2	1B.2
Cirsium praeteriens lost thistle	PDAST2E2B0	None	None	GX	SX	1A
Clarkia concinna ssp. automixa Santa Clara red ribbons	PDONA050A1	None	None	G5?T3	S3	4.3
Coastal and Valley Freshwater Marsh Coastal and Valley Freshwater Marsh	CTT52410CA	None	None	G3	S2.1	
Coastal Brackish Marsh Coastal Brackish Marsh	CTT52200CA	None	None	G2	S2.1	
Coccyzus americanus occidentalis western yellow-billed cuckoo	ABNRB02022	Threatened	Endangered	G5T2T3	S1	
Coelus globosus globose dune beetle	IICOL4A010	None	None	G1G2	S1S2	
Collinsia corymbosa round-headed Chinese-houses	PDSCR0H060	None	None	G1	S1	1B.2

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Collinsia multicolor San Francisco collinsia	PDSCR0H0B0	None	None	G2	S2	1B.2
Corynorhinus townsendii Townsend's big-eared bat	AMACC08010	None	None	G4	S2	SSC
Coturnicops noveboracensis yellow rail	ABNME01010	None	None	G4	S1S2	SSC
Cypseloides niger black swift	ABNUA01010	None	None	G4	S2	SSC
Dacryophyllum falcifolium tear drop moss	NBMUS8Z010	None	None	G2	S2	1B.3
Danaus plexippus pop. 1 monarch - California overwintering population	IILEPP2012	Candidate	None	G4T2T3	S2S3	
Delphinium californicum ssp. interius Hospital Canyon larkspur	PDRAN0B0A2	None	None	G3T3	S3	1B.2
Dicamptodon ensatus California giant salamander	AAAAH01020	None	None	G3	S2S3	SSC
Dipodomys heermanni berkeleyensis Berkeley kangaroo rat	AMAFD03061	None	None	G4T1	S1	
Dipodomys venustus venustus Santa Cruz kangaroo rat	AMAFD03042	None	None	G4T1	S1	
Dirca occidentalis western leatherwood	PDTHY03010	None	None	G2	S2	1B.2
Dudleya abramsii ssp. setchellii Santa Clara Valley dudleya	PDCRA040Z0	Endangered	None	G4T2	S2	1B.1
Dufourea stagei Stage's dufourine bee	IIHYM22010	None	None	G1G2	S1	
Egretta thula snowy egret	ABNGA06030	None	None	G5	S4	
Elanus leucurus white-tailed kite	ABNKC06010	None	None	G5	S3S4	FP
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
Erethizon dorsatum North American porcupine	AMAFJ01010	None	None	G5	S3	
Eriastrum tracyi Tracy's eriastrum	PDPLM030C0	None	Rare	G3Q	S3	3.2
Eriogonum nudum var. decurrens Ben Lomond buckwheat	PDPGN08492	None	None	G5T1	S1	1B.1
Eriophyllum latilobum San Mateo woolly sunflower	PDAST3N060	Endangered	Endangered	G1	S1	1B.1
Eryngium aristulatum var. hooveri Hoover's button-celery	PDAPI0Z043	None	None	G5T1	S1	1B.1

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Eryngium jepsonii Jepson's coyote-thistle	PDAPI0Z130	None	None	G2	S2	1B.2
Erysimum ammophilum sand-loving wallflower	PDBRA16010	None	None	G2	S2	1B.2
Erysimum teretifolium Santa Cruz wallflower	PDBRA160N0	Endangered	Endangered	G1	S1	1B.1
Eucyclogobius newberryi tidewater goby	AFCQN04010	Endangered	None	G3	S3	
Eumetopias jubatus Steller (=northern) sea-lion	AMAJC03010	Delisted	None	G3	S2	
Euphilotes enoptes smithi Smith's blue butterfly	IILEPG2026	Endangered	None	G5T1T2	S1	
Euphydryas editha bayensis Bay checkerspot butterfly	IILEPK4055	Threatened	None	G5T1	S1	
Falco columbarius merlin	ABNKD06030	None	None	G5	S3S4	WL
Falco mexicanus prairie falcon	ABNKD06090	None	None	G5	S4	WL
Falco peregrinus anatum American peregrine falcon	ABNKD06071	Delisted	Delisted	G4T4	S3S4	FP
Fissidens pauperculus minute pocket moss	NBMUS2W0U0	None	None	G3?	S2	1B.2
Fissilicreagris imperialis Empire Cave pseudoscorpion	ILARAE5010	None	None	G1	S1	
Fritillaria agrestis stinkbells	PMLIL0V010	None	None	G3	S3	4.2
Fritillaria biflora var. ineziana Hillsborough chocolate lily	PMLIL0V0M1	None	None	G3G4T1	S1	1B.1
Fritillaria falcata talus fritillary	PMLIL0V070	None	None	G2	S2	1B.2
Fritillaria liliacea fragrant fritillary	PMLIL0V0C0	None	None	G2	S2	1B.2
Geothlypis trichas sinuosa saltmarsh common yellowthroat	ABPBX1201A	None	None	G5T3	S3	SSC
Gilia millefoliata dark-eyed gilia	PDPLM04130	None	None	G2	S2	1B.2
Gilia tenuiflora ssp. arenaria Monterey gilia	PDPLM041P2	Endangered	Threatened	G3G4T2	S2	1B.2
Gonidea angulata western ridged mussel	IMBIV19010	None	None	G3	S1S2	
Grimmia torenii Toren's grimmia	NBMUS32330	None	None	G2	S2	1B.3

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Grimmia vaginulata vaginulate grimmia	NBMUS32340	None	None	G3	S1	1B.1
Grindelia hirsutula var. maritima San Francisco gumplant	PDAST470D3	None	None	G5T1Q	S1	3.2
Haliaeetus leucocephalus bald eagle	ABNKC10010	Delisted	Endangered	G5	S3	FP
Helianthella castanea Diablo helianthella	PDAST4M020	None	None	G2	S2	1B.2
Hemizonia congesta ssp. congesta congested-headed hayfield tarplant	PDAST4R065	None	None	G5T2	S2	1B.2
Hesperevax sparsiflora var. brevifolia short-leaved evax	PDASTE5011	None	None	G4T3	S3	1B.2
Hesperocyparis abramsiana var. abramsiana Santa Cruz cypress	PGCUP04081	Threatened	Endangered	G1T1	S1	1B.2
Hesperocyparis abramsiana var. butanoensis Butano Ridge cypress	PGCUP04082	Threatened	Endangered	G1T1	S1	1B.2
Hesperolinon congestum Marin western flax	PDLIN01060	Threatened	Threatened	G1	S1	1B.1
Heteranthera dubia water star-grass	PMPON03010	None	None	G5	S2	2B.2
Hoita strobilina Loma Prieta hoita	PDFAB5Z030	None	None	G2?	S2?	1B.1
Holocarpha macradenia Santa Cruz tarplant	PDAST4X020	Threatened	Endangered	G1	S1	1B.1
Horkelia cuneata var. sericea Kellogg's horkelia	PDROS0W043	None	None	G4T1?	S1?	1B.1
Horkelia marinensis Point Reyes horkelia	PDROS0W0B0	None	None	G2	S2	1B.2
Hydrochara rickseckeri Ricksecker's water scavenger beetle	IICOL5V010	None	None	G2?	S2?	
Hydroporus leechi Leech's skyline diving beetle	IICOL55040	None	None	G1?	S1?	
Hypogymnia schizidiata island tube lichen	NLT0032640	None	None	G2G3	S2	1B.3
Icteria virens yellow-breasted chat	ABPBX24010	None	None	G5	S3	SSC
Ischnura gemina San Francisco forktail damselfly	IIODO72010	None	None	G2	S2	
Lanius ludovicianus loggerhead shrike	ABPBR01030	None	None	G4	S4	SSC
Lasiurus cinereus hoary bat	AMACC05030	None	None	G3G4	S4	

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Lasthenia californica ssp. macrantha perennial goldfields	PDAST5L0C5	None	None	G3T2	S2	1B.2
Lasthenia conjugens Contra Costa goldfields	PDAST5L040	Endangered	None	G1	S1	1B.1
Laterallus jamaicensis coturniculus California black rail	ABNME03041	None	Threatened	G3G4T1	S1	FP
Lavinia exilicauda harengus Monterey hitch	AFCJB19013	None	None	G4T2T4	S2S4	SSC
Lavinia symmetricus subditus Monterey roach	AFCJB19026	None	None	G4T2T3	S2S3	SSC
Layia carnosa beach layia	PDAST5N010	Endangered	Endangered	G2	S2	1B.1
Legenere limosa legenere	PDCAM0C010	None	None	G2	S2	1B.1
Leptosiphon croceus coast yellow leptosiphon	PDPLM09170	None	Endangered	G1	S1	1B.1
Leptosiphon rosaceus rose leptosiphon	PDPLM09180	None	None	G1	S1	1B.1
Leptosyne hamiltonii Mt. Hamilton coreopsis	PDAST2L0C0	None	None	G2	S2	1B.2
Lessingia arachnoidea Crystal Springs lessingia	PDAST5S0C0	None	None	G2	S2	1B.2
Lessingia germanorum San Francisco lessingia	PDAST5S010	Endangered	Endangered	G1	S1	1B.1
Lessingia micradenia var. glabrata smooth lessingia	PDAST5S062	None	None	G2T2	S2	1B.2
Lichnanthe ursina bumblebee scarab beetle	IICOL67020	None	None	G2	S2	
Limnanthes douglasii ssp. ornduffii Ornduff's meadowfoam	PDLIM02039	None	None	G4T1	S1	1B.1
Limnanthes douglasii ssp. sulphurea Point Reyes meadowfoam	PDLIM02038	None	Endangered	G4T1	S1	1B.2
Linderiella occidentalis California linderiella	ICBRA06010	None	None	G2G3	S2S3	
Lomatium observatorium Mt. Hamilton lomatium	PDAPI1B2J0	None	None	G1	S1	1B.2
Lytta moesta moestan blister beetle	IICOL4C020	None	None	G2	S2	
Malacothamnus arcuatus arcuate bush-mallow	PDMAL0Q0E0	None	None	G2Q	S2	1B.2
Malacothamnus hallii Hall's bush-mallow	PDMAL0Q0F0	None	None	G2	S2	1B.2

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Margaritifera falcata western pearlshell	IMBIV27020	None	None	G4G5	S1S2	
Maritime Coast Range Ponderosa Pine Forest Maritime Coast Range Ponderosa Pine Forest	CTT84132CA	None	None	G1	S1.1	
Masticophis lateralis euryxanthus Alameda whipsnake	ARADB21031	Threatened	Threatened	G4T2	S2	
Meconella oregana Oregon meconella	PDPAP0G030	None	None	G2G3	S2	1B.1
Melospiza melodia pusillula Alameda song sparrow	ABPBXA301S	None	None	G5T2?	S2S3	SSC
Meta dolloff Dolloff Cave spider	ILARA17010	None	None	G1	S1	
Microcina edgewoodensis Edgewood Park micro-blind harvestman	ILARA47010	None	None	G1	S1	
Microcina homi Hom's micro-blind harvestman	ILARA47020	None	None	G1	S1	
Microcina jungi Jung's micro-blind harvestman	ILARA47030	None	None	G1	S1	
Microseris paludosa marsh microseris	PDAST6E0D0	None	None	G2	S2	1B.2
Mielichhoferia elongata elongate copper moss	NBMUS4Q022	None	None	G5	S3S4	4.3
Monardella sinuata ssp. nigrescens northern curly-leaved monardella	PDLAM18162	None	None	G3T2	S2	1B.2
Monolopia gracilens woodland woollythreads	PDAST6G010	None	None	G3	S3	1B.2
Monterey Pine Forest Monterey Pine Forest	CTT83130CA	None	None	G1	S1.1	
Mylopharodon conocephalus hardhead	AFCJB25010	None	None	G3	S3	SSC
Myotis evotis long-eared myotis	AMACC01070	None	None	G5	S3	
Myotis thysanodes fringed myotis	AMACC01090	None	None	G4	S3	
Myotis yumanensis Yuma myotis	AMACC01020	None	None	G5	S4	
N. Central Coast Calif. Roach/Stickleback/Steelhead Stream N. Central Coast Calif. Roach/Stickleback/Steelhead Stream	CARA2633CA	None	None	GNR	SNR	
Neochthonius imperialis Empire Cave pseudoscorpion	ILARAD1010	None	None	G1	S1	
Neotoma fuscipes annectens San Francisco dusky-footed woodrat	AMAFF08082	None	None	G5T2T3	S2S3	SSC

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
North Central Coast Drainage Sacramento Sucker/Roach River	CARA2623CA	None	None	GNR	SNR	
North Central Coast Drainage Sacramento Sucker/Roach River						
North Central Coast Short-Run Coho Stream	CARA2632CA	None	None	GNR	SNR	
North Central Coast Short-Run Coho Stream						
North Central Coast Steelhead/Sculpin Stream	CARA2637CA	None	None	GNR	SNR	
North Central Coast Steelhead/Sculpin Stream						
Northern Coastal Salt Marsh	CTT52110CA	None	None	G3	S3.2	
Northern Coastal Salt Marsh						
Northern Interior Cypress Forest	CTT83220CA	None	None	G2	S2.2	
Northern Interior Cypress Forest						
Northern Maritime Chaparral	CTT37C10CA	None	None	G1	S1.2	
Northern Maritime Chaparral						
Nycticorax nycticorax	ABNGA11010	None	None	G5	S4	
black-crowned night heron						
Nyctinomops macrotis	AMACD04020	None	None	G5	S3	SSC
big free-tailed bat						
Oncorhynchus kisutch pop. 4	AFCHA02034	Endangered	Endangered	G5T2T3Q	S2	
coho salmon - central California coast ESU						
Oncorhynchus mykiss irideus pop. 8	AFCHA0209G	Threatened	None	G5T2T3Q	S2S3	
steelhead - central California coast DPS						
Oncorhynchus mykiss irideus pop. 9	AFCHA0209H	Threatened	None	G5T2Q	S2	
steelhead - south-central California coast DPS						
Orthotrichum kellmanii	NBMUS56190	None	None	G1	S1	1B.2
Kellman's bristle moss						
Pandion haliaetus	ABNKC01010	None	None	G5	S4	WL
osprey						
Pedicularis dudleyi	PDSCR1K0D0	None	Rare	G2	S2	1B.2
Dudley's lousewort						
Penstemon rattanii var. kleei	PDSCR1L5B1	None	None	G4T2	S2	1B.2
Santa Cruz Mountains beardtongue						
Pentachaeta bellidiflora	PDAST6X030	Endangered	Endangered	G1	S1	1B.1
white-rayed pentachaeta						
Pentachaeta exilis ssp. aeolica	PDAST6X041	None	None	G5T2	S2	1B.2
San Benito pentachaeta						
Phacelia phacelioides	PDHYD0C3Q0	None	None	G2	S2	1B.2
Mt. Diablo phacelia						
Phalacrocorax auritus	ABNFD01020	None	None	G5	S4	WL
double-crested cormorant						
Philanthus nasalis	IIHYM20010	None	None	G1	S1	
Antioch specid wasp						
Phrynosoma blainvillii	ARACF12100	None	None	G3G4	S3S4	SSC
coast horned lizard						

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Pinus radiata Monterey pine	PGPIN040V0	None	None	G1	S1	1B.1
Piperia candida white-flowered rein orchid	PMORC1X050	None	None	G3	S3	1B.2
Plagiobothrys chorisianus var. chorisianus Choris' popcornflower	PDBOR0V061	None	None	G3T1Q	S1	1B.2
Plagiobothrys diffusus San Francisco popcornflower	PDBOR0V080	None	Endangered	G1Q	S1	1B.1
Plagiobothrys glaber hairless popcornflower	PDBOR0V0B0	None	None	GX	SX	1A
Plagiobothrys verrucosus warty popcornflower	PDBOR0V1D0	None	None	G4G5	S1	2B.1
Plebejus icarioides missionensis Mission blue butterfly	IILEPG801A	Endangered	None	G5T1	S1	
Polemonium carneum Oregon polemonium	PDPLM0E050	None	None	G3G4	S2	2B.2
Polygonum hickmanii Scotts Valley polygonum	PDPGN0L310	Endangered	Endangered	G1	S1	1B.1
Polyphylla barbata Mount Hermon (=barbate) June beetle	IICOL68030	Endangered	None	G1	S1	
Potentilla hickmanii Hickman's cinquefoil	PDROS1B370	Endangered	Endangered	G1	S1	1B.1
Progne subis purple martin	ABPAU01010	None	None	G5	S3	SSC
Puccinellia simplex California alkali grass	PMPOA53110	None	None	G3	S2	1B.2
Rallus obsoletus obsoletus California Ridgway's rail	ABNME05011	Endangered	Endangered	G3T1	S1	FP
Rana boylii foothill yellow-legged frog	AAABH01050	None	Endangered	G3	S3	SSC
Rana draytonii California red-legged frog	AAABH01022	Threatened	None	G2G3	S2S3	SSC
Reithrodontomys raviventris salt-marsh harvest mouse	AMAFF02040	Endangered	Endangered	G1G2	S1S2	FP
Riparia riparia bank swallow	ABPAU08010	None	Threatened	G5	S2	
Rosa pinetorum pine rose	PDROS1J0W0	None	None	G2	S2	1B.2
Rynchops niger black skimmer	ABNNM14010	None	None	G5	S2	SSC
Sacramento-San Joaquin Coastal Lagoon Sacramento-San Joaquin Coastal Lagoon	CALA1360CA	None	None	GNR	SNR	

