MOUNT UMUNHUM RADAR TOWER
Condition Assessment and Recommendations

Sierra Azul Open Space Preserve
Santa Cruz Mountains, California

Final Report
November 13, 2019
WJE No. 2018.0484

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

Prepared by:
Wiss, Janney, Elstner Associates, Inc.
2000 Powell Street, Suite 1650
Emeryville, California 94608
510.428.2907 tel | 510.428.0456 fax

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Brian E. Kehoe, SE #3398
Associate Principal

Aaron Weiss, Architect
Senior Associate
California Licensed Architect: C-35656

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EXECUTIVE SUMMARY

Wiss, Janney, Elstner Associates, Inc. (WJE) has been engaged by the Midpeninsula Regional Open Space District (District) to perform a structural and waterproofing evaluation of the former radar tower at the top of Mount Umunhum. This report provides our preliminary assessment of the building's present condition and recommendations to better seal the building against water intrusion and mitigate ongoing deterioration of the concrete structure.

In its current condition, several potential safety hazards exist at the radar tower, including loose concrete on the exterior walls and roof. Mitigation of some of these hazards is discussed further in this report and recommended to be completed prior to allowing public access at the area immediately adjacent to the radar tower. For the strategy of retain and seal that has been selected by the District, additional measures should be implemented to preserve the existing building and minimize future deterioration. In addition to the safety hazards, remediation of the water intrusion into the building through the walls and roof is recommended to mitigate further deterioration and to prevent the growth of mold or other materials that may propagate in the presence of moisture and stagnant air.

BACKGROUND

The Mount Umunhum radar tower is an 85-foot tall concrete building constructed from 1958 to 1962 as part of the Almaden Air Force Station. The radar tower building supported a large radar antenna (Figure 1) at the roof and operated from 1962 until 1980 when it was decommissioned and the radar antenna at the top of the building was removed. The building is located at the top of Mount Umunhum (Figure 2 through Figure 4) at an elevation of approximately 3,490 feet above sea level in what is now part of the District's Sierra Azul Open Space Preserve. The site is exposed to harsh weather conditions including high wind speeds and freezing temperatures in the winter.

The building has received limited maintenance since its decommissioning in 1980. The District acquired the site in 1986, but the radar tower has remained closed to the public due to hazardous materials and contamination at the former Air Force Station. Federal funding allowed for the removal of fuel-based hazardous materials in the mid-1990s. A survey of hazardous building materials performed by IHI Environmental in 2010 identified a number of asbestos- and lead-containing materials within the building which were recommended to be properly remediated. Additional Federal funding allowed for the removal of loose and peeling lead-containing paint on the exterior and interior of the radar tower in 2011. Limited abatement of hazardous materials was performed as recommended in 2011 by the Army Corps of Engineers and IHI Environmental provided monitoring of the abatement, however asbestos and lead hazards remain at the building. All of the Air Force Station buildings and structures except for the radar tower were removed in 2013.

The radar tower was listed on the Santa Clara County Heritage Resource Inventory in 2016 and the District Board of Directors (District Board) approved a "Retain and Seal" option for the long-term treatment of the radar tower, intended to reduce the incidence of water intrusion into the building in an effort to increase its longevity.

In July of 2016 an *Interim Radar Tower Repair Project* was completed, including short-term repairs focused on sealing openings to limit water and wildlife intrusion, removing unstable roof debris, and ground-level concrete repair. Landscaping and drainage improvements were also installed in 2017, including installation of the pathway around the tower. The Mount Umunhum Environmental Restoration and Public Access Project opened both the east and west mountain summits to public access, including around the radar tower site, in September of 2017.

In November of 2017, flakes of paint and concrete debris found on the ground adjacent to the radar tower tested positive for lead and asbestos, respectively. The area surrounding the radar tower, including the pathway to the east summit, was fenced off to prevent public access due to potential health and safety concerns. In June of 2018, all remaining paint was removed from the exterior of the building and further testing identified asbestos in some exterior concrete patching materials.

Figure 1. Historic photo of Mount Umunhum radar tower facing east. Photo courtesy of Midpeninsula Open Space District.

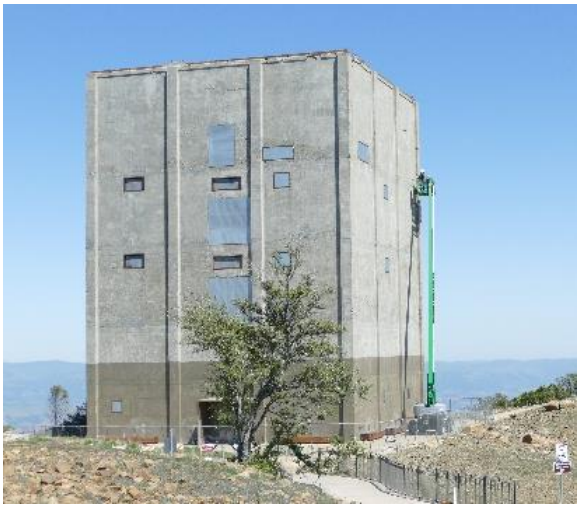

Figure 2. Recent exterior view of the radar tower facing east.

Figure 3. Aerial photo of the radar tower, facing north.

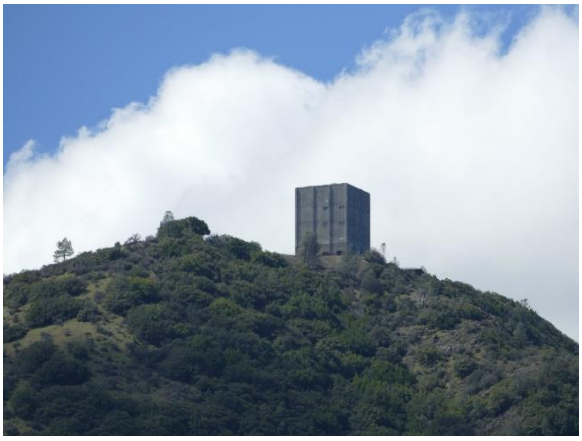

Figure 4. Photo of the radar tower, facing west.

Since the complete removal of the exterior paint, concrete debris as wide as 1.5 inches has been observed on the ground around the base of the building and the area surrounding the building remains closed to the public. A survey of the exterior concrete walls was performed by ZFA Structural Engineers in July of 2018 to determine the extent of deterioration and provide recommendations on improving the future performance of the concrete walls. Several alternative methods for addressing the concrete deterioration were presented.

The District engaged WJE to further evaluate the radar tower and provide repair recommendations that meet the following District Board approved criteria:

- Supports the Board-approved "Retain and Seal" option
- Ensures public and worker safety around the radar tower
- Avoids future contamination concerns
- Reduces (or eliminates) future need to enter building
- Protects workers if/when ingress is needed
- Avoids wildlife trappings and other resource impacts
- Reopens a visitor pathway to the east summit

At the request of the District, the Discussion and Basis of Design sections are presented first. The Basis of Design provides recommendations to meet the District Board approved criteria. The characteristics of the building and site observations are presented in the Building Description and Site Observation sections that follow the Discussion and Basis of Design sections.

DISCUSSION

There is widespread evidence of water leakage through the roof, concrete walls, and at the wall openings, and previous repairs at the exterior and staining at the interior suggest long-term leakage at these areas. Although some past repairs to the exterior walls and roof have been completed, the current poor condition of the exterior surfaces of the concrete and corroded steel surfaces at the walls and roof are not suitable as a substrate for paint, fluid-applied, or adhered waterproofing membranes for mitigating moisture intrusion, and would require significant surface repair and patching for use as a sound substrate for an adhered membrane.

Deferred Repairs

In its current state, the radar tower will continue to deteriorate if no efforts are made to remediate the observed conditions at the building enclosure. Continued deterioration of the walls and roof will allow additional water into the building which will cause further deterioration, likely increasing the rate of deterioration over time. The increased rate of deterioration can significantly increase the amount of repairs that will be necessary in the future. Some of the potential impacts of delaying repairs are discussed below.

Collapse Potential - There is very little chance of large-scale collapse of the radar tower in the next one hundred years even if no action is taken to address the current conditions. The structure is very robust as an unused structure that was designed to support heavy equipment that is no longer present. The building is also constructed of reinforced concrete, which is somewhat tolerant of moderate exposure to moisture, so the structural framing is anticipated to continue to support the floors and roof even with further deterioration.

Risks to the Public - The existing fencing around the radar tower, if maintained, is expected to provide adequate protection to the public from debris that may fall from the radar tower as the roof and concrete walls continue to deteriorate. Both of these conditions are likely to allow small pieces of concrete or other

debris to fall to the ground around the radar tower. As deterioration of the concrete walls and roof progresses, the size of the debris that may fall from the structure will likely increase, but larger pieces will not be transported as far from the radar tower by the wind as smaller pieces, and therefore will not increase the public hazard. Eventually, corroded steel elements from the roof are likely to become detached due to deterioration and be transported off the roof due to winds.

A covered walkway along the south side should be able to provide adequate protection to the public against falling debris, at least for the immediate future. Eventually, the size of debris that may become dislodged will exceed the capacity of the walkway to provide protection. It should be noted that due to the conditions at the site, a covered walkway would need to be designed as a permanent structure, capable to resisting high winds and it would also need to extend beyond the building to the east and west by at least half of the length of the structure in each direction to protect against falling debris that may be wind-blown.

Hazardous Materials Contamination - Most of the identified hazardous materials are located within the interior of the radar tower. Since the openings in the exterior walls are minimal and the doors for access into the building are opened infrequently, the potential for release of hazardous materials to the exterior of the radar tower will be negligible in the long term even with no repairs or abatement. The asbestos-containing concrete materials on the exterior walls however will gradually deteriorate and could produce airborne particles, particularly from the radar pedestal on the roof that is already significantly deteriorated. Small amounts of this concrete have likely been released already, and the amount will increase over time as the concrete continues to deteriorate. All concrete debris from the building will need to be treated as potentially containing asbestos and will need to be cleaned up on a regular basis using appropriate handling and disposal procedures. The falling debris would need to be cleaned up by personnel that have asbestos awareness training, with no other precautions. The frequency of the cleanup is hard to judge, but would probably be required at least once per year to start and would likely need to be more frequent as the deterioration of the concrete accelerates. SCA Environmental does not believe that the minor amounts of falling concrete debris would pose a threat of exposure to the public. Some materials that are part of the roofing system are also asbestos-containing and will also eventually deteriorate and become detached, creating a potential for release.

Risks to Maintenance Personnel - Existing plywood covers at floor openings in areas that may be exposed to water that leaks through the walls or wall openings are the items most likely to deteriorate into an unsafe condition in the near future if repairs to the building enclosure are delayed. Decay of the plywood could weaken these to a condition where they are unable to support the weight of a person that may inadvertently step on them.

Walls

Recent complete removal of the exterior paint may have increased what was likely pre-existing, long-term leakage condition through the concrete wall openings, joints, cracks, and voids due to poor concrete consolidation. Removal of the existing coating has uncovered some of the underlying areas of poorly consolidated concrete and some of the exposed reinforcing steel that has since started to corrode.

The areas of most extensive voids and loose concrete due to poor consolidation were observed to occur in the portions of the walls directly above the third through fifth floor slabs. The surface voids and loose concrete are in large part due to poor construction quality of the original concrete that resulted in areas of incomplete concrete consolidation. Based on our observations, the concrete for the walls was cast on top of the floor slabs one story level at a time. This led to the formwork for the walls above the third floor being over 15 feet high. Concrete placed into tall, narrow formwork can become segregated as it drops into the formwork, meaning that the cement paste and aggregate do not stay adequately mixed without the

application of proper vibration. The voiding observed shows that the larger aggregate particles have only marginal amounts of cement paste surrounding them, which is consistent with the segregation that would occur with tall formwork if the concrete was not properly vibrated during placement. Although acoustic hammer sounding of the walls identified localized delaminations, many areas of visually rough and poorly consolidated concrete were otherwise sound and remain well bonded to the wall. These rough surfaces however are not conducive to providing an adequate substrate for the installation of a waterproofing coating.

Repairs are needed to protect the concrete from further deterioration due to corrosion of the embedded reinforcing steel, and to prevent moisture intrusion into the building. The most extensive concrete deterioration occurs at the pilasters, where large surface voids are present and corroded reinforcing steel is exposed, and along the perimeter roof edge beam where it protrudes past the face of the wall below. In addition, crack and spall repairs are needed at various locations at the exterior walls where rebar is exposed or corroding, and significant shallow surface patching of rough, but otherwise sound, concrete would also be required to be repaired to provide a substrate for a coating to resist water penetration through the concrete walls. An alternative approach is to abandon the concrete walls as a substrate for a waterproofing coating and install a mechanically attached cladding system between the pilasters, such as cement plaster (stucco), which is not reliant on a smooth concrete substrate for reliable performance, and would provide a suitable substrate for a waterproofing coating. This alternative would include limited structural repairs to the concrete walls (between pilasters), only where necessary, and would perform more extensive concrete spall and rough surface repairs at the pilasters to prepare the surface for a waterproofing coating. These two approaches are discussed in the Basis of Design section below. Other materials that could be applied to the exterior surfaces of the walls to protect the existing concrete were evaluated such as concrete, metal panels, and polymer fibers; however these other materials would be more costly to install or would significantly alter the exterior appearance.

Wall Openings

The existing openings in the exterior walls other than two of the ground level doors have been infilled with either concrete or steel plates. Where steel plates have been installed, a small gap exists around the perimeter that allows ventilation and prevents wildlife intrusion into the building, but these gaps also allow water infiltration due to wind-driven rain. Three strategies can be considered for improving the weather resistance of the existing openings; likely a combination of multiple strategies should be selectively applied to the openings across the entire building. First, the openings can be maintained in their current condition while providing a new system to collect and discharge rain water that may enter through the existing steel plate assemblies. Second, the steel plates at openings can be replaced with louvers to allow air movement but reduce water intrusion and prevent wildlife intrusion. Thirdly, select openings could be permanently sealed to prevent water and wildlife intrusion.

Strategies two and three discussed above alter the existing ventilation capacity of the wall openings. The ventilation requirements for the unoccupied building are minimal; however application of these strategies across all of the wall openings should include an evaluation of the ventilation requirements for the entire building. Selection of specific repair strategies at individual openings should be coordinated to maintain adequate passive ventilation in the building for safe access by maintenance personnel, and to minimize water intrusion.

Sheet metal hoods could be added to any of the above strategies at locations that originally had hoods and provide additional weather protection to active louvers. Alternately, there may be cost savings by locating and configuring active louvers in the openings in the most efficient layout to satisfy the ventilation

requirements while reducing the potential for water intrusion. Application of these strategies to the radar tower, as three repair options, are discussed in the Basis of Design section below.

Roof

Conditions at the roof present multiple challenges for both interim repairs and installation of a long-term roofing system. In addition to the generally deteriorated, rough, weathered and poorly consolidated concrete surfaces, numerous corroded penetrations, obstructions, and other objects exposed at the roof significantly complicate the surface preparation and geometry of repairs. These combined conditions present significant challenges for the use of fluid-applied and self-adhering waterproofing membranes that might otherwise be an economical interim solution to leakage at the roof until long-term, low-maintenance repairs can be installed. A fluid-applied membrane was previously applied to the wearing slab, suggesting past leakage, but it is heavily deteriorated and is no longer effective.

Based on the District's stated goals to retain and seal the building and to reduce the necessary maintenance, the District should consider whether items protruding from the roof that complicate roofing repairs can be removed. Although the radar tower is listed on the Santa Clara County Heritage Resource Inventory, it is only intended to be viewed by the public from the ground level; not accessed from the interior or viewed from the roof. Removal of these abandoned items would significantly simplify the design of the new roof and therefore would also likely reduce the construction cost and necessary maintenance of the system.

The presence of the existing built-up waterproofing membrane beneath the wearing slab creates another challenge for the design of new roofing systems that are overlaid on top of the wearing slab, especially for adhered membranes, either sheet or fluid-applied. There is likely some amount of moisture trapped within the assembly due to natural exposure and ongoing leakage. This entrapped moisture could weaken the adhesion of new adhered membranes, or could cause condensation, corrosion or biological growth if the roof design does not adequately address this condition. Due to the significant amount of surface preparation that would be required and the possibility for moisture to be trapped within the existing roof assembly, the installation of a new fluid-applied membrane was not considered as a viable option to meet the project's stated goals. These conditions and limitations apply to any roofing systems that relies on adhesion to the existing concrete substrates, including modified bitumen membranes, single-ply membranes and spray-applied foam roofing. While mechanically attaching some of these systems directly to the existing concrete substrates may be possible, achieving a suitable system would be difficult, likely requiring installation of a cover or substrate board, predrilling fasteners, and removing the numerous obstructions at the roof to be flush with the roof deck. These factors led to considering methods of abandoning the existing concrete as a substrate and providing a new substrate suitable for new roofing, as described in the next section. An additional advantage of this approach is the ability to envelop the smaller obstructions within the new assembly, reducing the need to remove them to be completely flush with the roof deck.

The District has asked WJE to provide additional information about the possible use of spray foam roofing systems, such as Durafoam, for the Radar Tower roof. As discussed above, the poor condition of the existing concrete substrates, and the presence of the existing built-up waterproofing membrane beneath the wearing slab are not conducive to the use of any adhered roofing systems, including spray foam roofing, without significant surface preparation or substrate construction. If the concrete surface was sufficiently repaired and prepared, or a new substrate was constructed that is suitable to receive an adhered roofing system, and it is determined that moisture that may be trapped within the existing roofing assembly will not degrade the bond of an adhered system, there are other adhered sheet, or fluid-applied roofing membranes that offer significant advantages over spray foam roofing, especially regarding overall durability and required maintenance, which are important priorities of the District for this project.

Some additional drawbacks of using a spray foam roofing system at the Radar Tower include:

- The up-front material costs can be high, and installers often attempt to cut corners,
- They require a highly skilled contractor to install correctly,
- The market share for spray foam roofing is small, and skilled contractors are limited,
- There are limitations on the weather conditions (including wind speed) under which they can be installed,
- Any moisture trapped in the substrate, or contaminants on the substrate will affect the bond of the roofing,
- They are vulnerable to puncture or damage from foot traffic, hail, wind-driven debris and birds,
- On low-slope applications, their irregular surface can inhibit drainage and cause ponding and premature deterioration,
- It is recommended that they be inspected twice annually due to their limited durability,
- It is recommended that they be inspected for damage after high wind events,
- They require recoating every 8 to 10 years.

Due to the significant exposure to high wind, the new roof design should provide adequate attachment for all components of the roof system.

The existing roof lacks a functioning drainage system since the existing drainage plumbing was reportedly disconnected and sealed with grout. The Interim Repair Project Construction Drawings initially included reestablishment of roof drainage; however the notes and details showing this work are crossed out and were apparently removed from the project. The work would have included cutting the roof drainage pipes at ground level and routing them through the south wall onto a concrete splash block at grade.

Further evaluation will be required to determine the feasibility of reestablishing drainage through the existing roof drains and plumbing for either short-term or long-term use. It could not be determined if the roof drainage plumbing is also sealed just below the roof drains to prevent the plumbing from completely filling with water.

Any repair strategy for the roof system will require occasional access to the roof for inspection and maintenance, annually at a minimum. The current roof system does not have a fall protection or guardrail system that is compliant with Cal/OSHA regulations since the original perimeter railing system was removed. The current procedure for roof access requires trained personnel to provide adequate rigging to attach lifelines. As the roof continues to deteriorate, the availability of adequate, safe attachment points for lifelines will diminish. An appropriate system should be installed at the roof level to allow for safe access to the roof for periodic inspection and maintenance. One option would be the installation of new perimeter guardrails, which would likely require strengthening of the existing steel brackets that supported the original rails. The replacement guardrail should utilize more durable materials than the original wood guardrail. Alternately, since access to the roof is expected to be minimal, fall protection anchors can be installed on the roof around the concrete pedestal and a small guardrail system can be installed around the roof hatch to protect people from the fall hazard as they travel from the roof hatch at the edge of the roof to the central concrete pedestal to attach to the fall protection anchors.

Potential Interior Hazards

Several hazardous conditions exist at the interior of the radar tower, including the presence of hazardous materials, missing or damaged guardrails, openings in the existing floors, and the presence of abandoned equipment and debris. The District currently has restrictions in place for accessing the building interior, and these restrictions seem appropriate given the extent of the existing hazards. Since frequent interior access or occupancy is not anticipated, short-term remedial measures should address safety for periodic

maintenance use and implementing the interior and roof repairs. Fall hazards at the interior are limited to the stairs and the openings in the floors. Comprehensive remediation of the hazardous materials and removal of debris would be recommended as part of a long-term program.

Exterior Doors

Due to the remote location of the radar tower, the public use of the site, and the unoccupied condition of the building, site and building security and protection against vandalism are important project goals. In addition to re-application of an anti-graffiti coating along the base of the exterior walls after they are repaired, further improvements to the security of the entry doors may include additional heavy-duty locks added to the existing doors.

Site

The wood benches around the building are located very close to the exterior walls, which will make it difficult to install any concrete patching, coating, or other finishes on the portion of the wall obstructed by the benches. Since this occurs at the base of the walls, the omission of a new coating or finish at these location would not result in a condition where concrete spalling would cause a safety hazard, and would be unlikely to cause significant water intrusion.

The existing removable bollards between the parking area and the radar tower are susceptible to sand and other debris falling into the gap between the bollard and the sleeve embedded in the concrete, making the bollards difficult to remove. If the existing bollards are to remain, we recommend that on a monthly basis the bollards be removed, the surfaces of the bollards be wiped to remove adhered debris, and the inside of the sleeves be cleaned of debris. We recommend replacing the removable bollards with a different style of removable bollard that will be easier to operate and will require less maintenance.

BASIS OF DESIGN

The intent of the following proposed repairs is to follow the District's decision to retain and seal the radar tower building. The recommended strategies address the conditions identified during our evaluation, which are described in detail in the later Building Description and Site Observations sections. The proposed repairs are intended to allow safe access by the public around the exterior of the building, mitigate water intrusion into the building, and provide safe occasional access into the building for maintenance purposes. Since the building will receive only periodic maintenance, the proposed repairs also intend to minimize ongoing maintenance needs. A preliminary cost estimate for the base repairs and various options was provided by our cost estimating sub consultant and is included in Appendix B.

Site Conditions

Replace the two removable bollards with a bollard system that is tolerant of exposure to sand and debris. A foldable bollard system, similar to that used along the roadway to the peak of Mount Umunhum (Figure 5) would appear to be easier to operate and would be less likely to become jammed with debris. Replacement bollards would be expected to last at least 30 years.

