



Midpeninsula Regional
Open Space District

R-17-52
Meeting 17-10
April 26, 2017

AGENDA ITEM 4

AGENDA ITEM

Contract Amendment with Harris Design for \$362,536 for additional scope items including Design, Engineering, Construction Administration, and Permitting for the Combined Webb Creek Culvert and Trail Undercrossing at Alma College Parking Area at Bear Creek Redwoods Open Space Preserve for a total not-to-exceed contract amount of \$604,365.

GENERAL MANAGER'S RECOMMENDATIONS

Amend a contract with Harris Design for the Alma College Parking Area and Trail Crossing in the amount of \$362,536 for a total not-to-exceed contract amount of \$604,365, for the following additional scope items and cost:

1. Design, construction documents (CD), permitting support, and construction administration for the combined Webb Creek Culvert and Trail Undercrossing and Upper Lake Spillway Connection to Webb Creek Culvert in the amount of \$219,140.
2. Replenishment of contract funds for an undercrossing feasibility assessment that was completed to better inform the parking area schematic design in the amount of \$13,555.
3. Design of a public access area to Upper Lake in the amount of \$19,860.
4. An optional task to complete the design, construction documents (CD), and construction administration for the replacement of the lower section of the Webb Creek culvert, if deemed necessary, in the amount of \$19,860.
5. A 15% contingency of \$76,221 to cover potential unforeseen requirements.
6. A separate contract allowance of \$20,000 specifically for additional revisions related to permitting and regulatory requirements, site investigations and additional public meetings that are beyond the current scope of work to avoid implementation delays, for a combined not-to-exceed contract amount of \$604,365.

SUMMARY

To facilitate the opening of Bear Creek Redwoods Open Space Preserve in late 2018, the design of the Alma College Parking Area includes an at-grade trail crossing (crosswalk) on Bear Creek Road as part of Phase I public access improvements in the Board-approved Preserve Plan. In order to separate trail users from Bear Creek Road for a safer path of travel, an undercrossing is planned as part of Phase II improvements. The General Manager recommends amending the Harris Design contract at this time to integrate the Phase II undercrossing into the design and engineering of the adjacent new parking area so as to avoid potential constructability issues and added costs once the parking area is constructed. Sufficient funds for work completed through

end of June are included in the Fiscal Year 2016-17 Budget. Funds for work completed in subsequent budget cycles will be included as part of the three-year Capital Improvement Program, which the Board will review and consider in May 2017. This contract amendment does not include costs associated with the actual construction of either the Alma College Parking Area or the combined Webb Creek Culvert and Undercrossing.

DISCUSSION

In May 2016, the Board of Directors awarded a contract to Harris Design, Inc., for design, engineering, permitting assistance, and construction administration services for the Alma College Parking Area in the amount of \$241,829 (R-16-49). The original project scope included a new parking area, an at-grade trail crossing of Bear Creek Road, a vault restroom, signage, and other site furnishings consistent with District standards (Attachments 1, 2). The design contract also included repair/replacement recommendations for the degraded Webb Creek culvert, which passes under Bear Creek Road and the majority of the project site.

In January 2017, the Board approved the Bear Creek Redwoods Preserve Plan, including the proposed public access phasing, which sets the public opening of the west side of the Preserve for late 2018 (R-17-01). Included in the Preserve Plan is a later phase (Phase II) undercrossing of Bear Creek Road to provide an improved and safer crossing of the roadway for Preserve users (Attachment 3). A contract amendment is recommended at this time to complete and integrate the design and engineering of the undercrossing into the parking lot design plans to avoid constructability issues and potential added costs in the future. The recommended contract amendment includes other elements to address drainage issues and enhance visitor amenities at this site, as well as funds to address potential issues that may arise to keep the project moving and on schedule. More specifically, the contract amendment includes the following:

1. Design and engineering of the trail undercrossing and a spillway connection from Upper Lake to Webb Creek;
2. Replenishment of parking area design funds, which were used to conduct a feasibility assessment of the undercrossing;
3. Design of a new public access area to the edge of Upper Lake;
4. An optional task to incorporate the replacement of the Webb Creek culvert into the parking area construction documents, if deemed necessary;
5. A 15% contingency to cover unanticipated issues; and
6. A \$20,000 allowance for revisions to design documents resulting from the permitting process with the regulatory agencies.

A breakdown of costs for each item is provided below. Additional details about each task are provided in Attachment 4.

Recommended Contract Amendment – Additional Tasks	Amount
1. Trail Undercrossing Design and Upper Lake Spillway Connection	\$219,140
2. Replenishment of Contract Funds Set Aside for Later Phases of Work	\$13,555
3. Upper Lake Access Design	\$19,860
4. Webb Creek Culvert Replacement (Optional Task)	\$13,760
5. 15% Design Contingency	\$76,221
6. Permitting Allowance	\$20,000
Total	\$362,536

FISCAL IMPACT

This project is part of Measure AA Expenditure Plan Portfolio #21, Bear Creek Redwoods Public Recreation and Interpretation Projects, which specifies, in part: *Open for hiking, equestrian activities. Provide parking areas, trails,* and is identified as MAA Project #21-5 Phase I Public Access Improvements.

The Planning Department's FY2016-17 Budget for the Bear Creek Redwoods Public Access Phase I Implementation (MAA21-005) includes \$228,000 for schematic design, permitting, and construction documents. Funds for subsequent budget cycles will be included as part of the three-year Capital Improvement Program, which the Board will review and consider in May 2017.

	FY16-17	FY17-18	FY18-19	FY19-20
MAA 21-005 Planning Budget	\$228,000			
Spent to Date (as of 03/14/17):	\$73,096			
Encumbered:	\$151,719			
Proposed Contract Amendment (Harris Design):	\$0	\$155,000	\$100,000	\$104,351
Budget Remaining:	\$3,185			

The following table outlines the Measure AA Portfolio budget, costs to date, and the fiscal impact related to MAA 21-005 Bear Creek Redwoods Public Access Phase I Implementation.

MAA 21 Portfolio Allocation:	\$17,478,000
Life-to-Date Spent (as of 3/14/17):	\$593,183
Total Encumbrances:	\$188,601
Award of Contract to HydroScience Engineers (MAA21-003):	\$159,126
Award of Contract to Mesiti-Miller (MAA21-005):	\$132,894
Award of Contract to John Northmore Roberts and Associates (MAA 21-004):	\$922,190
Proposed Contract Amendment (Harris Design):	\$362,536
Total BCR Projects Budget Balances*:	\$1,116,295
Balance Remaining (Proposed):	\$14,003,175

*FY2017 BCR Projects Budgets *less* the proposed contracts, current encumbrances, and year-to-date expenditures, reflecting current fiscal commitments to other BCR projects this fiscal year.

BOARD COMMITTEE REVIEW

At the March 28, 2017 meeting, the Planning and Natural Resources (PNR) Committee reviewed and confirmed the recommended schematic design for the Alma College Parking area and at-grade trail crossing (Attachment 5). The Committee also reviewed the trail undercrossing conceptual design alternatives and confirmed a phased approach to the construction of the trail undercrossing. The Committee recommended forwarding to the full Board the contract amendment with Harris Design to complete design and engineering for a combined culvert-trail undercrossing.

PUBLIC NOTICE

Public notice was provided as required by the Brown Act. Additional noticing was sent to the residents along Bear Creek Road.

CEQA COMPLIANCE

Construction of the Alma College Parking Area and Trail Crossing was included in the Bear Creek Redwoods Preserve Plan EIR, which was certified by the Board on January 25, 2017 (R-17-15).

NEXT STEPS

Pending Board approval, the General Manager will direct staff to amend the contract with Harris Design to develop construction documents, which will form the basis for regulatory agency permit submittals. In Fall 2017, staff will bring the final design of the parking area, and schematic design of the culvert-trail undercrossing to the Board. Pending Board approval, construction contract will be brought to the Board in Spring 2018 for parking area construction. Final design of the combined Webb Creek Culvert and Undercrossing will be brought to the Board in late FY 2018-19.