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Sanicula saxatilis rock sanicle	PDAPI1Z0H0	None	Rare	G2	S2	1B.2
Scaphinotus behrensi Behrens' snail-eating beetle	IICOL4L070	None	None	G2G4	S2S4	
Senecio aphanactis chaparral ragwort	PDAST8H060	None	None	G3	S2	2B.2
Serpentine Bunchgrass Serpentine Bunchgrass	CTT42130CA	None	None	G2	S2.2	
Sidalcea malachroides maple-leaved checkerbloom	PDMAL110E0	None	None	G3	S3	4.2
Silene scouleri ssp. scouleri Scouler's catchfly	PDCAR0U1MC	None	None	G5T4T5	S2S3	2B.2
Silene verecunda ssp. verecunda San Francisco campion	PDCAR0U213	None	None	G5T1	S1	1B.2
Sorex vagrans halicoetes salt-marsh wandering shrew	AMABA01071	None	None	G5T1	S1	SSC
Speyeria adiaste adiaste unsilvered fritillary	IILEPJ6143	None	None	G1G2T1	S1	
Speyeria callippe callippe callippe silverspot butterfly	IILEPJ6091	Endangered	None	G5T1	S1	
Speyeria zerene myrtleae Myrtle's silverspot butterfly	IILEPJ608C	Endangered	None	G5T1	S1	
Spirinchus thaleichthys longfin smelt	AFCHB03010	Candidate	Threatened	G5	S1	
Stebbinsoseris decipiens Santa Cruz microseris	PDAST6E050	None	None	G2	S2	1B.2
Sternula antillarum browni California least tern	ABNNM08103	Endangered	Endangered	G4T2T3Q	S2	FP
Streptanthus albidus ssp. albidus Metcalf Canyon jewelflower	PDBRA2G011	Endangered	None	G2T1	S1	1B.1
Streptanthus albidus ssp. peramoenus most beautiful jewelflower	PDBRA2G012	None	None	G2T2	S2	1B.2
Streptanthus callistus Mt. Hamilton jewelflower	PDBRA2G0A0	None	None	G1G2	S1S2	1B.3
Stuckenia filiformis ssp. alpina slender-leaved pondweed	PMPOT03091	None	None	G5T5	S2S3	2B.2
Stygobromus imperialis Empire Cave amphipod	ICMAL05E30	None	None	G1	S1	
Stygobromus mackenziei Mackenzie's Cave amphipod	ICMAL05530	None	None	G1	S1	
Suaeda californica California seablite	PDCHE0P020	Endangered	None	G1	S1	1B.1

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Sycamore Alluvial Woodland	CTT62100CA	None	None	G1	S1.1	
Sycamore Alluvial Woodland						
Taricha rivularis	AAAAF02020	None	None	G2	S2	SSC
red-bellied newt						
Taxidea taxus	AMAJF04010	None	None	G5	S3	SSC
American badger						
Thaleichthys pacificus	AFCHB04010	Threatened	None	G5	S2	
eulachon						
Thamnophis sirtalis tetrataenia	ARADB3613B	Endangered	Endangered	G5T2Q	S2	FP
San Francisco gartersnake						
Trifolium amoenum	PDFAB40040	Endangered	None	G1	S1	1B.1
two-fork clover						
Trifolium buckwestiorum	PDFAB402W0	None	None	G2	S2	1B.1
Santa Cruz clover						
Trifolium hydrophilum	PDFAB400R5	None	None	G2	S2	1B.2
saline clover						
Trifolium polyodon	PDFAB402H0	None	Rare	G1	S1	1B.1
Pacific Grove clover						
Trimerotropis infantilis	IIORT36030	Endangered	None	G1	S1	
Zayante band-winged grasshopper						
Triphysaria floribunda	PDSCR2T010	None	None	G2?	S2?	1B.2
San Francisco owl's-clover						
Triquetrella californica	NBMUS7S010	None	None	G2	S2	1B.2
coastal triquetrella						
Tryonia imitator	IMGASJ7040	None	None	G2	S2	
mimic tryonia (=California brackishwater snail)						
Usnea longissima	NLLEC5P420	None	None	G4	S4	4.2
Methuselah's beard lichen						
Valley Needlegrass Grassland	CTT42110CA	None	None	G3	S3.1	
Valley Needlegrass Grassland						
Valley Oak Woodland	CTT71130CA	None	None	G3	S2.1	
Valley Oak Woodland						
Vireo bellii pusillus	ABPBW01114	Endangered	Endangered	G5T2	S2	
least Bell's vireo						
Vulpes macrotis mutica	AMAJA03041	Endangered	Threatened	G4T2	S2	
San Joaquin kit fox						

Record Count: 268

This page intentionally left blank

California Native Plant Society Species List

Inventory of Rare and Endangered Plants of California

Search Results

Back Export Results

117 matches found. Click on scientific name for details

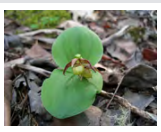
Search Criteria: Quad is one of
[**3712244,3712243,3712242,3712234,3712233,3712232,3712231,3712254,3712241,3712128,3712138,3712221,3712222,3712223,3712224,3712213**]

Scientific Name | Common Name | Family | Lifeform | Blooming Period | Fed List | State List | Global Rank | State Rank | CA Rare Plant Rank | General Habitats | Micro Habitats | Lowest Elevation | Highest Elevation | CA Endemic | Date Added | Photo

Search:

▲ SCIENTIFIC NAME	COMMON NAME	FAMILY	LIFEFORM	BLOOMING PERIOD	FED LIST	STATE LIST	GLOBAL RANK	STATE RANK	CA RARE PLANT RANK	PHOTO
Acanthomintha duttonii	San Mateo thorn-mint	Lamiaceae	annual herb	Apr-Jun	FE	CE	G1	S1	1B.1	No Photo Available
Agrostis blasdalei	Blasdale's bent grass	Poaceae	perennial rhizomatous herb	May-Jul	None	None	G2	S2	1B.2	No Photo Available
Allium peninsulare var. *franciscanum*	Franciscan onion	Alliaceae	perennial bulbiferous herb	(Apr)May-Jun	None	None	G5T2	S2	1B.2	No Photo Available
Amsinckia lunaris	bent-flowered fiddleneck	Boraginaceae	annual herb	Mar-Jun	None	None	G3	S3	1B.2	No Photo Available
Androsace elongata ssp. *acuta*	California androsace	Primulaceae	annual herb	Mar-Jun	None	None	G5? T3T4	S3S4	4.2	No Photo Available
Anomobryum julaceum	slender silver moss	Bryaceae	moss		None	None	G5?	S2	4.2	© 2013 Scot Loring
Arabis blepharophylla	coast rockcress	Brassicaceae	perennial herb	Feb-May	None	None	G4	S4	4.3	No Photo Available
Arctostaphylos andersonii	Anderson's manzanita	Ericaceae	perennial evergreen shrub	Nov-May	None	None	G2	S2	1B.2	No Photo Available
Arctostaphylos glutinosa	Schreiber's manzanita	Ericaceae	perennial evergreen shrub	Mar-Apr(Nov)	None	None	G1	S1	1B.2	No Photo Available

▲ SCIENTIFIC NAME	COMMON NAME	FAMILY	LIFEFORM	BLOOMING PERIOD	FED LIST	STATE LIST	GLOBAL RANK	STATE RANK	CA RARE PLANT RANK	PHOTO
Arctostaphylos montaraensis	Montara manzanita	Ericaceae	perennial evergreen shrub	Jan-Mar	None	None	G1	S1	1B.2	No Photo Available
Arctostaphylos ohloneana	Ohlone manzanita	Ericaceae	evergreen shrub	Feb-Mar	None	None	G1	S1	1B.1	No Photo Available
Arctostaphylos regismontana	Kings Mountain manzanita	Ericaceae	perennial evergreen shrub	Dec-Apr	None	None	G2	S2	1B.2	No Photo Available
Arctostaphylos silvicola	Bonny Doon manzanita	Ericaceae	perennial evergreen shrub	Jan-Mar	None	None	G1	S1	1B.2	No Photo Available
Astragalus nuttallii var. *nuttallii*	ocean bluff milk-vetch	Fabaceae	perennial herb	Jan-Nov	None	None	G4T4	S4	4.2	No Photo Available
Astragalus pycnostachyus var. *pycnostachyus*	coastal marsh milk-vetch	Fabaceae	perennial herb	(Apr)Jun-Oct	None	None	G2T2	S2	1B.2	No Photo Available
Astragalus tener var. *tener*	alkali milk-vetch	Fabaceae	annual herb	Mar-Jun	None	None	G2T1	S1	1B.2	No Photo Available
Calandrinia breweri	Brewer's calandrinia	Montiaceae	annual herb	(Jan)Mar-Jun	None	None	G4	S4	4.2	No Photo Available
Calochortus umbellatus	Oakland star-tulip	Liliaceae	perennial bulbiferous herb	Mar-May	None	None	G3?	S3?	4.2	No Photo Available
Calyptridium parryi var. *hesseae*	Santa Cruz Mountains pussypaws	Montiaceae	annual herb	May-Aug	None	None	G3G4T2	S2	1B.1	No Photo Available
Castilleja ambigua var. *ambigua*	johnny-nip	Orobanchaceae	annual herb (hemiparasitic)	Mar-Aug	None	None	G4T4	S3S4	4.2	No Photo Available
Castilleja latifolia	Monterey Coast paintbrush	Orobanchaceae	perennial herb (hemiparasitic)	Feb-Sep	None	None	G4	S4	4.3	No Photo Available
Centromadia parryi ssp. *congdonii*	Congdon's tarplant	Asteraceae	annual herb	May-Oct(Nov)	None	None	G3T1T2	S1S2	1B.1	No Photo Available
Centromadia parryi ssp. *parryi*	pappose tarplant	Asteraceae	annual herb	May-Nov	None	None	G3T2	S2	1B.2	No Photo Available
Chloropyron maritimum ssp. *palustre*	Point Reyes salty bird's-beak	Orobanchaceae	annual herb (hemiparasitic)	Jun-Oct	None	None	G4?T2	S2	1B.2	No Photo Available
Chorizanthe	San Francisco	Polygonaceae	annual herb	Apr-Jul(Aug)	None	None	G2T1	S1	1B.2	

cuspidata var. *cuspidata*	Bay spineflower								CA RARE	No Photo Available
▲ SCIENTIFIC NAME	COMMON NAME	FAMILY	LIFEFORM	BLOOMING PERIOD	FED LIST	STATE LIST	GLOBAL RANK	STATE RANK	PLANT RANK	PHOTO
Chorizanthe pungens var. *hartwegiana*	Ben Lomond spineflower	Polygonaceae	annual herb	Apr-Jul	FE	None	G2T1	S1	1B.1	No Photo Available
Chorizanthe robusta var. *robusta*	robust spineflower	Polygonaceae	annual herb	Apr-Sep	FE	None	G2T1	S1	1B.1	No Photo Available
Cirsium andrewsii	Franciscan thistle	Asteraceae	perennial herb	Mar-Jul	None	None	G3	S3	1B.2	No Photo Available
Cirsium fontinale var. *campylon*	Mt. Hamilton thistle	Asteraceae	perennial herb	(Feb)Apr-Oct	None	None	G2T2	S2	1B.2	No Photo Available
Cirsium fontinale var. *fontinale*	fountain thistle	Asteraceae	perennial herb	(Apr)May-Oct	FE	CE	G2T1	S1	1B.1	No Photo Available
Cirsium praeteriens	lost thistle	Asteraceae	perennial herb	Jun-Jul	None	None	GX	SX	1A	No Photo Available
Clarkia breweri	Brewer's clarkia	Onagraceae	annual herb	Apr-Jun	None	None	G4	S4	4.2	No Photo Available
Clarkia concinna ssp. *automixa*	Santa Clara red ribbons	Onagraceae	annual herb	(Apr)May-Jun(Jul)	None	None	G5?T3	S3	4.3	No Photo Available
Clarkia lewisii	Lewis' clarkia	Onagraceae	annual herb	May-Jul	None	None	G4	S4	4.3	No Photo Available
Collinsia corymbosa	round-headed Chinese-houses	Plantaginaceae	annual herb	Apr-Jun	None	None	G1	S1	1B.2	No Photo Available
Collinsia multicolor	San Francisco collinsia	Plantaginaceae	annual herb	(Feb)Mar-May	None	None	G2	S2	1B.2	No Photo Available
Cypripedium fasciculatum	clustered lady's-slipper	Orchidaceae	perennial rhizomatous herb	Mar-Aug	None	None	G4	S4	4.2	 © 2013 Scot Loring
Cypripedium montanum	mountain lady's-slipper	Orchidaceae	perennial rhizomatous herb	Mar-Aug	None	None	G4	S4	4.2	©2021 Scot Loring
Dirca occidentalis	western leatherwood	Thymelaeaceae	perennial deciduous shrub	Jan-Mar(Apr)	None	None	G2	S2	1B.2	No Photo

	leatherwood		deciduous shrub							No Photo Available
Dudleya abramsii ssp. setchellii	Santa Clara Valley dudleya	Crassulaceae	perennial herb	Apr-Oct	FE	None	G4T2	S2	1B.1	No Photo Available
Elymus californicus	California bottle-brush grass	Poaceae	perennial herb	May-Aug(Nov)	None	None	G4	S4	4.3	No Photo Available
Eriophyllum latilobum	San Mateo woolly sunflower	Asteraceae	perennial herb	May-Jun	FE	CE	G1	S1	1B.1	No Photo Available
Eryngium aristulatum var. *hooveri*	button-celery		herb							No Photo Available
Eryngium jepsonii	Jepson's coyote-thistle	Apiaceae	perennial herb	Apr-Aug	None	None	G2	S2	1B.2	No Photo Available
Erysimum ammophilum	sand-loving wallflower	Brassicaceae	perennial herb	Feb-Jun(Jul-Aug)	None	None	G2	S2	1B.2	No Photo Available
Erysimum franciscanum	San Francisco wallflower	Brassicaceae	perennial herb	Mar-Jun	None	None	G3	S3	4.2	No Photo Available
Fissidens pauperculus	minute pocket moss	Fissidentaceae	moss		None	None	G3?	S2	1B.2	©2021 Scot Loring
Fritillaria agrestis	stinkbells	Liliaceae	perennial bulbiferous herb	Mar-Jun	None	None	G3	S3	4.2	No Photo Available
Fritillaria biflora var. *ineziana*	Hillsborough chocolate lily	Liliaceae	perennial bulbiferous herb	Mar-Apr	None	None	G3G4T1	S1	1B.1	No Photo Available
Fritillaria liliacea	fragrant fritillary	Liliaceae	perennial bulbiferous herb	Feb-Apr	None	None	G2	S2	1B.2	No Photo Available
Galium andrewsii ssp. *gatense*	phlox-leaf serpentine bedstraw	Rubiaceae	perennial herb	Apr-Jul	None	None	G5T3	S3	4.2	No Photo Available
Grimmia torenii	Toren's grimmia	Grimmiaceae	moss		None	None	G2	S2	1B.3	©2021 Scot Loring
Grimmia vaginulata	vaginulate grimmia	Grimmiaceae	moss		None	None	G3	S1	1B.1	No Photo Available
Grindelia	San Francisco	Asteraceae	perennial herb	Jun-Sep	None	None	G5T1Q	S1	3.2	

▲ SCIENTIFIC NAME	COMMON NAME	FAMILY	LIFEFORM	BLOOMING PERIOD	FED LIST	STATE LIST	GLOBAL RANK	STATE RANK	CA RARE PLANT RANK	PHOTO
hirsutula var. *maritima*	gumplant									No Photo Available
Hesperevax sparsiflora var. *brevifolia*	short-leaved evax	Asteraceae	annual herb	Mar-Jun	None	None	G4T3	S3	1B.2	No Photo Available
Hesperocyparis abramsiana var. *abramsiana*	Santa Cruz cypress	Cupressaceae	perennial evergreen tree		FT	CE	G1T1	S1	1B.2	No Photo Available
Hesperocyparis abramsiana var. *butanoensis*	Butano Ridge cypress	Cupressaceae	perennial evergreen tree	Oct	FT	CE	G1T1	S1	1B.2	No Photo Available
Hesperolinon congestum	Marin western flax	Linaceae	annual herb	Apr-Jul	FT	CT	G1	S1	1B.1	No Photo Available
Hoita strobilina	Loma Prieta hoita	Fabaceae	perennial herb	May-Jul(Aug-Oct)	None	None	G2?	S2?	1B.1	© 2004 Janell Hillman
Horkelia cuneata var. *sericea*	Kellogg's horkelia	Rosaceae	perennial herb	Apr-Sep	None	None	G4T1?	S1?	1B.1	No Photo Available
Horkelia marinensis	Point Reyes horkelia	Rosaceae	perennial herb	May-Sep	None	None	G2	S2	1B.2	No Photo Available
Hosackia gracilis	harlequin lotus	Fabaceae	perennial rhizomatous herb	Mar-Jul	None	None	G3G4	S3	4.2	No Photo Available
Hypogymnia schizidiata	island rock lichen	Parmeliaceae	foliose lichen		None	None	G2G3	S2	1B.3	No Photo Available
Iris longipetala	coast iris	Iridaceae	perennial rhizomatous herb	Mar-May(Jun)	None	None	G3	S3	4.2	No Photo Available
Lasthenia californica ssp. *macrantha*	perennial goldfields	Asteraceae	perennial herb	Jan-Nov	None	None	G3T2	S2	1B.2	No Photo Available
Legenere limosa	legenere	Campanulaceae	annual herb	Apr-Jun	None	None	G2	S2	1B.1	No Photo Available
Leptosiphon acicularis	bristly leptosiphon	Polemoniaceae	annual herb	Apr-Jul	None	None	G4?	S4?	4.2	No Photo Available
Leptosiphon ambiguus	serpentine leptosiphon	Polemoniaceae	annual herb	Mar-Jun	None	None	G4	S4	4.2	No Photo