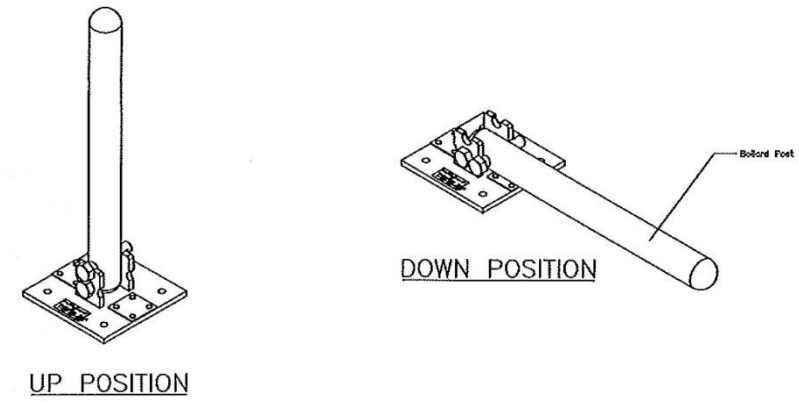

Figure 5. Foldable bollard used on Mt. Umunhum Road.

Exterior Doors

Option 1 - Maintain in Existing Configuration

The doors can be maintained in their existing configuration. We recommend performing the following repairs at the two remaining doors to improve their weather resistance. Given that the existing doors appear to be stainless steel, if they are coated with a high performance coating, they would be expected to last more than 50 years, with overcoating of the high performance coating after 20 years, and removal and replacement of the coating after 40 years.

This repair option includes:

- Install weather stripping at the doors.
    - Install gaskets around the door perimeter (all four sides).
    - Install a door sweep at the bottom edge of the door.
    - Modify the threshold to engage the gasket/sweep at the bottom edge of the door.
- Provide new heavy duty door locks.
- Prepare and paint the steel doors to protect them from corrosion.

Advantages	Disadvantages
• Lower cost	• Performance improvements may be limited

Option 2 - Replace with New Doors

To improve the functionality of the doors, the existing doors can be removed and replaced with new security doors. Installation of the new doors will include a new frame for the doors including thresholds and weather seals around the perimeter. The new doors should include internal locks and panic hardware on the interior. Replacement doors will likely be non-stainless steel, but would also be coated with a high performance coating. Replacement doors would be expected to last at least 50 years, with overcoating of the high performance coating after 20 years, and removal and replacement of the high performance coating after 40 years.

Advantages	Disadvantages
• Improved weather resistance • Improved security and safety	• Higher cost

Potential Interior Hazards

Short-term repairs at the interior focus on providing safe access to the floors of the building for occasional maintenance access into the building, including replacing missing and damaged handrails and addressing existing holes in the floors. Long-term repairs are intended to eliminate hazardous materials and implement additional measures as recommended for securing the radar tower. Access to the roof for maintenance and repair is discussed in the Roof section above.

Short-Term Repairs

- Review the existing plywood covers at floor openings to identify and repair any that may be damaged due to exposure to moisture.
- Cover holes in fifth floor mezzanine floor with steel plates, or restrict access to the mezzanine.
- Replace missing or damaged stair guardrails.

Long-Term Repairs

- Remove all non-essential equipment and debris from the interior.
- Replace plywood covers at floor openings with steel plate covers.
- Abate hazardous materials, including asbestos and lead-based paint.

Concrete Wall Repair

The existing walls have numerous areas with surface voids due to poor consolidation, loose concrete, and exposed reinforcing steel. Some of these locations are susceptible to allowing small pieces of concrete or aggregate to become dislodged and fall, creating a potential safety hazard. The surface voids expose reinforcing steel, which has started to corrode. This will lead to more concrete spalling or becoming dislodged as the corrosion progresses. The proposed repair design includes a base level of repairs to address the most significant areas of deterioration at the pilasters, perimeter roof edge beam at the top of the walls, and exterior wall surfaces. Additional surface repairs or over-cladding of the exterior wall surfaces between the pilasters and at the perimeter roof edge beam are necessary to mitigate the falling hazard and to provide an adequate substrate for application of a waterproof elastomeric wall coating. We considered several options for over cladding of the concrete walls including additional concrete, metal panels, and adhered fiberglass sheets. Each of these options were judged to have a significant negative impact on the appearance of the radar tower and would likely be more expensive than the options discussed below. The wall coating will also provide a protective layer over the asbestos-containing patching material in the concrete walls and mortar for the concrete block wind screens to limit further deterioration and damage due to water intrusion.

Base Wall Repairs

At a minimum, we recommend performing the following repairs at the walls to address the most significant areas of distress using common concrete repair procedures. Schematic details for these repairs are provided in Figure 6 through Figure 8. These repairs will be needed regardless of which other repair strategies for the remaining portions of the wall are selected. The base exterior concrete repairs are intended to address the conditions of significant concrete deterioration including the pilasters that provide a significant portion of the load-carrying capacity of the walls. The base repairs are likely to allow the structure to remain standing without collapse for at least one hundred years. Implementing only the base repairs, without Options 1 or 2, however does not allow for the installation of an elastomeric coating on the walls. The lack of coating on the walls will lead to continued moisture penetration into the building, resulting in standing water and deterioration of the floors and interior. WJE recommends the following base wall repairs:

- Repair large cracks, voids, spalls, and delaminations at pilasters, at the perimeter roof edge beam along the top of the walls, and at portions of the exterior walls with deep voids. These repairs should

include all locations where the reinforcing steel is exposed and any other location where the depth of the spall or void exceeds 1 inch.
    - Remove loose or delaminated concrete and sawcut the perimeter of the repair area.
    - Chip out the concrete to allow access around the exposed reinforcing steel.
    - Clean the corrosion and apply a protective coating to the exposed steel.
    - Supplement severely corroded or missing reinforcing steel with new reinforcing steel.
    - Patch the concrete spalls using an appropriate concrete repair mortar.
- Coat concrete walls and pilasters with an elastomeric coating.
- Re-apply an anti-graffiti coating on the lower portion of the walls, similar to what currently exists at the building.

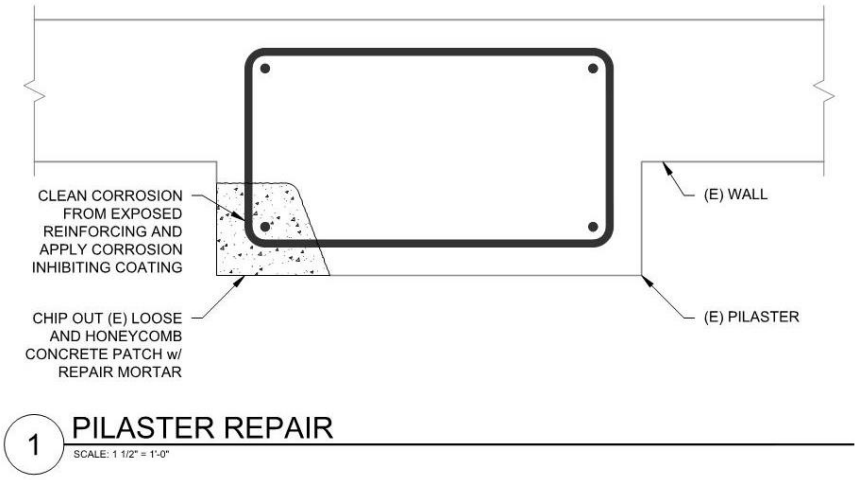

Figure 6. Base concrete pilaster repair.

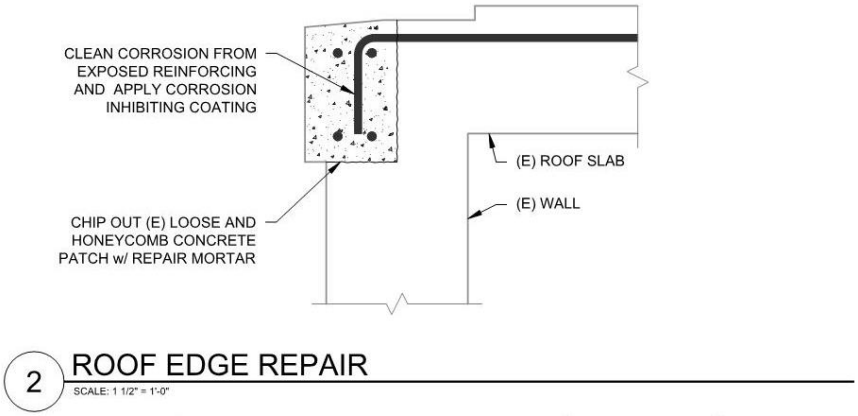

Figure 7. Base perimeter roof edge beam repair.

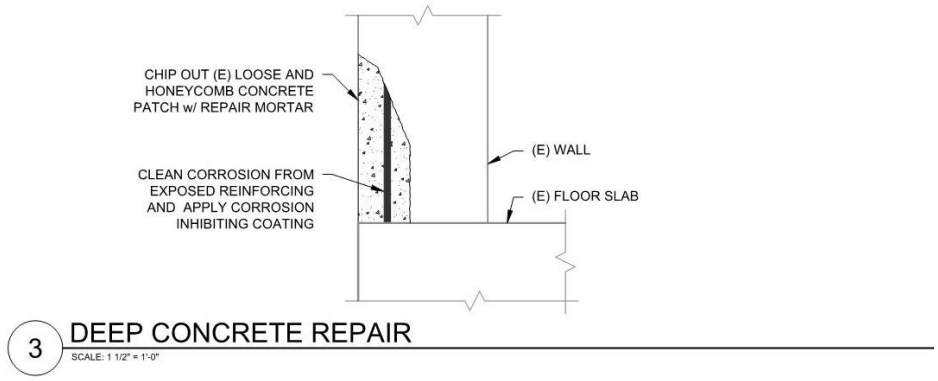

Figure 8. Base deep concrete void or spall repair.

Option 1 - Patch and Coat

This option repairs the surface of the exterior concrete walls between the pilasters to be suitable to receive an elastomeric waterproofing coating. Selection of an appropriate repair material for this option is critical since the depth of the patches will be very thin in some locations. This repair option maintains the original concrete surface profile of the entire building. The elastomeric coating would be expected to be overcoated every 5 to 7 years and removed and replaced after about 20 years. The concrete patching would last 30 to 40 years as long as the elastomeric coating is maintained.

This repair option includes:

- Repair shallow rough and poorly consolidated concrete at walls.
    - Remove loose concrete and roughen surface to receive concrete repair mortar.
    - Patch concrete for smooth, well-bonded finish.

Advantages	**Disadvantages**
• Maintains the original concrete surface • Creates a surface that can receive a waterproofing coating	• Significant surface patching and preparation will be required • Potential for additional concrete spalling in areas not patched

Option 2 - Stucco Cladding Between Pilasters

This option allows the existing rough surface to remain and installs mechanically attached 3-coat cement plaster (stucco) system (thickness of about 1 inch) on the walls between the concrete pilasters as a substrate for an elastomeric waterproofing coating (Figure 9). The finish of the stucco surface should be smooth to match the texture of a formed concrete surface; however crack control joints needed in the stucco and sealant joints needed between the stucco and the pilasters will be visible deviations from the current appearance. The elastomeric coating would be expected to be overcoated every 5 to 7 years and removed and replaced after about 20 years. The stucco cladding would last at least 40 years as long as the elastomeric coating is maintained, and the sealant would need to be replaced after about 20 years.

This repair option includes:

- Install mechanically fastened metal lath and 3-coat stucco on the exterior walls between pilasters, and below the perimeter roof edge beam.

- Install horizontal control joints at the bottom of each floor slab level (top of each story wall), and intermediate horizontal control joints at the mid-height of the fourth and fifth floor walls.

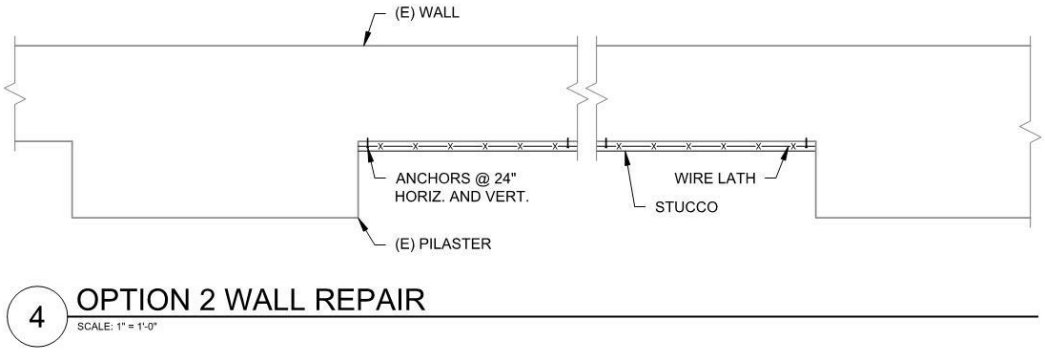

Figure 9. Wall repair option using a mechanically attached stucco system applied to the walls.

Advantages	Disadvantages
• Does not require extensive surface patching at concrete walls • Provides a uniform surface for coating • Provides a secondary layer of protection to limit the amount of water than can penetrate to the reinforcing steel and cause corrosion	• Requires installation of joints to control stucco cracking • More costly

Roof Repairs

Short-term or interim repairs at the roof could be implemented to mitigate some of the water intrusion but unfortunately the effectiveness of these repairs are limited by the poor condition and complex configuration of concrete and steel substrates. Targeted maintenance repairs and water management strategies are described as a short-term or interim measures to reduce or manage ongoing leakage until a long-term roofing system can be designed and installed. Given the District's stated goal to reduce ongoing maintenance, and the various challenges described in the Roof Discussion section above, we feel that there are two primary long-term roofing strategies, discussed in detail below. Base repairs will be needed in addition to implementing either the short-term or long-term strategies, including the installation of a fall protection system to allow periodic inspection, maintenance and repairs.

Base Roof Repairs

At a minimum, we recommend performing the following repairs at the roof regardless of which other repair strategies are elected:

- Reestablish roof drainage. There are three possible approaches to reestablishing roof drainage:
  - ***Option 1***: Reroute the existing roof drainage plumbing at the first floor to discharge at a splash block or other appropriate site drainage infrastructure to the southeast of the building. Further evaluation will be required to confirm that the existing drains and plumbing are in suitable condition, and to determine what anticipated service life may remain in the existing drainage plumbing system. This evaluation may determine that replacement of the roof drains is necessary, but the existing plumbing can be retained and

repaired, that this is only a short-term strategy and new plumbing should be installed when a new roof is installed at the building, or possibly that the existing plumbing cannot be reused at all. The service life for reusing the existing plumbing will depend on the findings of a more detailed evaluation of the condition of the existing plumbing.

Advantages	Disadvantages
• Minimal scope can be implemented at any time (if feasible) • Significantly less expensive than other options	• Requires evaluation of existing plumbing for reuse • May be determined to be a short-term solution • May not be feasible • Plumbing leakage would introduce water into the building

- ***Option 2***: Replace the four existing roof drains and pipes with new plumbing. The general configuration would match the existing layout, with a similar discharge at the southeast corner of the building onto a splash block or existing site drainage infrastructure. New plumbing would be expected to last more than 50 years with periodic maintenance.

Advantages	Disadvantages
• Significantly extends the expected service life	• Likely the most expensive of the three options • Plumbing leakage would introduce water into the building

- ***Option 3***: An alternate roof drainage strategy could utilize gutters and external downspouts. Gutters and downspouts may be designed and installed in a way to minimize the aesthetic impact on the structure. The use of an externally-plumbed drainage system would be dependent on the new roof design providing new slope towards the roof perimeter. Gutters and external downspouts would be expected to last about 30 years, with maintenance and repair at 10 year intervals.

Advantages	Disadvantages
• Likely less expensive than Option 2	• Visible at the exterior of the structure

- Remove the aluminum sheet shielding from the underside of the roof slab to observe the condition of the slab for locations of water intrusion and possible structural damage. Inspect the structural slab soffit and repair damage.
- The vertical surfaces (walls) of the concrete pedestal should be patched and coated with elastomeric coating.

Short-Term Targeted Maintenance Repairs and Water Management

A strategy that may be economical in the short-term is to monitor and manage water intrusion, performing targeted maintenance repairs where leakage is specifically occurring. This strategy is unlikely to eliminate leakage or prevent further deterioration of exposed materials at the roof, and the steel framing beneath areas where leakage persists will continue to deteriorate. This strategy will also require more maintenance activity by District staff, which is inconsistent with the project's stated long-term goals, but this strategy is offered

as an achievable short-term or interim goal. Maintenance at the roof should be performed annually, at a minimum with any strategy, and possibly more frequently with this strategy. This strategy also assumes that the surface membrane on top of the wearing slab is the membrane to be maintained since the original roofing membrane is concealed beneath the wearing slab and cannot be maintained. Some of the existing sealants used beneath the surface membrane contain asbestos and will need to be contained to prevent deterioration.

This repair strategy includes:

- Review leakage at the underside of the roof slab (after removal of the aluminum sheet shielding) to diagnose specific locations where water may be entering.
- Observe and document leakage through the roof during (and after) rainstorms. Maintain a leak log to track leakage and target areas where active leakage is originating.
- Perform targeted maintenance above areas where leakage is occurring with chemical-injection, sealant, sheet membranes, sheet metal, and possibly fluid-applied membranes, as appropriate. Performance of repairs may be limited by poor surface conditions and limited surface preparation. Follow-up repairs should be anticipated.
- Reseal expansion joints to encourage surface drainage and limit water penetration.
- Seal open gaps and joints around penetrations, pitch pockets, hatches and other rooftop items across the entire roof.

Long-Term Roofing System

For a long-term strategy, the existing membranes should be abandoned or removed, and a new waterproofing membrane should be installed. Two strategies for a new membrane are described below.

Option 1: Single-Ply Roofing Membrane over New Roof Framing.
This option abandons the concrete and steel surfaces as waterproofing membrane substrates and installs new light gauge metal framing and exterior sheathing with a single-ply membrane that is adhered, or both mechanically fastened and adhered to the sheathing. Single-ply membranes are durable and generally require minimal maintenance. As the roof is fully exposed to the sun, and will have minimal foot traffic, a membrane that is especially resistant to ultraviolet radiation should be selected. A durable single-ply roof membrane would be expected to last about 20 to 30 years with annual inspections and maintenance. Although the new roof framing alters the roofing assembly, the additional framing will not significantly impact the appearance of the roof from the ground.

This repair strategy includes:

- Remove rooftop penetrations and obstructions where possible.
    - Detach items that can be removed without damage.
    - Cut penetrating items close to flush with the top surface of the wearing slab or concrete pedestal.
- Coordinate the height of new and existing rooftop items to remain with the increased height of the new roof deck.
    - Remove the roof hatch and reconfigure roof access with a new roof hatch to accommodate the new (increased) height of the roof deck.
    - Coordinate location of fall protection anchors and guardrail height with height of new roof deck.
- Install light gauge metal framing with exterior sheathing to create a new sloped roof deck across the entire roof, including above the concrete pedestal. Ventilate the new cavity between the sheathing and wearing slab, or fill the cavity with closed-cell spray foam insulation for an unvented system.

- Conceal remaining rooftop penetrations and obstructions within the new roof deck assembly, or with box-outs where the penetration or obstruction is taller than the level of the new roof deck (sheathing). Protect existing materials with a separation layer, and fill cavity with closed-cell spray foam insulation to minimize the risk of condensation within the assembly.
- Slope new roofing to the location of existing roof drains and integrate with new drains. Alternately, the roof deck could be sloped towards the roof perimeter to utilize gutters and downspouts.

Advantages	**Disadvantages**
• Abandons deteriorated concrete and steel surfaces • Simplifies geometry of roofing details • Tolerant of moisture that may be trapped within the existing roof assembly • Likely less expensive than Option 2	• Roofing membrane is fully exposed to environment and will deteriorate due to UV exposure • Requires removal of rooftop penetrations

Option 2: Buried Roofing Membrane

This option would remove and replace the concrete wearing slab and original built-up roofing membrane with a hot rubberized asphalt (HRA) membrane with a new concrete wearing slab for protection. Additionally, a similar HRA membrane with concrete wearing slab would be installed on top of the concrete pedestal after removal of obstructions and surface patching and preparation.

This strategy is likely significantly more expensive than the single-ply membrane in Option 1, but offers greater protection of the roofing membranes from solar exposure with new wearing slabs. Some of the existing materials that will be removed contain asbestos, so special procedures will be needed for safe removal and disposal of the debris. The condition of the underlying structural slab is not known and will need to be investigated to confirm the viability of this approach after removal of the aluminum sheets on the underside of the roof and removal of the existing built-up membrane.

The strategy outlined below includes installation of an HRA membrane on top of the concrete pedestal which will require significant concrete repair work. It would also be possible to install a single-ply membrane on new light gauge metal framing and exterior sheathing, similar to that described above in Option 1, at the concrete pedestal as a cost saving measure. A buried HRA membrane would be expected to last about 30 to 40 years with annual inspections and minimal maintenance.

This repair strategy includes:

- Remove concrete wearing slab and underlying roofing assembly to expose the structural concrete slab.
    - Inspect the top of the structural slab and repair damage.
- Repair rough, delaminated and spalled concrete on both horizontal and vertical surfaces at the concrete pedestal.
- Remove rooftop penetrations and obstructions where possible.
    - Detach items that can be removed without damage.
    - Cut penetrating items flush with the top surface of the structural slab or concrete pedestal.
- Prepare remaining rooftop penetrations and obstructions for integration with HRA membrane by sand blasting steel.
- Install HRA membrane with new concrete wearing slab on horizontal roof surfaces.
    - Integrate HRA membrane with new roof drains in original locations.

- Remove corrosion from steel that is exposed above the roof and coat with a high performance coating system.

Advantages	Disadvantages
• HRA is durable, and will be protected by a topping slab	• Condition of structural roof slab will require investigation • Significant concrete repair will be required at the concrete pedestal in order to use HRA there • Removal and replacement of the topping slab adds significant expense

Fall Protection

As part of the base roof repairs, install fall protection measures to prevent the exposure of maintenance workers on the roof to fall hazards. This can be accomplished in several ways:

- ***Option 1***: Install dedicated rooftop fall arrest anchors meeting Cal/OSHA requirements into the side of the concrete pedestal at a minimum of six locations. Install a Cal/OSHA-compliant guardrail system around the existing roof hatch. Because the pedestal is composed of concrete with trace amounts of asbestos, the anchors will need to be installed using a drill with a built-in vacuum or using wet drilling methods. Fall arrest anchors would be expected to last at least 40 years.

  Rooftop fall anchors are an inexpensive option that is relatively easy to install. Installing these would provide safe access for ongoing short-term maintenance work as well as for the long-term roof construction project.

Advantages	Disadvantages
• Less expensive than Option 1 • Relatively easy to install • Requires less maintenance than Option 1	• Less convenient for maintenance workers to wear harnesses and safety lanyard

- ***Option 2***: Install a guardrail system around the entire roof to match the original guardrail system configuration, but using more durable materials than the original wood framing. A metal guardrail with a high performance coating would be expected to last at least 40 years, with overcoating of the high performance coating every 20 years.

Advantages	Disadvantages
• More convenient for maintenance works to access the roof without harnesses and safety lanyards	• Likely requires strengthening of existing guardrail supports • The guardrail will require periodic maintenance • More expensive

Wall Openings

The final design for this approach could take a variety of forms with varying impact to the appearance of the building exterior. For the purpose of presenting a basis for design for consideration, three conceptual options are presented below, however other permutations for the wall openings are possible.