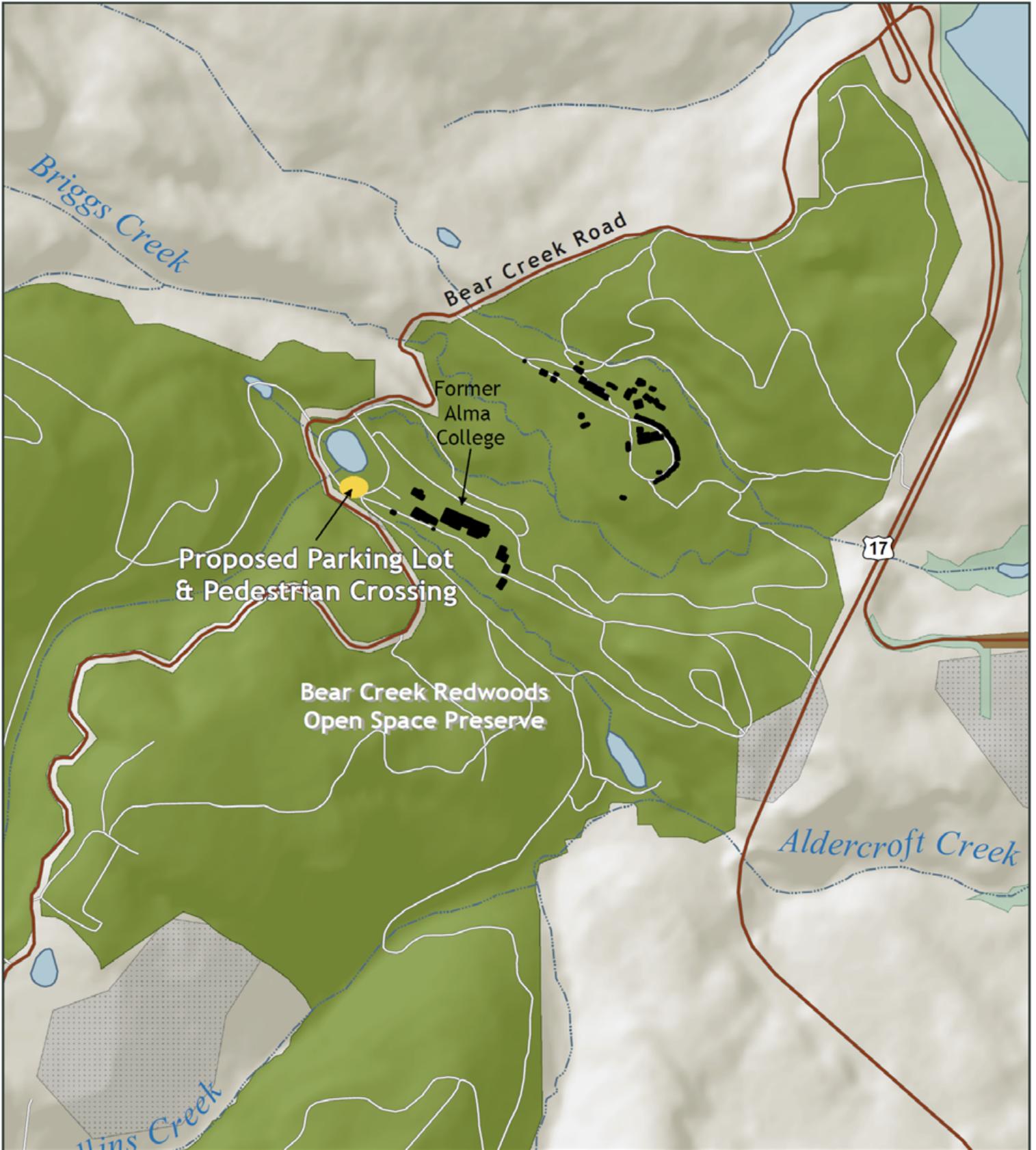
Attachment(s)

1. Project Location
2. Alma College Parking Area Preferred Schematic Design
3. Combined Webb Creek Culvert and Trail Undercrossing Conceptual Design
4. Recommended Contract Amendment List of Tasks and Cost Breakdown
5. PNR Committee Meeting Draft Minutes from March 28, 2017

Responsible Department Head:
Jane Mark, AICP, Planning Manager

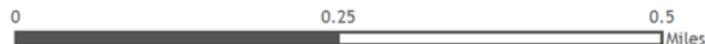
Prepared by:
Bryan Apple, Planner II
Lisa Bankosh, Planner III

Contact person:
Bryan Apple, Planner II



Attachment 1 - Project Location

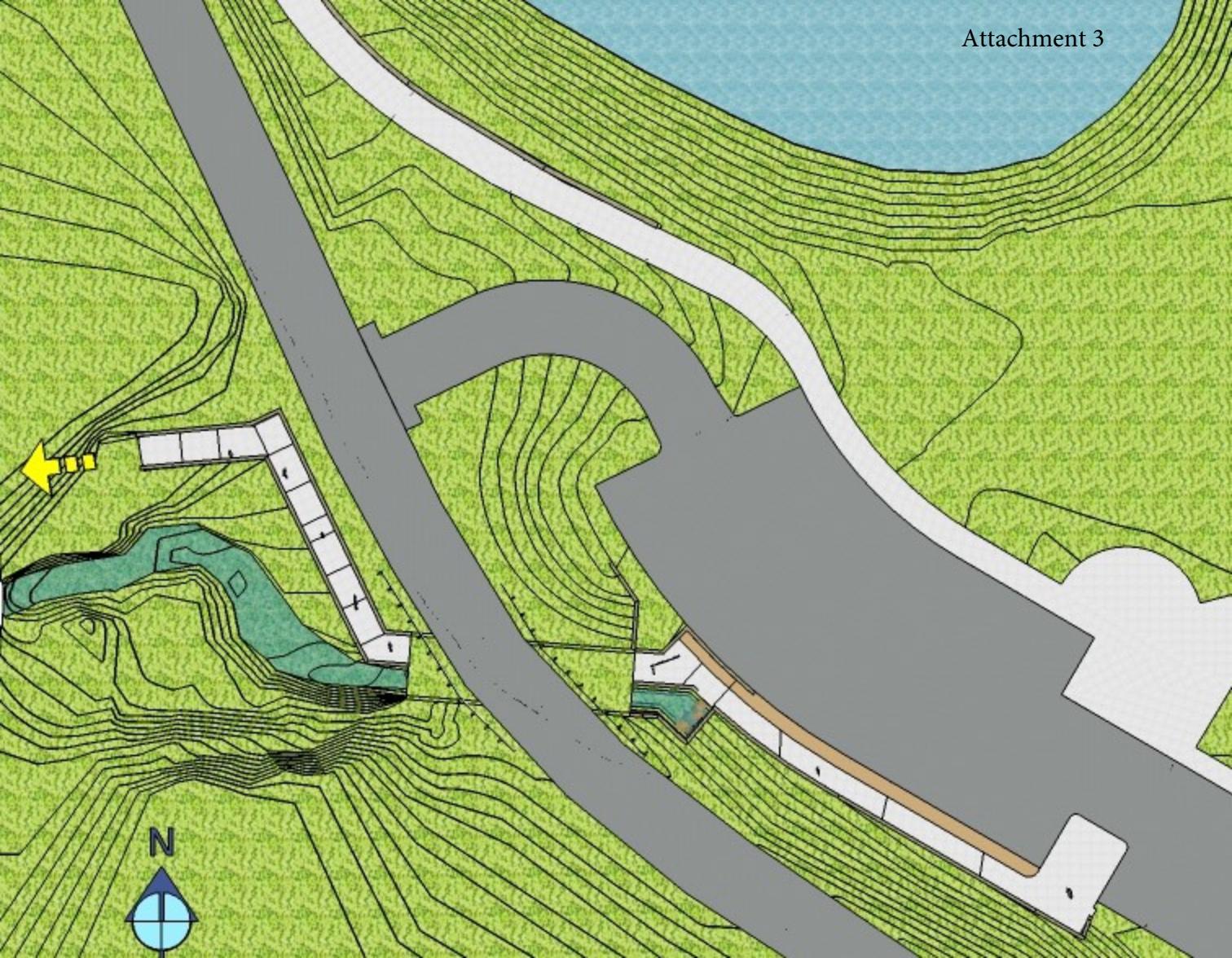
-  MROSD Preserves
-  Other Protected Open Space or Park Lands
-  Watershed Land
-  Urban Area