SCIENTIFIC NAME	COMMON NAME	FAMILY	LIFEFORM	BLOOMING PERIOD	FED LIST	STATE LIST	GLOBAL RANK	STATE RANK	CA RARE PLANT RANK	PHOTO
Leptosiphon ambiguus	leptosiphon									No Photo Available
Leptosiphon croceus	coast yellow leptosiphon	Polemoniaceae	annual herb	Apr-Jun	None	CE	G1	S1	1B.1	No Photo Available
Leptosiphon grandiflorus	large-flowered leptosiphon	Polemoniaceae	annual herb	Apr-Aug	None	None	G3G4	S3S4	4.2	No Photo Available
Leptosiphon latisectus	broad-lobed leptosiphon	Polemoniaceae	annual herb	Apr-Jun	None	None	G4	S4	4.3	No Photo Available
Leptosiphon rosaceus	rose leptosiphon	Polemoniaceae	annual herb	Apr-Jul	None	None	G1	S1	1B.1	No Photo Available
Lessingia arachnoidea	Crystal Springs lessingia	Asteraceae	annual herb	Jul-Oct	None	None	G2	S2	1B.2	No Photo Available
Lessingia hololeuca	woolly-headed lessingia	Asteraceae	annual herb	Jun-Oct	None	None	G2G3	S2S3	3	No Photo Available
Lessingia micradenia var. *glabrata*	smooth lessingia	Asteraceae	annual herb	(Apr-Jun)Jul-Nov	None	None	G2T2	S2	1B.2	No Photo Available
Lessingia tenuis	spring lessingia	Asteraceae	annual herb	May-Jul	None	None	G4	S4	4.3	No Photo Available
Limnanthes douglasii ssp. *ornduffii*	Ornduff's meadowfoam	Limnanthaceae	annual herb	Nov-May	None	None	G4T1	S1	1B.1	No Photo Available
Limnanthes douglasii ssp. *sulphurea*	Point Reyes meadowfoam	Limnanthaceae	annual herb	Mar-May	None	CE	G4T1	S1	1B.2	No Photo Available
Lupinus arboreus var. *eximius*	San Mateo tree lupine	Fabaceae	perennial evergreen shrub	Apr-Jul	None	None	G2Q	S2	3.2	No Photo Available
Malacothamnus arcuatus	arcuate bush-mallow	Malvaceae	perennial deciduous shrub	Apr-Sep	None	None	G2Q	S2	1B.2	© 2017 Keir Morse
Malacothamnus hallii	Hall's bush-mallow	Malvaceae	perennial deciduous shrub	(Apr)May-Sep(Oct)	None	None	G2	S2	1B.2	© 2017 Keir Morse
Micropus	Mt. Diablo	Asteraceae	annual herb	Mar-May	None	None	G3G4	S3S4	3.2	

▲ SCIENTIFIC NAME	COMMON NAME	FAMILY	LIFEFORM	BLOOMING PERIOD	FED LIST	STATE LIST	GLOBAL RANK	STATE RANK	CA RARE PLANT RANK	PHOTO
amphibolus	cottonweed									No Photo Available
Microseris paludosa	marsh microseris	Asteraceae	perennial herb	Apr-Jun(Jul)	None	None	G2	S2	1B.2	No Photo Available
Mielichhoferia elongata	elongate copper moss	Mielichhoferiaceae	moss		None	None	G5	S3S4	4.3	No Photo Available
Monolopia gracilens	woodland woollythreads	Asteraceae	annual herb	(Feb)Mar-Jul	None	None	G3	S3	1B.2	No Photo Available
Orthotrichum kellmanii	Kellman's bristle moss	Orthotrichaceae	moss	Jan-Feb	None	None	G1	S1	1B.2	No Photo Available
Pedicularis dudleyi	Dudley's lousewort	Orobanchaceae	perennial herb	Apr-Jun	None	CR	G2	S2	1B.2	No Photo Available
Penstemon rattanii var. *kleei*	Santa Cruz Mountains beardtongue	Plantaginaceae	perennial herb	May-Jun	None	None	G4T2	S2	1B.2	No Photo Available
Pentachaeta bellidiflora	white-rayed pentachaeta	Asteraceae	annual herb	Mar-May	FE	CE	G1	S1	1B.1	No Photo Available
Perideridia gairdneri ssp. *gairdneri*	Gairdner's yampah	Apiaceae	perennial herb	Jun-Oct	None	None	G5T3T4	S3S4	4.2	No Photo Available
Pinus radiata	Monterey pine	Pinaceae	perennial evergreen tree		None	None	G1	S1	1B.1	No Photo Available
Piperia candida	white-flowered rein orchid	Orchidaceae	perennial herb	(Mar)May-Sep	None	None	G3	S3	1B.2	No Photo Available
Piperia michaelii	Michael's rein orchid	Orchidaceae	perennial herb	Apr-Aug	None	None	G3	S3	4.2	No Photo Available
Plagiobothrys chorisianus var. *chorisianus*	Choris' popcornflower	Boraginaceae	annual herb	Mar-Jun	None	None	G3T1Q	S1	1B.2	No Photo Available
Plagiobothrys chorisianus var. *hickmanii*	Hickman's popcornflower	Boraginaceae	annual herb	Apr-Jun	None	None	G3T3Q	S3	4.2	No Photo Available
Plagiobothrys diffusus	San Francisco popcornflower	Boraginaceae	annual herb	Mar-Jun	None	CE	G1Q	S1	1B.1	No Photo Available
Plagiobothrys glaber	hairless popcornflower	Boraginaceae	annual herb	Mar-May	None	None	GX	SX	1A	No Photo

▲ SCIENTIFIC NAME	COMMON NAME	FAMILY	LIFEFORM	BLOOMING PERIOD	FED LIST	STATE LIST	GLOBAL RANK	STATE RANK	CA RARE PLANT RANK	PHOTO
Polemonium carneum	Oregon polemonium	Polemoniaceae	perennial herb	Apr-Sep	None	None	G3G4	S2	2B.2	No Photo Available
Potentilla hickmanii	Hickman's cinquefoil	Rosaceae	perennial herb	Apr-Aug	FE	CE	G1	S1	1B.1	No Photo Available
Ranunculus lobbii	Lobb's aquatic buttercup	Ranunculaceae	annual herb (aquatic)	Feb-May	None	None	G4	S3	4.2	No Photo Available
Rosa pinetorum	pine rose	Rosaceae	perennial shrub	May-Jul	None	None	G2	S2	1B.2	No Photo Available
Sanicula hoffmannii	Hoffmann's sanicle	Apiaceae	perennial herb	Mar-May	None	None	G3	S3	4.3	No Photo Available
Sanicula saxatilis	rock sanicle	Apiaceae	perennial herb	Apr-May	None	CR	G2	S2	1B.2	© 1998 John Game
Senecio aphanactis	chaparral ragwort	Asteraceae	annual herb	Jan-Apr(May)	None	None	G3	S2	2B.2	No Photo Available
Silene scouleri ssp. *scouleri*	Scouler's catchfly	Caryophyllaceae	perennial herb	(Mar-May)Jun-Aug(Sep)	None	None	G5T4T5	S2S3	2B.2	No Photo Available
Silene verecunda ssp. *verecunda*	San Francisco campion	Caryophyllaceae	perennial herb	(Feb)Mar-Jul(Aug)	None	None	G5T1	S1	1B.2	No Photo Available
Stebbinsoseris decipiens	Santa Cruz microseris	Asteraceae	annual herb	Apr-May	None	None	G2	S2	1B.2	No Photo Available
Streptanthus albidus ssp. *peramoenus*	most beautiful jewelflower	Brassicaceae	annual herb	(Mar)Apr-Sep(Oct)	None	None	G2T2	S2	1B.2	No Photo Available
Stuckenia filiformis ssp. *alpina*	slender-leaved pondweed	Potamogetonaceae	perennial rhizomatous herb (aquatic)	May-Jul	None	None	G5T5	S2S3	2B.2	Dana York (2016)
Suaeda californica	California seablite	Chenopodiaceae	perennial evergreen shrub	Jul-Oct	FE	None	G1	S1	1B.1	No Photo Available
Trifolium amoenum	two-fork clover	Fabaceae	annual herb	Apr-Jun	FE	None	G1	S1	1B.1	No Photo

									CA RARE PLANT RANK	Available
Trifolium buckwestiorum	Santa Cruz clover	Fabaceae	annual herb	Apr-Oct	None	None	G2	S2	1B.1	No Photo Available
Trifolium hydrophilum	saline clover	Fabaceae	annual herb	Apr-Jun	None	None	G2	S2	1B.2	No Photo Available
Trifolium polyodon	Pacific Grove clover	Fabaceae	annual herb	Apr-Jun(Jul)	None	CR	G1	S1	1B.1	No Photo Available
Triphysaria floribunda	San Francisco owl's-clover	Orobanchaceae	annual herb	Apr-Jun	None	None	G2?	S2?	1B.2	No Photo Available
Triquetrella californica	coastal triquetrella	Pottiaceae	moss		None	None	G2	S2	1B.2	No Photo Available
Usnea longissima	Methuselah's beard lichen	Parmeliaceae	fruticose lichen (epiphytic)		None	None	G4	S4	4.2	© 2021 Scot Loring

▲ SCIENTIFIC NAME | COMMON NAME | FAMILY | LIFEFORM | BLOOMING PERIOD | FED LIST | STATE LIST | GLOBAL RANK | STATE RANK | CA RARE PLANT RANK | PHOTO

Showing 1 to 117 of 117 entries

CONTACT US

Send questions and comments to rareplants@cnps.org.

ABOUT THIS WEBSITE

About the Inventory
Release Notes
Advanced Search
Glossary

ABOUT CNPS

About the Rare Plant Program
CNPS Home Page
About CNPS
Join CNPS

CONTRIBUTORS

The Calflora Database
The California Lichen Society
California Natural Diversity Database
The Jepson Flora Project
The Consortium of California Herbaria
CalPhotos

Developed by Rincon Consultants, Inc.

Log in

Copyright © 2010-2021 California Native Plant Society. All rights reserved.

This page intentionally left blank

Special Status Species Tables

Table 1 Special-Status Plant Species with Potential to Occur in the Program Area

Common Name (*Scientific Name*)	Status1	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Federally Listed or State-listed Endangered and Threatened Plant Species			
San Mateo thorn-mint (*Acanthomintha duttonii*)	FE, SE, CRPR 1B.1	Serpentine in grassland or chaparral.	**May be Present.** Suitable habitat for this species is present in preserves with serpentine grassland and/or chaparral, such as Pulgas Ridge OSP and Sierra Azul OSP. The closest known population is in Edgewood County Park just south of Pulgas Ridge OSP (CDFW 2020b).
San Bruno Mountain manzanita (*Arctostaphylos imbricata*)	SE, CRPR 1B.1	Rocky sites in chaparral or coastal scrub.	**Not Likely to be Present.** The range of this species is restricted to San Bruno Mountain (CDFW 2020b), which is outside the Program area.
Pacific manzanita (*Arctostaphylos pacifica*)	SE, CRPR 1B.2	Chaparral, coastal scrub.	**Not Likely to be Present.** The range of this species is restricted to San Bruno Mountain (CDFW 2020b), which is outside the Program area.
Marsh sandwort (*Arenaria paludicola*)	FE, SE, CRPR 1B.1	Sandy soils and opening in freshwater or brackish swamps and marsh.	**May be Present.** Though once much more widespread along the California coast, only one naturally-occurring population of this species is known to remain in California (in San Luis Obispo County). Marsh sandwort has also been re-introduced to sites in San Luis Obispo County, Santa Cruz County, and Marin County with mixed success. Midpen is in communication with USFWS about plans to attempt re-introducing this species in the Program area.
Robust spineflower *Chorizanthe robusta* var. *robusta*)	FE, CRPR 1B.1	Sandy or gravelly areas in coastal chaparral, openings in woodlands, coastal scrub, coastal grassland.	**May be present.** A historical occurrence is known from CNDDB records, with the location information listed as the "general vicinity of Los Gatos (CDFW 2020b). The current known range of this species is centered on the Monterey Bay in Santa Cruz and Santa Cruz Counties. Suitable habitat is present for this species in preserves in the southern portion of the Program area such as El Sereno OSP, St. Joseph's Hill OSP, and Sierra Azul OSP, where the species could occur in microhabitats such as sandy openings, or gravelly barrens where competition from non-native plants is low.

Common Name (*Scientific Name*)	Status1	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Crystal Springs fountain thistle (*Cirsium fontinale* var. *fontinale*)	FE, SE, CRPR 1B.1	Serpentine seeps.	**Present.** The species is known to occur in Sierra Azul OSP. Suitable habitat is potentially present in other preserves with serpentine soils, such as El Sereno OSP and St. Joseph's Hill, if seeps are present.
Santa Clara Valley dudleya (*Dudleya abramsii* ssp. *setchellii*)	FE, CRPR 1B.1	Cismontane woodland, valley and foothill grassland on serpentine; rocky/serpentine outcrop.	**Present.** The species is known to occur in the Program area only in Sierra Azul OSP, where small numbers are present within approximately one mile south and west/southwest of Guadalupe Dam. Suitable habitat is potentially present in other preserves in the southern portion of the Program area with serpentine soils, such as St. Joseph's Hill OSP and El Sereno OSP.
San Mateo woolly sunflower (*Eriophyllum latilobum*)	FE, SE, CRPR 1B.1	Often on serpentine in montane hardwood, oak woodlands.	**Present.** The species is known to occur in Coal Creek OSP and Russian Ridge OSP. This species has potential to occur in other nearby preserves with suitable habitat such as Monte Bello OSP, Russian Ridge OSP and Windy Hill OSP.
Butano Ridge cypress (*Hesperocyparis abramsiana* var. *butanoensis*)	FE, SE, CRPR 1B.2	Sandstone derived soils in closed cone conifer, Montane hardwood.	**Not Likely to be Present.** The species is restricted to a few locations in the Santa Cruz Mountains on specialized sandstone-derived microhabitats that do not occur in the Program area.
Marin western flax (*Hesperolinon congestum*)	FT, ST, CRPR 1B.1	Serpentine in grassland or chaparral.	**May be Present.** This species has a limited range and is known primarily from serpentine outcrops in San Mateo and Marin Counties. The closest known existing population to preserves in the Program area is in Edgewood County Park just south of Pulgas Ridge OSP (CDFW 2020b). Suitable habitat for this species is present in other preserves with serpentine grassland and/or chaparral, such as El Sereno OSP, St. Joseph's Hill OSP, and Sierra Azul OSP, though these preserves would be south of known range of this species.
San Francisco lessingia (*Lessingia germanorum*)	FE, SE, CRPR 1B.1	Remnant dunes in coastal scrub.	**Not Likely to be Present.** The known present range of this species is outside the Program area. It is known from one location at Hillside Park in Daly City, and from several populations at the Presidio of San Francisco (CDFW 2020).

Common Name (*Scientific Name*)	Status1	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Coast yellow leptosiphon (*Leptosiphon croceus*)	SC, CRPR 1B.1	Coastal scrub on bluffs, coastal grassland.	**May be Present.** Suitable habitat for this species is potentially present in Tunitas Creek OSP. The closest recently recorded population of this species is in coastal prairie on bluffs near the town of Moss Landing (CDFW 2020b).
Point Reyes meadowfoam (*Limnanthes douglasii* ssp. *sulphurea*)	SE, CRPR 1B.2	Coastal grassland, freshwater wetlands, vernal pools.	**Not Likely to be Present.** This species is primarily restricted to Marin County (Pt. Reyes peninsula); the only population recorded in San Mateo County was mapped in a wet meadow along Butano Creek approximately 4 air miles inland from the coast in the 1980s, but it was likely subsequently extirpated (CDFW 2020b). Due to the limited range of this species and lack of collections in the County, it is not likely to occur within the Program area.
Dudley's lousewort (*Pedicularis dudleyi*)	SR, CRPR 1B.2	Coastal chaparral, montane hardwood, montane hardwood conifer, oak woodlands, grassland. Found in deep, shady redwood forest.	**May be Present.** While it is known to occur from San Mateo County to San Louis Obispo County, recorded observations of this species are scarce. Where it has been found in the vicinity of the Program area (in Portola Redwoods State Park) it is known to occur in deep, shaded redwood forests (CDFW 2020b). This species has potential to occur in nearby preserves with similar habitat such as Purisima Creek Redwoods OSP, La Honda Ridge OSP, and Russian Ridge OSP.
White-rayed pentachaeta (*Pentachaeta bellidiflora*)	FE, SE, CRPR 1B.1	Oak woodlands, montane hardwood, often on serpentine in grassland.	**May be Present.** The closest known population of this species is in Edgewood County Park just south of Pulgas Ridge OSP (CDFW 2020b). Suitable habitat for this species is present in preserves with serpentine grassland and/or chaparral, such as Pulgas Ridge OSP, El Sereno OSP, St. Joseph's Hill OSP, and Sierra Azul OSP.
San Francisco popcorn-flower (*Plagiobothrys diffusus*)	SE, CRPR 1B.1	Coastal grassland.	**May be Present.** Suitable habitat for this species is potentially present in Tunitas Creek OSP. The closest recently recorded population of this species is present within the coastal zone in grassland just north of Año Nuevo (CDFW 2020b).
Hickman's cinquefoil (*Potentilla hickmanii*)	FE, SE, CRPR 1B.1	Coastal bluff scrub, closed-cone conifer forest, freshwater wetlands, wet meadows.	**May be Present.** Suitable habitat for this species is potentially present in Tunitas Creek OSP and in Purisima Creek Redwoods OSP. Known population of this species are present on Montara mountain just to the north of Miramontes Ridge OSP (CNPS 2020).