Option 1 - Maintain in Existing Configuration

This option maintains all wall openings in their current configuration and adds a system to collect and discharge water that currently leaks through the openings. There is a range of fluid-applied waterproofing membrane products that could be used to construct the water collection basins described below. Many of these products require slope to prevent water from ponding on them, which can cause them to deteriorate more quickly. Other products can tolerate ponding water, but are generally more expensive. The less expensive fluid-applied waterproofing products that may deteriorate from ponding water would be expected to require overcoating every 5 to 7 years, and would likely require complete replacement within 20 years. The more durable fluid-applied waterproofing products would be expected to last 20 years, or possibly longer, with minimal maintenance. It is possible to provide slope at the water collection basins, and a cost analysis during design of this repair option would help inform the most appropriate combination of slope and waterproofing products to minimize both the cost and maintenance of this option.

This repair option includes:

- Remove corrosion and apply a protective coating to the steel frames at openings.
- Install water collection and drainage systems at each area of wall openings where leakage occurs.
    - Construct a water collection basin with a perimeter curb of sufficient height to collect and discharge water. Assume 4 to 8 inches for most openings. Sheet metal pans can be used at smaller openings located above the floor levels. Provide slope to drain where possible.
    - Construct wood and sheet metal baffles at the interior that serve to collect wind-driven rain and limit how far it can penetrate into the building interior, directing it into the collection basin.
    - Extend collection basin a sufficient distance past opening jambs, and towards the building interior to collect water that may bypass baffles. Assume 2 to 4 feet for largest openings.
    - Install a waterproofing membrane within the collection basin, and up and over the perimeter curbs. Extend the waterproofing membrane through the gap beneath the steel plate that closes the opening, including a metal flashing with a drip edge at the exterior, if possible. Consider a fluid-applied waterproofing membrane due to the complex geometry at the opening sill where the closure plates are anchored to the steel frame.
    - Depending on the extent of actual water penetration at each opening, drains and plumbing to the exterior storm drainage system on the east side of the building may also be added at the larger or more exposed locations.

Advantages	**Disadvantages**
• Likely less expensive than other more involved options • Retains existing ventilation, without the need to evaluate the building ventilation requirements	• May allow a moderate amount of leakage past the collection system • Some amount of water will likely remain within the collection basins (due to lack of positive slope), evaporating into the building over time • Waterproofing membranes will require maintenance, and may deteriorate prematurely due to the ponding water

Option 2 - Selective Ventilation and Closure of Openings

This option evaluates the ventilation requirements for the building and installs louvers where needed for ventilation, and replaces the steel plates at the other openings with watertight infills. This option prioritizes reduced maintenance and construction cost. Aluminum louvers would be expected to last more than 40 years, and any sealants use to install them would need to be replaced after about 20 years. The durability of the watertight infills would depend on their specific construction, but they would generally be expected to last at least 40 years, with overcoating of the elastomeric coating every 5 to 7 years, removal and replacement of the elastomeric coating after about 20 years, and replacement of sealant after about 20 years.

This repair option includes:

- Evaluate building ventilation and hazardous materials requirements to determine appropriate treatment for each wall opening and overall ventilation of the building.
- Remove all steel plates at wall openings.
- Install aluminum ventilation louvers with animal screens where needed for ventilation.
- Infill openings that are not required for ventilation with concrete, light gauge metal framing and stucco, or steel plates without a gap at the perimeter to create watertight assemblies.
- Coordinate the locations of ventilation louvers and opening infills to optimize the ventilation requirements and to minimize potential maintenance and leakage.

Advantages	**Disadvantages**
• Reduces maintenance by concentrating potential leakage at louvers, while other openings will be sealed watertight	• Requires evaluation of ventilation requirements

Option 3 - Improved Weather Protection of Openings

This option is similar to Option 2, except that louvers with sheet metal hoods, and aluminum windows are installed to match the general appearance and configuration of original openings, as shown in Figure 1, but upgrade the weather protection where feasible. Aluminum louvers would be expected to last more than 40 years, and any sealants use to install them would need to be replaced after about 20 years. Aluminum windows with a high performance coating would be expected to last more than 40 years, with replacement of the gaskets and sealant required after about 20 years. The durability of the watertight infills would depend on their construction, but they would generally be expected to last at least 40 years, with overcoating of the elastomeric coating every 5 to 7 years, removal and replacement of the elastomeric coating after about 20 years, and replacement of sealants after about 20 years.

This repair option includes:

- Evaluate building ventilation and hazardous materials requirements to determine appropriate treatment for each wall opening.
- Coordinate locations for ventilation louvers, hoods and windows with configuration of original openings.
- Remove all steel plates at wall openings. Optionally, where hoods are to be installed but additional ventilation is not needed, the existing steel plates could remain.
- Install aluminum ventilation louvers and sheet metal hoods with animal screens similar in appearance and configuration to original louvers and hoods, adapted to meet the current ventilation requirements.
- The ventilation evaluation may determine that only some of the original louvers are required to provide sufficient ventilation.

- At equipment hoist openings that originally had removable hollow metal panels, install new watertight permanent infill panels similar in appearance to the original hollow core metal panels to fully close off access openings.

Advantages	Disadvantages
• Reduces maintenance by concentrating potential leakage at louvers, while other openings will be sealed watertight • Reduced potential for leakage at louvers by protecting them with sheet metal hoods	Increased cost

BUILDING DESCRIPTION

WJE reviewed available documents including previous construction, condition survey and repair projects at the building. Specifically, we reviewed the following documents:

- *Request for Qualifications and Proposals for Processional Structural/Engineering Design Services for the Mount Umunhum radar tower Assessment*, Midpeninsula Regional Open Space District, undated including Attachments A through O.
- Original construction drawings, *FD Radar Facilities FPS 24/24*, Indenco Engineers, Inc., July 1959.
- Civil and landscaping drawings, *Mount Umunhum Summit Project*, Restoration Design Group, July 2016.
- Architectural and structural drawings for *Mount Umunhum Interim Tower Repair Project*, Grossmann Design Group and Rutherford + Chekene Structural Engineers, July 2014.
- *Evaluation Report: Mount Umunhum Radar Tower Exterior Analysis Project*, by ZFA Structural Engineers, October 17, 2018.

The original construction drawings provide significant detail on the overall building configuration and construction, and our visual observations, discussed below in the Site Observations section, suggest that the structural and architectural features of the existing building matches them closely. The following description includes information, dimensions and other details obtained from the reviewed original construction drawings.

Site

The building is located along a ridge connecting the east and west peaks of the mountain. The building is fully exposed in all directions and experiences very high winds, powerful storms and freezing winter temperatures. A pedestrian pathway extends from the parking area at the west of the building, to a lookout at the east mountain peak, to the southeast of the building (Figure 10). The pathway consists of compacted resin pavement and extends around the perimeter of the building with several wood benches installed adjacent to each side of the building (Figure 11). Four bollards along the edge of the sidewalk block vehicular access to the pathway from the parking area. The middle two bollards are removable to allow authorized access.

Figure 10. Pathway (arrow) from parking area to east peak lookout adjacent to the building.

Figure 11. Wood bench installed close to exterior wall.

Building

The radar tower is about 85-feet tall and 60-feet square in plan with three structural bays in each direction. The exterior concrete walls are 10 inches thick, with structural bays delineated by 30-inch wide pilasters that protrude 8 inches from the exterior face of the walls at the column lines and corners (four per elevation). There are four interior columns that are 36-inches square at the first floor and 32-inches square above the second floor (Figure 12). The interior columns support concrete waffle slab floors. The walls are shown to be reinforced with two curtains of reinforcing steel (Figure 13). There are five concrete floors and a sixth level, which is a steel-framed mezzanine above the fifth floor.

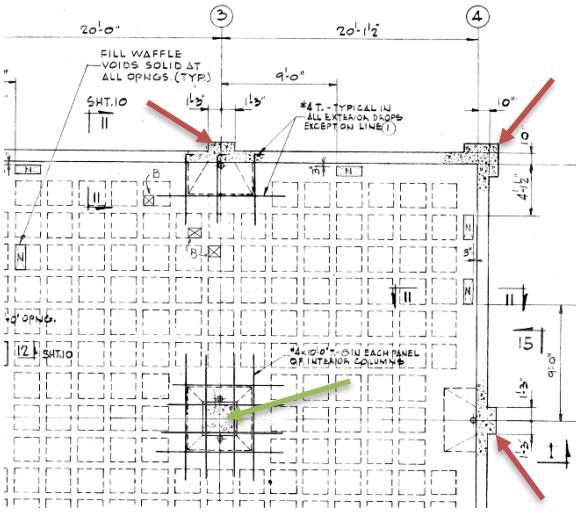

Figure 12. Partial second floor plan from original drawings showing pilasters at the sides and corner (red arrows) and interior column (green arrow).

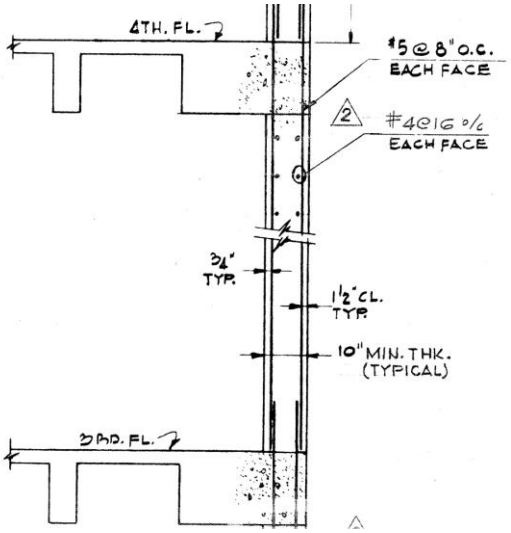

Figure 13. Partial cross section from original structural drawings showing exterior wall reinforcing.

The structural roof slab is specified to be an 8-inch thick slab with beams and an integral concrete pedestal that projects 39 inches above the top of the structural roof slab (Figure 14). The pedestal supported the radar antenna. The structural slab is topped with a built-up waterproofing membrane assembly and a 3-inch thick

concrete topping slab that is divided into four section with expansion joints. The roofing membrane and topping slab terminate at the sides of the concrete pedestal.

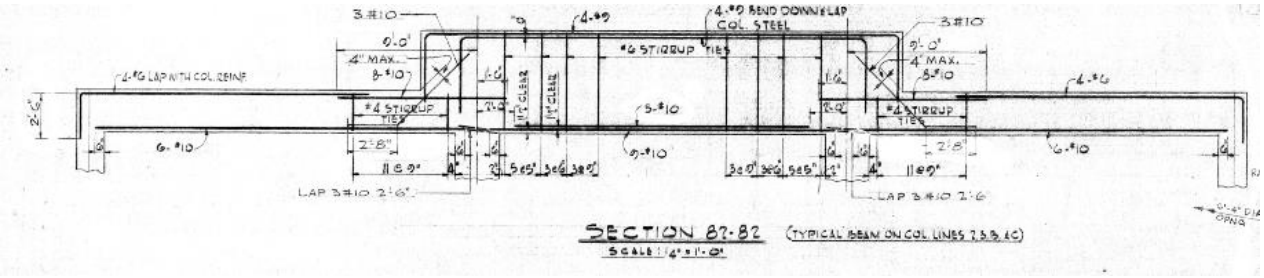

Figure 14. Cross section through roof slab showing concrete pedestal.

Walls

The exterior concrete walls have a variety of openings that served as windows, vents, louvers and removable panels for hoisting equipment (Figure 15). All of these openings have been closed off with steel plates or filled with concrete. The steel plates nearly fill the opening, allowing some ventilation (and moisture intrusion) into the building around their perimeter (Figure 16). Mesh installed in the perimeter gaps prevents wildlife intrusion. Reportedly some of these covers date from the building's operational period in the 1970s, but most were added in 2011 and 2016. At the top of the concrete walls, the roof slab extends past the exterior face of the walls creating a beam at the roof edge with a drip formed at the bottom edge.

At the ground level, there are three single doors at the east wall and a double door at the west, all with covered exterior entryways (wind screens) constructed of concrete block walls and reinforced concrete slab roofs (Figure 17). There are a variety of small metal items embedded in, or protruding from, the exterior of the concrete walls including abandoned pipes, brackets, inserts, bolts, and other unknown items (Figure 18), as well as a newer stacked dipole repeater antenna at the building's northeast corner.

Figure 15. Typical opening in concrete wall, closed with steel plate.

Figure 16. Interior of similar opening in concrete wall with gap around steel plate perimeter.

Figure 17. Covered exterior entryway around main entry door on west elevation. Note the spall at the edge of the roof slab.

Figure 18. Steel fixture attached to concrete wall.

Roof

The roof of the building is dominated by a dodecagonal (12-sided) concrete pedestal (Figure 19) in the center that extends 3.25 feet above the surface of the main (lower) roof surface and directly supported the radar antenna. This pedestal is shown on the original drawings to be integral with the roof slab. A multitude of embedded or otherwise attached supports, pipes and plates associated with the former antenna protrude from the top of the pedestal (Figure 20). The main roof also has pipe penetrations around the antenna pedestal, some of which serve as a conduit through the full roof assembly, as well as eye bolts and concrete curbs at the roof edge (Figure 21 and Figure 22). There is an access hatch (Figure 23) at the southeast corner, a larger equipment hatch near the northeast corner, and a large piece of mechanical equipment (Figure 24) supported directly on the wearing slab near the south edge.

Figure 19. Concrete pedestal that once supported the radar antenna, facing northwest.

Figure 20. Steel plates, pipes, conduit, and other penetrations at the top of the concrete pedestal.

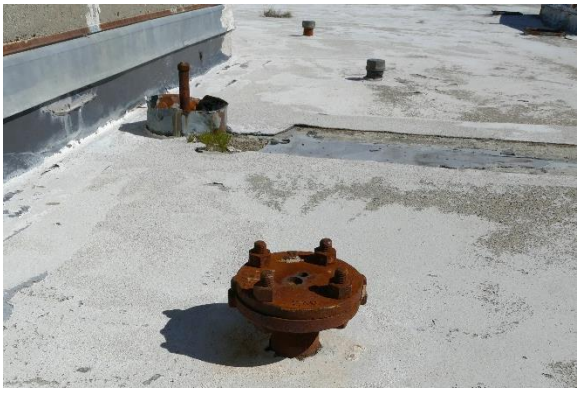

Figure 21. Various pipe penetrations, conduit in a pitch-pocket, and visible sealant repairs at the expansion joint. Photo facing north.

Figure 22. Curb with counterflashing at roof edge, facing north.

Figure 23. Roof hatch near east edge of roof, facing southeast.

Figure 24. Rooftop equipment, facing southwest.

As depicted on the drawings, the perimeter of the roof originally had wood guardrails supported by steel brackets (Figure 25). The wood guardrails were possibly modified into metal guardrails (Figure 26) before being eventually removed in 2015 due to safety concerns.

Figure 25. Perimeter brackets for supporting guardrail.

Figure 26. Apparently metal guardrail that was present circa 2013.

The main roofing assembly (outside of the concrete pedestal) is shown to be constructed (bottom to top) of an 8-inch-thick structural slab, a vapor barrier, 1-inch thick rigid insulation, a built-up roofing membrane, 1 inch of sand, and a 3-inch thick concrete wearing slab (Figure 27). The original built-up roofing membrane extends up the face of the concrete pedestal where it terminates behind a counterflashing set into the concrete (Figure 28 and Figure 29). The concrete pedestal does not appear to have any waterproofing provisions and was likely sheltered by the base of the radar antenna until it was removed in 1980.

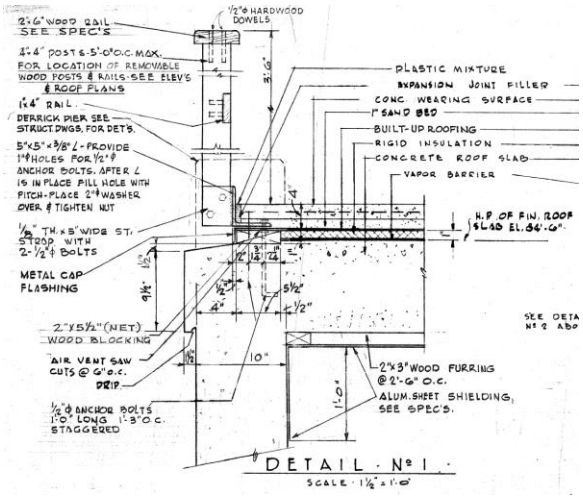

Figure 27. Roof edge detail from original drawings showing the basic configuration of the structural slab, waterproofing, topping slab, and wood guardrail.

Figure 28. Counterflashing at concrete pedestal. Note the single-ply membrane flashing that was later added, and has failed.

The roof is divided into quadrants by perpendicular expansion joints in the wearing slab (Figure 30) that do not extend through the structural slab (Figure 31). There is a roof drain (Figure 32) in the center of each quadrant, however the drain pipe was reportedly disconnected and sealed with grout to prevent animal intrusion. All four roof drains had plants growing out of them at the time of our observation.

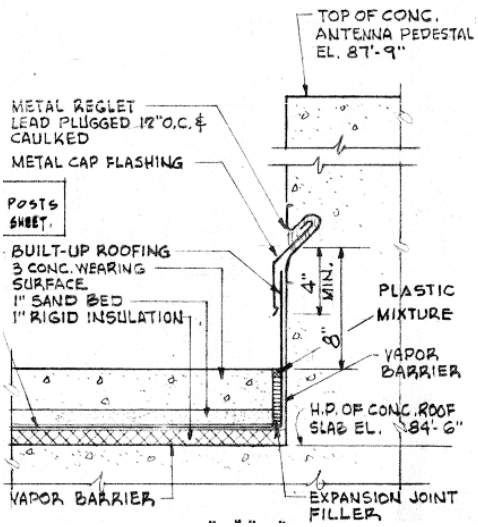

Figure 29. Roof-wall base flashing detail at concrete pedestal from original drawings.

Figure 30. Wearing slab expansion joint formed from folded copper sheet that was originally covered by sealant. Note that the other three joints in the slab were concealed by more modern repair sealant.

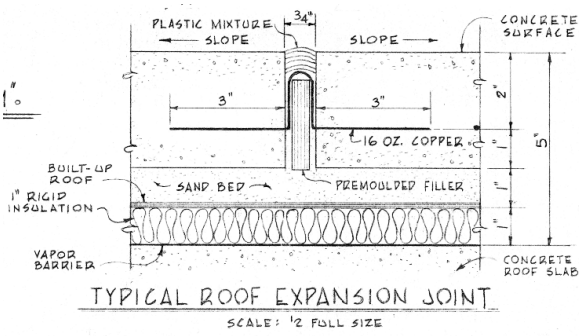

Figure 31. Roof expansion joint detail from the original drawings.

Figure 32. One of four area drains with plants growing out of the drain.

A utility trench (Figure 33 and Figure 34) extending beneath the south end of the east wall is visible in photographs from 2013, prior to construction of the site pathway surrounding the building. This location is assumed to be where the roof drainage plumbing was reportedly disconnected and sealed with grout.

Figure 33. Utility trenches at the southeast corner of the Radar Tower in 2013. Photo facing northwest.

Figure 34. Utility trench beneath the south end of the east elevation in 2013, prior to construction of the site pathway. Photo facing west.

Interior

The interior of the building has had minimal maintenance or modification since it was decommissioned in 1980. Nearly all of the furnishings and movable fixtures, and most of the other salvageable equipment and materials have been removed, but many of the partitions, ductwork, conduit, and finishes remain (Figure 35). Most of the floors are open, with some partitions remaining on the lower floors and abandoned and deteriorated HVAC equipment on some of the upper floors. There is a vertical utility shaft at the southeast corner of the building that extends the full height of the building, and a stair tower and freight elevator along the northern portion of the east wall. The fifth floor has a steel-framed mezzanine with a metal grate floor (Figure 36). There is presently no electrical power available in the building.

Figure 35. The building interior has remaining wood-framed partitions, furring and some abandoned HVAC equipment.

Figure 36. Steel-framed mezzanine at the fifth floor.

SITE OBSERVATIONS

WJE performed site investigations on March 29, April 22, and April 23, 2019, to document existing conditions at the radar tower. Our environmental consultant, SCA Environmental, accessed the building and roof on April 3, 2019, during which time samples of various materials inside the building and on the roof were taken and subsequently tested for the presence of hazardous materials. Our investigation focused

on the building enclosure, condition of the exterior surfaces of the concrete walls and roof, and limited interior areas relating to railings and accessibility for future maintenance considerations.

An unmanned aerial vehicle (drone) was used to photograph the radar tower exterior on March 29, 2019. The photos were used to develop a three-dimensional image of the radar tower and to allow for visual examination of areas that are not easily accessible by other means.

On April 22 and 23, 3019, an aerial lift was used to access the exterior concrete walls at most of the east, west and south elevations, and at limited areas at the west side of the north elevation. General conditions were noted, and the concrete was acoustically sounded with a hammer to identify concealed delaminations and voids.

The interior of the building and roof were accessed by WJE on April 22, 2019, with the assistance of District staff. The exterior walls, wall openings, roof slab, floor slabs, stairs and mezzanine were observed from the interior to document water leakage and potential hazards to maintenance personnel. The southeast portion of the roof was accessed to document conditions that require repair or will impact roofing designs.

Concrete Walls

The exterior surface of the concrete walls have an anti-graffiti coating on all four elevations up to a height of approximately 16 feet above the exterior grade. Above this level, the concrete walls are currently uncoated. The surfaces of the concrete are generally rough, weathered, and have numerous areas of poorly consolidated concrete with exposed aggregate, surface voids due to poor consolidation (honeycombing/rock pockets) (Figure 37 and Figure 38). Some areas have little or no concrete cover over reinforcing steel, with corrosion staining and spalls visible at these locations (Figure 39 and Figure 40). Also observed were debris embedded in the concrete from the original construction including pieces of wood and a cigarette lighter (Figure 41 and Figure 42). WJE sounded the surface of the concrete to identify areas of loose concrete. Areas of surface voids and loose concrete are indicated on elevation sketches for each wall, which are provided in Appendix C.

Figure 37. Poorly consolidated concrete.

Figure 38. Concrete with a rough surface and areas of poor consolidation.

Figure 39. Corroded reinforcing steel with minimal concrete cover.

Figure 40. Reinforcing steel with little to no cover.

Figure 41. Piece of wood embedded in the concrete wall on the east elevation.

Figure 42. Cigarette lighter embedded in the concrete wall on the south elevation.