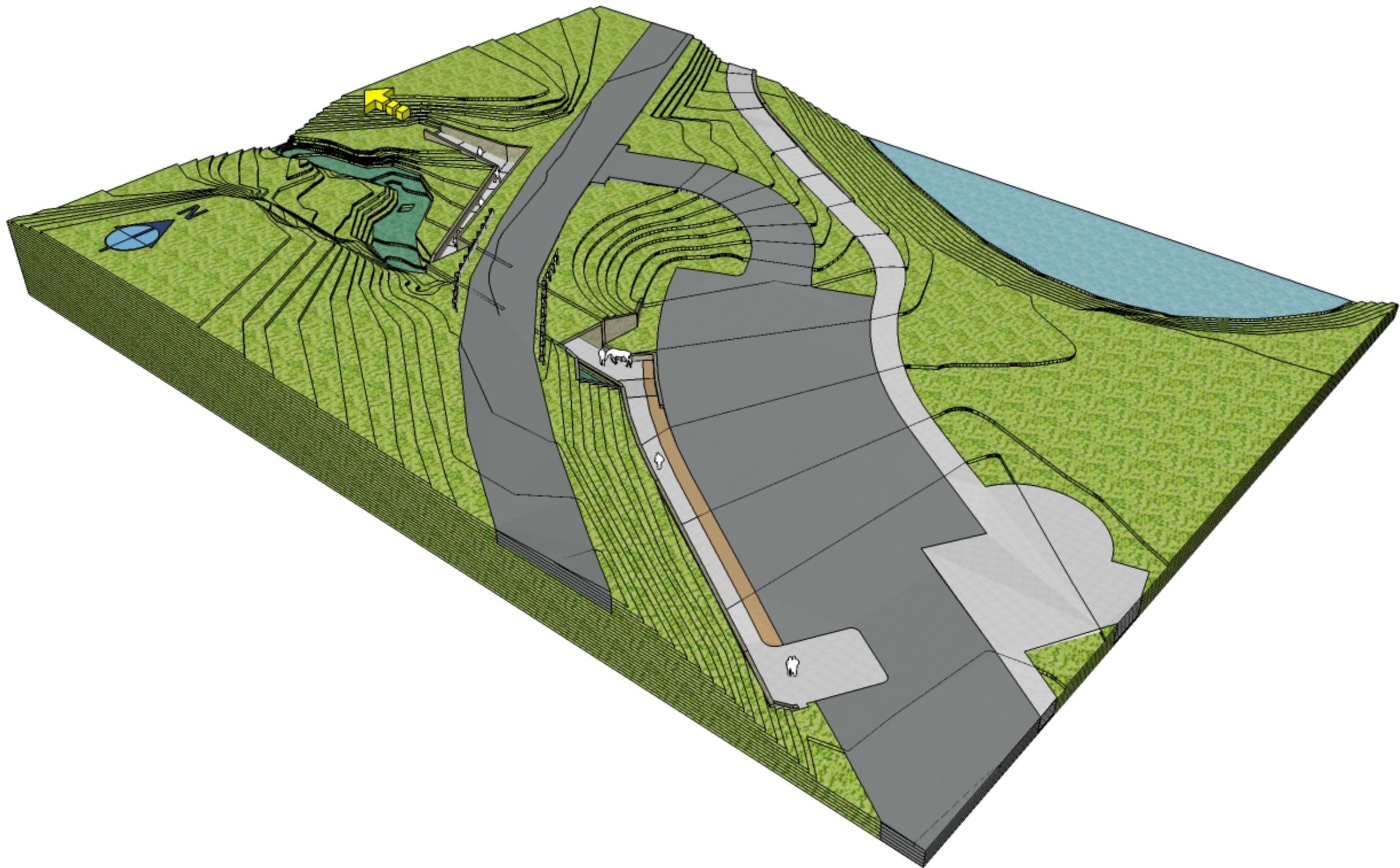


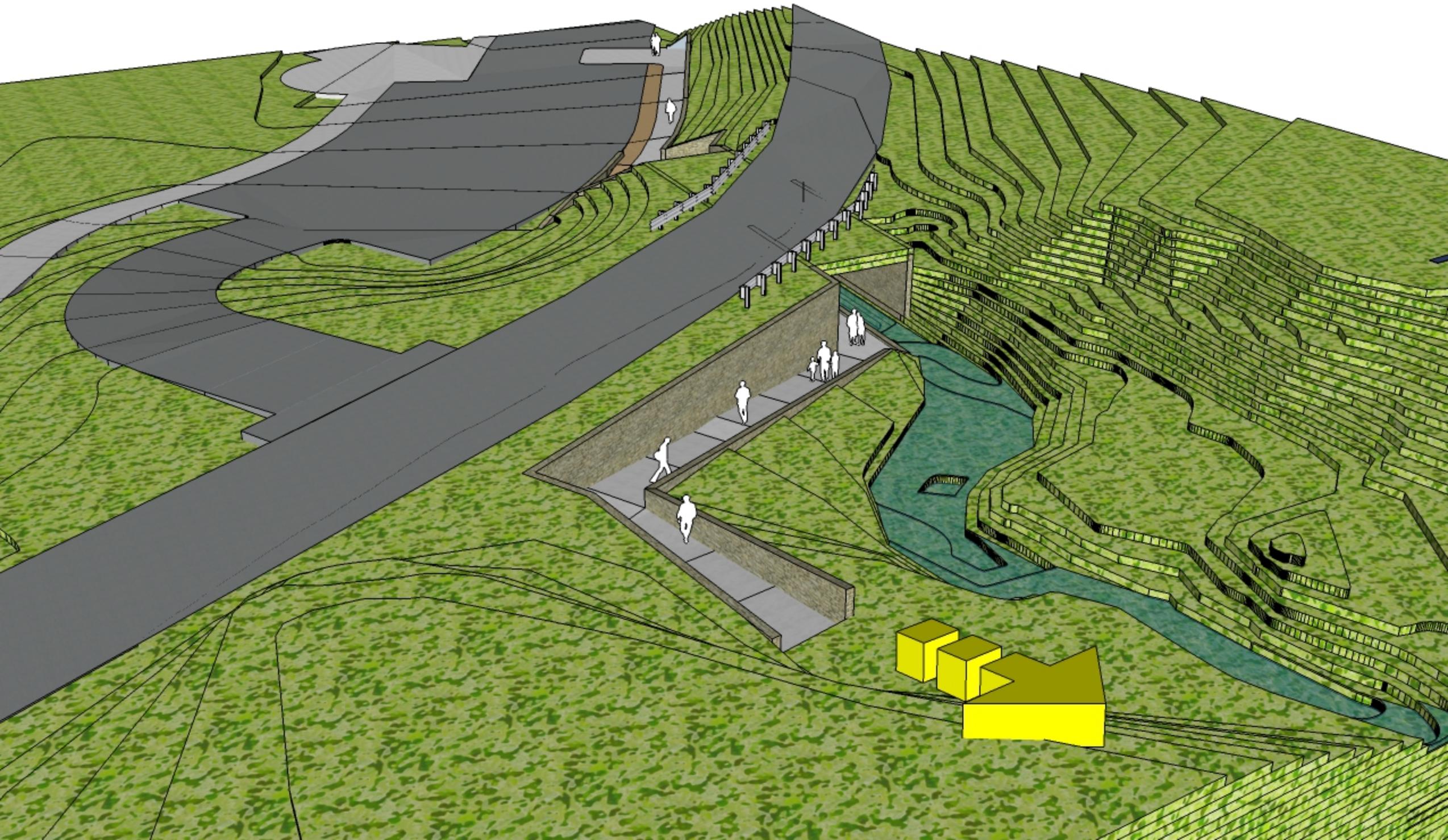
Midpeninsula Regional
Open Space District
(MROSD)