Common Name (*Scientific Name*)	Status1	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Metcalf Canyon jewel-flower (Streptanthus albidus ssp. albidus)	FE, CRPR 1B.1	Valley and foothill grassland (serpentinite)/serpentine bunchgrass grassland.	**May be Present.** The species is known to occur in Sierra Azul OSP. Suitable habitat for this species is potentially present in other preserves in the southern portion of the Program area with serpentine soils, such as St. Joseph's Hill and El Sereno OSP.
Two-fork clover (*Trifolium amoenum*)	SE, CRPR 1B.1	Bluffs in coastal scrub and sometimes on serpentine in coastal prairie (weak affinity to serpentine soils).	**May be Present.** The range of known extant populations is Marin and Sonoma counties. All populations in San Mateo are historical, with one population with a general locality of Colma on the south side of San Bruno Mountain being over 100 years old, and a record from the general area identified as "San Francisquito Creek near Searsville Lake" from 1950 (CDFW 2020b). Nevertheless, suitable habitat for this species is present in preserves with coastal chaparral or coastal scrub such as Tunitas Creek OSP or Miramontes Ridge OSP.
CNPS-Listed Plant Species (CRPR 1 and 2)			
Blasdale's bent grass (*Agrostis blasdalei*)	CRPR 1B.2	Bluffs in coastal scrub and coastal grassland.	**May be Present.** Suitable habitat for this species is present in preserves with coastal chaparral or coastal scrub such as Tunitas Creek OSP and Miramontes Ridge OSP. The nearest known population of this species to Midpen preserves is Bean Hollow State Beach to the south of Tunitas Creek OSP where it occurs in coastal bluff scrub (CDFW 2020b).
Franciscan onion (*Allium peninsulare* var. *franciscanum*)	CRPR 1B.2	Volcanic or clay soils, often on serpentine, in grassland, oak woodlands, or montane hardwood woodlands.	**Present.** The species is known to occur in Pulgas Ridge OSP. This species has the potential to occur in other preserves throughout the Program area with serpentine habitats such as El Sereno OSP, St. Joseph's Hill OSP, and Sierra Azul OSP.

Common Name (*Scientific Name*)	Status1	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Bent-flowered fiddleneck (*Amsinckia lunaris*)	CRPR 1B.2	Grassland, bluffs in coastal scrub, montane hardwood, oak woodlands.	**May be Present.** This species has a wide geographic range, from Glenn to Monterey Counties, but is not abundant where it is found (CNPS 2020). Throughout this range it occurs in wide variety of habitat types. Populations of this species are known to occur around Crystal Spring Reservoir just to the northeast of Pulgas Ridge OSP where it occurs in open grasslands as well in the deep shade of north-facing woodlands (CNPS 2020, CCH1 2019). Suitable habitat for this species is present in preserves with grasslands and woodlands.
Anderson's manzanita (*Arctostaphylos andersonii*)	CRPR 1B.2	Openings or edges in redwood, chaparral, montane hardwood.	**Present.** The species is known to occur in Saratoga Gap OSP, Long Ridge OSP, and Purisima Creek Redwoods OSP. Suitable habitat for this species is present in many of the preserves throughout the Program area, particularly those along the ridgetop of the Santa Cruz Mountains in San Mateo County.
Montara manzanita (*Arctostaphylos montaraensis*)	CRPR 1B.2	Coastal chaparral or coastal scrub.	**May be Present.** The known range of this species is restricted to Montara Mountain, which is north of the Program area (CDFW 2020b). However, suitable habitat for this species is present in preserves with coastal chaparral or coastal scrub near Montara Mountain such as Tunitas Creek OSP, Miramontes Ridge OSP, or Purisima Creek Redwoods OSP.
Kings Mountain manzanita (Arctostaphylos regismontana)	CRPR 1B.2	Granitic or sandstone derived soils in montane hardwood, chaparral, redwood.	**Present.** The species is known to occur in Pulgas Ridge OSP, Teague Hill OSP, Thornewood OSP, El Corte de Madera Creek OSP, and La Honda Creek OSP. Suitable habitat for this species is present in many of the preserves throughout the Program area, particularly those along the ridgetop of the Santa Cruz Mountains in San Mateo County.
Coastal marsh milk-vetch (*Astragalus pycnostachyus* var. *pycnostachyus*)	CRPR 1B.2	Salt marsh, coastal scrub, coastal grassland, saline wetlands.	**May be Present.** Suitable habitat for this species is present in Tunitas Creek OSP, and the species is known from just outside of the preserve (CDFW 2020b).

Common Name (*Scientific Name*)	Status1	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Big-scale balsamroot (Balsamorhiza macrolepis var. macrolepis)	CRPR 1B.2,	Chaparral, cismontane woodland, valley and foothill grassland sometimes in serpentinite/serpentine bunchgrass grassland, mixed serpentine chaparral, and oak woodland.	**May be Present.** The geographic range of this species is to the east of the Program area in the inner coast ranges (Diablo Range) as well as Sierra Nevada foothills (CNPS 2020). The closest known populations of this species occur on Coyote Ridge to the southeast of Sierra Azul OSP (CNPS 2020). However, this species has the potential to occur in preserves in the southern portion of the Program area with serpentine habitats, such as El Sereno OSP, St. Joseph's Hill OSP, and Sierra Azul OSP.
Santa Cruz Mountains pussypaws (*Calyptridium parryi* var. *hesseae*)	CRPR 1B.1	Sandy or gravelly soils, often in openings, in chaparral and cismontane woodland.	**May be Present.** The closest known populations of this species are historical populations in the Santa Cruz mountains near Eagle Rock approximately 4 miles south of Long Ridge OSP (CDFW 2020b). This species has the potential to occur in preserves along the ridgetop of the Santa Cruz Mountains with suitable microhabitats such as sandy openings, or gravelly barrens where competition from non-native plants is low.
Congdon's tarplant (*Centromadia parryi* ssp. *congdonii*)	CRPR 1B.1	California annual grassland habitat on alkaline soils, occasionally disturbed soils.	**Not Likely to be Present.** The species is known to occur in Stevens Creek Natural Study area and in the vicinity of Ravenswood OSP (though recent surveys of the Ravenswood population found only the common species), neither of which are included in the Program area. This species generally grows at a lower elevation and nearer to the Bay margin and is not expected to occur in preserves higher up in the Santa Cruz Mountains.
Pappose tarplant (*Centromadia parryi* ssp. *parryi*)	CRPR 1B.2	Coastal scrub, coastal grassland, bay margin, saline wetlands.	**May be Present.** Suitable habitat for this species is present in preserves with coastal chaparral or coastal scrub such as Tunitas Creek OSP and Miramontes Ridge OSP. Populations of this species are known to occur to the north of these preserves in the vicinity of Mori Point in San Mateo County (CDFW 2020b).

Common Name (*Scientific Name*)	Status1	Habitat Association	Potential to Occur on Current/Future Midpen Lands
San Francisco Bay spineflower (*Chorizanthe cuspidata* var. *cuspidata*)	CRPR 1B.2	Sandy areas in coastal scrub, coastal grassland.	**May be Present.** The geographic range and precise habitat requirements of this species are not well known due to the limited, and mostly historical collections of this species (CNPS 2020). All collections in the Program area are historical (CDFW 2020b). The closest occurrences records to the north in San Francisco County are also largely historical, though recent collections have been made on San Bruno Mountain and near Pacifica (CNPS 2020). This species has potential to occur in suitable habitat coastal scrub habitat in Tunitas Creek OSP and Miramontes Ridge OSP.
Franciscan thistle (*Cirsium andrewsii*)	CRPR 1B.2	Sometimes on serpentine in coastal scrub, coastal grassland, montane.	**May be Present.** Suitable habitat for this species is present in preserves with serpentine grassland and/or chaparral, such as Pulgas Ridge OSP, El Sereno OSP, St. Joseph's Hill OSP, and Sierra Azul OSP.
San Francisco collinsia (*Collinsia multicolor*)	CRPR 1B.2	Sometimes on serpentine in closed cone coniferous forest, coastal scrub.	**Present.** The species is known to occur in Sierra Azul OSP and Long Ridge OSP. Suitable habitat for this species is present in preserves serpentine soils such as Pulgas Ridge OSP, St. Joseph's Hill OSP and El Sereno OSP.
Western leatherwood (*Dirca occidentalis*)	CRPR 1B.2	Moist areas in closed cone pine, chaparral, oak woodland, montane hardwood, riparian forest, redwood.	**Present.** The species is known to occur in Windy Hill OSP, Rancho San Antonio OSP, Coal Creek OSP, Fremont Older OSP, La Honda Creek OSP, Pulgas Ridge OSP, and Los Trancos OSP. This species could occur in other nearby preserves with similar habitat, particularly those with more mesic, steep, brushy, north-facing slopes (CDFW 2020b).
Sand-loving wallflower (*Erysimum ammophilum*)	CRPR 1B.2	Sandy and openings in coastal chaparral or coastal scrub.	**May be Present.** The majority of recorded occurrences of this species are center around the Monterey Peninsula, though there is a recent CNDDB record from the Ano Nuevo Ranch State Park vicinity (CDFW 2020b). Suitable habitat for this species is present in Tunitas Creek OSP and Miramontes Ridge OSP.

Common Name (*Scientific Name*)	Status1	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Minute pocket moss (*Fissidens pauperculus*)	CRPR 1B.2	Damp coastal soil in redwood forest.	**May be Present.** The geographic range and precise habitat requirements of this species are not well known due to limit collections. The closest known population is in Portola Redwoods State Park just west of Long Ridge OSP (CDFW 2020b). Suitable habitat for this species is present in preserves with redwood forest.
Hillsborough chocolate lily (*Fritillaria biflora* var. *ineziana*)	CRPR 1B.1	Serpentine in grassland and oak woodland.	**May be Present.** The closest known population to preserves within the Program area is on SFPUC lands to the north of Pulgas Ridge OSP (CDFW 2020b). Suitable habitat for this species is present in preserves with serpentine grassland such as Pulgas Ridge OSP, El Sereno OSP, St. Joseph's Hill OSP, and Sierra Azul OSP.
Fragrant fritillary (*Fritillaria liliacea*)	CRPR 1B.2	Often serpentine in grassland, coastal scrub, oak woodland, montane hardwood.	**Present.** The species is known to occur in Sierra Azul OSP. Suitable habitat for this species is present in preserves with serpentine grassland and/or oak woodland such as Pulgas Ridge OSP, El Sereno OSP, St. Joseph's Hill OSP, and Sierra Azul OSP.
Toren's grimmia (*Grimmia torenii*)	CRPR 1B.3	On rocky, boulder and rock walls, carbonate, volcanic substrates in chaparral, cismontane woodland and lower montane coniferous forest.	**May be Present.** The closest known population of this species is Big Basin Redwoods State Park to the south Midpen preserves (CDFW 2020b). Suitable habitat for this species is present in preserves with suitable carbonate rock outcrops in oak woodland and forest, such as may occur in Bear Creek Redwoods OSP, Russian Ridge OSP, Skyline Ridge and La Honda Creek OSP.
Diablo helianthella (*Helianthella castanea*)	CRPR 1B.2	Montane hardwood, chaparral, oak woodland, coastal scrub, grassland.	**May be Present.** This species is primarily known from Contra Costa and Alameda counties around Mt. Diablo (CNPS 2020). The closest known population is on San Bruno Mountain where it occurs in grassland (CDFW 2020b). Suitable habitat for this species is present in Tunitas Creek OSP and Miramontes Ridge OSP.
Short-leaved evax (*Hesperevax sparsiflora* var. *brevifolia*)	CRPR 1B.2	Coastal grassland, sandy areas in coastal scrub.	**May be Present.** The closest known populations to Midpen preserves are historical collections from the vicinity of Big Basin Redwoods State Park that have not been re-observed in over forty years (CNNDB 2019). Suitable habitat for this species is present in Tunitas Creek OSP and Miramontes Ridge OSP.

Common Name (*Scientific Name*)	Status1	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Loma Prieta hoita (*Hoita strobilina*)	CRPR 1B.1	Usually on serpentine soils in chaparral, cismontane woodland, and riparian woodland.	**Present.** The species is known to occur in El Sereno OSP, Sierra Azul OSP, and St. Joseph's Hill OSP. The range of this species is generally restricted to the southern end of the Santa Cruz Mountains, and it is therefore not expected to occur in other preserves.
Point Reyes horkelia (*Horkelia marinensis*)	CRPR 1B.2	Sandy areas in coastal scrub or coastal grasslands.	**May be Present.** Suitable habitat for this species is present in Tunitas Creek OSP and Miramontes Ridge OSP. The closest known populations are located along the coast near Davenport and on Ben Lomond Mountain in Santa Cruz County (CDFW 2020b). Historical populations are known from Montara Mountain and San Bruno Mountain to the north of the Program area (CDFW 2020b).
Perennial goldfields (*Lasthenia californica* ssp. *macrantha*)	CRPR 1B.2	Coastal scrub on bluffs.	**May be Present.** Populations are known from coastal bluffs near Bean Hollow State Beach (CDFW 2020b). Suitable habitat for this species is present in Tunitas Creek OSP and Miramontes Ridge OSP.
Legenere (*Legenere limosa*)	CRPR 1B.1	Vernal pools in grassland.	**May be Present.** The geographic range of this species is widespread from Tehama to Santa Clara County, though populations are small and rare in the regions where they do occur (CNPS 2020). A historical population is known from a pond edge near Coal Mine Ridge in between Coal Creek OSP and Las Trancos OSP (CDFW 2020b). Suitable habitat for this species is present in preserves with vernal pools and seasonal wetlands around stock ponds, reservoirs or lakes.
Rose Leptosiphon (*Leptosiphon rosaceus*)	CRPR 1B.1	Coastal scrub on bluffs.	**May be Present.** The nearest known population of this species is present at Pillar Point bluff to the north of Tunitas Creek OSP. Suitable habitat for this species is present on coastal bluffs in Tunitas Creek OSP.
Crystal Springs lessingia (*Lessingia arachnoidea*)	CRPR 1B.2	Serpentine in oak woodland, coastal scrub, grassland.	**May be Present.** The range of this species is restricted to the serpentine outcrops in San Mateo County. Populations of this species occur in Edgewood County Park to the south of Pulgas Ridge OSP and in serpentine grasslands on SFPUC lands to the north (CDFW 2020b). This species has potential to occur in Pulgas Ridge OSP. Given the restricted range of this species, however, it is not expected to occur in other preserves to the south.

Common Name (*Scientific Name*)	Status1	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Smooth lessingia (*Lessingia micradenia* var. *glabrata*)	CRPR 1B.2	Chaparral, cismontane woodland- on serpentinite, often roadsides/mixed serpentine chaparral and oak woodland.	**Present.** The species is known to occur in Sierra Azul OSP. Suitable habitat for this species is present in other preserves in the southern portion of the Program area with serpentine soils such as St. Joseph's Hill and El Sereno OSP.
Coast lily (*Lilium maritimum*)	CRPR 1B.1	Montane hardwood, closed cone conifer forest, coastal grassland, coastal scrub, freshwater wetlands, redwood.	**Not Likely to be Present.** The known range of this species is the north coast of California, from Marin County north to the Oregon border (CNPS 2020). This species is presumed to be extinct in San Mateo County (CNPS 2020).
Ornduff's meadowfoam (*Limnanthes douglasii* ssp. *ornduffii*)	CRPR 1B.1	Wet meadows in cropland.	**May be Present.** The geographic distribution and habitat preferences of this species are not well-known due to the limited number of collections. Populations are known from coastal areas to the north and south of the coastal Midpen preserves in San Mateo County (CDFW 2020b). This species has potential to occur in Tunitas Creek OSP and Miramontes Ridge OSP if suitable wet meadow habitat near the coast was present in those preserves.
Indian Valley bush-mallow (*Malacothamnus aboriginum*)	CRPR 1B.2	Rocky areas in chaparral, oak woodland.	**May be Present.** The range of this species is centered on the inner coast range to the south of the Program area; however, historical populations are known from areas just to the north of Foothills OSP and Windy Hill OSP (CCH1 2019; CDFW 2020b). This species tends to occur in rocky granitic soils in chaparral, particularly after burns. It has the potential to occur in preserves with this microhabitat type, particularly those in the central and southern portions of the Program area with large areas of chaparral.

Common Name (*Scientific Name*)	Status1	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Arcuate bush-mallow (*Malacothamnus arcuatus*)	CRPR 1B.2	Chaparral, oak woodland.	**Present.** The species is known to occur in Skyline Ridge OSP, Pulgas Ridge OSP, and Rancho San Antonio OSP. Historical populations are known from near La Honda Creek OSP and Los Trancos Woods OSP. Like other special-status *Malacothamnus* species, this species tends to establish following fires, and its limited range and abundance is likely due to altered fire regimes (CNPS 2020). This species has the potential to occur in other preserves throughout the Program area, particularly those along the ridgetop of the Santa Cruz Mountains in San Mateo County with chaparral habitats that have recently burned.
Davidson's bush-mallow (*Malacothamnus davidsonii*)	CRPR 1B.2	Chaparral, oak woodland, coastal scrub, riparian woodland.	**May be Present.** The range of this species based on current occurrences is well to the south of the Program area in Monterey County and south (CNPS 2020). Historical populations are known from the hills just to the east of Pulgas Ridge OSP, as well as near Foothills OSP and Rancho San Antonio OSP (CDFW 2020b). As with the other special-status *Malacothamnus* species, this species has the potential to occur in preserves with chaparral habitats that have recently burned.
Hall's bush-mallow (*Malacothamnus hallii*)	CRPR 1B.2	Chaparral, coastal scrub.	**May be Present.** The range of this species based on current occurrences is centered in the Diablo Range in Santa Clara County to the south of the Program area (CDFW 2020b). A historical population is known from near Los Trancos Woods OSP and Monte Bello OSP (CDFW 2020b). As with the other special-status *Malacothamnus* species, this species has the potential to occur in preserves with chaparral habitats that have recently burned.
Marsh Microseris (*Microseris paludosa*)	CRPR 1B.2	Closed-cone pine, oak woodland, coastal scrub, grassland.	**May be Present.** This species occurs in the coastal zone from Mendocino to San Louis Obispo Counties. Extant populations are known from grassy opening in coastal scrub to the south of Tunitas Creek in the vicinity of Pescadero marsh (CDFW 2020b). Suitable habitat for this species is present in Tunitas Creek OSP.