Areas of poor consolidation of the concrete are typically concentrated at the base of the walls immediately above the second through fourth floor slabs (Figure 43 and Figure 44). At these locations horizontal construction joints between the slab and wall concrete placements contain a key (a small formed ridge of concrete along the top of the top of the slab along and within the thickness of the wall to enhance the mechanical bond between the separately-placed slab and wall). At numerous locations, the poorly consolidated concrete extends sufficiently deep into the wall's thickness to expose the reinforcing steel. Acoustic hammer sounding suggested a majority of the concrete adjacent to the visible areas of poorly consolidated concrete with pockets of exposed aggregate are structurally sound, with aggregate well-bonded to the wall, despite their appearance and localized small areas of loose aggregate. Some of these areas of poor consolidation appear to have been modified at some time in the past, by the addition of a trowel applied patch material, possibly following initial concrete placement. These patches were identifiable by their surface finish and coloration, which distinctly differ from the cast-in-place concrete wall (Figure 43). Some of these patches appear to be delaminating from the concrete substrate.

Figure 43. Poorly consolidated concrete above the horizontal construction joint above the floor slab with a smooth patch area above.

Figure 44. Poorly consolidated concrete above the horizontal construction joint above the floor slab revealing the joint key and reinforcing steel (arrows).

Diagonal cracks were observed at multiple locations on the exterior walls. At the first floor on the east side, previously patched cracks were observed between window and door openings (Figure 45) that likely formed during the Loma Prieta Earthquake in 1989, whose epicenter was only 5 miles to the southeast. The most significant of these cracks were present until about 2014 when they were repaired and the adjacent window and door openings were infilled with concrete (Figure 46).

Figure 45. Cracks visible at east elevation (arrows). (Photo taken in 2013 by WJE)

Figure 46. Repaired cracks and infilled openings at east elevation.

The concrete pilasters have experienced significantly more frequent and severe concrete spalling than the surface of the walls. This spalling has exposed corroded reinforcing steel. Most of the spalling at the horizontal reinforcing is the result of inadequate concrete cover over the horizontal reinforcing (Figure 47 and Figure 48).

Figure 47. Concrete spalling on face of pilaster due to inadequate concrete cover.

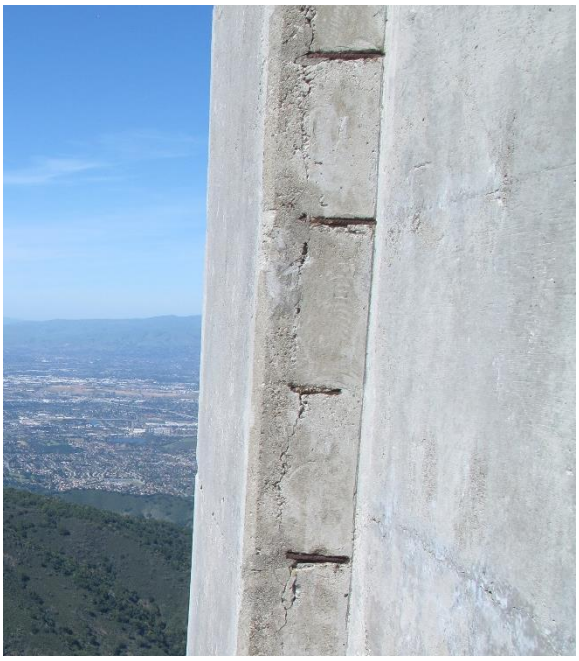

Figure 48. Concrete spalling on side of pilaster due to inadequate concrete cover.

In other locations where the vertical reinforcing is exposed, spalling occurs in areas of poor concrete consolidation on the sides and corners of the pilasters between the vertical reinforcing bars and the finished exterior concrete surface (Figure 49 and Figure 50).

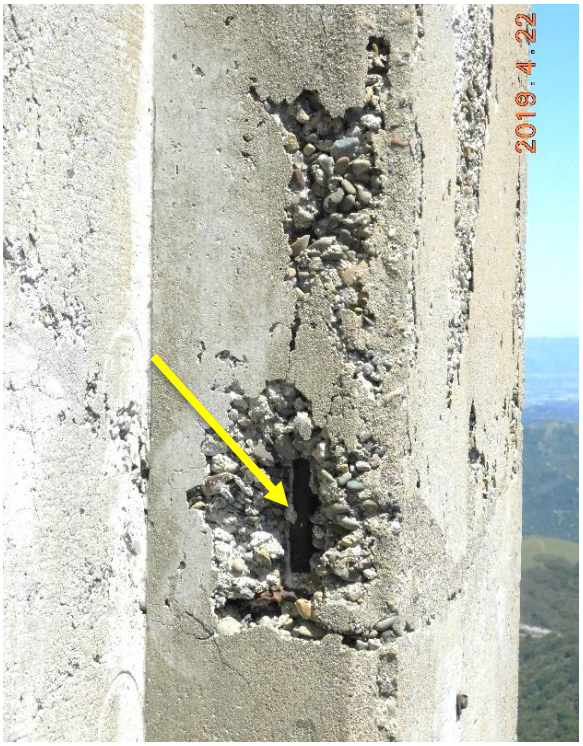

Figure 49. Poorly consolidated concrete on the side and corner of the pilaster. Note exposure of reinforcement steel (arrow).

Figure 50. Poorly consolidated concrete on the sides and corner of the pilaster. Note exposure of reinforcement steel (arrow).

Significant concrete spalling has occurred along the perimeter beam along the edge of the roof slab, which it protrudes from the exterior face of the walls, exposing the wall and roof slab reinforcing steel in places (Figure 51 and Figure 52). Smaller concrete spalls that are not associated with corroded reinforcing are also present, primarily along the bottom of the perimeter roof edge beam at the drip (Figure 53 and Figure 54).

Figure 51. Concrete spalling and exposed reinforcing along the perimeter roof edge beam.

Figure 52. Concrete spalling and exposed reinforcing along the perimeter roof edge beam.

Figure 53. Small concrete spalls along the bottom edge of perimeter roof edge beam.

Figure 54. Small concrete spall along the bottom edge of perimeter roof edge beam.

Several of the concrete block wind screens were also observed to have some spalling (Figure 55). Spalling of the concrete slab forming the roof of the wind screens was also observed (Figure 56).

Figure 55. Spalling of concrete block wall of wind screen

Figure 56. Spalling of concrete slab at top of roof of wind screen.

Wall Interiors

There is widespread evidence of leakage through the concrete walls in the form of efflorescence stains at the interior of the walls and on the floor where puddles appear to routinely form based on staining patterns (Figure 57 and Figure 58). Efflorescence stains are common along the base of the interior of the concrete walls immediately surrounding the construction joint between the floor slab and wall above. These areas also tend to correlate to the pattern of poorly consolidated concrete at the exterior, which is particularly susceptible to water absorption and intrusion. Efflorescence stains were also noted in areas at the underside of floor slabs where puddles that form on top of the floor slab leak down through the slab (Figure 59). Areas of peeling paint were observed on the interior face of the exterior walls (Figure 60). At several locations

reinforcing steel is exposed and observed to be corroded along the base of the wall (Figure 61 and Figure 62),

Figure 57. Efflorescence stains at interior of concrete walls.

Figure 58. Efflorescence stains in utility shaft at southeast building corner, facing east.

Figure 59. Efflorescence visible on the underside of the third floor slab where water leaks into the building and through the slab.

Figure 60. Peeling paint on the inside face of the exterior wall.

Figure 61. Exposed reinforcing steel observed along the base of the wall (arrows).

Figure 62. Exposed reinforcing steel observed along the base of the wall (arrows).

Wall Openings

The galvanized steel plates that cover the wall openings are generally in good to fair condition (Figure 63) however some of the original steel frames embedded into the concrete wall around openings that they are attached to are corroded, with corrosion staining below and adjacent to some openings at the interior (Figure 64). The ventilation gap around the perimeter of these plates allows water to enter the building with no means to collect and discharge it. There was standing water on the floor in several locations below these openings at the time of our visit.

Figure 63. Galvanized steel plate with light oxidation and corroded steel frame.

Figure 64. Water and corrosion staining below wall penetration.

Spalling of the concrete was observed on the exterior adjacent to several of the openings. At some locations spalls expose corroded reinforcing steel (Figure 65), but at most locations there is poorly consolidated concrete adjacent to the steel frames (Figure 66).

Figure 65. Concrete spalling and exposed reinforcing steel (arrow) adjacent to infilled window opening.

Figure 66. Voids in concrete due to poor consolidation adjacent to window opening.

Roof

Overall, the roof is in poor condition with multiple areas of damaged concrete and widespread surface corrosion of exposed steel embedments, penetrations and anchorages. The concrete at the pedestal is heavily

weathered with areas of exposed aggregate and reinforcing steel, spalls and what appears to be delamination of previous concrete repairs.

The built-up roofing membrane is concealed beneath the wearing slab and could not be observed. Single-ply membrane flashings have been added around the concrete pedestal and roof hatches (Figure 67), and a fluid-applied waterproofing coating has been applied to the wearing slab over the entire main roof area (Figure 68) and onto these single-ply flashings (Figure 69). There is also evidence of waterproofing repairs at underlying cracks in the concrete wearing slab, and spray foam in many joints and gaps at penetrations and flashings. There are grasses and moss growing along many joints, cracks and gaps at the roof, including plants growing out of all four roof drains (Figure 32).

Figure 67. Single-ply membrane flashing (black), spray foam (yellow), and fluid-applied coating (white) at roof equipment hatch.

Figure 68. White traffic coating on main roof, facing east. Note the darker stripes where underlying cracks were treated.

Figure 69. Damaged counterflashing at concrete pedestal showing single-ply membrane flashing (black sheet, damaged), fluid-applied coating (white), and original built-up flashing (black residue adhered to interior surface of single-ply flashing, arrow).

The concrete pedestal was likely protected by the radar antenna, relying on the mass of the concrete as the waterproofing. It does not appear to have a membrane integrated into the assembly. Large areas on the top surface and on the edges have extensive concrete spalling (Figure 70 and Figure 71).

Figure 70. Concrete spalling and corroded steel plates on the top surface of the concrete pedestal.

Figure 71. Concrete spalling along the edge of the concrete pedestal.

Interior

Roof drainage plumbing visible beneath the roof slab (Figure 72) runs from the four original roof drains to the utility shaft at the southeast corner of the building where it descends to the ground floor (Figure 73). The plumbing stack originally exited the building in the utility trench that extends beneath the south end of the east wall, but the pipe was reportedly disconnected and sealed with grout. The drainage plumbing has surface corrosion in many areas.

Figure 72. Cast iron drainage plumbing with widespread corrosion running into the utility shaft at the southeast corner (arrow). Photo facing south.

Figure 73. Cast iron drainage plumbing stack in utility shaft. Photo facing southeast.

The ceiling beneath the roof is finished with aluminum sheets originally used as shielding (Figure 74), limiting direct observation of the underside of the structural slab. These aluminum sheets are generally oxidized, indicating long-term exposure to moisture, and there are signs of leakage at multiple areas throughout the ceiling including staining, heavier corrosion and efflorescence at the aluminum sheeting and adjacent materials (Figure 75). Several steel beams which serve to anchor steel rods extending through the roof slab that are visible at the underside of the roof have surface corrosion (Figure 76). Although the aluminum sheets prevent direct observation of the roof slab, the presence of staining of the aluminum sheets

indicates water leakage through the roof slab and some degree of corrosion of the reinforcing steel within the roof slab is likely.

The steel-framed stair structure has surface corrosion in limited areas and many of the railings are deteriorated, corroded, or missing (Figure 77 and Figure 78). Some stair railings have been supplemented with wood railings attached with tie wire and are not of sufficient strength to reasonably perform as a guardrail (Figure 79).

Figure 74. Aluminum sheets installed beneath the roof slab are noted as radar shielding in the construction drawings.

Figure 75. Efflorescence deposits around penetration in concrete roof slab, with aluminum sheets in foreground.

Figure 76. Surface corrosion on steel beam clamp.

Figure 77. Surface corrosion on metal stair handrail.

Figure 78. Missing guardrail.

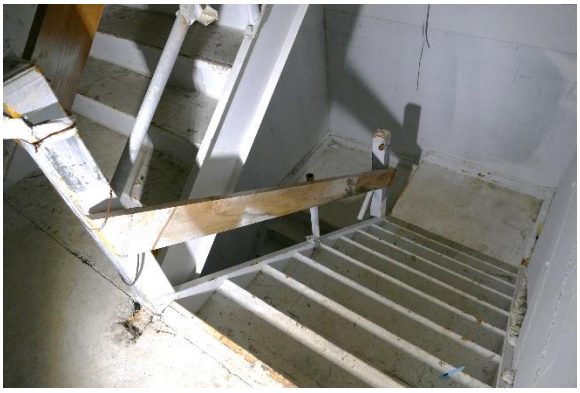

Figure 79. Partially missing handrail with temporary wood railing.

The guardrails at the mezzanine above the fifth floor also show signs of corrosion (Figure 80). The soffit of the fifth floor slab exhibits staining and discoloration along exposed portions of the reinforcing steel (Figure 81).

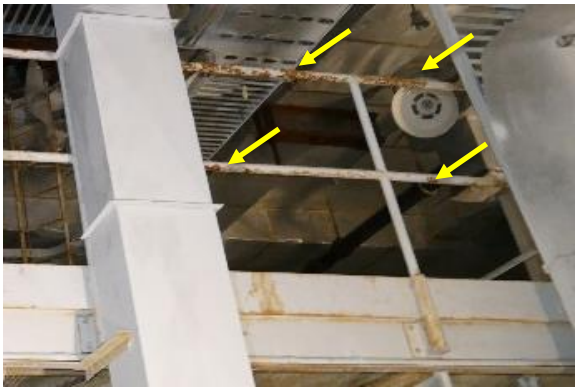

Figure 80. Corrosion of guard rails at the mezzanine.

Figure 81. Corrosion staining of reinforcing steel at the soffit of the fifth floor (arrows)

Several abandoned openings (former mechanical penetrations) in the floor slabs are covered with metal plates which may date to the building's decommissioning, but most floor openings are covered with plywood fastened to the floor, reportedly installed in 2016. The metal plates typically have surface corrosion (Figure 82), and the wood covers are generally in fair condition (Figure 83), though ongoing deterioration of these wood covers should be expected given the indications of moisture intrusion throughout the building. The metal grate floor of the fifth-floor mezzanine has a number of rectangular holes (Figure 84) that someone could be injured by stepping into, and generally has surface corrosion (Figure 85).

Figure 82. Corroded metal plate covering opening in floor.

Figure 83. Plywood covering openings in floor.

Figure 84. Rectangular holes in the mezzanine floor grating are large enough to accidentally step through.

Figure 85. Surface corrosion at mezzanine floor grating below concrete pedestal at roof above.

Exterior Doors

Originally, there were three exterior single-leaf metal outswing doors in the east wall of the building, and a larger double-leaf outswing door opening in the center of the west wall. The two northern doors in the east wall have been removed and the openings filled with concrete. The southern door at the east wall remains (Figure 86). The door at the west is shown as a double-leaf outswing door in the original construction drawings, but currently consists of fixed metal plates that close the opening, with a single access door at the northern side (Figure 87). We are not aware of the date for this modification.

The paint has been removed from the two remaining exterior doors, exposing bare steel. Based on the absence of surface corrosion, the doors are assumed to be constructed of stainless steel. Both doors appear to be relatively secure and resistant to tampering, and have key-operated locks.

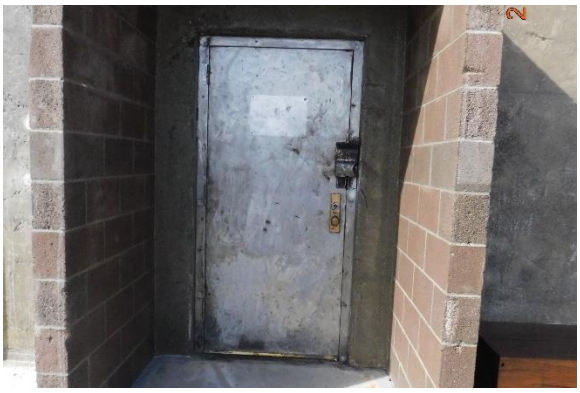

Figure 86. Steel door at south of east wall.

Figure 87. The west door was originally a double-leaf door, but appears to have been modified and has only a small access door in a larger metal plate.

Hazardous Materials

On April 3, 2019, WJE's hazardous materials consultant, SCA Environmental (SCA), performed a survey of materials within the building, as well as on the building exterior, to assess the presence of hazardous materials, including asbestos, lead, and PCBs. A copy of their report is attached as Appendix A. Table 1 summarizes the locations where their testing identified detectable levels of asbestos and lead. A fire door at the elevator mechanical room is also suspected to contain asbestos within the core of the door. The specific locations of the materials are provided in the SCA report.

Table 1. Hazardous Materials

Type of Material	Location	Hazard
Electrical wiring with black canvas sheathing	First floor interior	Asbestos
Black tar at circuit breaker support	First floor interior	Asbestos
Tan paint on concrete masonry	Second floor interior	Asbestos
Off-white dust on the floors	Fourth and fifth floor interior	Asbestos
Green roof coating over black roofing tar	Roof	Asbestos
Black roofing tar under roof flashing	Roof	Asbestos
Grey caulking	Roof	Asbestos
Concrete pedestal for radar antenna	Roof	Asbestos
Grey mortar for concrete masonry units	First floor exterior	Asbestos
Off-white paint on walls and equipment	All floors	Lead
Green paint on walls	All floors	Lead
Yellow paint on handrails	Stairs	Lead
Gray paint on concrete slab	First floor exterior	Lead

Work activities within the building, on the roof, and at the building exterior will require special handling when the materials identified as hazardous are to be affected in addition to the District's current requirements for personal protective equipment.

Site

The pathway from the parking area to the building has a row of four steel pipe bollards along the sidewalk to the west of the building to restrict vehicle access. The two central bollards are set into steel sleeves in

the concrete sidewalk and can be removed (Figure 88 and Figure 89). Removing these bollards can be difficult due to sand and debris that collects between the bollard and the sleeve.

The wood benches adjacent to the building are constructed of a single large timber that is in close proximity to the building wall and the ground (Figure 90). Most of the benches are located with a gap of about 1 inch between the bench and the exterior wall of the tower. The timber benches are supported by wood bases that are reportedly well anchored to a concrete foundation below, and may be difficult or impossible to remove without damaging the benches.

Figure 88. Bollards along the sidewalk. Arrows indicate the two removable bollards.

Figure 89. Base of removable bollard. Note sand in the recess adjacent to the bollard sleeve (arrow).

Figure 90. Wood benches are very close to the concrete walls.

APPENDIX A: HAZARDOUS MATERIALS SURVEY BY SCA ENVIRONMENTAL

SCA
ENVIRONMENTAL, INC.

April 18, 2019

Mr. Brian Kehoe, SE
Wiss, Janney, Elstner Associated, Inc. (WJE)
2000 Powell Street, Suite 1650
Emeryville, CA 94608 bkehoe@wje.com

Re: Non-destructive Pre-renovation Hazardous Materials Survey
Mount Umunhum Radar Tower, 17000 Mt. Umunhum Road
Los Gatos, CA 95030
SCA Project No.: B-12936

Dear Mr. Kehoe:

As requested, SCA Environmental, Inc. (SCA) completed a non-destructive pre-renovation survey at the above-referenced site in Los Gatos, CA on April 3, 2019 as part of the future planned renovations. A picture of the building is shown below:

Sampling was limited to materials expected to be impacted by the renovations. Sampling was conducted by Mr. Dan Leung, CIH, CSP, a Cal/OSHA Certified Asbestos Consultant (CAC #07-4175) and a California Department of Public Health Certified Lead Inspector/Assessor (CDPH #7329). Reservoirs Environmental, Inc. (REI), an NVLAP-accredited laboratory in Denver, CO, completed bulk asbestos and lead analyses. McCampbell Analytical (McCampbell), a ELAP-accredited laboratory in Pittsburg, CA completed the bulk polychlorinated biphenyl (PCB) analysis.

Prior to any renovations or demolition, the National Emission Standard for Hazardous Air Pollutants (NESHAP) mandated by the Environmental Protection Agency (EPA) and locally enforced by the Bay Area Air Quality Management District (BAAQMD) require that all buildings be inspected for asbestos-containing materials (ACM) and materials subject to damage or which will be made friable, be removed.

Methodology
Asbestos sampling was performed in a fashion designed to minimize exposure of the surveyor or others to airborne asbestos fibers. Samples were typically removed from the substrate utilizing a knife or hollow drill bit bored through a wet sponge; the sample material was then placed into an airtight plastic vial. The vial's exterior was decontaminated with a wet sponge, and a unique sample I.D. written on the vial. The vial was then stored in a plastic bag. Sample substrates were patched with a high-temperature caulking compound, where required.

Samples of suspect materials were collected using triplicate sampling procedures, where applicable. Under these procedures, the first sample is analyzed. If it tests positive for asbestos (>1%), the analysis is suspended for further samples of that material. If the first sample tests only trace positive (between 0.1 to 1%), or negative, then the second and third samples are analyzed sequentially, in order to determine the possible presence of asbestos, as applicable. If all three samples test negative, the material is considered as non-asbestos. If one or more samples test "trace" positive (<1%), the material is considered to be trace positive. If one or more samples are positive for asbestos, the material is considered positive.

All asbestos samples collected were submitted to REI for analysis by polarized light microscopy with dispersion staining (DS/PLM). The Bay Area Air Quality Management District's (BAAQMD), the Federal Environmental Protection Agency's (EPA), and California Environmental Protection Agency's (Cal/EPA) regulations all specify the DS/PLM method.

Asbestos Standards
ACM is defined by EPA regulations as those substances containing greater than 1% asbestos. The BAAQMD and the Cal/EPA provide local enforcement of these regulations. Friable ACM with greater than 1% asbestos needs to be disposed of as asbestos waste.

Prior to demolition of a building, the BAAQMD requires abatement of friable ACM, as well as non-friable ACM that may become friable during demolition (practically, this means all non-friable ACM).

Federal Occupational Safety and Health Administrations (OSHA) regulations, locally enforced by CAL/OSHA, defines ACM as substances that contain greater than 1% asbestos. Cal/OSHA also mandates special training, medical exams, personal protective equipment and record keeping for employees working with ACM. If a material contains less than 1% asbestos but more than 0.1% asbestos, the material may be disposed of as non-ACM, but the Cal/OSHA requirements would still have to be followed regarding workers' protection and Contractor licensing.

"Trace" materials are currently regulated in California and require the following:

- Removal using wet methods;
- Prohibition of removal using abrasive saws or methods which would aerosolize the material;
- Prompt clean-up of the impacted zone, using HEPA-filtered vacuums, as applicable;
- Employer registration by Cal/OSHA for removal quantities exceeding 100 sq. ft. per year; and
- Cal/OSHA Carcinogen Registration by the Demolition or Abatement Contractor impacting such materials.

Lead Standards
Since elemental lead is a suspect carcinogen and known teratogen and neurotoxic in high doses, lead-containing materials need to be identified prior to the on-set of demolition activities. Using combinations of engineering controls and personal protective equipment, lead-containing materials can be remediated safely. Several sources of applicable standards are listed as follows:

1. Lead exposures in the workplace are regulated by Cal/OSHA, which has certain regulatory requirements for identifying and controlling potential lead exposures. Currently applicable regulations for the construction industry have been adopted by Cal/OSHA (8 CCR 1532.1) from the Federal OSHA

regulations. The current OSHA 8-hour Permissible Exposure Level (PEL) for lead is 50 µg/m^3.