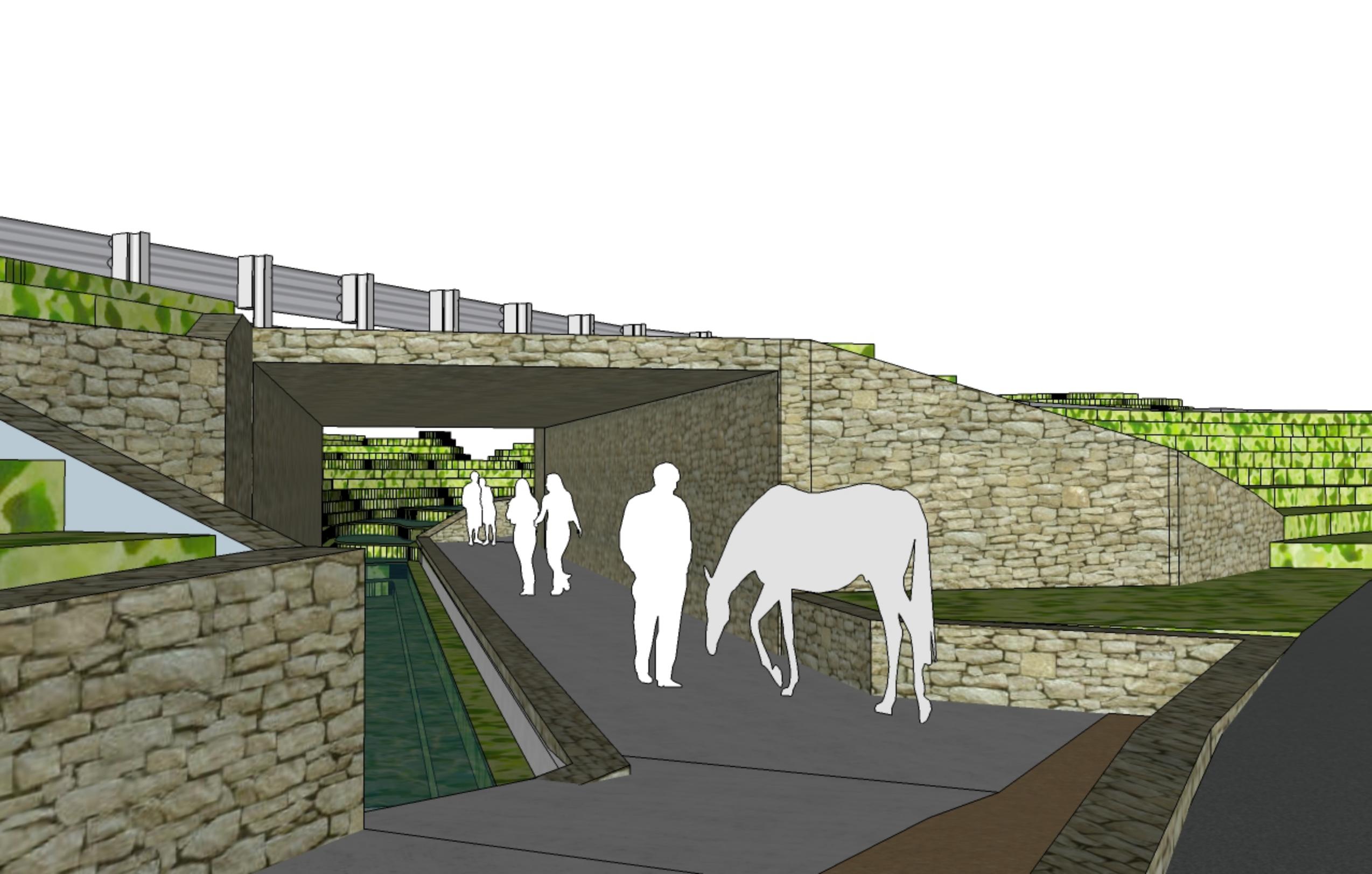
October, 2015













Recommended Contract Amendment List of Tasks and Cost Breakdown

Recommended Contract Amendment – Additional Tasks	Amount
1. Trail Undercrossing Design and Upper Lake Spillway Connection	\$219,140
2. Replenishment of Contract Funds Set Aside for Later Phases of Work	\$13,555
3. Upper Lake Access Design	\$19,860
4. Webb Creek Culvert Replacement (Optional Task)	\$13,760
5. 15% Design Contingency	\$76,221
6. Permitting Allowance	\$20,000
Total	\$362,536

Trail Undercrossing Design and Upper Lake Spillway Connection

Trail Undercrossing

In January of 2017, the District met with the Santa Clara County Roads and Airports Department to discuss the Alma College Parking Area and at-grade trail crossing on Bear Creek Road. County Roads shared concerns with proposed safety improvements (asphalt striping, flashing lights) at the at-grade crossing, which are not typically installed at mid-block crossings on County roads. The District shared the concept of a potential undercrossing as a Phase II project. County Roads indicated that an undercrossing is preferred at this location, but that an at-grade crossing, and associated safety improvements, would be acceptable as a first phase. County Roads understood that the Phase I at-grade crossing may be removed once the new trail undercrossing is built and operational.

The original Harris Design contract included an assessment of the structural integrity and hydraulic capacity of the Webb Creek culvert (Attachment 4A). Due to issues identified with the portion of the culvert that underlies Bear Creek Road, along with the desire to provide a safer path of travel for Preserve users, the concept of combining the Webb Creek culvert and trail undercrossing was identified.

A feasibility analysis was completed for two trail undercrossing options, including a combined Webb Creek culvert-trail undercrossing, and a separate trail undercrossing. These options were vetted by the Planning and Natural Resources (PNR) Committee (R-17-39), who recommended the combined culvert-trail undercrossing. This recommendation was based on a number of factors including visitor experience, maintenance requirements, constructability, and compatibility with the open space character. A conceptual design of the combined culvert-trail undercrossing is included as Attachment 3 of Board Report R-17-52.

Despite its advantages, the combined culvert-trail undercrossing will require permits from multiple regulatory agencies, including US Army Corps of Engineers, Regional Water Quality Control Board, and California Department of Fish and Wildlife, as well as the County of Santa Clara. Due to the complexities of the regulatory process, the proposed contract amendment includes a permitting specialist. The anticipated length of the permitting process precludes

construction of the undercrossing by the 2018 Preserve opening date; therefore, construction is expected during Phase II.

The proposed contract amendment includes completion of the detailed trail undercrossing design and engineering, as well as its integration into the parking lot design plans, construction documentation, and construction administration assistance.

Upper Lake Spillway Connection to Webb Creek Culvert

A Pond Assessment detailing hydrological and structural assessment of the onsite pond features was completed in February of 2017. The consultant that prepared the Ponds Assessment study recommended a new spillway that connects overflows from Upper Lake to the Webb Creek watershed. The spillway would direct pond overflows from Briggs Creek to Webb Creek, which is a more stable watershed and has capacity to accept these flows. The appropriate location for the spillway, which will likely be a below-grade pipe, can be placed within the footprint of the Alma College Parking Area.

Replenishment of Contract Funds Set Aside for Later Phases of Work

The project scope was expanded to address numerous site and environmental constraints related to special status species, potential impacts to cultural resources, the discovered presence of a subsurface degraded culvert, and the adjacent Webb Creek drainage. In order to understand the significance of these constraints and develop the design options accordingly, the District authorized the consultant team to conduct additional data collection and analysis, resulting in several new, revised design options. The District also authorized the consultant team to evaluate the feasibility of a trail undercrossing by reallocating funds from tasks in subsequent phases of the project. These additional services and unexpected work required the full expenditure of the design contract contingency in the amount of \$19,844, as well as the shifting of contract funds from tasks in later phases of the project. The recommended contract amendment includes the replenishment of the contract funds to complete future phases of work.

Upper Lake Access Design

During the PNR Committee Meeting, Committee members discussed the concept of providing public access to Upper Lake. This feature would focus the public's interaction with Upper Lake to a desired location(s) consistent with the goals of the Pond Management Plan and the Western Pond Turtle Mitigation Plan, thereby avoiding multiple, voluntary, social trails along the pond's edge that would impact habitat quality. Such a feature would likely be constructed at a later phase due to resource agency permitting requirements and timelines.

Webb Creek Culvert Replacement (Optional Task)

The installation of the combined Webb Creek culvert and trail undercrossing would replace approximately 100 feet of the most degraded section of the existing culvert. Approximately 490 feet of the culvert that extends beyond the road is currently scheduled to remain in place. This section runs below the proposed parking area. The structural evaluation of the culvert indicates no issue with this approach at this time. Nonetheless, the design team will further review this recommendation, and in the event a serious structural issue is identified, the proposed contract amendment includes the optional task of incorporating the entire culvert replacement into the parking area construction documents. A culvert replacement would require resource agency

permits, and may significantly alter the schedule to open the Preserve. For this reason, the District would only pursue this optional task if replacement is deemed necessary to protect the investment of the parking area facility.

15% Design Contingency

A new 15% contingency is recommended to replenish the original design contingency that was expended to fund the additional studies and analysis during the early design process. This work was required to better address site issues, including protection of Western Pond Turtle habitat and impact avoidance to cultural resources.

Permitting Allowance

Finally, a \$20,000 allowance limited specifically for revisions to design documents resulting from the permitting process with the regulatory agencies is recommended given the multiple permits needed for the various project elements. This allowance would only be used if additional permit submittals, extensive permitting consultation, and multiple revisions are necessary beyond those already included in the scope of work.

Attachment A: Webb Creek Culvert Assessment Report

**FALL CREEK ENGINEERING, INC.***Civil • Environmental • Water Resource Engineering and Sciences*

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September 14, 2016

Lisa Bankosh
Midpeninsula Regional Open Space District
330 Distel Circle
Los Altos, CA 94022

Subject: **Draft Culvert Condition and Capacity Technical Letter
 Bear Creek Redwoods Open Space Preserve
 Santa Clara County, California**

Dear Ms. Bankosh:

Fall Creek Engineering, Inc., (FCE) is pleased to present to you this Draft Culvert Condition and Capacity (C&C) Analysis Technical Letter. The information in this report was compiled using the historic data that was provided to FCE by the Midpeninsula Regional Open Space District (District), an extensive in-person condition inspection of the culvert, and hydrologic and hydraulic calculations. In this letter report, FCE includes a project Introduction, Condition Analysis, Capacity Analysis, and Recommendations.

INTRODUCTION

The Bear Creek Redwoods Open Space Preserve (Preserve) is located in the Santa Cruz Mountain range approximately 1 mile west of the Bear Creek Road (BCR) exit off Highway 17. The Preserve encompasses 1,432 acres which contains historic Jesuit structures, several freshwater ponds, and expansive second growth redwood and fir forest. The District is preparing to open the facility for general public access in 2018.

The Preserve is divided by BCR which is a moderately traveled commuter road that serves the nearby communities in the Santa Cruz Mountains. There is a large culvert adjacent to BCR that collects and conveys the entirety of Webb Creek which has a drainage area of 0.7 square miles. The culvert inlet is located on the west side of BCR and the culvert passes underneath the road, and extends into the ravine alongside Alma College Road as shown in Figure 1 and Figure 3.