Common Name (*Scientific Name*)	Status1	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Woodland woollythreads (*Monolopia gracilens*)	CRPR 1B.2	Serpentine areas in montane hardwood openings, chaparral openings, oak woodland, redwood openings, grassland.	**Present.** The species is known to occur in Los Trancos OSP, Rancho San Antonio OSP, Sierra Azul OSP, and St. Joseph's Hill OSP. The species has potential to occur in other preserves with serpentine soils including El Sereno OSP and Pulgas Ridge OSP.
Kellman's bristle moss (*Orthotrichum kellmanii*)	CRPR 1B.2	Sandstone or carbonate substrates in chaparral, oak woodland.	**May be Present.** Suitable habitat for this species is present in preserves with suitable sandstone or carbonate substrates in chaparral and oak woodland. The closest known population is in Big Basin Redwoods State Park to the south of the Program area (CDFW 2020b).
Santa Cruz Mountains beardtongue (Penstemon rattanii var. kleei)	CRPR 1B.2	Chaparral, lower montane coniferous forest, North Coast coniferous forest.	**Present.** The species is known to occur in Sierra Azul OSP. This species has potential to occur in other preserves in the southern portion of the Program area with suitable habitat such as El Sereno OSP, St. Joseph's Hill OSP and Bear Creek Redwoods OSP.
Monterey pine (*Pinus radiata*)	CRPR 1B.1	Closed cone pine, montane hardwood conifer, native populations restricted to three locations at Cambria (San Luis Obispo County), the Monterey Peninsula (Monterey County) and Año Nuevo (San Mateo and Santa Cruz Counties).	**Not Likely to be Present.** Native stands of Monterey pine are not known to occur within the Program area, the closest being at Año Nuevo (CNPS 2020, CDFW 2020b).
White-flowered rein orchid (*Piperia candida*)	CRPR 1B.2	Sometimes on serpentine in montane hardwood conifer, redwood, montane hardwood.	**Present.** The species is known to occur in Los Trancos OSP. This species has potential to occur in other surrounding and nearby preserves such as Russian Ridge OSP, Coal Creek OSP and Skyline Ridge OSP.

Common Name (*Scientific Name*)	Status1	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Choris' popcorn-flower (*Plagiobothrys chorisianus* var. *chorisianus*)	CRPR 1B.2	Moist areas in chaparral, coastal grassland, coastal scrub.	**Present.** The species is known to occur in Russian Ridge OSP, Tunitas Creek OSP, La Honda Creek OSP, and Miramontes Ridge OSP (CDFW 2020b, CNPS 2020). Many occurrences in San Mateo County are known only from herbarium collections over 50 years old and are known or presumed extirpated (CDFW 2020b). This species tends to occur along the coast, but many of the occurrences (including known occurrences in preserves within the Program area) are inland. This species has the potential to occur in other preserves where vernally-wet swales, vernal pools, and other seasonal wetlands are present.
Hairless popcornflower (*Plagiobothrys glaber*)	CRPR 1A	Alkali meadows and seeps, coastal salt marshes and swamps; 45 – 590 ft.	**May be Present.** The species was recorded in El Sereno OSP and St. Joseph's Hill OSP according to Midpen records, though all verified collections of this species in the California Consortium of Herbaria are historical (CCH1 2019) and the species is still presumed to be extinct, or possibly just a variety of the more common *Plagiobothrys stipitatus* (CNPS 2020; CDFW 2020b).
Chaparral ragwort (*Senecio aphanactis*)	CRPR 2B.2	Alkaline soils in chaparral, cismontane woodland, coastal scrub.	**May be Present.** The geographic range of this species is broad from the San Francisco Bay to Baja California, though the species is rare where it is found (CNPS 2020). Historical populations of this species are known from Foothills Park (City of Palo Alto) and just outside of Pulgas Ridge OSP (CDFW 2020b) where it had been observed in recently burned chaparral. This species has potential to occur in preserves with chaparral that has recently burned.
Scouler's catchfly (*Silene scouleri* ssp. *scouleri*)	CRPR 2B.2	Coastal bluff scrub, Coastal prairie, Valley and foothill grassland.	**May be Present.** Suitable habitat for this species is present in Tunitas Creek OSP. Populations are known from coastal scrub to the south of Tunitas Creek in the Pescadero marsh area (CDFW 2020b).
San Francisco campion (*Silene verecunda* ssp. *verecunda*)	CRPR 1B.2	Sandy areas in coastal scrub, grassland, chaparral.	**May be Present.** Suitable habitat for this species is present in Tunitas Creek OSP and Miramontes Ridge OSP. Populations are known from coastal scrub and chaparral to north of these preserves on Montara Mountain (CDFW 2020b).

Common Name (*Scientific Name*)	Status1	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Most beautiful jewel-flower (Streptanthus albidus ssp. peramoenus)	CRPR 1B.2	Chaparral, cismontane woodland, valley and foothill grassland in serpentinite/ serpentine bunchgrass grassland, mixed serpentine chaparral.	**Present.** The species is known to occur in Sierra Azul OSP and St. Joseph's Hill OSP (CDFW 2020b). This species has potential to occur in other preserves in the southern portion of the Program area with serpentine soils such as El Sereno OSP.
Slender-leaved pondweed (*Stuckenia filiformis* ssp. *alpina*)	CRPR 2B.2	Freshwater wetlands, shallow water on pond edges or in riparian zones.	**May be Present.** This species has a wide geographic range, which includes the Modoc plateau and high elevation areas of the Sierra Nevada (CNPS 2020). The limited number of CNDDB occurrences in San Mateo, Santa Cruz and Santa Clara counties are all historical and have not been recently re-collected (CDFW 2020b). The collection from Ano Nuevo State Reserve was from a pond on a bluff (CDFW 2020b). Precise information on exact kinds of freshwater marshes or open water areas where this species could be found within the Program area is lacking due to the limited number of collections of this species.
Santa Cruz clover (*Trifolium buckwestiorum*)	CRPR 1B.1	Moist grassland, and/or gravelly margins in coastal prairie and mixed evergreen forest.	**May be Present.** The range of the species extends from Mendocino to Monterey County, where it is primarily found in areas with coastal influence (i.e. the outer coast ranges) (CNPS 2020). An unspecified collection is known from an area long Skyline Boulevard near the convergence of Coal Creek OSP, Russian Ridge OSP, Los Trancos Ridge OSP and Skyline Ridge OSP, and there is no specific ecological information associated with this collection (CNPS 2019, CDFW 2020b). The majority of the recent collections from Santa Cruz County occur closer to the coast. There is potential for this species to occur in preserves with more coastal influences such as Miramontes Ridge OSP, Purisima Creek Redwoods OSP, La Honda Creek OSP, and Tunitas Creek OSP.
Coastal triquetrella (*Triquetrella californica*)	CRPR 1B.2	Bluffs in coastal scrub.	**May be Present.** Suitable habitat for this species is present in Tunitas Creek OSP and Miramontes Ridge OSP. One population is known from coastal scrub to north of these preserves on Montara Mountain (CDFW 2020b).

Common Name (*Scientific Name*)	Status1	Habitat Association	Potential to Occur on Current/Future Midpen Lands
CNPS-Listed Plant Species (CRPR 3 and 4) and Midpen Sensitive species			
California androsace (*Androsace elongata* ssp. *acuta*)	CRPR 4.2	Openings in chaparral, cismontane woodland, coastal scrub, and valley and foothill grassland; sometimes in meadows and seeps.	**May be Present.** This is a widespread species ranging from the Oregon border to San Diego County, though it tends to occur more inland than the Santa Cruz Mountains (CNPS 2020). Historical populations of this species are known from the hills just to the north and east of Foothills OSP, Los Trancos OSP, and Rancho San Antonio OSP. This species has the potential to occur in these preserves and others along the ridgeline of the Santa Cruz Mountains in openings where cover of other species (particularly dense, non-native annual grasses) is low.
Brewer's calandrinia (*Calandrinia breweri*)	CRPR 4.2	Sandy or loamy, disturbed sites and burns in chaparral and coastal scrub.	**May be Present.** This is a widespread species ranging from Shasta County to the border with Mexico and into Baja California (CNPS 2020). Historical populations are present in the vicinity of Teague Hill OSP where it grew in recently burned chaparral (CDFW 2020b). This species has potential to occur in preserves with chaparral that have recently burned or in sandy openings on edges of chaparral and/or coastal scrub.
Oakland star-tulip (*Calochortus umbellatus*)	CRPR 4.2	Often on serpentine substrates in broadleafed upland forest, chaparral, cismontane woodland, lower montane coniferous forest, and valley and foothill grassland.	**May be Present.** Suitable habitat for this species is present in preserves with serpentine soils. A historical population of this species is recorded from the ridge in between Purisima Creek Redwoods OSP and Teague Hill OSP along State Route 35 (CDFW 2020b).
Pink star-tulip (*Calochortus uniflorus*)	CRPR 4.2	Coastal prairie, coastal scrub, meadows and seeps, North Coast coniferous forest.	**May be Present.** Most populations of this species occur to the north of the San Francisco Bay or around the Monterey Bay (CNPS 2020). Extant populations of this species are present on the east slopes of Montara mountain to the north of preserves in the Program area as well as in mixed conifer forest in Santa Cruz county to the south and west of preserves such as Sierra Azul OSP and Bear Creek Redwoods OSP (CNPS 2019; CCH1 2019).

Common Name (*Scientific Name*)	Status1	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Johnny-nip (*Castilleja ambigua* var. *ambigua*)	CRPR 4.2	Vernal pool margins in coastal bluff scrub, coastal prairie, coastal scrub, valley and foothill grassland.	**May be Present.** Populations are known from seasonal wetlands on coastal prairies to the south of Tunitas Creek OSP in the Pescadero area (CCH1 2019). Suitable habitat for this species is present in Tunitas Creek OSP.
Seaside paintbrush (*Castilleja latifolia*)	CRPR 4.3	Sandy soils in closed-cone coniferous forest and cismontane woodland; coastal dunes and coastal scrub.	**May be Present.** Historical populations are known from the vicinity of Tunitas Creek OSP, but have not been observed in over one hundred years (CCH1 2019; CNPS 2019). Suitable habitat for this species is present in Tunitas Creek OSP and Miramontes Ridge OSP.
Clustered lady's-slipper (*Cypripedium fasciculatum*)	CRPR 4.2	Usually serpentine seeps and streambanks in lower montane coniferous forest, North Coast coniferous forest.	**May be Present.** Historical records are known from Purisima Creek Redwoods OSP and Monte Bello OSP, but these populations have not been encountered in over 100 years (CCH1 2019). Suitable habitat is present in preserves with mature conifer forest, such as Bear Creek Redwoods OSP, La Honda Creek OSP and Russian Ridge OSP.
Mountain lady's-slipper (*Cypripedium montanum*)	CRPR 4.2	Broadleafed upland forest, cismontane woodland, lower montane coniferous forest, North Coast coniferous forest.	**May be Present.** Historical records are known from Purisima Creek Redwoods OSP and near Sierra Azul OSP, St. Joseph's Hill OSP and El Sereno OSP, but these populations have not been encountered in over 100 years (CCH1 2019). Suitable habitat is present in preserves with mature conifer forest, such as Bear Creek Redwoods OSP, La Honda Creek OSP and Russian Ridge OSP.
California bottle-brush grass (*Elymus californicus*)	CRPR 4.3	Broadleafed upland forest, cismontane woodland, North Coast coniferous forest, riparian woodland. Occurs in seasonally wet areas in openings in the forest.	**Present.** This species is known to occur in La Honda Creek OSP. In addition, a historical population occurs just outside Russian Ridge OSP (CCH1 2019). This current extent, range and abundance of this species is possibly limited by fire suppression (CNPS 2020). This species has potential to occur in preserves that have suitable forest openings.
Abrams' woollystar (*Eriastrum abramsii*)	Midpen	Chaparral.	**Present.** The species is known to occur in Monte Bello OSP and Rancho San Antonio OSP. This species has the potential to occur in other preserves along the Santa Cruz Mountain ridgetop with chaparral habitat.

Common Name (*Scientific Name*)	Status1	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Jepson's woolly sunflower (Eriophyllum jepsonii)	CRPR 4.3	Chaparral, cismontane woodland, and coastal scrub, sometimes serpentinite.	**May be Present.** The closest known population occurs to the east of Sierra Azul OSP in Henry Coe State Park (CNPS 2019). Suitable habitat for this species is present in preserves in the southern portion of the Program area with serpentine soils such as El Sereno OSP, St. Joseph's Hill OSP, and Sierra Azul OSP.
San Francisco wallflower (*Erysimum franciscanum*)	CRPR 4.2	Chaparral, coastal dunes, coastal scrub, Valley and foothill grassland (often serpentinite or granitic, sometimes roadsides).	**May be Present.** The known distribution of this species is not well known (CNPS 2020). Populations are known to occur on SFPUC watershed lands just to the north of Miramontes Ridge OSP (CCH1 2019; CNPS 2019). Suitable habitat is present in preserves with chaparral, coastal scrub, rocky cliffs, and grassland particularly in the northern half of the program area such as Miramontes Ridge OSP and Purisima Creek Redwoods OSP.
Small leaved monkeyflower (*Erythranthe microphylla*)	Midpen	Seeps, streambanks, wet meadows in chaparral.	**May be Present.** Suitable habitat is present in preserves containing chaparral with seep, wet meadow, or streambank microhabitat.
Stinkbells (*Fritillaria agrestis*)	CRPR 4.2	Clay, sometimes serpentinite substrates in chaparral, cismontane woodland, pinyon and juniper woodland, valley and foothill grassland.	**May be Present.** This species occurs on a wide variety of habitats, including on and off of serpentine substrates (CNPS 2020). Suitable habitat for this species is present in many preserves. A known population of this species occurs near Año Nuevo in similar habitat to that in Tunitas Creek OSP (CNPS 2019).
San Francisco gumplant (*Grindelia hirsutula* var. *maritima*)	CRPR 3.2	Sandy or serpentine substrates in coastal bluff scrub, coastal scrub, and valley and foothill grassland.	**May be Present.** The taxonomic certainty of this species is in flux, as is it distribution and range (CNPS 2020). This species is generally considered to occur in the coastal zone (CNPS 2020). Suitable habitat for this species is present in the Tunitas Creek OSP.

Common Name (*Scientific Name*)	Status1	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Harlequin lotus (*Hosackia gracilis*)	CRPR 4.2	In wetlands and roadsides within broadleafed upland forest, Coastal bluff scrub, closed-cone coniferous forest, cismontane woodland, coastal prairie, coastal scrub, meadows and seeps, marshes and swamps, North Coast coniferous forest, valley and foothill grassland.	**May be Present.** Suitable habitat for this species is present in many Midpen preserves. Historical populations of this species are present in coastal bluff scrub and grassland habitats just south of Tunitas Creek OSP in the Pescadero area, and just west of Miramontes Ridge OSP in the Half Moon Bay area (CNPS 2019).
Coast iris (*Iris longipetala*)	CRPR 4.2	Mesic sites (meadows and seeps) in coastal prairie and lower montane coniferous forest.	**May be Present.** Historical populations of this species are present just outside of Thornewood OSP and just to the west of Miramontes Ridge OSP in the Half Moon Bay area (CNPS 2019). Suitable habitat for this species is present in preserves with more coastal influences such as Miramontes Ridge OSP, Purisima Creek Redwoods OSP, and Tunitas Creek OSP.
Bristly leptosiphon (*Leptosiphon acicularis*)	CRPR 4.2	Chaparral, cismontane woodland, coastal prairie, valley and foothill grassland.	**May be Present.** The current geographic range of this species is predominantly north of the Program area in the North Coast Ranges or in the East Bay area. Historical populations of this species occurred just outside of Windy Hill OSP and Coal Creek OSP where the species had been recorded in grassland (CNPS 2019). Suitable habitat for this species is present in preserves in the central portion of the Program area with grasslands.
Serpentine leptosiphon (*Leptosiphon ambiguus*)	CRPR 4.2	Usually serpentine substrates in montane woodland, coastal scrub, valley and foothill grassland.	**Present.** Known to occur in Sierra Azul OSP. Suitable habitat for this species is present in other preserves in the Program area with serpentine substrates such as Pulgas Ridge OSP, El Sereno OSP and St. Joseph's Hill OSP.

Common Name (*Scientific Name*)	Status1	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Large-flowered leptosiphon (*Leptosiphon grandiflorus*)	CRPR 4.2	Usually sandy substrates in coastal bluff scrub, closed-cone coniferous forest, cismontane woodland, coastal dunes, coastal prairie, coastal scrub, valley and foothill grassland.	**Present.** Known to occur in Sierra Azul OSP. Suitable habitat for this species is present in other preserves in the Program area with serpentine substrates such as Pulgas Ridge OSP, El Sereno OSP and St. Joseph's Hill OSP.
Woolly-headed lessingia (*Lessingia hololeuca*)	CRPR 3	Clay or serpentine substrates in broadleafed upland forest, coastal scrub, lower montane coniferous forest, valley and foothill grassland.	**May be Present.** Historical populations of this species are present just outside of El Sereno OSP (CNPS 2019). Suitable habitat for this species is present in preserves with serpentine soils such as El Sereno OSP, Sierra Azul OSP, and St. Joseph's Hill OSP.
San Mateo tree lupine (*Lupinus arboreus* var. *eximius*)	CRPR 3.2	Chaparral and coastal scrub.	**May be Present.** Many recently recorded populations of this species are present just to the north of Miramontes Ridge OSP on Montara Mountain (CNPS 2019). Identification of this species is considered to be very difficult, and further study on its taxonomic status is needed (CNPS 2020). This species has the potential to occur in preserves with coastal scrub habitats such as Tunitas Creek OSP and Miramontes Ridge OSP.
Elongate copper moss (*Mielichhoferia elongata*)	CRPR 4.3	Metamorphic rock, usually acidic, usually vernally mesic, and often on roadsides (sometimes carbonate) in broadleafed upland forest, chaparral, cismontane woodland, coastal scrub, lower montane coniferous forest, meadows and seeps, and subalpine coniferous forest.	**May be Present.** Suitable habitat for this species is present in preserves with the appropriate acidic metamorphic rock substrates. The closest known populations of this species are in the vicinity of Big Basin Redwoods State Park (CNPS 2019).