2. Current EPA and Cal/EPA regulations do not require LBP to be removed prior to demolition, unless loose and peeling. Provided that the paints are securely adhered to the substrates (i.e., non-flaking or non-peeling), disposal of intact demolition debris can generally be handled in California as non-hazardous and non-RCRA waste.

The applicable standards for lead are tabulated below:

Agent	Total Threshold Level Concentration (TTLC) Wet-Weight Standard (mg/kg)[1]	Soluble Threshold Level Concentration (STLC) Standard (mg/l)[1]	CalOSHA Standard for Occupational Safety
Lead	1000	5	Any detectable levels; spot abatement required from coated metals before torching/welding

In California, loose and peeling LCP or other wastes require characterization and testing for leachability. Disposal requirements are outlined as follows:

Lead Disposal Standards

Classification and Disposal of Inorganic Lead Wastes in California								
Standards	TTLC	Leachable Lead						
Concentations	1000 mg/kg	5 mg/L						
	Test Methods & Results			Classifications				
Condition	Total Pb (mg/kg)	STLC Pb (mg/L)	TCLP Pb (mg/L)	Non-haz waste	CalHaz (Non-RCRA)	Fed Haz (RCRA)	Stabilization Required	Landfill Class
1a	<50 (a1)	NA		Yes	no	no	no	III
1b	<100 (a2)		NA	Yes	no	no	no	III
2a	50 to <1000	<5	<5	Yes (c)	no	no	no	III or II (d)
2b		>5	<5	no	Yes	no	no	I
2c		>5	>5	no	Yes	Yes	Yes	I
2d (b)		<5	>5	no	no	Yes	Yes	I
3a	>1000	<5	<5	No	Yes	No	no	I
3b		>5	<5	no	Yes	no	no	I
3c		>5	>5	no	Yes	Yes	Yes	I
3d (b)		<5	>5	no	no	Yes	Yes	I
4	any	any	>5	no	no	Yes	Yes	I

(a1) 50 = 10 x 5 (STLC for Pb). Per WET method, impossible to exceed STLC even if 100% soluble.
(a2) 100 = 20 x 5 (TCLP for Pb). Per TCLP method, impossible to exceed STLC even if 100% soluble.
(b) Physically impossible due to the stronger acid used in WET than TCLP.
(c) Landfills will likely require documentation that TCLP is <5, even though TCLP is almost always less than WET.
(d) Landfill dependent, function of permit, landfill liner, or landfill policy

3. The major definitions of LCP or lead-coated surfaces are listed as follows:

a. California Department of Public Health (CDPH) defines LBP as paint that contains either ≥0.5% by weight of lead, or ≥1 mg/cm^2.

b. Consumer Product Safety Commission (CPSC) prohibits the manufacturing of paint that contains more than 90 ppm of lead.

Note that adherence to CalOSHA's Construction Lead Standard is required for all paint with any measurable lead content.

4. Lead is on the "Proposition 65" list, given its toxic potential in causing reproductive hazards.

5. California Department of Public Health (CDPH) requires the use of Certified Lead Workers and Supervisors for lead abatement projects at public buildings with a greater than 20 years expected life or whenever work is completed specifically to abate Lead-Based Paint. The CDPH certification requirements do not apply to this facility; however, dust controls and personnel protection are still required under 17 CCR Sections 35001 through 36100.

Results
Asbestos analyses by polarized light microscopy (PLM) analytical methods found the following results:

Asbestos-Containing: Nine (9) suspect materials were confirmed to contain asbestos that may be impacted by the renovation activities, and are listed below:

Material ID	Asbestos Materials Description
EL-1	Electrical wiring with black canvas sheathing (thin gauge)
EL-5	Black circuit breaker supports (-) w/black tar (+)
WL-10	16”x8” Off-white painted (-) w/tan compound (+) on concrete masonry unit (CMU) wall (-) w/gray mortar (tr)
DUST-13	Dust/debris on floors (Multi-colored paint (-), off-white compound (+) and gray concrete (-))
RF-15	Beige (-)/yellow (-)/ green (+)/gray (-) roof coating over black roofing tars (+)
RFMAS-17	Black roofing tars/mastic under roof flashing
CAULK-18	Gray caulking (-) along expansion joints w/black tars/mastic (+)
WL-21	16”x8” Red concrete masonry unit (CMU) wall (-) w/gray mortar (+)
CONC-19	Gray concrete (tr) radar pedestal

Note: (+) = Asbestos; (tr) = Trace Asbestos (<1%); (-) = Non-asbestos

Assumed Asbestos-Containing: One (1) suspect material was assumed to contain asbestos that may be impacted by the renovation activities, and will require further destructive testing. These materials are listed below:

Material ID	Asbestos Materials Description
FIREDOOR-AAA1	Fire-rated core in firedoor

Non-Asbestos: Several suspect materials that may be impacted by the renovation activities were tested or visually determined negative for asbestos, as listed below:

Material ID	Non-asbestos Materials Description
EL-2-1,2	Electrical wiring with black canvas sheathing (medium gauge)
EL-3-1	Electrical wiring with off-white canvas sheathing (thin gauge)
EL-4-1,2	Light gray/black paper behind circuit breakers
EL-6-1	Pink circuit breaker supports
EL-7-1	Black circuit breaker supports
PAINT-8-1,2,3	Off-white paint on concrete walls and equipment
GASKET-9-1	Black rubber gasket at access port of water tank
FLEX-11-1,2	Black flex connector between duct connections
CAULK-12-1,2,3	Residual beige interior caulking around window openings
VAPBAR-14-1,2	Black felts and tar vapor barrier under gray mortar bed
RF-16-1,2	Beige canvas under roof reglet
STAIR-20-1,2,3	Gray concrete steps and landing
CONC-22-1,2,3	Gray concrete perimeter walls
PAINT-23-1,2,3	Beige elastomeric exterior paint on walls in divots, cracks and behind benches

Lead: Paint samples collected from the interior and exterior were found to contain lead ranging from 254 to 203,819 ppm. Dust control procedures are required during demolition of painted elements to comply with the CalOSHA regulations under 8 CCR 1532.1. Torching and welding on coated items require prior spot-abatement, as required by CalOSHA.

Polychlorinated Biphenyls (PCB): The levels of PCB in various caulking were found to be below or at detection (below the TTLC of 50 ppm) in the following suspect materials tested:

Material ID	Material Description of Suspect PCB Tested
CAULK-12	Residual beige interior caulking around window openings
CAULK-18	Gray caulking along expansion joints

Please contact me if you have any questions.

Sincerely,
SCA ENVIRONMENTAL, INC.

Dan Leung, CIH, CSP, CAC, CDPH
Vice President
(415) 867-9544
dleung@sca-enviro.com

Table 1. Materials Matrix Report

Figures 1 – 2. Sample Location Diagrams

Attachments:
1. Asbestos Laboratory Report
2. Lead Laboratory Report
3. PCB Laboratory Report

Table 1: Materials Matrix Report-MPROSD, Mt. Umunhum Radar Tower, 17000 Mt. Umunhum Road, Los Gatos, CA		Sub-sample #					First Floor	Second Floor	Third Floor	Fourth floor	Fifth Floor	Mezzanine	Stairs	Roof	Exterior	
Material ID	**Material Description**	A	B	C	**Asbestos? Positive. Trace. Assumed. Negative**	**UNITS (LF, SF, EA)**	**Inteiror**	**Interior**	**Interior**	**Interior**	**Interior**	**Interior**	**Stairs**	**Roof**	**Exterior**	**TOTAL (+/-15%)**
ASBESTOS																
EL-1	Electrical wiring with black canvas sheathing (thin gauge)	45% CH				LF	100									100
EL-5	Black circuit breaker supports (-) w/black tar (+)	ND	40% CH			SF	100			50						150
WL-10	16”x8” Off-white painted (-) w/tan compound (+) on concrete masonry unit (CMU) wall (-) w/gray mortar (tr)	4% CH in cpd	0.58% CH in mortar	ND		SF		1200	700							1900
DUST-13	Dust/debris on floors (Multi-colored paint (-), off-white compound (+) and gray concrete (-))	6% CH	NA	NA	**Positive**	SF	500	500	500	500	500		800			3300
RF-15	Beige (-)/yellow (-)/ green (+)/gray (-) roof coating over black roofing tars (+)	5% CH in coating; 5% in tar	NA	NA		SF								4900		4900
RFMAS-17	Black roofing tars/mastic under roof flashing	35% CH	NA			SF								160		160
CAULK-18	Gray caulking (-) along expansion joints w/black tars/mastic (+)	35% CH	NA	NA		LF								150		150
WL-21	16”x8” Red concrete masonry unit (CMU) wall (-) w/gray mortar (+)	0.83% CH	ND	1.5% CH		SF									400	400
CONC-19	Gray concrete (tr) radar pedestal	ND	ND	0.58% CH	**Trace**	SF								750		750
ASSUMED ASBESTOS (Destructive Testing Required to Confirm)																
FIREDOOR-AAA	Fire-rated core in firedoor				**Assumed**	EA						1				1
NON-ASBESTOS																
EL-2	Electrical wiring with black canvas sheathing (medium gauge)	ND	ND			LF	100									100
EL-3	Electrical wiring with off-white canvas sheathing (thin gauge)	ND				LF	100									100
EL-4	Light gray/black paper behind circuit breakers	ND	ND			SF	100			20						120
EL-6	Pink circuit breaker supports	ND				SF	100									100
EL-7	Black circuit breaker supports	ND				SF	50									50
PAINT-8	Off-white paint on concrete walls and equipment	ND	ND	ND		SF	2500	1800	1800	1800	1800	1800	320			11820
GASKET-9	Black rubber gasket at access port of water tank	ND				EA	1									1
FLEX-11	Black flex connector between duct connections	ND	ND		Negative	EA		2			6					8
CAULK-12	Residual beige interior caulking around window openings	ND	ND	ND		LF	300	300	300	300	300					1500
VAPBAR-14	Black felts and tar vapor barrier under gray mortar bed	ND	ND			SF		100			100					200
RF-16	Beige canvas under roof reglet	ND	ND			LF								160		160
STAIR-20	Gray concrete steps and landing	ND	ND	ND		SF							800			800
CONC-22	Gray concrete perimeter walls	ND	ND	ND		SF							12800			12800
PAINT-23	Beige elastomeric exterior paint on walls in divots, cracks and behind benches	ND	ND	ND		SF							2560			2560
PCBs					**PPM**											
CAULK-12	Residual beige interior caulking around window openings				1.3	LF	300	300	300	300	300					1500
CAULK-18	Gray caulking along expansion joints				<0.50	LF								150		150
LEAD					**PPM**											
OW-1	Off-white paint on walls and equipment				254	SF	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ			PNQ
GR-2	Green paint on walls				2,027	SF	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ			PNQ
YW-3	Yellow paint on handrails				**203,819**	SF							PNQ			PNQ
GY-4	Gray paint on exterior porch				**5,526**	SF									PNQ	PNQ

Notes:
PNQ = Present, not quantified; CH = Chrysotile; ND = Not detected; NA = Not analyzed

Figure 1. Sample Location Diagram
MPROSD, Mt Umunhum Radar Tower
Interior
SCA Proj. #: B-12936
April 3, 2019

CORPS OF ENGINEERS

U. S. ARMY

RF-15-1

CAULK-18-1

CAULK-18-2

RF-15-2

RF-15-3

CAULK-18-3

CONC-19-1

RFMAS-17-1

RF-16-1

RFMAS-17-2

RF-16-2

CONC-19-2

CONC-19-3

WL-21-1

CONC-22-1

PAINT-23-1

PAINT-23-2

CONC-22-2

WL-21-2

WL-21-3

PAINT-23-3

CONC-22-3

GY-4

DETAIL · Nº 1 ·

SCALE · 1½" = 1'-0"

DETAIL Nº 2

SCALE · 1½" = 1'-0"

SECTION "T-T"

SCALE 1½" = 1'-0"

PLAN-REMOVABLE WOOD RAIL

REMOVABLE GUARD RAIL

ROOF PLAN

SCALE · 1" = 1'-0"

(FOR FPS-35/24 & 35/35 INSTALLATIONS)

SEE SHEET #7

NOTE: ALL ELEVATIONS GIVEN FROM FIN. 1ST FL. EL. 0'-0"

SECTION "U-U"

SCALE 1½" = 1'-0"

SECTION "W-W"

SCALE: 1½" = 1'-0"

SECTION · C-C ·

SECT. THRU · 2'-6" x 4'-6" · HATCHWAY

SCALE · ½" = 1'-0"

SECT. THRU · G-0" x G-0" · HATCHWAY

SCALE · ½" = 1'-0"

NOTE: ALUMINUM SHEET JOINTS TO BE TAPED WHEN HATCHWAYS ARE IN CLOSED POSITION (SEE SPECS.)

SECTION V-V

SCALE: 1½" = 1'-0"

ELEVATION "1"

SCALE · ⅛" = 1'-0"

(SEE SHEET Nº 2)

ELEVATION "2"

SCALE · ⅛" = 1'-0"

(SEE SHEET Nº 2)

ELEVATION "3"

SCALE · ⅛" = 1'-0"

(SEE SHEET Nº 2)

TYPICAL ROOF EXPANSION JOINT

SCALE: ½ FULL SIZE

NOTE: FOR SPECIFIC INSTALLATIONS REQUIRING EXTERIOR WALL OPENINGS MARKED THUS: (A) SEE SCHEDULE OF OPENINGS ON SHEET #4

NOTE: FOR DETAILS OF WALL OPENINGS MARKED (A) & (B) SEE SHEET NO. 5

GRAPHIC SCALES

Figure 2. Sample Location Diagram
MPROSD, Mt Umunhum Radar Tower
Exterior and Roof
SCA Proj. #: B-12936
April 3, 2019

SYMBOL	DESCRIPTION	DATE	APPROVAL
	REVISIONS		
6	AS - BUILT NO CHANGES MADE 86		
5	INDICATED B.B. STACK ON ROOF PLANS & EXTENDED ON ELEV. 3 AS PER OCE AMEND. #6 DATED 4-12-60	25 MAY 60	
4	ADDED EYE BOLT PITCH POCKETS AS PER OCE REV. #2 OF 6/19/59. DELETED FORM PATTERN, D.T. #'s REVISED WIND SCREEN ROOF.	31 JUL 59	
3	SITE ADAPTED FOR ALMADEN A.F.S.S REVISED AS PER N.E.D. LETTER DATED JUNE 17, 1959	8 JUL 59	
2	1) DELETED (G) PITCH POCKETS AT ANTENNA PEDESTAL ON ROOF PLANS 2) DELETED NOTE (B) 3) ADDED NOTE (A) ADDED SECTION "W-W" 4) REVISED FLASHING AND HOOD LOCATION AT SECTION "T-T" 5) INCREASED LENGTH OF PEDESTAL BASE 6) CLARIFIED CONTROL JOINTS ON ELEVATIONS 7) ADDED DETAIL NO. 6 (8) ADDED NOTE AT DETAIL NO. 1 (9) REVISED HEIGHT OF PLAYGROUND FENCE (10) ADDED ANTI-FREEZE HYDRANT (11) REVISED REMOVABLE GUARD RAIL DETAILS (12) REMOVED LOUVERS (13) ADDED LOUVERS (14) ADDED DERRICK PIER AND REMOVABLE RAILING (15) ADDED DERRICK PIER IN DETAILS (1) (1-A) (1-B) ADDED DERRICK PIERS ON ROOF PLANS (16) ADDED NOTE TO SECTION V-V	4/23/59	
1		3/23/59	

BURNS AND ROE, INC. — ARCHITECT-ENGINEER — NEW YORK

DEPARTMENT OF THE AIR FORCE
DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
PREPARED UNDER SUPERVISION OF
ENGINEER DISTRICT, NEW YORK
WASHINGTON, D. C.

DRAWN BY: R.A.F. | CHECKED BY: K.J.S.

CHIEF DRAFTSMAN: [illegible] 1/6/59
CHIEF ARCHITECT
SUBMITTED: [illegible] 1/6/59 — BURNS AND ROE, INC.
REVIEWED: [illegible] — ENGR. DIV. N. Y. DIST.
APPROVED AND RECOMMENDED: [illegible] — DISTRICT ENGINEER
APPROVED: [illegible] 1 MAY 1959 — CHIEF ENGINEERING DIV. MIL. CONSTR., O.C.E.
SATISFACTORY TO CHIEF OF STAFF, U. S. AIR FORCE
DATE 1 MAY 1959

UNITED STATES AIR FORCE
FD RADAR FACILITIES - FPS - 35/24
CONCRETE
ARCHITECTURAL
ELEVATIONS-DETAILS & ROOF PLANS
FPS- 24/24

SCALE AS SHOWN | SPEC. NO. 60-02-63-

DRAWING NUMBER 60-02-63

SHEET 3

REVIEWED BY SAFETY BRANCH [illegible] G-1

CONCRETE - W.O. 1911-05 DWG 4152-1

DISTRICT FILE NO. AW118-16-32 SHEET (8)

FILED: DRAWER No. G SEQUENCE No. 159

Attachment 1

Asbestos Laboratory Report

Reservoirs Environmental, Inc.

April 12, 2019

Subcontract Number: **NA**
Laboratory Report: **RES 432245-1**
Project # / P.O. # **B12936**
Project Description: **Mt. Umunhum Radar Tower**

Dan Leung
SCA Environmental, Inc.
320 Justin Drive
San Fransisco CA 94112

Dear Customer,

Reservoirs Environmental, Inc. is an analytical laboratory accredited for the analysis of Industrial Hygiene and Environmental matrices by the National Voluntary Laboratory Accreditation Program (NVLAP), Lab Code 101896-0 for Transmission Electron Microscopy (TEM) and Polarized Light Microscopy (PLM) analysis and the American Industrial Hygiene Association (AIHA), Lab ID 101533 - Accreditation Certificate #480 for Phase Contrast Microscopy (PCM) analysis. This laboratory is currently proficient in both Proficiency Testing and PAT programs respectively.

Reservoirs Environmental, Inc. has analyzed the following samples for asbestos content as per your request. The analysis has been completed in general accordance with the appropriate methodology as stated in the attached analysis table. The results have been submitted to your office.

RES 432245-1 is the job number assigned to this study. This report is considered highly confidential and the sole property of the customer. Reservoirs Environmental, Inc. will not discuss any part of this study with personnel other than those of the client. The results described in this report only apply to the samples analyzed. This report must not be used to claim endorsement of products or analytical results by NVLAP or any agency of the U.S. Government. This report shall not be reproduced except in full, without written approval from Reservoirs Environmental, Inc. Samples will be disposed of after sixty days unless longer storage is requested. If you have any questions about this report, please feel free to call 303-964-1986.

Sincerely,

Jeanne Spencer
President

RESERVOIRS ENVIRONMENTAL INC.

NVLAP Lab Code 101896-0

TABLE: PLM BULK ANALYSIS, PERCENTAGE COMPOSITION BY VOLUME

RES Job Number: **RES 432245-1**
Client: **SCA Environmental, Inc.**
Client Project Number / P.O.: **B12936**
Client Project Description: **Mt. Umunhum Radar Tower**
Date Samples Received: **April 05, 2019**
Method: **EPA 600/R-93/116 - Short Report, Bulk**
Turnaround: **Standard**
Date Samples Analyzed: **April 08, 2019 - April 12, 2019**

ND=None Detected
TR=Trace, <1% Visual Estimate
Trem/Act=Tremolite/Actinolite

Client Sample Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
EL-1-1	A	Green resinous wire wrap	5		**ND**	0	100
	B	Off white fibrous wire wrap w/ dark gray resinous material	95	**Chrysotile**	**45**	25	30
EL-2-1	A	White fibrous material	1		**ND**	100	0
	B	Dark gray resinous wire wrap	49		**ND**	0	100
	C	Off white wire wrap w/ dark gray resinous material	50		**ND**	80	20
EL-2-2	A	Tan fibrous wire wrap w/ black resinous material	10		**ND**	80	20
	B	Black resinous wire wrap	90		**ND**	0	100
EL-3-1	A	Light gray/red/green fibrous wire wrap	45		**ND**	95	5
	B	Clear resinous wire wrap	55		**ND**		100
EL-4-1	A	Gray fibrous material w/ yellow resinous material	100		**ND**	95	5
EL-4-2	A	Black fibrous material	100		**ND**	85	15
EL-5-1	A	Black fibrous material	100		**ND**	85	15
EL-5-2	A	Black fibrous tar	100	**Chrysotile**	**40**	0	60

TEM Analysis recommended for organically bound material (i.e. floor tile) if PLM results are <1%.
**Sample contains non-asbestiform serpentine aggregate as part of the matrix components.