FCE has been retained to inspect the culvert and provide technical recommendations based on the condition and capacity of the drainage feature and the results of that analysis are presented below.

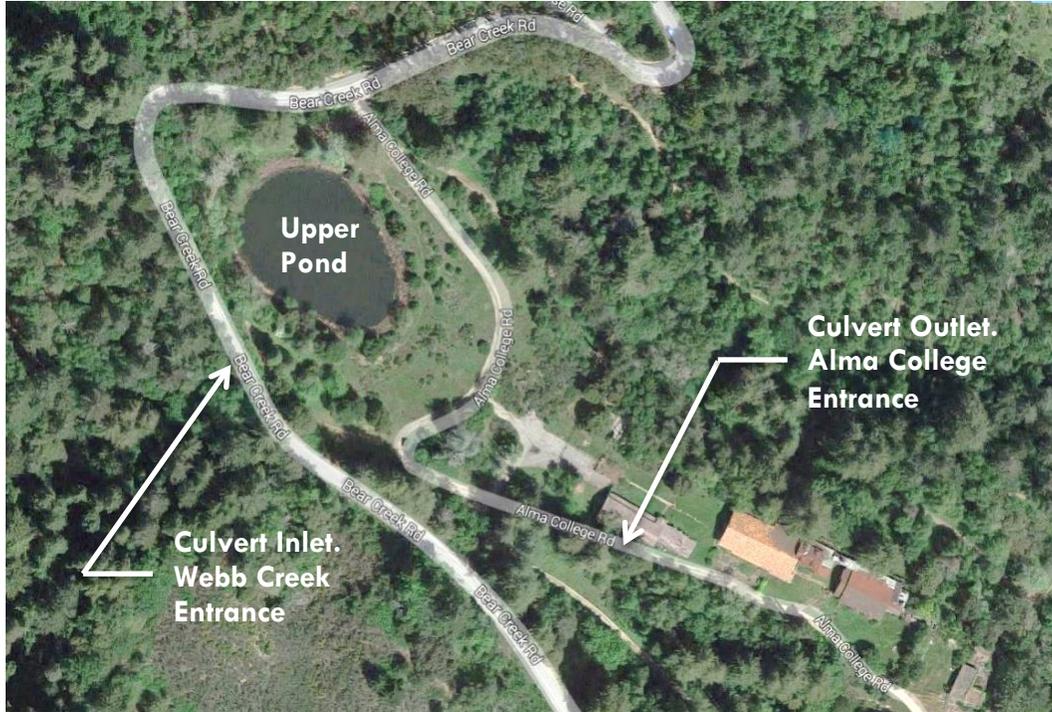


Figure 1. Approximate location of culvert inlet and outlet

The original concrete culvert was constructed in 1916 and was later lined with a corrugated metal pipe (CMP) in 1950. Since then, a number of improvements have been made, most notable, a concrete slurry lining on the culvert invert. The existing culvert is 60" in diameter, spans 587 feet and is constructed using a variety of materials including: highly corroded CMP, concrete slurry lined CMP and reinforced concrete. A comparison of the culvert materials is shown in Figure 2



Figure 2. Pipe culvert materials. Left to right: highly corroded CMP, concrete lined CMP, and concrete

CONDITION ANALYSIS

FCE conducted a confined space entry into the culvert on July 19, 2016 to visually inspect and record the condition of the culvert. In strict adherence to OSHA regulations there was a supervisor, an attendant and a confined space entrant. The entrant was the only person allowed in the culvert at any given time, and safety was a primary concern. The entrant inspected the culvert from both ends of the pipe: the entrance along Webb Creek (inlet) as well as the entrance along Alma College Road (outlet). The entrant was able to record the condition of the culvert with the use of video and still photos, and the results of those findings have been analyzed and presented in this report. The following provides the results of the condition analysis.

Culvert Condition from Upstream to Downstream

The culvert inlet at Webb Creek has a concrete collar that supports the CMP as it crosses underneath BCR. According to a traffic memorandum conducted by Hexagon Traffic Consultants Inc., BCR is a two lane county road that supports a modest amount of commuter traffic during weekdays, as well as recreational traffic on weekends (Black 2015). The road has an overall width of 28 feet and has a 4-5 foot vertical drop off the eastern side of the road where the culvert crosses into the Preserve. An approximate map of the culverts location is shown in Figure 3.

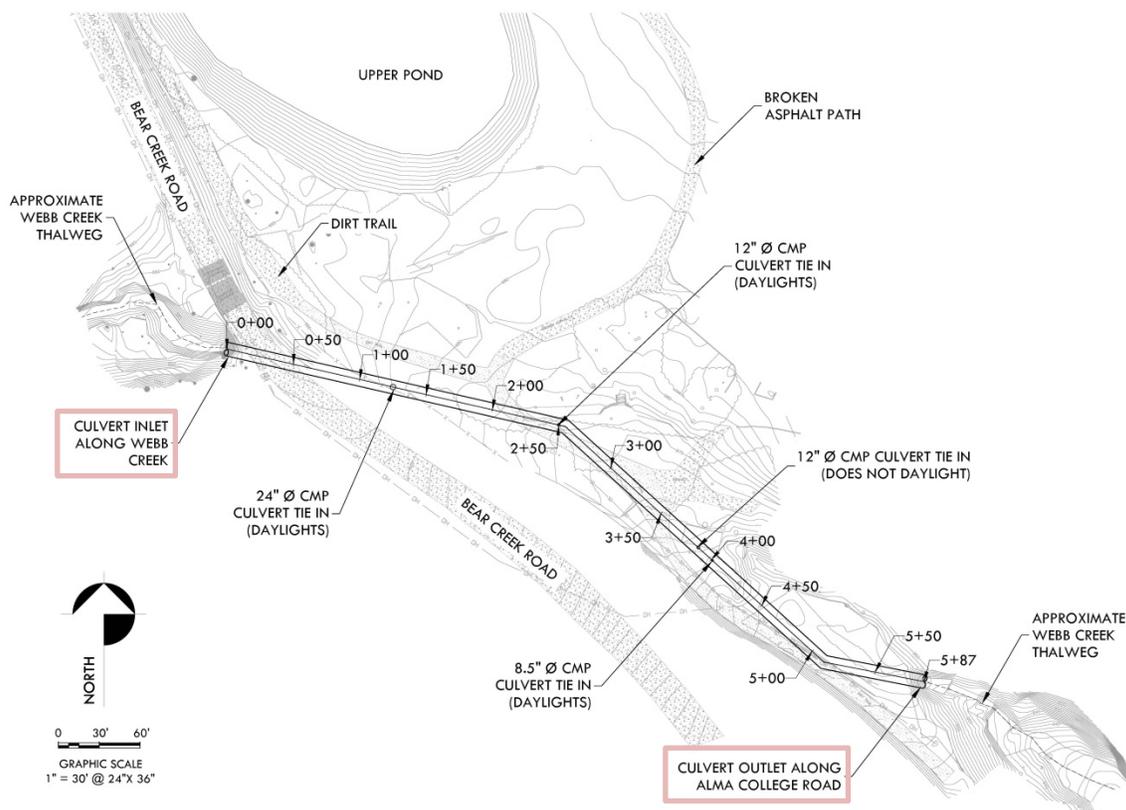


Figure 3. Approximate location of culvert with inlet and outlet highlighted in red. Note that minor pipe bends not shown and the true and accurate location of the culvert needs to be verified before any construction commences.

The condition of the culvert inlet on the along BCR is significantly damaged, and the damage can be visually noted from the outside of the culvert. Figure 4 shows the poor condition of the culvert; with up to 32" of the pipe invert completely corroded away, and up to 18" deep pools that expose the natural creek bed below the culvert.



Figure 4. Damaged culvert inlet on the southwestern side of BCR at Webb Creek

The condition of the first 66 feet of the CMP culvert is extremely impacted; especially in the segment that crosses underneath BCR. Major structural damage has occurred along that length of pipe, including; absence of pipe invert, complete pipe collapse, pipe buckling, pipe sagging and joint separation. This span of pipe is identified as the most probable source of hydraulic losses and possible pipe bed undercutting and overall destabilization. The depth of the creek channel that formed in the absence of the culvert measured up to 18-inches below the pipe's invert.

A significant separation of approximately 9 inches between pipe sections was noted 25.5 feet in from the culvert inlet and the damage can be seen in Figure 5.



Figure 5. Separation at CMP pipe joint (looking into culvert from Webb Creek Inlet)

Both sections of CMP culvert shown in Figure 5 were initially the same diameter, but over time, the corrosion along the pipe invert, combined with the soil pressure loading above, caused the pipe to

roll inwards and constrict the culvert's inner diameter. The constricted culvert extends from 25.5 feet from the inlet to 62 feet from the inlet (approximately 36.5 lineal feet). The culvert shows additional pipe sagging and overall roof distortion at 62 feet from the culvert entrance, and the damage is shown in Figure 6.