Common Name (*Scientific Name*)	Status1	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Gairdner's yampah (*Perideridia gairdneri* ssp. *gairdneri*)	CRPR 4.2	Vernal pools and vernally mesic sites in broadleafed upland forest, chaparral, coastal prairie, and valley and foothill grassland.	**Present.** The species is known to occur in St. Joseph's Hill OSP and at Teague Hill OSP. Suitable habitat is present in other preserves with seasonal wetlands and/or vernal pools.
Michael's rein orchid (*Piperia michaelii*)	CRPR 4.2	Coastal bluff scrub, closed-cone coniferous forest, chaparral, cismontane woodland, coastal scrub, and lower montane coniferous forest.	**May be Present.** The geographic range of this species is widespread occurring in both the coast ranges from Marin to Ventura County, as well as the Sierra Nevada foothills (CNPS 2020). A historical population is known from Purisima Creek Redwoods OSP but has not been observed since 1907 (CCH1 2019). Suitable habitat for this species is present in Tunitas Creek OSP, Miramontes Ridge OSP, Purisima Creek Redwoods OSP, La Honda Creek OSP and Russian Ridge OSP.
Hickman's popcornflower (*Plagiobothrys chorisianus* var. *hickmanii*)	CRPR 4.2	Vernal pools, marshes and swamps in closed-cone coniferous forest, chaparral, and coastal scrub.	**Present.** The species is known to occur in Bear Creek Redwoods OSP. Suitable habitat is present in other preserves with seasonal wetlands and/or vernal pools.
Lobb's aquatic buttercup (*Ranunculus lobbii*)	CRPR 4.2	Vernal pools and other mesic sites in cismontane woodland, North Coast coniferous forest, and valley and foothill grassland.	**May be Present.** Most of populations of this species in San Mateo and Santa Cruz Counties are historical and from collections that are over 100 years old (CNPS 2019). Historical populations are known from the vicinity of Skyline Ridge OSP, Russian Ridge OSP, Monte Bello OSP, Coal Creek Preserve, and Windy Hill OSP where this species occurred on seasonally moist margins of stock ponds and reservoirs, or in wet meadows (CNPS 2019). This species has the potential to occur in preserves with seasonal wetlands and/or vernal pool habitats.
Hoffmann's sanicle (*Sanicula hoffmannii*)	CRPR 4.3	Often serpentine or clay soils in broadleafed upland forest, coastal bluff scrub, chaparral, cismontane woodland, coastal scrub, and lower montane coniferous forest.	**May be Present.** Suitable habitat is present in many preserves, as this species is not restricted to serpentine soils. Known populations are present in Butano State Park in similar habitats to those present in La Honda Creek OSP to the north (CNPS 2019).

Common Name (*Scientific Name*)	Status1	Habitat Association	Potential to Occur on Current/Future Midpen Lands
Marsh Zigadenus (*Toxicoscordion fontanum*)	CRPR 4.2	Vernally mesic, often serpentine meadows, seeps, marshes, or swamps in chaparral, cismontane woodland, lower montane coniferous forest.	**May be Present.** The known geographic range of this species is broad, ranging from Mendocino to San Louis Obispo Counties. A known population occurs just outside of to the west (CCH1 2019). Records within the Program area are limited to a single record from San Mateo County from just outside of Pulgas Ridge OSP, and a single record from Santa Cruz County on Empire Grade Road (CCH1 2019). This species has potential to occur in preserves with serpentine soils such as Pulgas Ridge OSP, El Sereno OSP, St. Joseph's Hill OSP, and Sierra Azul OSP.
Methuselah's beard lichen (*Usnea longissima*)	CRPR 4.2	Growing on tree branches; usually on old growth hardwoods and conifers in broadleafed upland forest and north coast coniferous forest.	**Present.** The species is known to occur in Purisima Creek Redwoods OSP. The range and specific habitat requirements of this species is not well-known due to the limited number of collections. This species has potential to occur in preserves with mature conifer forest, and likely those with greater coastal influence.

Source: H.T. Harvey 2020

Table 2 Special-Status Animal Species with Potential to Occur in the Program Area

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Federal or State Endangered, Threatened, Proposed, or Candidate Species			
Mission blue butterfly (Icaricia icarioides missionensis)	FE	Found in coastal chaparral and coastal grasslands. Adults fly from late March to early July and feed on the nectar of hairy false goldenaster (Heterotheca villosa), bluedicks (Dichelostemma capitatum), and seaside buckwheat (Eriogonum latifolium) (Black and Vaughn 2005a). Larval host plants consist of three lupines – silver lupine (Lupinus albifrons), summer lupine (Lupinus formosus), and manycolored lupine (Lupinus versicolor), which grow in poor soils with little grass, on rocky outcrops, and in recently disturbed areas, such as road cuts and landslides (County of San Mateo 1982).	**Absent.** Remaining populations of the Mission blue butterfly are found in only a few locations around the San Francisco Bay area. Known populations are present on the ridgetops just east of Pacifica, including Milagra Ridge. These locations are just north of the Midpen Program area. Host plants for the Mission blue are present at some Midpen preserves, but the species is not known to occur on Midpen lands.

[1] Special-status species are listed in the following order: state or federally listed, proposed, or candidate species first, followed by California species of special concern, then species classified as fully protected. Within each of those groups, species are listed in the following order: invertebrates, fish, amphibians, reptiles, birds, then mammals.

[2] Status Codes: FE = Federally Endangered; FT = Federally Threatened; FC = Candidate for Federal Listing; SE = State Endangered; ST = State Threatened; SC = Candidate for State Listing; CSSC = California Species of Special Concern; SP = State listed as Fully Protected

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Callippe silverspot butterfly (*Speyeria callippe callippe*)	FE	Native grasslands containing Johnny jump-ups (*Viola pedunculata*). Males seek hilltops and hillsides of native grasslands for mates. Females lay their eggs in the dead or dying larval food plant, *V. pedunculata*, or in nearby woody debris (Black and Vaughan 2005b).	**Absent.** Historically, the callippe silverspot butterfly occupied grasslands in much of the San Francisco Bay region. However, all known locations are currently restricted to San Francisco and San Mateo Counties, where several populations are known from San Bruno Mountain, Milagra Ridge, the San Francisco Peninsula Watershed, and Montara Mountain. Adults have one flight period, which is typically from mid-May to July (Black and Vaughan 2005b). Critical habitat has not been designated for this species (USFWS 2007). The host plant is in portions of the Program area (Calscape 2019), but high-quality habitat containing large numbers of the host plant is absent, and there is no evidence that this species is extant in the Program area.
Myrtle's silverspot butterfly (*Speyeria zerene myrtleae*)	FE	The Myrtle's silverspot butterfly was listed as endangered by the USFWS June 1992 (USFWS 1992). This species is found in coastal dune, prairie, coastal bluff scrub, and associated grasslands in areas protected from wind (Steiner et al. 1994, USFWS 1998a). Adults feed on nectar from gumplant (*Grindelia* spp.), sand verbena (*Abronia latifolia*), mints (*Mondardella* spp.), bull thistle (*Cirsium vulgare*), and seaside daisy (*Erigeron glaucus*). Females lay their eggs in debris and the dried stems of violets, typically hookedspur violets (*Viola adunca*), the larvae's host plant (Black and Vaughn 2005c, USFWS 2007).	**Absent.** No myrtle silverspot populations are currently present in existing Midpen preserves, and none are expected to occur given the fact that the species is not known to have occurred in San Mateo County in 70 years (CNDDB 2019). Although there are historical records from the vicinity of Pescadero and from Pigeon Point, this species has been extirpated south of the Golden Gate Bridge and is now restricted to 4 populations in northwestern Marin County and southern Sonoma County (Steiner et al. 1994, Black and Vaughn 2005c, USFWS 2007, CNDDB 2019, iNaturalist 2019). This species is found in association with host plants that occur in coastal dune, prairie, coastal bluff scrub, and associated grasslands, in areas protected from wind (Steiner et al. 1994, USFWS 1998a). Potentially suitable habitat for this species may be present at Tunitas Creek OSP and Miramontes Ridge OSP.

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Bay checkerspot butterfly (*Euphydryas editha bayensis*)	FT	Native grasslands on serpentine soils. Larval host plants are *Plantago erecta* and/or *Castilleja* spp. High-quality habitat consists of extensive serpentine grassland in areas with variable slope aspects to sustain populations during periods of variable precipitation (USFWS 1998b, Black and Vaughan 2005d).	**May be Present.** No Bay checkerspot populations are currently present in existing Midpen preserves. However, the species was historically observed in the Sierra Azul OSP and has been reintroduced to Edgewood County Park (Friends of Edgewood 2015), located just south of Midpen's Pulgas Ridge OSP. There is some potential for very small numbers of individuals to occasionally disperse to Pulgas Ridge, though the species is not expected to breed there due to the absence of high-quality habitat. Designated critical habitat Unit 3 (Edgewood Park/Triangle) is present immediately adjacent to Midpen lands, and Midpen holds an easement over Edgewood Park. However, no critical habitat has been designated on existing Midpen preserves, and suitable habitat is not present at any other Midpen preserve.
Smith's blue butterfly (*Euphilotes enoptes smithi*)	FE	Coastal sand dunes and coastal sage scrub where sea cliff buckwheat (*Eriogonum parvifolium*) and coast buckwheat (*Eriogonum latifolium*) are present (Center for Biological Diversity 2019).	**Absent.** No Smith's blue butterfly populations are currently present in or very close to existing Midpen preserves. The species was historically reported from Loma Prieta Road in the Sierra Azul OSP, although the details associated within the record suggest that the identification was uncertain (CDFW 2020b). Moreover, the host plants that Smith's blue is associated with and dependent on, sea cliff buckwheat (*Eriogonum parvifolium*) and coast buckwheat (*Eriogonum latifolium*), are not present at the location (Calscape 2019) where the butterflies were observed. This species is not expected to occur on current or future Midpen lands.
Zayante band-winged grasshopper (*Trimerotropis infantilis*)	FE	Restricted to the Zayante sandhills ecosystem – sand parkland found on ridges and hills, characterized by scattered ponderosa pines (USFWS 1998c).	**Absent**. No Zayante band-winged grasshopper populations are currently present in or near existing Midpen preserves. The species historically occurred, but is now locally extinct, in the area surrounding Lexington Reservoir near Bear Creek Redwoods and Sierra Azul OSPs. Designated critical habitat is located south of the Program area in the sandhills of the Santa Cruz Mountains (USFWS 1998c). This species is not expected to occur on current or future Midpen lands.

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Western bumble bee (*Bombus occidentalis occidentalis*)	SC	Meadows and grasslands with abundant floral resources.	**Absent.** This species was historically found throughout much of central and northern California, including the Program area. For example, historical records include a 1953 record from Miramontes Ridge OSP (CNNDB 2019) as well as records from Johnston Ranch. However, this species is not expected to currently occur within the Program area due to recent range contractions. Its current range is believed to be restricted to northeastern California (iNaturalist 2019, Hatfield et al. 2019).
Crotch's bumble bee (*Bombus crotchii*)	SC	Open grassland and scrub habitats.	**Absent.** Although the historical distribution of this species included much of the Bay Area, it is not expected to occur in the Program area due to recent range contractions. Despite a recent observation at Santa Teresa County Park, approximately 4.0 miles from Sierra Azul OSP, this species' current range is believed to be restricted primarily to southern California (iNaturalist 2019; Hatfield et al. 2019). In the Program area, this species is considered absent and extirpated.
Monarch butterfly (*Danaus plexippus plexippus*)	FC	Overwinters along the Pacific coastline of California and move inland in the spring to reproduce. During the breeding season, require milkweed (*Asclepias* spp.) plants upon which to rear their larvae.	**Present.** Along the Peninsula and throughout the Program area, monarch butterflies occur primarily as migrating individuals in the fall and spring (CDFW 2020b). Wintering sites are mostly coastal or near the edge of San Francisco Bay. Purisima Uplands property within Purisima Creek OSP and perhaps Tunitas Creek OSP contain wintering habitat. There are also records of this species from Midpen preserves such as Foothills OSP and Rancho San Antonio OSP (iNaturalist 2019), and this species is expected to occur in small numbers at other preserves.

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Central California Coast Coho salmon (*Oncorhynchus kisutch*)	FE, SE	Open ocean, estuaries, and rivers. Spawning habitat in medium to small coastal streams in heavily forested watersheds characterized by perennially-flowing reaches of cool, high-quality water; dense riparian canopy; deep pools with abundant overhead cover; instream cover consisting of large, stable woody debris and undercut banks; and gravel or cobble substrates (NFMS 2016). Juveniles rear in freshwater for one year, seeking out cool, deep (>3.2 feet) water with substantial overhead cover and instream cover such as woody debris (Moyle 2002). Juveniles do not persist in streams where summer temperatures reach 72.7 °F for extended periods of time (Moyle 2002).	**May be Present.** Central California Coast Coho salmon have recently been recorded spawning in the southwestern portion of the Program area in Pescadero Creek (POST 2021), and the species spawns in San Gregorio Creek, Pescadero Creek, and Gazos Creek, although it has not been recorded in Gazos Creek during annual monitoring since 2008 (Smith 2013 as cited in CDFW 2015, Midpen 2017). The species was historically collected from San Mateo Creek (Leidy 2007) and may have been present in the San Francisquito Creek watershed (Leidy et al. 2005). However, it has been extirpated from all San Mateo County streams flowing to the Bay (Leidy 2007). Designated critical habitat occurs in the Program area and includes all accessible reaches of all rivers including estuarine areas and tributaries between Punta Gorda and the San Lorenzo River (inclusive) in California. Designated critical habitat is present in or immediately adjacent to La Honda Creek OSP (NMFS 1999).

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Central California Coast steelhead (*Oncorhynchus mykiss*)	FT	Cool streams with suitable spawning habitat and conditions allowing migration between spawning and marine habitats.	**Present.** In the Program area, steelhead are known to occur in a number of coastal streams, as well as in a few streams entering San Francisco Bay, such as Stevens Creek, Guadalupe River/Creek, and San Francisquito Creek (including Los Trancos Creek) (Spence et al. 2008, Center for Ecosystem Management and Restoration 2008). Designated critical habitat includes all river reaches and estuarine areas accessible to listed steelhead in coastal river basins from the Russian River to Aptos Creek, California (inclusive), and the drainages of San Francisco and San Pablo Bays (NMFS 2005). Designated critical habitat is present in or immediately adjacent to the following Midpen preserves: Tunitas Creek, La Honda Creek, Russian Ridge, Miramontes Ridge, Skyline Ridge, Long Ridge, Purisima Creek Redwoods, Fremont Older, Los Trancos, and Sierra Azul OSPs. Steelhead could therefore use those creek reaches for spawning, rearing, and/or migration.
Tidewater goby (*Eucyclogobius newberryi*)	FE, CSSC	Brackish water habitats along coast, fairly still but not stagnant water and high oxygen levels.	**Absent**. The species has been recorded in the lower mouths of creeks along the southern portion of the San Mateo County coast north to San Gregorio Creek, including San Gregorio Creek, Pescadero Creek, and Arroyo De Los Frijoles and Lake Lucerne at Bean Hollow State Beach (CDFW 2020b). However, an apparently natural gap in the species' distribution along the California coast occurs north of San Gregorio Creek to the San Francisco Bay (USFWS 2005). Four designated critical habitat units occur in the Program area. However, although the tidewater goby occurs in the Program area, it is not known or expected to occur on current or future Midpen lands due to the absence of suitable habitat.

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
California red-legged frog (*Rana draytonii*)	FT, CSSC	Uses streams, freshwater pools, and ponds with emergent or overhanging vegetation as breeding and nonbreeding aquatic habitat. It can disperse through a variety of habitats, such as grassland or woodland, particularly during the wet season.	**Present.** California red-legged frogs are fairly widespread in suitable habitat within the Program area, and occur in a number of Midpen preserves including Tunitas Creek OSP, La Honda Creek OSP, La Purisima Creek Redwoods OSP, Rancho San Antonio OSP, Pichetti Ranch OSP, Coal Creek OSP, Russian Ridge OSP, Long Ridge OSP, Monte Bello OSP, Skyline Ridge OSP, Bear Creek Redwoods OSP, and Sierra Azul OSP. California red-legged frog designated critical habitat units SNM-1 (Cahill Ridge) and SNM-2 (Pescadero) are located in the Program area, and El Corte de Madera Creek OSP, La Honda Creek OSP, Long Ridge OSP, Russian Ridge OSP, Miramontes Ridge OSP, and Skyline Ridge OSP, all contain designated critical habitat.
Foothill yellow-legged frog (*Rana boylii*)	SE, CSSC	Occurs in a variety of habitats in coast ranges, but all contain partially shaded shallow streams and riffles with a rocky substrate.	**Present.** Suitable habitat for the foothill yellow-legged frog is present at multiple locations in the Program area, but the species has essentially been extirpated throughout much of San Mateo County, at least east of the crest of the Santa Cruz Mountains, as there are no records from that area since 1960 (CDFW 2020b). Single records west of the crest of the Santa Cruz Mountains within the past 25 years, from Pescadero Creek County Park and Portola Redwoods State Park, suggest the species may persist west of the crest. In Santa Clara County, east of State Route 17, the species is extant in suitable habitat, including in creeks in Sierra Azul OSP – the only Midpen preserve where the species is likely to occur.