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NVLAP Lab Code 101896-0

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Client Sample Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
EL-6-1	A	Pink fibrous resinous material	100		**ND**	65	35
EL-7-1	A	Black fibrous resinous material	100		**ND**	35	65
PAINT-8-1**	A	White/multi-colored paint	35		**ND**	0	100
	B	Gray granular material	65		**ND**	0	100
PAINT-8-2	A	White/multi-colored paint w/ green compound	100		**ND**	0	100
PAINT-8-3	A	White/multi-colored paint w/ green compound	100		**ND**	0	100
GASKET-9-1	A	Black resinous material	100		**ND**	0	100
WL-10-1	A	Green/multi-colored paint	TR		**ND**	0	100
	B	Tan compound	TR	**Chrysotile**	**4**	0	96
	C	Gray cinder block	40		**ND**	0	100
	D	Gray granular material	60		**ND**	0	100

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Client Sample Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
WL-10-2	A	Black/multi-colored paint	15		**ND**	0	100
	B	Gray cinder block	25		**ND**	0	100
	C	Tan gray plaster	60	**Chrysotile**	**TR**	0	100
				Point Count	**0.58**		
WL-10-3	A	White/multi-colored paint	15		**ND**	0	100
	B	Gray/red cinder block	85		**ND**	0	100
FLEX-11-1	A	Black resinous material w/ white fibrous material & gray paint	100		**ND**	50	50
FLEX-11-2	A	White paint w/ yellow resinous material	2		**ND**	0	100
	B	Black resinous material w/ white fibrous material	98		**ND**	50	50
CAULK-12-1	A	Green/gray paint	5		**ND**	0	100
	B	Off white resinous material	95		**ND**	10	90
CAULK-12-2	A	Off white-gray resinous material	100		**ND**	15	85

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CAULK-12-3	A	Green paint	5		**ND**	0	100
	B	Gray-off white resinous material	95		**ND**	15	85
DUST-13-1**	A	Off white compound	2	**Chrysotile**	**6**	0	94
	B	Off white compound	2		**ND**	4	96
	C	White multi-colored paint w/ multi-colored debris	10		**ND**	0	100
	D	Gray granular debris	86		**ND**	0	100
DUST-13-2**		Not Analyzed per Client Request.					
DUST-13-3**		Not Analyzed per Client Request.					
VAPBAR-14-1	A	White paint	1		**ND**	0	100
	B	Black multi-layered tar	35		**ND**	0	100
	C	Black multi-layered felt	64		**ND**	75	25

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Client Sample Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
VAPBAR-14-2	A	Black tar w/ white paint	10		**ND**	0	100
	B	Light gray granular material	15		**ND**	0	100
	C	Black felt	35		**ND**	80	20
	D	Gray plaster	40		**ND**	0	100
RF-15-1	A	Tan resinous material	5		**ND**	0	100
	B	Yellow resinous material	5		**ND**	0	100
	C	Green resinous material	10	**Chrysotile**	**5**	0	95
	D	Gray resinous material	30		**ND**	0	100
	E	Black fibrous tar	50	**Chrysotile**	**5**	0	95
RF-15-2		Not Analyzed per Client Request.					
RF-15-3		Not Analyzed per Client Request.					
RF-16-1	A	Off white tape w/ silver/gray resinous material	100		**ND**	90	10
RF-16-2	A	Off white tape w/ silver/gray resinous material	100		**ND**	80	20

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Client Sample Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
RFMAS-17-1	A	Gray/black fibrous tar	100	**Chrysotile**	**35**	0	65
RFMAS-17-2		Not Analyzed per Client Request.					
CAULK-18-1	A	Gray resinous material	50		**ND**	0	100
	B	Black fibrous tar	50	**Chrysotile**	**35**	0	65
CAULK-18-2		Not Analyzed per Client Request.					
CAULK-18-3		Not Analyzed per Client Request.					
CONC-19-1**	A	Off white/multi-colored granular resinous material	40		**ND**	0	100
	B	Gray granular material	60		**ND**	0	100
CONC-19-2**	A	Gray cementitious material	100		**ND**	0	100
CONC-19-3**	A	Gray cementitious material	100	**Chrysotile**	**TR**	0	100
				Point Count	**0.58**		

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Client Sample Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
STAIR-20-1	A	Dark gray plaster	15		**ND**	0	100
	B	White/gray paint/multi-colored paint w/ white resinous material	35		**ND**	0	100
	C	Gray granular material	50		**ND**	0	100
STAIR-20-2	A	White/gray/multi-colored paint	15		**ND**	0	100
	B	Gray granular material	85		**ND**	0	100
STAIR-20-3**	A	Gray granular material	40		**ND**	0	100
	B	Gray/gray paint	60		**ND**	0	100
WL-21-1	A	Brown cinder block	40		**ND**	0	100
	B	Gray granular material	60	**Chrysotile**	**TR**	0	100
				Point Count	**0.83**		
WL-21-2	A	Clear resinous material	3		**ND**	0	100
	B	Brown cinder block	25		**ND**	0	100
	C	Gray granular material	72		**ND**	0	100

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Client Sample Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
WL-21-3**	A	Gray granular material	25	**Chrysotile**	**TR**	0	100
				Point Count	**1.50**		
	B	Brown granular material	75		**ND**	0	100
CONC-22-1	A	Clear resinous material	5		**ND**	0	100
	B	Gray cementitious material	95		**ND**	0	100
CONC-22-2	A	Tan-gray cementitious material	35		**ND**	0	100
	B	Dark gray granular material w/ clear resinous material	65		**ND**	0	100
CONC-22-3**	A	Clear resinous material	2		**ND**	0	100
	B	Gray granular material	98		**ND**	0	100
PAINT-23-1	A	Clear resinous material	10		**ND**	0	100
	B	Off white granular material	90		**ND**	0	100
PAINT-23-2	A	Clear resinous material	25		**ND**	0	100
	B	Off white granular material	75		**ND**	0	100

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TR=Trace, <1% Visual Estimate
Trem/Act=Tremolite/Actinolite

Client Sample Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
PAINT-23-3	A	Clear resinous material	50		**ND**	0	100
	B	Off white granular material	50		**ND**	0	100

TEM Analysis recommended for organically bound material (i.e. floor tile) if PLM results are <1%.
**Sample contains non-asbestiform serpentine aggregate as part of the matrix components.

Anita Grigg
Analyst / Data QA

Due Date _____
Due Time: _____

RES 432245

Page 1 of 3

Reservoirs Environmental, Inc.

REI LAB

5801 Logan St. Denver, CO 80216 • Ph: 303 964-1986 • Fax 303-477-4275 • Toll Free :866 RESI-ENV

After Hours Cell Phone: 720-339-9228

SUBMITTED BY:		INVOICE TO: (IF DIFFERENT)		CONTACT INFORMATION:	
Company:	SCA Environmental, Inc.	Company:	SAME	Contact:	Dan Leung
Address:	320 Justin Drive	Address:		Phone:	
	San Fransisco CA 94112			Fax:	
				Cell/pager:	
Project Number and/or P.O. #:	B12936			Final Data Deliverable Email Address:	
Project Description/Location:	Mt. Umunhum Radar Tower				

ASBESTOS LABORATORY HOURS: Weekdays: 7am - 7pm & Sat. 8am - 5pm

PLM / PCM / TEM ___ RUSH (Same Day) ___ PRIORITY (Next Day) x STANDARD (3-5 Day)
(Rush PCM = 2hr, TEM = 6hr.)

CHEMISTRY LABORATORY HOURS: Weekdays: 8am - 5pm

Metal(s) / Dust** ___ RUSH ___ 24 hr. ___3-5 Day
RCRA 8 / Metals & Welding Fume Scan / TCLP** ___RUSH (3 Day)___5 Day ___10 Day
Organics ___ 24 hr. ___ 3 day ___5 Day

Prior notification is required for RUSH turnarounds.

MICROBIOLOGY LABORATORY HOURS: Weekdays: 9am - 6pm

E.coli and/or Coliforms* ___ 24-48 Hour Other: _____
Pathogens* ___ 24-48 Hour
Microbial Growth* ___ 5-10 Day
Legionella ___ 10 Day
Mold ___ RUSH ___24 Hr ___48 Hr ___3 Day ___5 Day

TAT dependent on speed of microbial growth.

Turnaround times establish a laboratory priority, subject to laboratory volume and are not guaranteed. Additional fees apply for afterhours, weekends and holidays.

Special Instructions: **3 DayStandard**

REQUESTED ANALYSIS

VALID MATRIX CODES

Air = A	Bulk = B
Dust = D	Paint = P
Soil = S	Wipe = W
Swab = SW	F = Food
Drinking Water = DW	Waste Water = WW
O = Other	

ASTM E1792 approved wipe media only

Client sample ID number (Sample ID's must be unique)	PLM - Short report	TEM - AHERA, Level II, 7402, ISO, +/- (Air, Bulk or Dust), Quant, Semi-Quant, Micro-vac, ISO-indirect Preps	PCM - 7400A, 7400B, OSHA	DUST - Total, Respirable	METALS - Analyte(s) RCRA 8, TCLP, Welding Fume, Metals Scan, pH	ORGANICS - METH, TSS	MICROBIOLOGY: Pathogens: Aerobic Plate Count, Salmonella, E.coli O157:H7, Listeria, S.aureus, Camphlobacter: +/- or Quantification	MICROBIOLOGY: E.coli and/or Coliforms: +/- or Quantification State Water (Please Circle One) Yes / No	MICROBIOLOGY: Microbial Growth: Aerobic Plate Count ID, Y & M or Bacteria, Fungal, +/- or Quantification	MICROBIOLOGY: Legionella: +/- or Quantification	MICROBIOLOGY: Other: Bioburden, LAL or Environmental	MICROBIOLOGY: Mold: Spore Trap or Bulk: +/-, Identification, Quantification, Viable or Non-Viable	SAMPLER'S INITIALS OR OTHER NOTES:	Sample Volume (L) / Area	Matrix Code	# Containers	Date Collected mm/dd/yy	Time Collected hh/mm a/p	LAB NOTES: / EM Number (Laboratory Use Only)
1 EL-1-1	X														B			
2 EL-2-1	X														B			
3 EL-2-2	X														B			
4 EL-3-1	X														B			
5 EL-4-1	X														B			
6 EL-4-2	X														B			
7 EL-5-1	X														B			
8 EL-5-2	X														B			
9 EL-6-1	X														B			
10 EL-7-1	X														B			

Number of samples received: 52 (Additional samples shall be listed on attached long form.)

NOTE: REI will analyze incoming samples based upon information received and will not be responsible for errors or omissions in calculations resulting from the inaccuracy of original data. By signing client/company representative agrees that submission of the following samples for requested analysis as indicated on this Chain of Custody shall constitute an analytical services agreement with payment terms of NET 30 days, failure to comply with payment terms may result in a 1.5% monthly interest surcharge.

Relinquished By: Mailed Date/Time:

Laboratory Use Only
Received By: Date/Time: 4/6/19 9:35A Carrier: Hand / FedEx / UPS / USPS / Drop Box / Courier

Sample Condition: On Ice Yes / No Sealed Yes / No Intact Yes / No
Temp. (F°) _____

Data Entry QA:	Contact	Phone	Email	Fax	Date	Time	Initials	Contact	Phone	Email	Fax	Date	Time	Initials
	Contact	Phone	Email	Fax	Date	Time	Initials	Contact	Phone	Email	Fax	Date	Time	Initials

REI LAB **Reservoirs Environmental, Inc.**
5801 Logan St. Denver, CO 80216 • Ph: 303 964-1986 • Fax 303-477-4275 • Toll Free :866 RESI-ENV

RES #: 432245-1

Submitted by: **SCA Environmental, Inc.**

Client sample ID number (Sample ID's must be unique)		REQUESTED ANALYSIS: PLM - Short report, Long report, Point Count	TEM - AHERA, Level II, 7402, ISO, +/-, Quant, Semi-quant, Micro-vac, ISO-Indirect Preps	PCM - 7400A, 7400B, OSHA	DUST - Total, Respirable	METALS - Analyte(s) _____ RCRA 8, TCLP, Welding Fume, Metals Scan	ORGANICS - METH, TSS	MICROBIOLOGY: Pathogens: Aerobic Plate Count, Salmonella, E.coli O157:H7, Listeria, S.aureus, Campylobacter: +/- or Quantification	MICROBIOLOGY: E.coli and/or Coliforms: +/- or Quantification State Water (Please Circle One) Yes / No	MICROBIOLOGY: Microbial Growth: Aerobic Plate Count ID, Y & M or Bacteria, Fungal, +/- or Quantification	MICROBIOLOGY: Legionella: +/- or Quantification	MICROBIOLOGY: Other: Bioburden, LAL or Environmental	MICROBIOLOGY: Mold: Spore Trap or Bulk: +/-, Identification, Quantification, Viable or Non-Viable	SAMPLER'S INITIALS OR OTHER NOTES:	Sample Volume (L) / Area	Matrix Code	# Containers	Date Collected mm/dd/yy	Time Collected hh/mm a/p	EM Number (Laboratory Use Only)
11	PAINT-8-1	X														B			
12	PAINT-8-2	X														B			
13	PAINT-8-3	X														B			
14	GASKET-9-1	X														B			
15	WL-10-1	X														B			
16	WL-10-2	X														B			
17	WL-10-3	X														B			
18	FLEX-11-1	X														B			
19	FLEX-11-2	X														B			
20	CAULK-12-1	X														B			
21	CAULK-12-2	X														B			
22	CAULK-12-3	X														B			
23	DUST-13-1	X														B			
24	DUST-13-2	X														B			
25	DUST-13-3	X														B			
26	VAPBAR-14-1	X														B			
27	VAPBAR-14-2	X														B			
28	RF-15-1	X														B			
29	RF-15-2	X														B			
30	RF-15-3	X														B			
31	RF-16-1	X														B			
32	RF-16-2	X														B			
33	RFMAS-17-1	X														B			
34	RFMAS-17-2	X														B			
35	CAULK-18-1	X														B			
36	CAULK-18-2	X														B			
37	CAULK-18-3	X														B			
38	CONC-19-1	X														B			
39	CONC-19-2	X														B			
40	CONC-19-3	X														B			
41	STAIR-20-1	X														B			

VALID MATRIX CODES

Air = A	Bulk = B
Dust = D	Paint = P
Soil = S	Wipe = W
Swab = SW	F = Food
Drinking Water = DW	Waste Water = WW
O = Other	

ASTM E1792 approved wipe media only

LAB NOTES:

1-2017_version 1

REI LAB **Reservoirs Environmental, Inc.**
5801 Logan St. Denver, CO 80216 • Ph: 303 964-1986 • Fax 303-477-4275 • Toll Free :866 RESI-ENV

RES #: 432245-1

Page 3 of 3

Submitted by: **SCA Environmental, Inc.**

REQUESTED ANALYSIS

VALID MATRIX CODES

Air = A	Bulk = B
Dust = D	Paint = P
Soil = S	Wipe = W
Swab = SW	F = Food
Drinking Water = DW	Waste Water = WW
O = Other	

ASTM E1792 approved wipe media only

LAB NOTES:

Client sample ID number (Sample ID's must be unique)	PLM - Short report, Long report, Point Count	TEM - AHERA, Level II, 7402, ISO, +/-, Quant, Semi-quant, Micro-vac, ISO-Indirect Preps	PCM - 7400A, 7400B, OSHA	DUST - Total, Respirable	METALS - Analyte(s) _____ RCRA 8, TCLP, Welding Fume, Metals Scan	ORGANICS - METH, TSS	MICROBIOLOGY: Pathogens: Aerobic Plate Count, Salmonella, E.coli O157:H7, Listeria, S.aureus, Camphlobacter: +/- or Quantification	MICROBIOLOGY: E.coli and/or Coliforms: +/- or Quantification Viables State Water (Please Circle One) Yes / No	MICROBIOLOGY: Microbial Growth: Aerobic Plate Count ID, Y & M or Bacteria, Fungal, +/- or Quantification	MICROBIOLOGY: Legionella: +/- or Quantification	MICROBIOLOGY: Other: Bioburden, LAL or Environmental	MICROBIOLOGY: Mold: Spore Trap or Bulk: +/-, Identification, Quantification, Viable or Non-Viable	SAMPLER'S INITIALS OR OTHER NOTES:	Sample Volume (L) / Area	Matrix Code	# Containers	Date Collected mm/dd/yy	Time Collected hh/mm a/p	EM Number (Laboratory Use Only)
42 STAIR-20-2	X														B				
43 STAIR-20-3	X														B				
44 WL-21-1	X														B				
45 WL-21-2	X														B				
46 WL-21-3	X														B				
47 CONC-22-1	X														B				
48 CONC-22-2	X														B				
49 CONC-22-3	X														B				
50 PAINT-23-1	X														B				
51 PAINT-23-2	X														B				
52 PAINT-23-3	X														B				
53																			
54																			
55																			
56																			
57																			
58																			
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64																			
65																			
66																			
67																			
68																			
69																			
70																			
71																			
72																			

CHAIN OF CUSTODY FORM

Bill to: SCA

Email report/COC/Invoice to:
DAN LEUNG (PROJ MGR)
Dan Leung (TECH)
labreports99@gmail.com (ACCT)

EMAIL HEADING: (Project #) - (Project Manager Initials) - (Site Name/Address) - (Date MMDD)
WSE MT UMUNHUM RADAR TWR SVY B12936 DL MT UMUNHUM RADAR TOWER 4/3

LAB REI

COURIER
LAB REP NOTIFIED: Notification DATE/TIME:
AIRBILL/FLIGHT NO.: Shipper REFERENCE I.D.
EST ARRIVAL DATE: EST. ARRIVAL TIME:

Method Reference 7400 PCM AHERA TEM (≤0.005 s/cc AnaSen) CARB-AHERA TEM 0.001 s/cc Ana Sensitivity
(PLM (asbestos)) Flame AA (Lead) ICP/MS (Lead)
Sample Media 25 37 mm 0.45 0.8 micron MCEF (Bulk) Water Wipe

RESULTS DUE: 3 DAYS AM / PM

CHAIN OF CUSTODY DATA:
Sending Info 52 samples submitted by DL on 4/4 at 4:00 P
Received by Lab: 52 samples received by DD on 4/5 at 9:35A
Received by Analyst: _____ samples received by _____ on _____ at _____

SAMPLE ID	LITERS	~~Results~~ SAMPLE ID	Ins/Blanks/Outs
EL-1-1		STAIR-20-1,2,3	
EL-2-1,2		WL-21-1,2,3	
EL-3-1		CONC-22-1,23	
EL-4-1,2		PAINT-23-1,2,3	
EL-5-1,2			
EL-6-1			
EL-7-1			
PAINT-8-1,2,3			
GASKET-9-1			
WL-10-1,2,3			
FLEX-11-1,2			
CAULK-12-1,2,3			
DUST-13-1,2,3			
VAPBAR-14-1,2			
RF-15-1,2,3			
RF-16-1,2			
RFMAS-17-1,2	0 LITERS		BLANK
CAULK-18-1,2,3	0 LITERS		BLANK
CONC-19-1,2,3	0 LITERS		BLANK

INSTRUCTIONS TO LAB:
1) PLM CH (1200 PLS) ANY SAMPLE W/RESULTS < 1%.

INSTRUCTIONS TO LAB (delete items not applicable AND circle items applicable):
1. Pickup requested:
Contact: _____ Time of Call: _____
2. Call contact to acknowledge receipt of samples.
3. Analyze samples by PCM only.
4. Analyze inside samples by PCM first; if any sample >0.01 f/cc, contact project manager.
5. If all samples are <0.01 f/cc, proceed with items 6, 7 or 8, as noted.
6. Analyze inside samples only; stop if Avg >70 str/mm^2, contact PM before analyzing outsides or blanks.
7. Analyze all samples, including outside samples and blanks.
8. Do NOT analyze outside or blank samples.
9. Analyze by TEM only the inside air sample with the highest PCM result.
(10.) Serial analysis; stop at first positive (>1%); first trace (<0.1%);except sheetrock and plaster samples.
11. Analyze all bulk samples, unless otherwise indicated.
12. PCB: 1 PPM detection limit required. Authorized to perform Florisil cleanup and Soxhlet extraction to meet the detection limit.
13. For AHERA TEM, only analyze for REGULATED ASBESTOS.
14. _____

Report Number:

Invoice Number:

Supplies /Equipment	Qty
Hi-Vol (3040)	
Lo-Vol (3020)	
TEM / Pb cassettes (3520)	
PCM cassettes (3500)	
Bulk sampling supply (3710)	52

ver 2015

Attachment 2

Lead Laboratory Report

REI LAB **Reservoirs Environmental, Inc.**

April 9, 2019

Laboratory Code:	**RES**
Subcontract Number:	**NA**
Laboratory Report:	**RES 432224-1**
Project # / PO #:	**B12936**
Project Description:	**Mt. Umunhum Radar Tower**

Dan Leung
SCA Environmental, Inc.
320 Justin Drive
San Fransisco CA 94112

Dear Customer,

Reservoirs Environmental, Inc. is an analytical laboratory accredited for the analysis of Industrial Hygiene and Environmental matrices by the American Industrial Hygiene Association, Lab ID 101533 - Accreditation Certificate #480. The laboratory is currently proficient in both IHPAT & ELPAT programs respectively.

Reservoirs has analyzed the following sample(s) using Atomic Absorption Spectroscopy (AAS) / Inductively Coupled Plasma - Mass Spectrometry (ICP-MS) per your request. Reported sample results were not blank corrected. The analysis has been completed in general accordance with the appropriate methodology as stated in the analysis table. Results have been sent to your office.

RES 432224-1 is the job number assigned to this study. This report is considered highly confidential and the sole property of the customer. Reservoirs Environmental, Inc. will not discuss any part of this study with personnel other than those authorized by the client. The results described in this report only apply to the samples analyzed. This report shall not be reproduced except in full, without written approval from Reservoirs Environmental, Inc. Samples will be disposed of after sixty days unless longer storage is requested. If you should have any questions about this report, please feel free to call me at 303-964-1986.

Sincerely,

Jeanne Spencer
President

RESERVOIRS ENVIRONMENTAL, INC.

5801 Logan St., Suite 100
Denver CO 80216

TABLE ANALYSIS: LEAD IN BULK

RES Job Number:	**RES 432224-1**
Client:	**SCA Environmental, Inc.**
Client Project Number / P.O.:	**B12936**
Client Project Description:	**Mt. Umunhum Radar Tower**
Date Samples Received:	**April 5, 2019**
Analysis Type:	**REI CHEMISTRY SOP / USEPA SW846 3050B/6020A**
Turnaround:	**Standard**
Date Samples Analyzed:	**April 9, 2019**

Client ID Number	Reporting Limit (mg/kg)	LEAD CONCENTRATION (mg/kg)
OW-1	0.59	254
GR-2	0.66	2,027
YW-3	0.65	203,819
GY-4	0.63	5,526

*** Unless otherwise noted, all quality control samples are performed within specifications established by the laboratory.**

David E. Monagle

Analyst / Data QA:_____

RES 432224

Page 1 of _____

Due Date _____
Due Time: _____

REI LAB Reservoirs Environmental, Inc.

5801 Logan St. Denver, CO 80216 • Ph: 303 964-1986 • Fax 303-477-4275 • Toll Free :866 RESI-ENV

After Hours Cell Phone: 720-339-9228

SUBMITTED BY:	INVOICE TO: (IF DIFFERENT)	CONTACT INFORMATION:
Company: SCA Environmental, Inc.	Company: SAME	Contact: Dan Leung
Address: 320 Justin Drive	Address:	Phone:
San Fransisco CA 94112		Fax:
		Cell/pager:
Project Number and/or P.O. #: B12936		Final Data Deliverable Email Address:
Project Description/Location: Mt. Umunhum Radar Tower		

ASBESTOS LABORATORY HOURS: Weekdays: 7am - 7pm & Sat. 8am - 5pm

PLM / PCM / TEM ___ RUSH (Same Day) ___ PRIORITY (Next Day) ___ STANDARD (3-5 Day)
(Rush PCM = 2hr, TEM = 6hr.)

CHEMISTRY LABORATORY HOURS: Weekdays: 8am - 5pm

Metal(s) / Dust** ___ RUSH ___ 24 hr. ___3-5 Day
RCRA 8 / Metals & Welding Fume Scan / TCLP** _x_RUSH (3 Day)__5 Day __10 Day
Organics ___ 24 hr. ___ 3 day ___5 Day

Prior notification is required for RUSH turnarounds.

MICROBIOLOGY LABORATORY HOURS: Weekdays: 9am - 6pm

E.coli and/or Coliforms* ___ 24-48 Hour Other: _____
Pathogens* ___ 24-48 Hour
Microbial Growth* ___ 5-10 Day
Legionella ___ 10 Day
Mold ___ RUSH ___24 Hr ___48 Hr ___3 Day ___5 Day

TAT dependent on speed of microbial growth.

Turnaround times establish a laboratory priority, subject to laboratory volume and are not guaranteed. Additional fees apply for afterhours, weekends and holidays.