Figure 6. Roof collapse at 62 feet from entrance at Webb Creek (looking towards culvert outlet)

The distortions in the pipe are a clear indication that the structural integrity of the culvert has been severely compromised. Four feet past the pipe roof collapse, at 66 feet from the inlet, there is another pipe joint that has completely separated that can be seen in Figure 7.



Figure 7. Pipe joint separation at 66 feet from the culvert inlet (looking towards culvert inlet)

The invert of the CMP culvert is lined with concrete slurry from 64 feet to 106 feet (42 lineal feet) until the CMP culvert transitions to a concrete culvert. The concrete culvert extends from 106 feet to 171 feet (65 lineal feet) and then transitions back to concrete slurry lined CMP for the remainder of the culvert length (416 lineal feet).

The general condition of the concrete slurry lined CMP was similar for the segment of pipe after the concrete culvert (171 feet) until the outlet along Alma College Road (416 lineal feet). Figure 10 shows a typical section of slurry lined CMP and indicates how the culvert is reliably transporting water during the conditions when the culvert was investigated.



Figure 8. Typical section of concrete slurry lined CMP

The single structural abnormality that was encountered within this segment of pipe was a significant pipe collapse at 422 feet from the inlet. The distortion impacts approximately 17 lineal feet of pipe and encompasses an approximately 9-inch pipe joint separation. The damaged section of pipe is shown in Figure 11.



Figure 9. Left: Distorted CMP pipe 422 feet from inlet along BCR (looking towards inlet). **Right:** The 9-inch gap (looking towards outlet along Alma College Road).

The cause of the roof collapse is unknown, however, it is apparent that the constriction in the pipe diameter would cause impeded flow during high flow conditions.

Piped Inlets

FCE identified 4 piped inlets of various sizes that all connect to the main culvert. The piped inlets are all constructed of corrugated metal pipe (CMP) and have inside diameters of 24-inches, 12-inches, 12-inches, and 8.5-inches. A summary of the piped inlets is shown in Table 1 and images of the piped inlets are presented in Figure 8.

Table 1. Drainage features encountered in main culvert

Number	Station (ft)*	Description	Notes
1	125	24" I.D. CMP culvert	daylights
2	220	12" I.D. CMP culvert	does not daylight
3	387	12" I.D. CMP culvert	daylights
4	401	8.5" I.D. CMP culvert	daylights

* Station measured from inlet along Bear Creek Road



Figure 10. Four piped inlets. Starting top left: Clockwise: 24-inch, 12-inch, 12-inch, 8.5-inch

During the inspection, FCE was able to determine that three of the four piped inlets daylight as noted in Table 1. The fourth piped inlet had an old corroded steel pipe in the center that appeared to be approximately 4 inches in diameter and can be seen in Figure 9.



Figure 11. 12-inch piped inlet with steel pipe in center.

The inlet of the steel pipe is unknown; however it is clear that water has historically flowed in this inlet as indicated by the corrosion along the invert of the pipe.

It is unlikely that any of the piped inlets have an effect on the Upper Pond hydraulics due to their orientation to the Pond. All of the small piped inlets are likely serving as area drains for low points on the Preserve.

Additional Site Considerations

One of the added difficulties of the site is the presence of the San Andreas Fault line in relation to the culvert location. The fault line runs directly through the Preserve and can be seen in Figure 12.

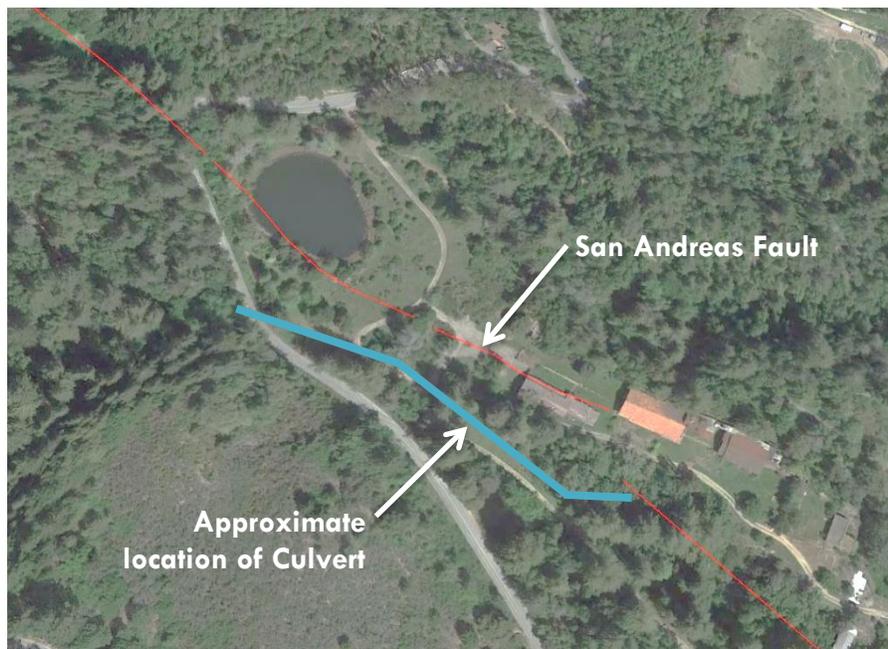


Figure 12. USGS generated map of San Andreas Fault crossing through site with approximate location of culvert shown. Actual location of culvert must be verified before any construction commences.

The presence of the fault line within such close proximity to the culvert may have been the cause of some of the pipe damage that was noted. The alignment of the culvert and the fault line parallel each other and slight subterranean shifts over the course of years may have impacted the culvert's integrity and caused some of the pipe joint separation that was noted in Figure 5, Figure 7, and Figure 11.

In addition to the condition analysis of the culvert, FCE was tasked with determining the hydraulic capacity of the existing culvert. FCE employed several methods to determine the peak design storm flow and determine whether or not the culvert is appropriately sized to handle the volume of water that will be generated in a design storm.

CULVERT CAPACITY ANALYSIS

Paired Watershed Analysis

Webb Creek is an ungaged creek and FCE approximated peak flood conditions by conducting a paired watershed analysis (PWA) using known data at a gaged site. FCE conducted a paired watershed analysis between nearby Saratoga Creek and Webb Creek. The correlation is based on known peak annual flow data obtained from United States Geological Survey (USGS) gaging station 11169500, located along Saratoga Creek and the relationship between the areas of each watershed. The gaging station is located approximately 5.3 miles from the inlet of the culvert on Webb Creek and both creeks share very similar climate, precipitation, and topographic features.

FCE utilized the USGS streamflow data for Saratoga Creek, in combination with the US Army Corp of Engineer's Hydrologic Engineering Center's Statistical Software Package (HEC-SSP), to analyze the flood flow frequency of Saratoga Creek. Peak discharge flows for Saratoga Creek were calculated for the 1, 2, 5, 10, 25 and 100-year return period design storm. The flow values that were generated for Saratoga Creek were then scaled by the ratio between the watershed areas of each creek to estimate the flow of Webb Creek. Saratoga Creek has a watershed area of 9.22 square miles and Webb Creek has a watershed area of 0.7 square miles which equates to a scaling factor of 13.2. The Peak discharge flows of Webb Creek are the result of dividing the Saratoga Creek peak discharge generated from HEC-SSP by the watershed scaling factor of 13.2. The results of the paired watershed analysis are shown in Table 2.

Table 2. Peak Discharge values for Saratoga Creek and Webb Creek using HEC-SSP.

Flood Frequency	Saratoga Creek Peak Discharge (cfs)	Webb Creek Peak Discharge (cfs)
2-yr	392	30
5-yr	920	70
10-yr	1,411	107
25-yr	1,991	151
50-yr	2,911	221
100-yr	3,735	284

USGS gaging station 11169500 on Saratoga Creek has 82 discreet peak flow measurements that were recorded between the years of 1934 and 2014. This large database covers years of extreme drought and years of extreme flooding, which statistically improves the accuracy of the predicted peak flow values for Webb Creek.

Regional Regression Equations

In addition to estimating the peak flow of Webb Creek using the PWA, FCE employed the USGS California regional flood frequency equations, or regional regression equations (RRE). The equations are based on regression analysis that has been applied to data collected from 705 individual gauging stations throughout California and empirically verified for each region within the state.

The annual peak discharge flows for the Central Coast region are estimated using the following equations:

2-yr	$(0.0061 * A^{0.92}) * (P^{2.54}) * (H^{-1.10})$
5-yr	$(0.118 * A^{0.91}) * (P^{1.95}) * (H^{-0.79})$
10-yr	$(0.583 * A^{0.90}) * (P^{1.61}) * (H^{-0.64})$
25-yr	$(2.91 * A^{0.89}) * (P^{1.26}) * (H^{-0.50})$
50-yr	$(8.20 * A^{0.89}) * (P^{1.09}) * (H^{-0.41})$
100-yr	$(19.7 * A^{0.88}) * (P^{0.84}) * (H^{-0.33})$

Where:

- Q = peak discharge (cfs)
- A = drainage area (square miles)
- P = mean annual precipitation (in)
- H = altitude index (thousands of feet)

The peak discharge for each storm frequency was determined using the following input data for Webb Creek: drainage area (A) was determined to be 0.7 square miles from an online GIS query using USGS StreamStats software (USGS 2016), mean annual precipitation (P) was estimated to be 43.3 inches from StreamStats and the altitude index (H) was determined from a Google Earth elevation query. Table 3 presents the results from the Webb Creek RRE analysis and Table 4 presents the results for both the RRE and PWA analysis.