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
California tiger salamander (*Ambystoma californiense*)	FT, ST	An endemic member of the California grassland community, the California tiger salamander's preferred breeding habitat consists of temporary ponded environments free of predators including exotic fishes, crayfish, and bullfrogs, surrounded by uplands that support small mammal burrows which provide refugia for juvenile and adult salamanders during the dry season. Adults are terrestrial, and spend most of their lives in widely dispersed, underground retreats.	**May be Present.** Southeastern San Mateo County represents the northernmost limit of the species' range on the San Francisco Peninsula. The last recorded occurrence in San Mateo County was located in the Palo Alto, California U.S. Geological Survey 7.5-minute quadrangle just west of San Francisquito Creek in 2002 (CDFW 2020b). This species occurs more widely in Santa Clara County, but it is not known to occur in any existing Midpen preserves. If the species occurs on Midpen lands, it is most likely to occur along the northeastern edge of Sierra Azul OSP, where some potentially suitable (nonbreeding) habitat exists, and due to the species' known occurrence in the nearby Santa Teresa Hills (Midpen 2017). Potentially suitable habitat also exists in Almaden Quicksilver County Park, immediately adjacent to Sierra Azul OSP. The closest known population to Sierra Azul is located at Calero County Park; designated critical habitat is also located at Calero County Park (CDFW 2020b), but not within any Midpen preserves.

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
San Francisco garter snake (*Thamnophis sirtalis tetrataenia*)	FE, SP	Prefer freshwater habitats with dense herbaceous vegetation. May use upland burrows for aestivation, and uses grassland for dispersal and aestivation. Often suns itself in, or immediately adjacent to, dense vegetation along the edges of freshwater ponds.	**Present.** The San Francisco garter snake occurs on the San Francisco Peninsula from just north of the San Francisco–San Mateo County line south to approximately the San Mateo–Santa Cruz County line. An intergrade zone composed of hybrids between the San Francisco garter snake and red-sided garter snake (*Thamnophis sirtalis sirtali*s) occurs from Palo Alto north to the Pulgas region near Upper Crystal Springs Reservoir (Barry 1994). San Francisco garter snake have been historically documented in four Midpen preserves – Tunitas Creek, Russian Ridge, Skyline Ridge, and Long Ridge (USFWS 2016). The only Preserve with confirmed presence at this time is Russian Ridge. Midpen has implemented a San Francisco garter snake habitat management plan for the 1,047-acre Mindego Ranch (part of Russian Ridge OSP) to encourage the recovery of the species by improving habitat conditions for San Francisco garter snake and California red-legged frog, a primary food source for San Francisco garter snake. SFGS are also found in the Cloverdale property, currently owned by POST, but which Midpen intends to purchase in the coming years.

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Marbled murrelet (*Brachyramphus marmoratus*)	FT, SE (nesting)	Requires dense, mature forests of redwood and Douglas-fir (especially old-growth) for breeding. Forages entirely in nearshore oceanic waters.	**Present.** In San Mateo County, the marbled murrelet is restricted to old-growth redwood forests and isolated patches of late-seral forest, where it breeds, and to coastal waters, where it forages (SAS 2001, Cornell Lab of Ornithology 2021). This species is known to occur in at least one Midpen preserve, Purisima Creek Redwoods OSP, and it may occur in or near other preserves if old-growth redwood forests or late seral forest are present, such as in El Corte de Madera Creek OSP. However, most known breeding areas are further downslope from the crest of the Santa Cruz Mountains, and are centered in the area bounded by San Mateo County Memorial Park, Sam McDonald County Park, Pescadero Creek County Park, Portola Redwoods State Park, Butano State Park, and in adjacent Santa Cruz County, Big Basin State Park (CDFW 2020b). Four marbled murrelet designated critical habitat units are present in San Mateo County (CA-12, CA-13, CA14a, and CA14b), and a portion of the Long Ridge preserve is designated as critical habitat. Designated critical habitat is also located in Huddart County Park, immediately adjacent to Purisima Creek Redwoods OSP and Teague Hill OSP (CDFW 2020b).
Bald eagle (*Haliaeetus leucocephalus*)	SE, SP	Occurs mainly along seacoasts, rivers, and lakes; nests in tall trees or in cliffs, occasionally on electrical towers. Feeds mostly on fish, but will also feed on large carcasses. Mature tall trees are used for roosting.	**Absent as Breeder.** In the Program area, the bald eagle occurs primarily as a migrant and winter visitor and is rare during the summer months (Cornell Lab of Ornithology 2021). Although there are no known nesting records from any Midpen preserve, this species has nested east of Lexington Reservoir, just north of Bear Creek Redwoods OSP, in recent years, and it has also nested at Crystal Springs Reservoir, from 2013 through 2015. Potentially suitable nesting habitat is present at Guadalupe Reservoir, immediately adjacent to Sierra Azul OSP. This species is currently known to occur in Midpen preserves only as a nonbreeding forager, but it could potentially nest in preserves, particularly those close to lakes, such as Bear Creek Redwoods, El Sereno, and Sierra Azul OSPs.

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Willow flycatcher (*Empidonax trailli brewsteri*)	SE	Nests in dense willow thickets in riparian woodlands.	**Absent as breeder.** This species occurs in the Program area, but only during spring and fall migration. Although this species historically bred in the Program area, it was extirpated from the entire San Francisco Bay Area and central coast decades ago. Small numbers of birds from more northerly populations occur in the Program area (including Midpen lands) during spring and fall migration.
Swainson's hawk (*Buteo swainsoni*)	ST (nesting)	Swainson's hawks in California are strongly associated with riparian habitats, though they are also found in oak woodlands and other open habitats. Swainson's hawks build sturdy stick nests in low willows, box elders, oaks, or other trees. They forage in a variety of open habitats, such as grasslands and wetlands.	**Absent as Breeder.** This species occurs in the Program area only as a rare migrant (Cornell Lab of Ornithology 2021). The closest nesting pair(s) are located in Coyote Valley, approximately 4 mi from the Program area. Swainson's hawks could occur as a migrant at any Midpen preserve, although they are not expected to do so on a regular basis, and when they do occur, they are most likely to occur only as flyovers, rather than using the habitat within the preserve. This species has been observed at Sierra Azul OSP and on Tunitas Creek Road, not far from Tunitas Creek OSP (Cornell Lab of Ornithology 2021).
Bank swallow (*Riparia riparia*)	ST (nesting)	Colonial nester on vertical banks or cliffs with fine-textured soils near water.	**Absent as Breeder.** Bank swallows occur as rare migrants along the coast and South Bay, although they could potentially occur anywhere in the Program area. As breeders, they are very rare in the Program area, with the only known only known extant breeding colony occurring at Anõ Nuevo State Park (CDFW 2020b; Cornell Lab of Ornithology 2021); however, suitable habitat may also be present at Tunitas Creek Beach, located across State Route 1 from Midpen's Tunitas Creek property. There is a historical nesting record (1896) from Pescadero Beach (CDFW 2020b). This species is likely to occur on current or future Midpen lands only as a transient or nonbreeding forager, and then only in small numbers.

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Tricolored blackbird (*Agelaius tricolor*)	ST (nesting colony)	Nests most commonly near fresh water in dense emergent vegetation, but also in grain fields, fallow fields, and extensive thickets of blackberry. Highly colonial in its nesting habits and forms dense breeding colonies that, in some parts of the Central Valley, may consist of up to tens of thousands of pairs.	**May be Present.** In the Program area, the tricolored blackbird occurs primarily along the coastal lowlands and in the San Francisco Bay lowlands. It occurs less frequently along the ridgeline of the Santa Cruz Mountains. It is an uncommon to common migrant and wintering visitor and a very rare breeder (SAS 2001, Cornell Lab of Ornithology 2021). Tricolored blackbirds form large, often multi-species flocks during the non-breeding period and range more widely than during the breeding season. Suitable breeding habitat for this species is absent from most Midpen preserves, and it is most likely to occur in preserves as a nonbreeding forager. However, potential nesting habitat may be present in ponds at some preserves, such as at Tunitas Creek OSP.
Mountain lion (*Puma concolor*)	SC (petitioned for state listing)[3]	Occurs in a wide variety of habitats, including woodland, forest, chaparral, and grassland, as long as rock outcrops or areas of dense vegetation providing cover are present.	**Present.** Mountain lions are present in low densities throughout much of the Santa Cruz Mountains. Although they typically tend to avoid areas of high human activity, they occasionally venture into suburban areas. Mountain lions have been recorded in numerous Midpen preserves and could potentially occur in any preserve within the Program area.
California Species of Special Concern			
California giant salamander (*Dicamptodon ensatus*)	CSSC	Typically found in moist forests and riparian zones in or near clear, cold streams or seeps. Found under logs and debris, and occasionally in trees and shrubs near water. Breeds in clear, cold rivers, creeks, and ponds.	**Present.** Suitable habitat for the California giant salamander is present in the Program area, and the species has been observed at many Midpen preserves, including Tunitas Creek OSP, Skyline Ridge OSP, Sierra Azul OSP, Saratoga Gap OSP, Purisima Creek Redwoods OSP, Monte Bello OSP, Long Ridge OSP, La Honda Creek OSP, El Sereno OSP, El Corte de Madera Creek OSP, and Bear Creek Redwoods OSP (Midpen 2019, CDFW 2020b). It is most likely to occur near streams, but dispersing individuals could occur in nearby upland habitats.

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Santa Cruz black salamander (*Aneides flavipunctatus niger*)	CSSC	Moist forests and riparian zones in or near clear, cold streams or seeps. This subspecies is mostly terrestrial, staying underground during dry periods and foraging for small invertebrates aboveground at night during wet weather.	**Present.** The Santa Cruz black salamander is endemic to California and is found in moist streamside habitats in woodlands and forests in the Santa Cruz Mountains in western Santa Clara, northern Santa Cruz, and southernmost San Mateo Counties. This species is found in moist forests and riparian zones in or near streams or seeps. This species has been observed at Sierra Azul OSP, as well as from Bear Creek Redwoods OSP, Long Ridge OSP, Monte Bello OSP, Russian Ridge OSP, and Saratoga Gap OSP (Midpen 2019, CDFW 2020b), and it likely occurs in suitable habitat at other Midpen preserves as well.
Red-bellied newt (*Taricha rivularis*)	CSSC	Moist forests and riparian zones, usually in or near clear, cold streams; range strongly associated with redwood (*Sequoia sempervirens*) forests.	**Present.** Suitable habitat for the red-bellied newt is present in the Program area, and the species is known to occur at Monte Bello OSP. However, because this recently discovered population is disjunct and isolated from the primary population, which is located in Humboldt, Mendocino, Lake, and Sonoma Counties by 80 miles (Reilly et al. 2014), this species is unlikely to occur at any other Midpen preserve.
Western pond turtle (*Actinemys marmorata*)	CSSC	Permanent or nearly permanent water in a variety of habitats. Preferred habitat features include partially submerged logs and branches for basking. Nests in uplands near waterbodies, particularly in grassland.	**Present.** Creeks, lakes, ponds, and freshwater marshes in the Program area provide suitable habitat for the western pond turtle. This species has been observed at La Honda Creek OSP, Bear Creek Redwoods OSP, Sierra Azul OSP, Russian Ridge OSP, Skyline Ridge OSP, Windy Hill OSP, and Long Ridge OSP (Midpen 2019; CDFW 2020b), and likely occurs in other preserves where suitable habitat is present.

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Coast horned lizard (*Phrynosoma blainvillii*)	CSSC	Occurs in sandy, loose-textured soils interspersed with scattered shrubs in woodlands, grasslands, and shrublands.	**Present.** This species was historically known to occur throughout San Mateo County and the Program area. Although there are no recent records from San Mateo County, this species is known to persist in at least three Midpen preserves located in Santa Clara County, with recent records from Bald Mt in the Sierra Azul OSP (2009), Monte Bello OSP (2014), and five records from Rancho San Antonio OSP, including two recent records (2014 and 2018) (Midpen 2019; iNaturalist 2019).
Northern harrier (*Circus hudsonius*)	CSSC (nesting)	Nests in marshes and moist fields, forages over open areas, including grasslands, marshes, and moist fields.	**Present.** In the Program area, during the breeding season the northern harrier occurs primarily in marshes and grasslands along the coast (Cornell Lab of Ornithology 2021). There is at least one breeding season occurrence at Tunitas Creek OSP, near potentially suitable habitat. Northern harriers observed during the summer in grassland habitat at Midpen preserves in the Santa Cruz Mountains, such as at Russian Ridge OSP, Skyline Ridge OSP, and La Honda Creek OSP are likely to only be foraging, as the San Mateo County Breeding Bird Atlas did not find this species nesting away from the coast or the San Francisco Bay (SAS 2001, Cornell Lab of Ornithology 2021).
Short-eared owl (*Asio flammeus*)	CSSC (nesting)	Nests on ground in tall emergent vegetation or grasses, forages over a variety of open habitats.	**Absent as Breeder.** In the Program area, the short-eared owl occurs primarily from October to March, with most records confined to coastal marshes, grasslands, and fallow fields and to tidal marshes of South San Francisco Bay (SAS 2001, Cornell Lab of Ornithology 2021). There are no known breeding season records from any Midpen preserves, and no breeding records away from the South Bay (SAS 2001, Cornell Lab of Ornithology 2021). This species may occur irregularly and in low numbers on current or future Midpen lands, but only as a nonbreeders.

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Long-eared owl (*Asio otus*)	CSSC (nesting)	Riparian bottomlands with tall, dense willows and cottonwood stands; also dense live oak and California Bay along upland streams; forages primarily in adjacent open areas.	**Present.** There are scattered recorded of the long-eared owl throughout the Program area in appropriate habitat; based on known occurrences it is relatively scarce and local (SAS 2001, Cornell Lab of Ornithology 2021), but that impression may result at least in part from its very secretive nature. It is known to have nested at Monte Bello OSP, and there is at least one record of this secretive species from Russian Ridge OSP (CDFW 2020b, Cornell Lab of Ornithology 2021). There is some potential for this species to occur on almost any Midpen land, such as Coal Creek, Los Trancos, Monte Bello, Russian Ridge, Rancho San Antonio, and Sierra Azul OSPs, though due to its scarcity, it is likely present in only a small subset of Midpen lands.
Burrowing owl (*Athene cunicularia*)	CSSC	Open grasslands and ruderal habitats with suitable burrows, usually those made by California ground squirrels.	**Absent as Breeder.** In the Program area, the burrowing owl occurs as a rare winter visitor to more extensive grasslands. Most wintering records are from the coast, such as from Tunitas Creek OSP, but individuals have been detected in winter at Windy Hill OSP, Purisima Creek Redwoods OSP, and La Honda Creek OSP. At least one individual is known to have overwintered at Russian Ridge OSP (Cornell Lab of Ornithology 2021). A statewide survey conducted between 1991 and 1993 indicated that breeding owls had nearly been extirpated from San Mateo County where only one to two known breeding pairs remained (DeSante et al. 2007). Recent records in the Program area are all of wintering birds or migrants (CDFW 2020b, Cornell Lab of Ornithology 2021).

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Vaux's swift (*Chaetura vauxi*)	CSSC (nesting)	Nests in snags in coastal coniferous forests or, occasionally, in chimneys; forages aerially.	**Present.** In the Program area, Vaux's swift breeds in mature redwood forests and occasionally in chimneys in residential areas (SAS 2001, Rottenborn 2007a). There are numerous breeding season records from Midpen preserves along the crest of the Santa Cruz Mountains with records Monte Bello OSP, Skyline Ridge OSP, Windy Hill OSP, Rancho San Antonio, and Mt. Umunhum in Sierra Azul OSP, but no evidence of nesting at any Midpen preserve. It is possible that small numbers may nest in Midpen preserves in hollows in large redwoods or Douglas-firs, but this species occurs in the Program area primarily as a spring and fall migrant (Cornell Lab of Ornithology 2021).
Black swift (*Cypseloides niger*)	CSSC (nesting)	Nest behind waterfalls in the Sierra Nevada, and formerly at Big Basin State Park, and in sea caves along coastal bluffs in San Mateo County and Santa Cruz County. Forages aerially for insects.	**Present.** In the Program area, the black swift occurs primarily along the coast and coastal ranges, although it can forage and fly over virtually any area (Cornell Lab of Ornithology 2021). In the Program vicinity, the only known breeding location is at Anõ Nuevo State Park (SAS 2001, Cornell Lab of Ornithology 2021). Suitable nesting habitat is absent from Midpen preserves, but the species has been observed at Windy Hill OSP, Skyline Ridge OSP, Monte Bello OSP, and Russian Ridge OSP (Cornell Lab of Ornithology 2021). These birds could be either migrants or coastal nesters flying inland to forage.
Olive-sided flycatcher (*Contopus cooperi*)	CSSC (nesting)	Breeds in mature forests with open canopies, along forest edges in more densely vegetated areas, in recently burned forest habitats, and in selectively harvested landscapes (Altman and Sallabanks 2000, Robertson and Hutto 2007).	**Present.** The olive-sided flycatcher breeds in montane and coastal forests and woodlands in the Program area. During spring and fall migration, it can occur anywhere in the Program area (Cornell Lab of Ornithology 2021). Has been observed, and presumably breeds, at La Honda Creek OSP, Russian Ridge OSP, Skyline Ridge OSP, Long Ridge OSP, Rancho San Antonio OSP, Los Trancos OSP, Coal Creek OSP, and Monte Bello OSP (Cornell Lab of Ornithology 2021). Suitable habitat is present at most Midpen preserves, and small numbers may breed at nearly any preserve.