Special Instructions: **3 Day Standard**

VALID MATRIX CODES

Air = A	Bulk = B
Dust = D	Paint = P
Soil = S	Wipe = W
Swab = SW	F = Food
Drinking Water = DW	Waste Water = WW
O = Other	

ASTM E1792 approved wipe media only

LAB NOTES:

REQUESTED ANALYSIS

Client sample ID number (Sample ID's must be unique)	PLM - Short report, Point Count, Long report, Qualitative	TEM - AHERA, Level II, 7402, ISO, +/- (Air, Bulk or Dust), Quant, Semi-Quant, Micro-vac, ISO-Indirect Preps	PCM - 7400A, 7400B, OSHA	DUST - Total, Respirable	METALS - Analyte(s) Pb by ICP RCRA 8, TCLP, Welding Fume, Metals Scan, pH	ORGANICS - METH, TSS	MICROBIOLOGY: Pathogens: Aerobic Plate Count, Salmonella, E.coli O157:H7, Listeria, S.aureus, Camphlobacter: +/- or Quantification	MICROBIOLOGY: E.coli and/or Coliforms: +/- or Quantification Yes / No State Water (Please Circle One)	MICROBIOLOGY: Microbial Growth: Aerobic Plate Count ID, Y & M or Bacteria, Fungal, +/- or Quantification	MICROBIOLOGY: Legionella: +/- or Quantification	MICROBIOLOGY: Other: Bioburden, LAL or Environmental	MICROBIOLOGY: Mold: Spore Trap or Bulk: +/-, Identification, Quantification, Viable or Non-Viable	SAMPLER'S INITIALS OR OTHER NOTES:	Sample Volume (L) / Area	Matrix Code	# Containers	Date Collected mm/dd/yy	Time Collected hh/mm a/p	EM Number (Laboratory Use Only)
1 OW-1					x										B			
2 GR-2					x										B			
3 YW-3					x										B			
4 GY-4					x										B			
5																		
6																		
7																		
8																		
9																		
10																		

Number of samples received: 4 (Additional samples shall be listed on attached long form.)

NOTE: REI will analyze incoming samples based upon information received and will not be responsible for errors or omissions in calculations resulting from the inaccuracy of original data. By signing client/company representative agrees that submission of the following samples for requested analysis as indicated on this Chain of Custody shall constitute an analytical services agreement with payment terms of NET 30 days, failure to comply with payment terms may result in a 1.5% monthly interest surcharge.

Relinquished By: Date/Time:

Laboratory Use Only
Received By: Date/Time: 4/5/19 1509:30A Carrier: Hand / FedEx / UPS / USPS / Drop Box / Courier

Sample Condition: On Ice Yes / No (Yes) Sealed Yes / No (Yes) Intact Yes / No
Temp. (F°) _____

Data Entry QA:	Contact	Phone	Email	Fax	Date	Time	Initials	Contact	Phone	Email	Fax	Date	Time	Initials
	Contact	Phone	Email	Fax	Date	Time	Initials	Contact	Phone	Email	Fax	Date	Time	Initials

RES 432224

CHAIN OF CUSTODY FORM

Bill to: SCA

Email report/COC/Invoice to:
DAN LEUNG (PROJ MGR)
Dan Leung (TECH)
labreports99@gmail.com (ACCT)

EMAIL HEADING: (Project #) - (Project Manager Initials) - (Site Name/Address) - (Date MMDD)
WSE M1 UMUNHUM RADAR TWR SVY B12936 DL M1 UMUNHUM RADAR TOWER 4/3

LAB REI

INSTRUCTIONS TO LAB:

COURIER
LAB REP NOTIFIED:
AIRBILL/FLIGHT NO.:
EST ARRIVAL DATE:
Notification DATE/TIME:
Shipper REFERENCE I.D.
EST. ARRIVAL TIME:

Method Reference 7400 PCM | AHERA TEM (≤0.005 s/cc AnaSen) | CARB-AHERA TEM 0.001 s/cc Ana Sensitivity
PLM (asbestos) | Flame AA (Lead) | (ICP/MS (Lead))

Sample Media 25 37 mm 0.45 0.8 micron | MCEF (Bulk) Water Wipe

RESULTS DUE: 3 DAYS AM / PM

CHAIN OF CUSTODY DATA:
Sending Info: 4 samples submitted by DL on 4/4 at 4:00 P
Received by Lab: _____ samples received by _____ on _____ at _____
Received by Analyst: _____ samples received by _____ on _____ at _____

SAMPLE ID	LITERS	Results	Ins/Blanks/Outs
OW-1			REPORT RESULTS IN PPM
GR-2			
YW-3			
GY-4			
	0 LITERS		BLANK
	0 LITERS		BLANK
	0 LITERS		BLANK

INSTRUCTIONS TO LAB (delete items not applicable AND circle items applicable):
1. Pickup requested:
Contact: _____ Time of Call: _____
2. **Call contact to acknowledge receipt of samples.**
3. **Analyze samples by PCM only.**
4. Analyze inside samples by PCM first; if any sample >0.01 f/cc, contact project manager.
5. **If all samples are <0.01 f/cc, proceed with items 6, 7 or 8, as noted.**
6. Analyze inside samples only; stop if Avg >70 str/mm^2, contact PM before analyzing outsides or blanks.
7. **Analyze all samples, including outside samples and blanks.**
8. **Do NOT analyze outside or blank samples.**
9. **Analyze by TEM only the inside air sample with the highest PCM result.**
10. Serial analysis; stop at first positive (>1%); first trace (<0.1%);except sheetrock and plaster samples.
11. **Analyze all bulk samples, unless otherwise indicated.**
12. **PCB: 1 PPM detection limit required. Authorized to perform Florisil cleanup and Soxhlet extraction to meet the detection limit.**
13. **For AHERA TEM, only analyze for REGULATED ASBESTOS.**
14. _____

Report Number:

Invoice Number:

Supplies /Equipment	Qty
Hi-Vol (3040)	
Lo-Vol (3020)	
TEM / Pb cassettes (3520)	
PCM cassettes (3500)	
Bulk sampling supply (3710)	4

ver 2015

Attachment 3

PCB Laboratory Report

McCampbell Analytical, Inc.

"When Quality Counts"

Analytical Report

WorkOrder:	1904245
Report Created for:	SCA Environmental, Inc. 1 Lakeside Drive, Suite 215 Oakland, CA 94612
Project Contact:	Dan Leung
Project P.O.:	
Project:	B12936; WJE MT UMUNHUM RADAR TOWER SVY
Project Received:	04/04/2019

Analytical Report reviewed & approved for release on 04/10/2019 by:

Yen Cao

Project Manager

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Glossary of Terms & Qualifier Definitions

Client: SCA Environmental, Inc.
Project: B12936; WJE MT UMUNHUM RADAR TOWER SVY
WorkOrder: 1904245

Glossary Abbreviation

%D	Serial Dilution Percent Difference
95% Interval	95% Confident Interval
DF	Dilution Factor
DI WET	(DISTLC) Waste Extraction Test using DI water
DISS	Dissolved (direct analysis of 0.45 µm filtered and acidified water sample)
DLT	Dilution Test (Serial Dilution)
DUP	Duplicate
EDL	Estimated Detection Limit
ERS	External reference sample. Second source calibration verification.
ITEF	International Toxicity Equivalence Factor
LCS	Laboratory Control Sample
MB	Method Blank
MB % Rec	% Recovery of Surrogate in Method Blank, if applicable
MDL	Method Detection Limit
ML	Minimum Level of Quantitation
MS	Matrix Spike
MSD	Matrix Spike Duplicate
N/A	Not Applicable
ND	Not detected at or above the indicated MDL or RL
NR	Data Not Reported due to matrix interference or insufficient sample amount.
PDS	Post Digestion Spike
PDSD	Post Digestion Spike Duplicate
PF	Prep Factor
RD	Relative Difference
RL	Reporting Limit (The RL is the lowest calibration standard in a multipoint calibration.)
RPD	Relative Percent Deviation
RRT	Relative Retention Time
SPK Val	Spike Value
SPKRef Val	Spike Reference Value
SPLP	Synthetic Precipitation Leachate Procedure
ST	Sorbent Tube
TCLP	Toxicity Characteristic Leachate Procedure
TEQ	Toxicity Equivalents
TZA	TimeZone Net Adjustment for sample collected outside of MAI's UTC.
WET (STLC)	Waste Extraction Test (Soluble Threshold Limit Concentration)

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
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Glossary of Terms & Qualifier Definitions

Client: SCA Environmental, Inc.
Project: B12936; WJE MT UMUNHUM RADAR TOWER SVY
WorkOrder: 1904245

Analytical Qualifiers

A	The reported value is determined using a "single point" calibration by GC-ECD as allowed by the method.
a4	Reporting limits raised due to the sample's matrix prohibiting a full volume extraction.
h4	Sulfuric acid permanganate (EPA 3665) cleanup.

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Analytical Report

Client:	SCA Environmental, Inc.	**WorkOrder:**	1904245
Date Received:	4/4/19 14:25	**Extraction Method:**	SW3540C/3630C
Date Prepared:	4/4/19	**Analytical Method:**	SW8082
Project:	B12936; WJE MT UMUNHUM RADAR TOWER SVY	**Unit:**	mg/kg

Polychlorinated Biphenyls (PCBs) Aroclors w/ Soxhlet Extraction and Silica Gel Clean-up

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
CAULK- 12	**1904245-001A**	**Solid**	**04/03/2019**	**GC23 04081918.d**	**175749**

Analytes	Result	Qualifiers	RL	DF	Date Analyzed
Aroclor1016	ND		0.50	1	04/08/2019 13:59
Aroclor1221	ND		0.50	1	04/08/2019 13:59
Aroclor1232	ND		0.50	1	04/08/2019 13:59
Aroclor1242	ND		0.50	1	04/08/2019 13:59
Aroclor1248	ND		0.50	1	04/08/2019 13:59
Aroclor1254	**1.3**	A	0.50	1	04/08/2019 13:59
Aroclor1260	ND		0.50	1	04/08/2019 13:59
PCBs, total	**1.3**		0.50	1	04/08/2019 13:59

Surrogates	REC (%)	Limits	
Decachlorobiphenyl	94	70-130	04/08/2019 13:59

Analyst(s): LT Analytical Comments: a4,h4

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
CAULK- 18	**1904245-002A**	**Solid**	**04/03/2019**	**GC23 04081919.d**	**175749**

Analytes	Result	RL	DF	Date Analyzed
Aroclor1016	ND	0.50	1	04/08/2019 14:14
Aroclor1221	ND	0.50	1	04/08/2019 14:14
Aroclor1232	ND	0.50	1	04/08/2019 14:14
Aroclor1242	ND	0.50	1	04/08/2019 14:14
Aroclor1248	ND	0.50	1	04/08/2019 14:14
Aroclor1254	ND	0.50	1	04/08/2019 14:14
Aroclor1260	ND	0.50	1	04/08/2019 14:14
PCBs, total	ND	0.50	1	04/08/2019 14:14

Surrogates	REC (%)	Limits	
Decachlorobiphenyl	98	70-130	04/08/2019 14:14

Analyst(s): LT Analytical Comments: a4,h4

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Quality Control Report

Client:	SCA Environmental, Inc.	**WorkOrder:**	1904245
Date Prepared:	4/4/19	**BatchID:**	175749
Date Analyzed:	4/4/19 - 4/5/19	**Extraction Method:**	SW3540C/3630C
Instrument:	GC23	**Analytical Method:**	SW8082
Matrix:	Solid	**Unit:**	mg/kg
Project:	B12936; WJE MT UMUNHUM RADAR TOWER SVY	**Sample ID:**	MB/LCS/LCSD-175749

QC Summary for SW8082

Analyte	MB Result	MDL	RL	SPK Val	MB SS %REC	MB SS Limits
Aroclor1016	ND	0.050	0.050	-	-	-
Aroclor1221	ND	0.050	0.050	-	-	-
Aroclor1232	ND	0.050	0.050	-	-	-
Aroclor1242	ND	0.050	0.050	-	-	-
Aroclor1248	ND	0.050	0.050	-	-	-
Aroclor1254	ND	0.050	0.050	-	-	-
Aroclor1260	ND	0.050	0.050	-	-	-
PCBs, total	ND	N/A	0.050	-	-	-
Surrogate Recovery						
Decachlorobiphenyl	0.045			0.050	91	70-130

Analyte	LCS Result	LCSD Result	SPK Val	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Limit
Aroclor1016	0.12	0.11	0.15	78	76	70-130	2.67	20
Aroclor1260	0.12	0.13	0.15	81	89	70-130	9.40	20
Surrogate Recovery								
Decachlorobiphenyl	0.051	0.053	0.050	102	105	70-130	3.43	20

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Pittsburg, CA 94565-1701
(925) 252-9262

CHAIN-OF-CUSTODY RECORD

WorkOrder: 1904245 **ClientCode: SCAO**

☐ WaterTrax ☐ WriteOn ☐ EDF ☐ Excel ▣ EQuIS ☑ Email ☐ HardCopy ☐ ThirdParty ☐ J-flag
▣ Detection Summary ▣ Dry-Weight

Report to:
Dan Leung
SCA Environmental, Inc.
1 Lakeside Drive, Suite 215
Oakland, CA 94612
415-378-4188 FAX: (510) 839- 6200

Email: dleung@sca-enviro.com; labreports99@gm
cc/3rd Party:
PO:
Project: B12936; WJE MT UMUNHUM RADAR TOWER SVY

Bill to:
Accounts Payable
SCA Environmental, Inc.
1 Lakeside Drive, Suite 215
Oakland, CA 94612
pgervasio@scaehs.com

Requested TAT: **10 days;**

Date Received: **04/04/2019**
Date Logged: **04/04/2019**

Lab ID	Client ID	Matrix	Collection Date	Hold	Requested Tests (See legend below) 1	2	3	4	5	6	7	8	9	10	11	12
1904245-001	CAULK- 12	Solid	4/3/2019 00:00	☐	A											
1904245-002	CAULK- 18	Solid	4/3/2019 00:00	☐	A											

Test Legend:

1	8082_Soxhlet_SG_Solid	2		3		4	
5		6		7		8	
9		10		11		12	

Project Manager: Angela Rydelius

Prepared by: Tina Perez

Comments:

NOTE: Soil samples are discarded 60 days after results are reported unless other arrangements are made (Water samples are 30 days).
Hazardous samples will be returned to client or disposed of at client expense.

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WORK ORDER SUMMARY

Client Name: SCA ENVIRONMENTAL, INC. **Project:** B12936; WJE MT UMUNHUM RADAR TOWER SVY **Work Order:** 1904245
Client Contact: Dan Leung **QC Level:** LEVEL 2
Contact's Email: dleung@sca-enviro.com; labreports99@gmail.com **Comments:** **Date Logged:** 4/4/2019

☐ WaterTrax ☐ WriteOn ☐ EDF ☐ Excel ☐ EQuIS ☑ Email ☐ HardCopy ☐ ThirdParty ☐ J-flag

Lab ID	Client ID	Matrix	Test Name	Containers /Composites	Bottle & Preservative	De-chlorinated	Collection Date & Time	TAT	Sediment Content	Hold	SubOut
1904245-001A	CAULK- 12	Solid	SW8082 (PCBs w/ Soxhlet Extraction & SG CU)	1	100ml White Cap	☐	4/3/2019	5 days		☐	
1904245-002A	CAULK- 18	Solid	SW8082 (PCBs w/ Soxhlet Extraction & SG CU)	1	100ml White Cap	☐	4/3/2019	5 days		☐	

NOTES: - STLC and TCLP extractions require 2 days to complete; therefore, all TATs begin after the extraction is completed (i.e., One-day TAT yields results in 3 days from sample submission).

- MAI assumes that all material present in the provided sampling container is considered part of the sample - MAI does not exclude any material from the sample prior to sample preparation unless requested in writing by the client.

1904245

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CHAIN OF CUSTODY RECORD

TURN AROUND TIME: RUSH ☐ 1 DAY ☐ 2 DAY ☐ 3 DAY ☐ 5 DAY ☒

GeoTracker EDF ☐ PDF ☒ EDD ☐ Write On (DW) ☐ EQuIS ☐ 10 DAY ☐

Effluent Sample Requiring "J" flag ☐ **UST Clean Up Fund Project** ☐ ; **Claim #**_____

Report To: Dan Leung **Bill To:** SCA Environmental, Inc.

Company: SCA Environmental, Inc.

1 Lakeside Drive, #215 Oakland, CA 94612 labreports99@gmail.com

Tele: (415) 867-9544 **E-Mail:** dleung@sca-enviro.com

Project #: B12936 **Project Name:** WSE MT UMUNHUM RADAR TOWER SVY

Project Location: MT UMUNHUM RADAR **Purchase Order#**

Sampler Signature: Dan Leung TWR

SAMPLE ID	Location/ Field Point Name	SAMPLING Date	SAMPLING Time	# Containers	MATRIX: Ground Water	Waste Water	Drinking Water	Sea Water	Soil	Air	Sludge	Other	METHOD PRESERVED: HCL	HNO_3	Other	Analysis Request: BTEX & TPH as Gas (8021/ 8015) MTBE	TPH as Diesel (8015)	Total Petroleum Oil & Grease (1664 / 5520 E/B&F)	Total Petroleum Hydrocarbons (418.1)	EPA 505/ 608 / 8081 (Cl Pesticides)	EPA 608 / 8082 PCB's ; Aroclors only	EPA 507 / 8141 (NP Pesticides)	EPA 515 / 8151 (Acidic Cl Herbicides)	EPA 524.2 / 624 / 8260 (VOCs)	EPA 525.2 / 625 / 8270 (SVOCs)	EPA 8270 SIM / 8310 (PAHs / PNAs)	CAM 17 Metals (200.8 / 6020)***	LUFT 5 Metals (200.8 / 6020)***	Metals (200.8 / 6020)***	Lab to Filter sample for Dissolved metals analysis	PCB
CAULK - 12		4/3		1								X																			X
CAULK - 18		4/3		1								X																			X

**MAI clients MUST disclose any dangerous chemicals known to be present in their submitted samples in concentrations that may cause immediate harm or serious future health endangerment as a result of brief, gloved, open air, sample handling by MAI staff. Non-disclosure incurs an immediate $250 surcharge and the client is subject to full legal liability for harm suffered. Thank you for your understanding and for allowing us to work safely.

*** If metals are requested for water samples and the water type is not specified on the chain of custody, then MAI will default to metals by E200.8.

Relinquished By:	Date:	Time:	Received By:
Dan Leung	4/4	2:25 P	
Relinquished By:	Date:	Time:	Received By:
Relinquished By:	Date:	Time:	Received By:

ICE/t°_____
GOOD CONDITION_____
HEAD SPACE ABSENT_____
DECHLORINATED IN LAB_____
APPROPRIATE CONTAINERS_____
PRESERVED IN LAB_____

COMMENTS:
PCBs: 1 ppm detection limit required. Authorized to perform ~~Florisil~~ cleanup and Soxhlet extraction to meet the detection limit.
SG

VOAS O&G METALS ~~OTHER~~ NO ICE HAZARDOUS:
PRESERVATION_____ pH<2_____

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Sample Receipt Checklist

Client Name:	**SCA Environmental, Inc.**	Date and Time Received:	**4/4/2019 14:25**
Project:	**B12936; WJE MT UMUNHUM RADAR TOWER SVY**	Date Logged:	**4/4/2019**
		Received by:	Tina Perez
WorkOrder №:	**1904245** Matrix: Solid	Logged by:	Tina Perez
Carrier:	Client Drop-In		

Chain of Custody (COC) Information

Chain of custody present?	Yes	☑	No	☐	
Chain of custody signed when relinquished and received?	Yes	☑	No	☐	
Chain of custody agrees with sample labels?	Yes	☑	No	☐	
Sample IDs noted by Client on COC?	Yes	☑	No	☐	
Date and Time of collection noted by Client on COC?	Yes	☑	No	☐	
Sampler's name noted on COC?	Yes	☑	No	☐	
COC agrees with Quote?	Yes	☐	No	☐	NA ☑

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Yes	☐	No	☐	NA ☑
Shipping container/cooler in good condition?	Yes	☑	No	☐	
Samples in proper containers/bottles?	Yes	☑	No	☐	
Sample containers intact?	Yes	☑	No	☐	
Sufficient sample volume for indicated test?	Yes	☑	No	☐	

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes	☑	No	☐	NA ☐
Samples Received on Ice?	Yes	☐	No	☑	
Sample/Temp Blank temperature	Temp:				NA ☑
Water - VOA vials have zero headspace / no bubbles?	Yes	☐	No	☐	NA ☑
Sample labels checked for correct preservation?	Yes	☑	No	☐	
pH acceptable upon receipt (Metal: <2; Nitrate 353.2/4500NO3: <2; 522: <4; 218.7: >8)?	Yes	☐	No	☐	NA ☑
UCMR Samples:					
pH tested and acceptable upon receipt (200.8: ≤2; 525.3: ≤4; 530: ≤7; 541: <3; 544: <6.5 & 7.5)?	Yes	☐	No	☐	NA ☑
Free Chlorine tested and acceptable upon receipt (<0.1mg/L)?	Yes	☐	No	☐	NA ☑

Comments:

APPENDIX B: OPINION OF PROBABLE CONSTRUCTION COST BY HATTIN CONSTRUCTION MANAGEMENT

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT
MT UMUNHUM RADAR TOWER REPAIR
Los Gatos, CA

Opinion of Probable Construction Cost
Conceptual Cost Estimate

Prepared for : ***Wiss Janney Elstner Associates, Inc.***

July 11, 2019

by:

HATTIN CONSTRUCTION MANAGEMENT, INC.
300 Frank H. Ogawa Plaza, Suite 239
Oakland, CA 94102
Telephone: (510) 832-5800 Fax: (510) 832-5900
www.hattincm.com

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT
MOUNT UMUNHUM RADAR TOWER REPAIR
Los Gatos, CA

ESTIMATE OF PROBABLE CONSTRUCTION COST

EXECUTIVE SUMMARY

Introduction:
This Conceptual Design Cost Estimate represents the probable construction cost of **Midpeninsula Regional Open Space District – Mount Umunhum Radar Tower Repair, Los Gatos, CA**. Considering that the drawings are preliminary design submittal, certain components, which may be required as part of this project may not be shown or mentioned in this estimate. Allowances have been made when detail description of equipment, work definition, or quantities are not available. Material pricing and labor costs are obtained from historical cost data and similar projects. Mechanical and electrical costs are based similar projects. The unit costs include material, labor, and subcontractor's markup, and are based on the design level of documents received.

Project Descriptions:
Repair of Radar Tower in Mount Umunhum, Los Gatos, CA – The scope includes several Options.

Documents Received as a Basis of Cost Estimate:
The following documentation was used in preparation of this estimate:
- Preliminary Drawings S1 thru S6.