Table 3. Webb Creek RRE results

Flood Frequency	Webb Creek Peak Discharge (cfs)
2-yr	41
5-yr	97
10-yr	142
25-yr	201
50-yr	247
100-yr	300

Table 4. Webb Creek results comparison between PWA and RRE analysis

Flood Frequency	PWA Peak Discharge (cfs)	RRE Peak Discharge (cfs)
2-yr	30	41
5-yr	70	97
10-yr	107	142
25-yr	151	201
50-yr	221	247
100-yr	283	300

The difference between the predicted peak discharge for the PWA as compared to that of the RRE was small especially for the 100-year return period design storm which had a percent difference of only 6%.

For each return period design storm event, the RRE generated a more conservative estimate for the expected peak discharge, so FCE applied the values generated from the RRE to the capacity analysis.

Capacity Analysis

FCE utilized the RRE flow values from the 25-year and 100-year storm events to conduct a capacity analysis of the existing 60" diameter culvert. The design storms were selected based on the criteria outlined in the Santa Clara County Drainage Manual (SCCDM) and the California Department of Transportation (CALTRANS) Highway Design Manual.

The SCCDM states in section 5.1.5.2 *Minimum Design Criteria for Culverts*, that "Culverts shall be sized to pass the 25-year design flow under free outfall conditions, without an inlet head in excess of the top of culvert, [...] and culvert sizing shall be checked under all inlet and outlet control conditions to safely pass the 100-year design flow." (SCCDM 2007)

Additionally, section 821.3 of the CALTRANS *Highway Design Manual* indicates that a 100-year design flood should be used to size the culvert "with-out headwaters rising above an elevation that would cause objectionable backwater depths or outlet velocities." (CALTRANS 2006)

FCE used the Hydraflow software program that is part of the Autodesk Civil 3D software package to evaluate the culvert's ability to convey the design storm. FCE analyzed both the 25-year design flow of 201 cfs and the 100-year design flow of 300 cfs. The results of the Hydraflow model can be seen in Figure 13 and Figure 14. The green line in the figure represents the embankment height, or in this instance the grade elevation of BCR, and the blue line represents the hydraulic grade line during the storm event. The black lines indicate the extent of the 60" circular CMP culvert.

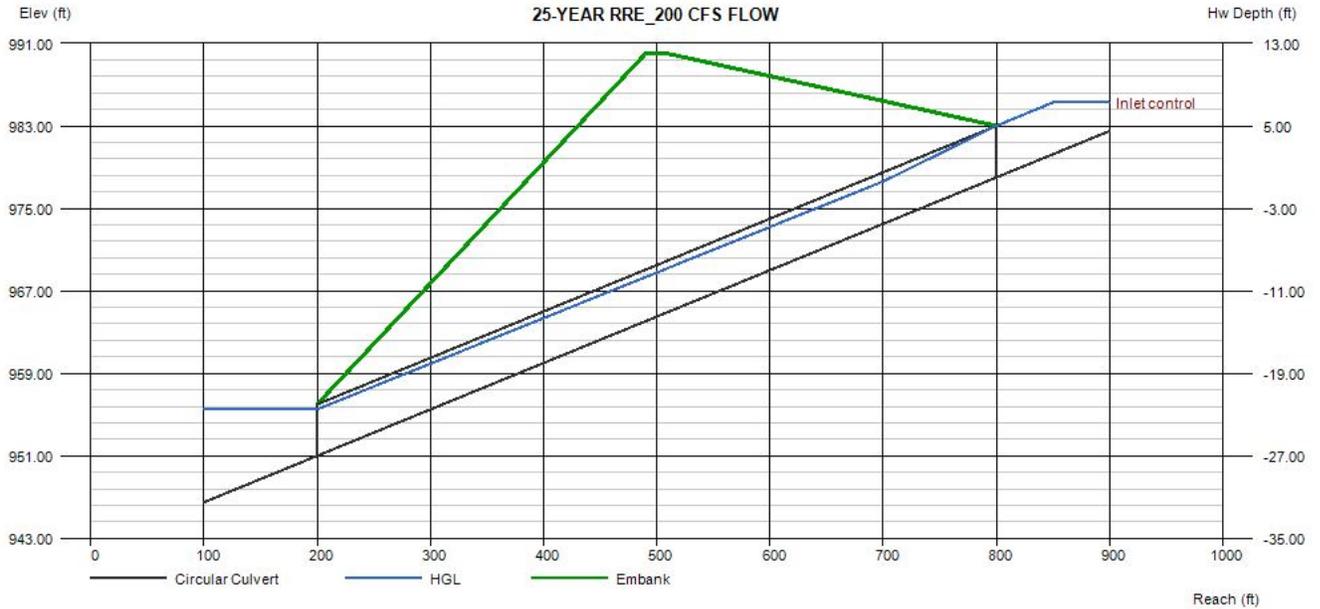


Figure 13. Hydraflow model for 25-year design storm

After running the Hydraflow model it was apparent that the 60" diameter culvert is adequately sized to convey the 25-year design storm flow. The water surface elevation at the inlet of the culvert along Bear Creek Road rises under these circumstances; however the culvert maintains several feet of freeboard from the top of the embankment. FCE also ran a 100-year storm flow value of 300 cfs using the Hydraflow model and the results can be seen in Figure 14.

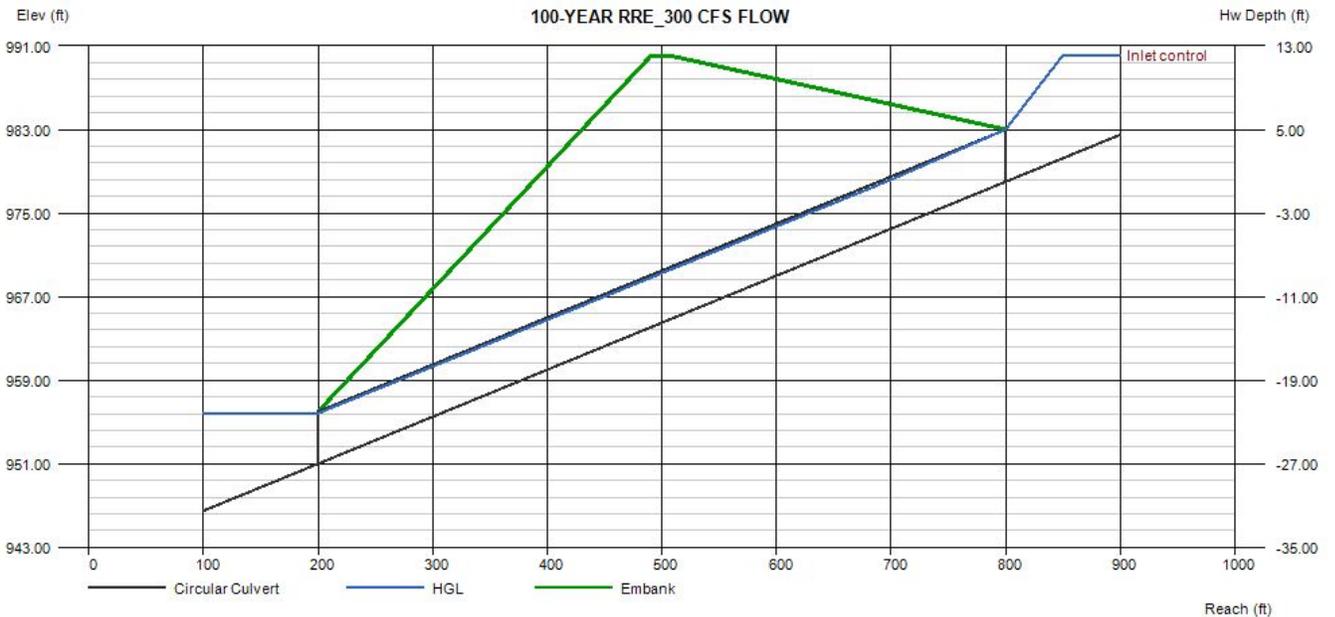


Figure 14. Hydraflow model for 100-year design storm

Based on the results of the Hydraflow analysis for the 100-year design storm, the existing culvert is inadequately sized to safely convey the design flow. The inlet of the culvert along Webb Creek is predicted to backwater and overtop the embankment, causing BCR to flood. The results of the

model suggest that the culvert needs to be replaced in order to satisfy the design requirements of the SCCDM and CALTRANS Highway Design Manual.