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Purple martin (*Progne subis*)	CSSC (nesting)	Nest in abandoned woodpecker holes. Forages aerially for insects.	**Present.** Purple martins occur in San Mateo County as rare migrants along the coast and very rare and local breeders along the ridgeline of the Santa Cruz Mountains (SAS 2001, Rana Creek Habitat Restoration 2002, Cornell Lab of Ornithology 2021). Known summering and nesting locations include the southern edge of Sierra Azul OSP along Loma Prieta Road (Cornell Lab of Ornithology 2021). Suitable habitat may exist at other preserves, but this species is a scarce and very local breeder in the Program area, and it is expected to occur in Midpen preserves primarily as a scarce migrant.
Loggerhead shrike (*Lanius ludovicianus*)	CSSC (nesting)	Nests in tall shrubs and dense trees; forages in grasslands, marshes, and ruderal habitats.	**Present.** Grassland, ruderal, and marsh communities throughout the Program area provide potentially suitable nesting and foraging habitat for this species. However, it occurs primarily as a migrant and wintering visitor along the coastal and San Francisco Bay lowlands, and is generally absent from the crest of the Santa Cruz Mountains. Due to population declines, it is currently a rare breeder in the Program area, and only a few may nest in preserves (particularly those with extensive grassland). The few known recent nesting records from San Mateo County are all from the San Francisco Bay lowlands, outside the Program area (SAS 2001, Cornell Lab of Ornithology 2021).

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Yellow-breasted chat (*Icteria virens*)	CSSC (nesting)	Nests in a variety of habitats with low, dense vegetation without a closed tree canopy, including shrubby habitat along stream, swamp, and pond margins, forest edges, fencerows, and upland thickets of recently abandoned farmland.	**Absent as breeder.** This species has been recorded very infrequently in the Program area, with scattered records throughout San Mateo County and Santa Clara County, typically singing birds present for a single day in May or June. These birds are likely spring overshoots. There are at least two records from Midpen preserves, a historical record of a bird from La Honda Creek OSP in 1956, and a May 14, 2019 record from Alpine Pond at Russian Ridge OSP (Cornell Lab of Ornithology 2021). South of the Program area, in southern Santa Clara County and northern San Benito County, this species is a very scarce breeder, nesting almost exclusively in willow-dominated riparian habitats, often where thick clumps of willows are interspersed with or adjacent to weedy open areas. This species is not expected to occur in the Program area on a regular basis, and is not known to currently breed in the Program area; at most, an occasional pair might breed on Midpen lands.
Yellow warbler (*Setophaga petechia*)	CSSC (nesting)	Nests in riparian woodlands. Suitable breeding habitat consists of riparian corridors, often with an overstory of mature cottonwoods and sycamores, a mid-story of box elder and willow, and a substantial shrub understory (Bousman 2007).	**Present.** The yellow warbler is an uncommon to rare breeder in wooded riparian habitats throughout the Program area, occurring primarily in association with alders, cottonwoods, and willows, in both San Mateo County and Santa Clara County. Riparian woodlands provide suitable nesting and foraging habitat for this species, but the species is scarce and local, being particularly scarce as a breeder on the immediate coast (SAS 2001). It breeds in somewhat greater numbers in Santa Clara County. It is an abundant migrant during the spring and fall (Cornell Lab of Ornithology 2021). This species has been observed during the breeding season at Los Trancos OSP and Windy Hill OSP, and it likely breeds in small numbers in Midpen preserves providing suitable riparian breeding habitat (Cornell Lab of Ornithology 2021).

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
San Francisco common yellowthroat (*Geothlypis trichas sinuosa*)	CSSC	Nests in herbaceous vegetation, usually in wetlands or moist floodplains.	**Present.** Freshwater marsh habitat, as well as willow riparian habitat and even dense weedy vegetation throughout much of the Program area, provides suitable breeding and foraging habitat for this subspecies. This subspecies could nest at any Midpen preserve that contains potentially suitable habitat such as Mindego Lake at Russian Ridge OSP, Alpine Pond at Russian Ridge OSP, or farm ponds or weedy vegetation at Tunitas Creek. During the breeding season, the species has been observed at Skyline Ridge OSP, La Honda Creek OSP, Purisima Creek OSP, and Windy Hill OSP (Cornell Lab of Ornithology 2021). The approximate southern edge of the range of *G. t. sinuosa* is thought to be at approximately Lexington Reservoir. South of Lexington Reservoir, in Sierra Azul OSP, common yellowthroats present during the breeding season are likely of the subspecies *arizela*.
Grasshopper sparrow (*Ammodramus savannarum*)	CSSC (nesting)	Breeds and forages in grasslands, meadows, fallow fields, and pastures.	**Present.** Breeding grasshopper sparrows occur in relatively low numbers in extensive grasslands throughout the Program area (SAS 2001, Cornell Lab of Ornithology 2021, Unitt 2008). This species been observed at Tunitas Creek OSP, La Honda Creek OSP, Russian Ridge OSP, Miramontes Ridge OSP, Monte Bello OSP, Skyline Ridge OSP, and Windy Hill OSP (Midpen 2019, Cornell Lab of Ornithology 2021), and suitable habitat may exist at other preserves.
Alameda song sparrow (*Melospiza melodia pusillula*)	CSSC	Breeds and forages almost exclusively in tidally influenced salt marsh, dominated by cordgrass and gumplant, and is occasionally found in brackish marshes dominated by bulrushes (Rottenborn 2007b). However, this subspecies is not expected to disperse upstream into adjacent freshwater habitats.	**Absent.** Within San Mateo County, the Alameda song sparrow is known to occur only in tidally influenced salt and brackish marshes along San Francisco Bay (Chan and Spautz 2008). No Midpen OSPs in this Program Area include bayside tidal marsh habitat.

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Bryant's savannah sparrow (*Passerculus sandwichensis alaudinus*)	CSSC	Outside the Program area, nests in pickleweed-dominant salt marsh and adjacent ruderal habitat. Within the Program area, nests in extensive grasslands in the Santa Cruz Mountains.	**Present.** Extensive grasslands in the Santa Cruz Mountains provides suitable breeding and foraging habitat for this species. Savannah sparrows have been observed during at La Honda Creek OSP, Windy Hill OSP, Monte Bello OSP, Russian Ridge OSP, Skyline Ridge OSP, Pichetti Ranch OSP, and Sierra Azul OSP (Cornell Lab of Ornithology 2021). Suitable habitat for this species may be present at other Midpen preserves as well, although this species appears to have declined in abundance in Santa Cruz Mountains grasslands in recent decades, and it is unlikely to be more than a scarce and local breeder. Larger numbers of savannah sparrows of multiple subspecies occur in grasslands throughout the Program area during migration and winter.
San Francisco dusky-footed woodrat (*Neotoma fuscipes annectens*)	CSSC	Nests in a variety of habitats including riparian areas, oak woodlands, and scrub.	**Present.** Woodlands and scrub throughout the Program area provide suitable nesting and foraging habitat for this relatively common species, which can be abundant in some areas. Stick nests may be placed in trees, shrubs, or on the ground. This species may also nest in and around old structures.
Pallid bat (*Antrozous pallidus*)	CSSC	Forages over many habitats; roosts in caves, rock outcrops, buildings, and hollow trees.	**Present.** This species has been recorded in scattered locations in open areas and along roads of the Pacific coastal regions and the Santa Cruz Mountains within the Program area. While this species is apparently extirpated from the urban Santa Clara Valley floor, with no recent records, it is known to occur at several Midpen preserves, with multiple records in the past 20 years from La Honda Creek OSP, as well as recent records from El Sereno OSP, Pichetti Ranch OSP, Skyline Ridge OSP, and Bear Creek Redwoods OSP. There is also one relatively recent record and from Hicks Rd, near Sierra Azul OSP (Midpen 2019, CNSSB 2019). This species may occur in Midpen preserves with old buildings or large trees (especially oaks) with large cavities. However, pallid bats are expected to occur in low numbers and only in limited areas.

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Western red bat (*Lasiurus blossevillii*)	CSSC	Roosts in foliage in forest or woodlands, especially in or near riparian habitat.	**Present.** The western red bat is a migratory species that occurs from Shasta County to the Mexican border, west of the Sierra Nevada (CDFG 2008). Both day and night roosts usually are located in the foliage of trees. This species day roosts and night roosts in the foliage of trees except during inclement weather periods in winter when it is expected to roost on the ground under leaf litter. Females typically give birth to twins in June and maternity roosts, sites where females give birth and raise young, occur in mature lowland riparian habitat in the Central Valley and some coastal valleys from Salinas Valley south. Western red bats do not raise young in the San Francisco Bay Area west of the Delta; however, males and females overwinter throughout forested and wooded areas of the Bay Area region, particularly along creek riparian habitats. Western red bats have been detected in a number of Midpen preserves, such as Rancho San Antonio, El Sereno, Skyline Ridge, Monte Bello, Bear Creek Redwoods, La Honda Creek, Pichetti Ranch, Monte Bello, Sierra Azul, Skyline Ridge, and Purisima Creek Redwoods OSPs (Midpen 2019).

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Townsend's big-eared bat (*Corynorhinus townsendii*)	SC, CSSC	Roosts in caves and mine tunnels, and occasionally in deep crevices in trees such as redwoods or in abandoned buildings, in a variety of habitats.	**Present.** This species is a scarce resident of the Program area, potentially roosting in old mines, caves, very large cavities in redwood trees, and barns and abandoned buildings in the Santa Cruz Mountains. Townsend's big-eared bats have been detected at several Midpen preserves, including Bear Creek Redwoods OSP, La Honda Creek OSP, Long Ridge OSP, Pichetti Ranch OSP, Russian Ridge OSP, Skyline Ridge OSP, Sierra Azul OSP, and Windy Hill OSP (Midpen data). This species has also been detected at Tunitas Creek Beach, less than 1/2 mile from Midpen's Tunitas Creek OSP. Many of these records are very recent, within the past three years, and in many instances, detections have occurred during the known breeding season for this species, which extends through August. In many cases, Townsend's big-eared bats detected in Midpen preserves have been found in buildings, such as sheds or barns. Therefore, this species may occur in a number of Midpen preserves, albeit in very small numbers.
American badger (*Taxidea taxus*)	CSSC	Burrows in grasslands and occasionally in infrequently disked agricultural areas.	**Present.** Badgers are present in low numbers in open habitats of the Program area, with many recent records from Midpen preserves along the crest of the Santa Cruz Mountains that have open grasslands, including Skyline Ridge OSP, Russian Ridge OSP, Windy Hill OSP, Tunitas Creek OSP, Monte Bello OSP, Coal Creek OSP, and La Honda Creek OSP. Suitable habitat may exist at other preserves. However, populations of this species in the Santa Cruz Mountains are likely low, and this species is expected to occur only in low numbers in any Midpen preserve.

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
State Fully Protected Species			
White-tailed kite (*Elanus leucurus*)	SP	Nests in tall shrubs and trees, forages in grasslands, marshes, and ruderal habitats.	**Present.** Grasslands within the Program area provide suitable breeding and foraging habitat. Has been observed at the following Midpen preserves — Russian Ridge OSP, Los Trancos OSP, Windy Hill, Monte Bello OSP, Coal Creek OSP, Pichetti Ranch OSP, La Honda Creek OSP, Purisima Creek Redwoods OSP, and Pulgas Ridge OSP (Cornell Lab of Ornithology 2021). Suitable habitat is present at other preserves, and this species may occur in relatively low numbers in any preserve with more than a minimal amount of grassland.
American peregrine falcon (*Falco peregrinus anatum*)	SP	Forages in many habitats; nests on cliffs and tall bridges and buildings.	**Absent as breeder.** American peregrine falcons may forage in suitable habitat throughout the Program area. Recently, the species has been documented nesting along the Devil's Slide Coastal Trail, within the Program Area in San Mateo County, and it is known to nest at Castle Rock State Park, just outside the Program area. It is possible that it may nest on cliffs elsewhere in the Program area. Although there are no known nest sites nor suitable nesting habitat in any Midpen preserve, small numbers of individuals can occur virtually anywhere while foraging. Has been observed at La Honda Creek OSP, El Corte de Madera Creek OSP, Purisima Creek Redwoods OSP, Thornewood OSP, Rancho San Antonio OSP, Monte Bello OSP, Skyline Ridge OSP, Long Ridge OSP, and Sierra Azul OSP (Cornell Lab of Ornithology 2021).

Common Name[1] (*Scientific Name*)	Status[2]	Habitat	Potential for Occurrence on Current/Future Midpen Lands
Golden eagle (*Aquila chrysaetos*)	SP	Breeds on cliffs or in large trees (rarely on electrical towers), forages in open areas.	**Present.** In the Program area, the golden eagle is an uncommon to rare permanent resident (Cornell Lab of Ornithology 2021). It occurs sparingly in open spaces throughout the Program area, primarily as a nonbreeder, although a few pairs may nest (SAS 2001). Has been observed at Sierra Azul OSP, La Honda Creek OSP, Russian Ridge OSP, Coal Creek OSP, Rancho San Antonio OSP, Pichetti Ranch OSP, Monte Bello OSP, Skyline Ridge OSP; Purisima Creek Redwoods OSP, and Windy Hill OSP. Suitable habitat for foraging may exist at other preserves. Although no nest sites are known to occur in any Midpen preserves, this species nests very nearby (e.g., at Almaden-Quicksilver County Park), and it is possible that very low numbers of pairs could nest in Midpen preserves.
Ringtail (*Bassariscus astutus*)	SP	Cavities in rock outcrops and talus slopes, as well as hollows in trees, logs, and snags that occur in riparian habitats and dense woodlands, usually in close proximity to water.	**Present.** The status of this species in Santa Clara and San Mateo County is not well known. Although this species' strictly nocturnal habits may be at least partially responsible for the lack of information on its distribution in these counties, it is likely very rare because of the lack of sightings and the scarcity of roadkill records (e.g., compared to the nocturnal American badger, which is much more frequently detected by roadkill). Suitable habitat is present in portions of the Program area that contain dense woodlands and/or rocky outcroppings. It is known to have occurred at Sierra Azul OSP, Saratoga Gap OSP, and Long Ridge OSP (Midpen 2019), and may be present at other Midpen preserves, although it is expected to be rare and local.

Source: H.T. Harvey 2020

This page intentionally left blank

APPENDIX E.

Noise Calculations

Noise Calculations for Midpeninsula Regional Open Space District
Open Space Maintenance and Restoration Program

Daytime calculations		
Construction Equipment 1 (Multiple)	85	dBA at 50 feet
Construction Equipment 2 (Multiple)	85	dBA at 50 feet
Combined Daytime Noise at 50 feet (Ltotal at 50 feet)	88.0	dBA
Ltotal=10 log(10^L1/10+10^L2/10)		

Noise Threshold	**Threshold Level - Leq (dBA)**	**Distance to Leq Threshold from Middle of Project Site (feet)**
FTA	90	39.8
Town of Los Gatos	85	70.7
City of Cupertino	80	125.7

Vibration Source Levels for Construction Equipment (FTA 2018)		
Equipment	**PPV at 25 feet**	**VBA**
Dumptrucks	0.076	86
Bulldozer (Large)	0.089	87

Vibration Calculations with Equations for Vibration-Causing Equipment (use of dumptrucks) for Project Site		
Threshold	**Distance to Threshold from Middle of Project Site (feet)**	**Notes**
PPV=PPVref * (25/d)^1.5	18.4	Building damage threshold (0.5 ppv)
Lvd=Lvref-30log(D/25)	39.6	Annoyance (Federal 80 VdB)

Vibration Calculations with Equations for Vibration-Causing Equipment (use of bulldozer) for Project Site		
Threshold	**Distance to Threshold from Middle of Project Site (feet)**	**Notes**
PPV=PPVref * (25/d)^1.5	20.5	Building damage threshold (0.5 ppv)
Lvd=Lvref-30log(D/25)	42.8	Annoyance (Federal 80 VdB)

This page intentionally left blank

APPENDIX F.

Public Comments

California Department of Transportation

DISTRICT 4
OFFICE OF TRANSIT AND COMMUNITY PLANNING
P.O. BOX 23660, MS–10D | OAKLAND, CA 94623-0660
www.dot.ca.gov

September 2, 2021

SCH #: 2021080129
GTS #: 04-MULTIPLE-2021-00270
GTS ID: 23880
Co/Rt/Pm: MULT/VAR/VAR

Aaron Hebert
Senior Resource Management Specialist
Midpeninsula Regional Open Space District
330 Distel Circle
Los Altos, CA 94022

Re: Midpeninsula Regional Open Space District Open Space Maintenance and Restoration Program Draft Mitigated Negative Declaration (MND)

Dear Aaron Hebert:

Thank you for including the California Department of Transportation (Caltrans) in the environmental review process for this project. We are committed to ensuring that impacts to the State's multimodal transportation system and to our natural environment are identified and mitigated to support a safe, sustainable, integrated and efficient transportation system. The following comments are based on our review of the August 2021 MND.

Project Understanding

The Open Space Maintenance and Restoration Program Manual provides a detailed and consistent approach for the Midpeninsula Regional Open Space District to conducting program activities including routine maintenance, small-scale facility improvements, new facility construction, and restoration and enhancement projects.

Construction-Related Impacts

Potential impacts to the State Right-of-Way (ROW) from project-related temporary access points should be analyzed. Mitigation for significant impacts due to construction and noise should be identified. Project work that requires movement of oversized or excessive load vehicles on State roadways requires a transportation permit that is issued by Caltrans. To apply, visit: https://dot.ca.gov/programs/traffic-operations/transportation-permits. Prior to construction, coordination may be required with Caltrans to develop a Transportation Management Plan (TMP) to reduce construction traffic impacts to the State Transportation Network.