The Hydraflow model generates a “best-case-scenario” for the flow conditions and doesn’t take into account other site conditions that may be associated with the 100-year design storm. Under the 100-year return period storm event, the culvert inlet would likely experience higher than normal volume of debris which could result in clogging of the inlet that would diminish the culvert’s ability to convey the design flow, and increase the amount of overtopping and flooding of BCR. Similarly, the constricted diameter of the culvert where the CMP rolled inward (Figure 4), combined with the decreased diameter due to the concrete slurry along the invert, would all contribute to non-ideal conditions that are not accounted for in the model. Finally, during a large storm event, the structural integrity of the culvert could become damaged even further due to increased scouring, headwall bank erosion, pipe bed undercutting and overall culvert destabilization.

CONCLUSIONS AND RECOMMENDATIONS

FCE has determined that the structural condition of the 60” diameter culvert is compromised as indicated by the various forms of damage that were encountered during the condition analysis. The damage is most apparent within the first 66 feet from the culvert inlet along Webb Creek, and the structural implications of the damage are unknown. However, it is known that the options for repairing the culvert are limited due to the extent of damage as well as the constricted pipe diameter caused by inward pipe roll. The damaged culvert eliminates the possibility of slip-lining the culvert because the existing CMP is structurally jeopardized.

On top of the apparent structural damage, the results of the capacity analysis indicate that the existing culvert is undersized and incapable of reliably conveying the 100-year design storm flow according to both the SCCDM and CALTRANS Highway Design Manual. This result confirms that the culvert will need to be replaced with a larger diameter option that will safely pass the 100-year flow underneath Bear Creek Road, without overtopping and negatively impacting the road.

FCE recommends the following:

1. At minimum, replace the length of culvert that crosses underneath Bear Creek Road with a larger diameter culvert. In particular, the section that extends for the first 66 feet is the highest priority because it is the most structurally compromised.
2. As part of the continued culvert replacement design options, FCE recommends conducting additional analysis and assessment; including but not limited to: structural engineering, geotechnical engineering, biological surveys, hydrological modeling (HEC-RAS) and permitting requirement research.

Thank you for the opportunity to assist you with this project. Please contact me if you have any questions or require any additional information.

Sincerely,



ROBYN COOPER, MS, PE
Senior Engineer



ALEX HILL, MS
Associate Engineer

REFERENCES

Black, G. 2015. Bear Creek Redwoods Traffic Study. Hexagon Traffic Consultants Inc.

California Department of Transportation (CALTRANS) Highway Design Manual. 2006. Section 821.3 *Selection of a Design Flood*.

Santa Clara County Drainage Manual (SCCDM). 2007. Section 5.1.5.2 *Minimum Design Criteria for Culverts*.

USGS. 2016. California StreamStats. Retrieved August 22, 2016, from <http://water.usgs.gov/osw/streamstats/california.html>



Midpeninsula Regional
Open Space District

Attachment 5

PLANNING AND NATURAL RESOURCES COMMITTEE

Administrative Office
330 Distel Circle
Los Altos, CA 94022

March 28, 2017

DRAFT MINUTES

CALL TO ORDER

Director Riffle called the meeting of the Planning and Natural Resources Committee to order at to order at 2:30 p.m.

ROLL CALL

Members Present: Pete Siemens and Curt Riffle

Members Absent: Jed Cyr

Staff Present: Assistant General Manager Ana Ruiz, General Counsel Sheryl Schaffner, Planning Manager Jane Mark, Planner II Bryan Apple, District Clerk Jennifer Woodworth, Engineering and Construction Manager Jay Lin, Planner III Lisa Bankosh, Natural Resources Manager Kirk Lenington

ORAL COMMUNICATIONS

No speakers present.

ADOPTION OF AGENDA

Motion: Director Siemens moved, and Director Riffle seconded the motion to adopt the agenda.

VOTE: 2-0-0

COMMITTEE BUSINESS

1. Selection of Committee Chair for Calendar Year 2017

Motion: Director Siemens moved, and Director Riffle seconded the motion to nominate Director Cyr as the Planning and Natural Resources Committee Chair for calendar year 2017.

VOTE: 2-0-0 (Director Cyr absent)

2. Approve the October 5, 2016 Planning and Natural Resources Committee Minutes

Motion: Director Siemens moved, and Director Riffle seconded the motion to approve the minutes for the October 6, 2016 Planning and Natural Resources Committee meeting.

VOTE: 2-0-0 (Director Cyr absent)

3. Schematic Design of the Alma College Parking Area and Bear Creek Road Trail Crossing at Bear Creek Redwoods Open Space Preserve (R-17-39)

Planner II Bryan Apple, Planner II provided the staff presentation reviewing the project goals and the proposed location of the Alma College parking lot. Staff encountered several design constraints related to the proposed location of the parking lot, including western pond turtle breeding ground, mountainous topography, nearby creeks, and Alma College cultural landscape. Mr. Apple introduced Bill Harris of landscape architectural firm Harris Design.

Mr. Harris displayed and described several conceptual design options for the parking area and the schematic design recommended to address the various design constraints. Mr. Harris also described the proposed at-grade road crossing for the trailhead, including location and traffic signs. The estimated construction costs for Phase I of the parking lot and at-grade crossing are \$1.2 million.

Director Siemens inquired when and how the western trail network would be opened to the public, and suggested signage indicating a future trail will be built in the area.

Mr. Apple explained staff is currently working on potential trail connections for the trail network in the western side of the preserve.

Director Siemens inquired when cyclists will be able to access the preserve trails.

Mr. Apple explained bicycle access will be part of the Phase II of the Preserve Plan as part of a multi-use trail. The proposed multi-use trail will end in the Alma College parking lot area.

Director Riffle expressed his concern regarding the proposed size of the parking lot and asked regarding alternate parking areas and signage for safe parking areas.

Mr. Apple explained an additional parking lot would be constructed as part of Phase II.

Assistant General Manager Ana Ruiz reported staff will be monitoring the parking lot and preserve use to address parking issues as they arise. Also the eastern trail system, which are more accessible and will most likely receive more use, will not be opened until additional parking areas are built.

Director Riffle suggested interpretive and warning signage related to the Western Pond Turtle breeding area.

Mr. Apple reported Natural Resources staff is creating a Western Pond Turtle mitigation plan to help address these concerns.

Directors Riffle and Siemens suggested the proposed shrubbery radial spokes from the pond are not necessary and to prioritize public access and Western Pond Turtle protection.

Director Riffle suggested including the proposed benches in the memorial bench inventory and suggested including members of the public in the design process.

Director Riffle expressed his concern regarding pedestrians crossing near the parking lot entrance.

Mr. Harris discussed various options to address the concern and reported once the undercrossing is complete; the at-grade crossing will be decommissioned.

Director Riffle suggested providing public access to the pond's edge.

Public comment opened at 3:37 p.m.

No speakers present.

Public comment closed at 3:37 p.m.

Mr. Apple introduced Robyn Cooper of Fall Creek Engineering to present information regarding two proposed undercrossing options. Ms. Cooper described the combined or separated undercrossing options, including the constraints and advantages of each. Ms. Cooper also discussed the potential flooding of an undercrossing due to storm water flow and possible debris blockages.

Mr. Harris displayed various renderings of a potential combined or separated undercrossing. A combined undercrossing could cost between \$500,000 and \$750,000, and a separated crossing would cost more due to required walls and the western trail approach.

Mr. Apple further discussed the pros and cons of the combined and separated undercrossings.

Director Siemens suggested evaluation of the current culvert is necessary before the parking lot was constructed.

Mr. Apple reported the culvert under the parking lot currently appears to be structurally sound, and replacement would require additional permitting and delays. Staff and the consultant will further evaluate the culvert.

Director Riffle expressed concern regarding flooding the undercrossing in large storms.

Ms. Cooper explained the undercrossing would be designed to minimize impact on the trail; however, the type of large storm that could cause trail flooding would also likely require closure of the preserve and parking lot.

Public comment opened at 4:11 p.m.

No speakers present.

Public comment closed at 4:11 p.m.

Mr. Apple reviewed the proposed schedule for the project

Motion: Director Siemens moved, and Director Riffle seconded the motion to:

1. Confirm the recommended schematic design for the parking area to allow the General Manager to direct staff to proceed with further design development.
2. Confirm a recommended phased approach to construction of the Bear Creek Road trail undercrossing Option A as presented.
3. Recommend to the full Board of Directors a contract amendment with Harris Design to complete design and engineering for a combined culvert-trail undercrossing.

VOTE: 2-0-0 (Director Cyr absent)

ADJOURNMENT

Director Riffle adjourned the meeting of the Planning and Natural Resources Committee of Midpeninsula Regional Open Space District at 4:21 p.m.

Jennifer Woodworth, MMC
District Clerk