Exclusions:
The following items are excluded:
- Change Order Contingency
- Land Cost
- Cost of money
- Offsite Utilities & Connection Fees
- Professional Consultants' and Construction Management fees
- Administrative costs
- Fees for testing construction materials
- Plan checks and inspection
- Permits
- Legal and financing costs
- Furnishings, furniture, and equipment (FFE)
- Relocation costs, if required
- Contractor off-hours and compressed time work schedule, if required
- Escalation beyond that stated.
- LEED

Possible Additional Cost Items:
Items that may change the Estimate of Probable Construction Cost include, but are not limited to, the following:
- Modifications to the scope of work, drawings, specifications included in this estimate
- Unforeseen conditions
- Construction phasing requirements

- Excessive contract and general conditions, and restrictive technical specifications
- Equipment, material, systems or product that cannot be obtained from at least three different sources
- Delays beyond the projected schedule
- Any other non-competitive bid situations
- Any addenda, changes not included in the basis of estimates.

Escalation:
Escalation of 6% up to midpoint of construction is included in the estimate, assumed at 18 months from June 16, 2019 at the rate of 4% per annum.

ESTIMATING ASSUMPTIONS AND COMMENTS
General:

a. Material prices are at 2nd Quarter 2019 level; include taxes and contractor's markups.
b. Labor cost is based on prevailing wages.
c. Work to be done during normal business hours.
d. This estimate can vary due to change in scope.
e. Quantities were obtained as shown on the drawings.
f. Allowances are provided for items not shown in the drawings and are anticipated to be part of the estimate.
g. Installation cost, supervision, and coordination for material and equipment are included in the estimate.
h. General conditions assumed at 20% include mobilization, insurance, office personnel costs, dust control, and other items not mentioned in General requirements.
i. Design Contingency/Estimating Contingency is assumed at 25% due to the level of drawings used in the estimate.

ESTIMATE OF PROBABLE CONSTRUCTION COST
The estimated Probable Construction Costs reflects the anticipated cost of the **MROSD Mount Umunhum Radar Radio Tower in Los Gatos, CA.** This estimate is based on a competitive open bid process with a recommended five or more bids from reputable general contractors, and a minimum of three bids for all subcontracted items.

Cost of materials, labor, equipment or services furnished by others, and the contractors' or vendors' methods of determining prices are determined by market and/or economic conditions. Hence, the Estimator cannot and does not guarantee that proposals, bids or actual project costs will not vary from this Estimate of Probable Construction Cost.

This Estimate of Probable Construction Cost is exclusive of all costs associated with changes, modifications or addenda to the drawings and/or specifications subsequent to the preparation of this estimate.

Hattin Construction Management, Inc.
Project and Construction Management Services

300 Frank H. Ogawa Plaza, Suite 239 Oakland, CA 94102
Telephone: (510)832-5800 - Fax: (510)832-5900

SUMMARY OF PROBABLE CONSTRUCTION COST

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT — Gross Area (SF)
MOUNT UMUNHUM RADAR TOWER REPAIR — HCM Job Number: 2019-047

Los Gatos, CA — Lead Estimator: EEV
Type of Estimate: CONCEPTUAL ESTIMATE — Date: 6/17/2019
Revised: 7/11/2019

ITEM	DESCRIPTION	AREA (SF)	TOTAL	%
1	SITEWORK & STAIRS		$ 38,538	
2	CONCRETE			
	WALL CONCRETE REPAIR - BASE		$ 301,936	
	WALL CONCRETE REPAIR - OPTION 1		$ 698,603	
	WALL CONCRETE REPAIR - OPTION 2		$ 1,112,564	
3	THERMAL & MOISTURE PROTECTION			
	ROOF REPAIR - BASE		$ 210,588	
	SHORT TERM REPAIR		$ 114,318	
	LONG TERM REPAIR - OPTION 1		$ 255,120	
	LONG TERM REPAIR - OPTION 2		$ 491,698	
	ROOF FALL PROTECTION (GUARDRAIL) - OPTION 1		$ 89,866	
	ROOF FALL PROTECTION - OPTION 2		$ 35,424	
	WALL OPENING REPAIR - OPTION 1		$ 39,535	
	WALL OPENING REPAIR - OPTION 2		$ 60,631	
	WALL OPENING REPAIR - OPTION 3		$ 83,116	

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		Estimate:	Conceptual
MOUNT UMUNHUM RADAR TOWER REPAIR		HCM Job Number:	2019-047
Los Gatos, CA		Date:	6/17/2019
SITEWORK & STAIRS		Revised:	7/11/2019
Hattin Construction Management, Inc.	AREA : SF	Estimator:	EEV/ARB

Description: Replace (E) Bollards, Exterior Steel Doors, & Stair Handrails

Div.	Description	Qty	Unit	Cost	Extension	Total
01	General Requirements					
	Included in the General Conditions below.					
	General Requirements					$ -
02	Existing Conditions					
	Sitework & Interior Repairs					
	Remove two (2) existing bollards & replace w/ foldable bollards	2	EA	$ 1,650.00	$ 3,300	
	Remove & replace single steel door on east side @ 1st floor level	1	EA	$ 1,535.00	$ 1,535	
	Remove & replace single steel door on west side @ 1st floor level	1	EA	$ 1,535.00	$ 1,535	
	Remove & replace steel handrail from 1st floor level to 5th floor levels	108	LF	$ 100.00	$ 10,800	
	Infill openings w/ 12" x 24" metal grating	14	EA	$ 250.00	$ 3,500	
	Existing Conditions					$ 20,670
	TOTAL DIRECT COST					$ 20,670
	General Conditions/General Requirements	20.0%				$4,134
	SUBTOTAL					$ 24,804
	General Contractor's Overhead & Profit	10.0%				$2,480
	SUBTOTAL					$ 27,284
	Historic Preservation Factor	5.0%				$1,364
	Design Contingency/Estimating Contingency	25.0%				$6,821
	SUBTOTAL					$ 35,470
	Escalation up to midpoint of construction (18 months from June 12, 2019 @ 4%/year)	6.0%				$2,128
	SUBTOTAL					$ 37,598
	Bonds	2.5%				$940
	TOTAL PROBABLE BID DAY CONSTRUCTION COST - SITEWORK & STAIRS					$ 38,538

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT — Estimate: Conceptual
MOUNT UMUNHUM RADAR TOWER REPAIR — HCM Job Number: 2019-047
Los Gatos, CA — Date: 6/17/2019
WALL CONCRETE REPAIR - BASE — Revised: 7/11/2019
Hattin Construction Management, Inc. — AREA : SF — Estimator: EEV/ARB

Div.	Description	Qty	Unit	Cost	Extension	Total
Description:	Repair large cracks, voids, spalls, & delaminations at pilasters, the thickened roof slab edge along tops of the walls, & selected portions					
01	General Requirements					
	Included in the General Conditions below.					
	General Requirements					$ -
03	CONCRETE					
	Remove loose or delaminated concrete & sawcut the perimeter of the repair area, assume all pilaster edges require repair	2,028	LF	$ 35.00	70,980	
	Clean the corrosion & apply a protective coating to the exposed steel, allow	1,582	SF	$ 7.50	11,865	
	Patch the concrete spalls using an appropriate repair mortar, allow	1,582	SF	$ 50.00	79,100	
	CONCRETE					$ 161,945
	TOTAL DIRECT COST					$ 161,945
	General Conditions/General Requirements	20.0%				$32,389
	SUBTOTAL					$ 194,334
	General Contractor's Overhead & Profit	10.0%				$19,433
	SUBTOTAL					$ 213,767
	Historic Preservation Factor	5.0%				$10,688
	Design Contingency/Estimating Contingency	25.0%				$53,442
	SUBTOTAL					$ 277,898
	Escalation up to midpoint of construction (18 months from June 12, 2019 @ 4%/year)	6.0%				$16,674
	SUBTOTAL					$ 294,571
	Bonds	2.5%				$7,364
	TOTAL PROBABLE BID DAY CONSTRUCTION COST -WALL CONCRETE REPAIRS - BASE					$ 301,936

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		Estimate:	Conceptual
MOUNT UMUNHUM RADAR TOWER REPAIR		HCM Job Number:	2019-047
Los Gatos, CA		Date:	6/17/2019
WALL CONCRETE REPAIR - OPTION 1		Revised:	7/11/2019
Hattin Construction Management, Inc.	AREA : SF	Estimator:	EEV/ARB

Div.	Description	Qty	Unit	Cost	Extension	Total
Description:	Patch & Coat; Repair the surface of the exterior concrete wall between pilasters to be suitable to receive an elastomeric					
01	General Requirements					
	Included in the General Conditions below.					
	General Requirements					$ -
03	CONCRETE					
	Repair shallow rough & poorly consolidated concrete at walls using the following procedures					
	Remove loose concrete & roughen surface to receive concrete repair mortar, allow 20% of total wall area	7,320	SF	$ 10.00	73,200	
	Surface patch concrete for smooth, well bonded finish	7,320	SF	$ 25.00	183,000	
	Coat concrete walls & pilasters w/ elastomeric coating	23,700	SF	$ 5.00	118,500	
	CONCRETE					$ 374,700
	TOTAL DIRECT COST					$ 374,700
	General Conditions/General Requirements	20.0%				$74,940
	SUBTOTAL					$ 449,640
	General Contractor's Overhead & Profit	10.0%				$44,964
	SUBTOTAL					$ 494,604
	Historic Preservation Factor	5.0%				$24,730
	Design Contingency/Estimating Contingency	25.0%				$123,651
	SUBTOTAL					$ 642,985
	Escalation up to midpoint of construction (18 months from June 12, 2019 @ 4%/year)	6.0%				$38,579
	SUBTOTAL					$ 681,564
	Bonds	2.5%				$17,039
	TOTAL PROBABLE BID DAY CONSTRUCTION COST -WALL CONCRETE REPAIRS - OPTION 1					$ 698,603

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		Estimate:	Conceptual
MOUNT UMUNHUM RADAR TOWER REPAIR		HCM Job Number:	2019-047
Los Gatos, CA		Date:	6/17/2019
WALL CONCRETE REPAIR - OPTION 2		Revised:	7/11/2019
Hattin Construction Management, Inc.	AREA : SF	Estimator:	EEV/ARB

Div.	Description	Qty	Unit	Cost	Extension	Total
Description:	Stucco Cladding between Pilasters					
01	General Requirements					
	Included in the General Conditions below.					
	General Requirements					$ -
09	FINISHES					
	Installs mechanically attached 3-coat cement plaster (stucco) system (thickness of about ¾") on the walls between the concrete pilasters as a substrate for an elastomeric waterproofing coating					
	Install mechanically fastened metal lath & 3-coat on the exterior walls between pilasters.	18,930	SF	$ 25.00	473,250	
	Install horizontal control joints at the bottom of each floor slab level	832	LF	$ 5.00	4,160	
	Install intermediate horizontal control joints at the 4th & 5th floors	164	LF	$ 5.00	820	
	Coat stucco & conc. pilasters w/ elastomeric coating	23,700	SF	$ 5.00	118,500	
	FINISHES					$ 596,730
	TOTAL DIRECT COST					$ 596,730
	General Conditions/General Requirements	20.0%				$119,346
	SUBTOTAL					$ 716,076
	General Contractor's Overhead & Profit	10.0%				$71,608
	SUBTOTAL					$ 787,684
	Historic Preservation Factor	5.0%				$39,384
	Design Contingency/Estimating Contingency	25.0%				$196,921
	SUBTOTAL					$ 1,023,989
	Escalation up to midpoint of construction (18 months from June 12, 2019 @ 4%/year)	6.0%				$61,439
	SUBTOTAL					$ 1,085,428
	Bonds	2.5%				$27,136
	TOTAL PROBABLE BID DAY CONSTRUCTION COST -WALL CONCRETE REPAIRS - OPTION 2					$ 1,112,564

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		Estimate:	Conceptual
MOUNT UMUNHUM RADAR TOWER REPAIR		HCM Job Number:	2019-047
Los Gatos, CA		Date:	6/17/2019
ROOF REPAIR - BASE		Revised:	7/11/2019
Hattin Construction Management, Inc.	AREA : SF	Estimator:	EEV/ARB

Div.	Description	Qty	Unit	Cost	Extension	Total
Description:	Base Roof Repairs					
01	General Requirements					
	Included in the General Conditions below.					
	General Requirements					$ -
07	Thermal & Moisture Protection					
	Remove and replace (e) roof drains & plumbing w/in the building to the storm drainage system on the east side of the building	4	EA	$ 1,000.00	$ 4,000	
	Remove aluminum sheet shielding from underside of the roof slab to observe the condition of the slab for locations of water intrusion & possible structural damage	3,630	SF	$ 5.00	$ 18,150	
	Inspect the structural slab soffit & repair damage, allow 25%	908	SF	$ 100.00	$ 90,800	
	Thermal & Moisture Protection					$ 112,950
	TOTAL DIRECT COST					$ 112,950
	General Conditions/General Requirements	20.0%				$22,590
	SUBTOTAL					$ 135,540
	General Contractor's Overhead & Profit	10.0%				$13,554
	SUBTOTAL					$ 149,094
	Historic Preservation Factor	5.0%				$7,455
	Design Contingency/Estimating Contingency	25.0%				$37,274
	SUBTOTAL					$ 193,822
	Escalation up to midpoint of construction (18 months from June 12, 2019 @ 4%/year)	6.0%				$11,629
	SUBTOTAL					$ 205,452
	Bonds	2.5%				$5,136
	TOTAL PROBABLE BID DAY CONSTRUCTION COST - ROOF BASE REPAIR					$ 210,588

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		Estimate:	Conceptual
MOUNT UMUNHUM RADAR TOWER REPAIR		HCM Job Number:	2019-047
Los Gatos, CA		Date:	6/17/2019
SHORT TERM REPAIR		Revised:	7/11/2019
Hattin Construction Management, Inc.	AREA : SF	Estimator:	EEV/ARB

Div.	Description	Qty	Unit	Cost	Extension	Total
Description:	Targeted Maintenance Repairs & Water Management					
01	General Requirements					
	Included in the General Conditions below.					
	General Requirements					$ -
07	Thermal & Moisture Protection					
	Short -Term Target Maintenance Repairs & Water Management					
	Perform targeted maintenance above areas where leakage is occurring possibly w/ fluid-applied membranes, as appropriate, allow 100% of roof area	3,630	SFRo	$ 10.00	$ 36,300	
	Perform follow-up repairs, allow 50% of initial repair	1	LS	$ 15,000.00	$ 15,000	
	Re-seal expansion joints to encourage surface drainage & limit water penetration	94	LF	$ 10.00	$ 940	
	Seal open gaps & joints around penetrations, pitch pockets, hatches, & other roof flop items across the entire roof, allow	3,630	SFRo	$ 2.50	$ 9,075	
	Thermal & Moisture Protection					$ 61,315
	TOTAL DIRECT COST					$ 61,315
	General Conditions/General Requirements	20.0%				$12,263
	SUBTOTAL					$ 73,578
	General Contractor's Overhead & Profit	10.0%				$7,358
	SUBTOTAL					$ 80,936
	Historic Preservation Factor	5.0%				$4,047
	Design Contingency/Estimating Contingency	25.0%				$20,234
	SUBTOTAL					$ 105,217
	Escalation up to midpoint of construction (18 months from June 12, 2019 @ 4%/year)	6.0%				$6,313
	SUBTOTAL					$ 111,530
	Bonds	2.5%				$2,788
	TOTAL PROBABLE BID DAY CONSTRUCTION COST - SHORT TERM REPAIR					$ 114,318

Div.	Description	Qty	Unit	Cost	Extension	Total
Description:	Single- Ply Membrane over (N) Roof Membrane					
	Abandon the concrete and steel surface as membrane substrates & install (n) light gauge metal framing & sheathing w/ a single ply membrane that is adhered, or both mechanically fastened & adhered to the sheathing.					
01	General Requirements					
	Included in the General Conditions below.					
	General Requirements					$ -
07	Thermal & Moisture Protection					
	Remove roof top penetrations & obstructions where possible					
	Detach (e) equipment that can be removed w/o damage	1	EA	$ 1,000.00	$ 1,000	
	Cut penetrating items flush with the top surface of the wearing slab or concrete pedestal, allow	3,630	SF	$ 3.00	$ 10,890	
	Coordinate the height of new & existing rooftop items to remain w/ increased height of the (n) roof deck				$ -	
	Remove the roof hatch & reconfigure roof access; replace roof hatch to accommodate the new (increased) height of the roof deck	2	EA	$ 3,500.00	$ 7,000	
	Coordinate location of fall protection anchors & height guardrails w/ height of (n) roof deck	16	HRS	$ 150.00	$ 2,400	
	Install light gauge metal framing w/ exterior sheathing to create a (n) sloped roof deck across the entire roof including above the concrete pedestal; ventilate the cavity between the sheathing & wearing slab	3,630	SF	$ 15.00	$ 54,450	
	Conceal remaining roofrop penetrations & obstructions w/in the (n) roof deck assembly or w/ box-outs where the penetrations or obstruction is taller than the level of the (n) roof deck (sheathing); protect (e) materials w/ a separation layer, (fill cavity w/ closed-cell spray foam insulation to minimize the risk of condensation w/in the assembly	60	SF	$ 20.00	$ 1,200	
	Install single-ply roofing membrane	3,630	SF	$ 15.00	$ 54,450	
	Slope (n) roofing to the location of (e) roof drains & integrate w/ (n) drains	3,630	SF	$ 1.50	$ 5,445	
	Thermal & Moisture Protection					$ 136,835
	TOTAL DIRECT COST					$ 136,835
	General Conditions/General Requirements	20.0%				$27,367
	SUBTOTAL					$ 164,202
	General Contractor's Overhead & Profit	10.0%				$16,420
	SUBTOTAL					$ 180,622
	Historic Preservation Factor	5.0%				$9,031
	Design Contingency/Estimating Contingency	25.0%				$45,156
	SUBTOTAL					$ 234,809
	Escalation up to midpoint of construction (18 months from June 12, 2019 @ 4%/year)	6.0%				$14,089
	SUBTOTAL					$ 248,897
	Bonds	2.5%				$6,222
	TOTAL PROBABLE BID DAY CONSTRUCTION COST - LONG TERM REPAIR OPTION 1					$ 255,120

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		Estimate:	Conceptual
MOUNT UMUNHUM RADAR TOWER REPAIR		HCM Job Number:	2019-047
Los Gatos, CA		Date:	6/17/2019
LONG TERM REPAIR - OPTION 2		Revised:	7/11/2019
Hattin Construction Management, Inc.	AREA : SF	Estimator:	EEV/ARB

Div.	Description	Qty	Unit	Cost	Extension	Total
Description:	Buried Roofing Membrane					
	Remove & replace the concrete wearing slab & original built-up roofing w/ hot rubberized asphalt w/ a (n) concrete wearing slab protection					
01	General Requirements					
	Included in the General Conditions below.					
	General Requirements					$ -
07	Thermal & Moisture Protection					
	Remove concrete wearing slab & underlying roofing assembly to expose then structure concrete slab	2,510	SF	$ 7.50	$ 18,825	
	Inspect the top of the structural slab & repair damage, allow	1	LS	$ 15,000.00	$ 15,000	
	Repair rough, delaminated, & spalled concrete on both horizontal & vertical surfaces at the concrete pedestal, allow 50% of area for repair	1,570	SF	$ 80.00	$ 125,600	
	Remove roof top penetrations & obstructions where possible, allow	3,630	SF	$ 1.50	$ 5,445	
	Detach items that can be removed w/o damage	3	EA	$ 500.00	$ 1,500	
	Cut penetrating items flush with the top surface of the wearing slab or concrete pedestal, allow	3,630	SF	$ 3.00	$ 10,890	
	Prepare remaining rooftop penetrations & obstruction for integration into HRA membrane by sand blasting steel	3	EA	$ 500.00	$ 1,500	
	Install HRA membrane w/ (n) concrete wearing slab on horizontal roof surface	2,510	SF	$ 25.00	$ 62,750	
	Integrate HRA membrane w/ (n) roof drains in original locations, allow roof area	3,630	SF	$ 2.50	$ 9,075	
	Install elastomeric coating on vertical surface (wall) of concrete pedestal	450	SF	$ 5.00	$ 2,250	
	Remove corrosion from steel that is exposed above the roof & coat w/ high performance coating system, allow	3,630	SFRc	$ 3.00	$ 10,890	
	Thermal & Moisture Protection					$ 263,725

TOTAL DIRECT COST		$	263,725
General Conditions/General Requirements	20.0%		$52,745
SUBTOTAL		$	316,470
General Contractor's Overhead & Profit	10.0%		$31,647
SUBTOTAL		$	348,117
Historic Preservation Factor	5.0%		$17,406
Design Contingency/Estimating Contingency	25.0%		$87,029
SUBTOTAL		$	452,552
Escalation up to midpoint of construction (18 months from June 12, 2019 @ 4%/year)	6.0%		$27,153
SUBTOTAL		$	479,705
Bonds	2.5%		$11,993
TOTAL PROBABLE BID DAY CONSTRUCTION COST - LONG TERM REPAIR OPTION 2		$	491,698

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		Estimate:	Conceptual
MOUNT UMUNHUM RADAR TOWER REPAIR		HCM Job Number:	2019-047
Los Gatos, CA		Date:	6/17/2019
ROOF FALL PROTECTION REPAIRS - OPTION 1		Revised:	7/11/2019
Hattin Construction Management, Inc.	AREA : SF	Estimator:	EEV/ARB

Description: Install a guardrail system around the entire roof

Div.	Description	Qty	Unit	Cost	Extension	Total
01	General Requirements					
	Included in the General Conditions below.				See General Conditions/General Requirements below	
	General Requirements					$ -
07	Thermal & Moisture Protection					
	Install a guardrail system around the entire roof to match the original guardrail system configuration, but using more durable materials than ther original wood framing	241	LF	$ 200.00	$ 48,200	
	Thermal & Moisture Protection					$ 48,200
	TOTAL DIRECT COST					$ 48,200
	General Conditions/General Requirements	20.0%				$9,640
	SUBTOTAL					$ 57,840
	General Contractor's Overhead & Profit	10.0%				$5,784
	SUBTOTAL					$ 63,624
	Historic Preservation Factor	5.0%				$3,181
	Design Contingency/Estimating Contingency	25.0%				$15,906
	SUBTOTAL					$ 82,711
	Escalation up to midpoint of construction (18 months from June 12, 2019 @ 4%/year)	6.0%				$4,963
	SUBTOTAL					$ 87,674
	Bonds	2.5%				$2,192
	TOTAL PROBABLE BID DAY CONSTRUCTION COST -ROOF FALL PROTECTION REPAIRS OPTION 1					$ 89,866

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		Estimate:	Conceptual
MOUNT UMUNHUM RADAR TOWER REPAIR		HCM Job Number:	2019-047
Los Gatos, CA		Date:	6/17/2019
ROOF FALL PROTECTION REPAIRS - OPTION 2		Revised:	7/11/2019
Hattin Construction Management, Inc.	AREA : SF	Estimator:	EEV/ARB

Div.	Description	Qty	Unit	Cost	Extension	Total
Description:	Install dedicated rooftop fall arrest anchors meeting CAL/OSHA requirement into the side of the concrete pedestal					
01	General Requirements Included in the General Conditions below.					
	General Requirements					$ -
07	Thermal & Moisture Protection					
	Install dedicated rooftop fall arrest anchors meeting CAL/OSHA requirement into the side of the concrete pedestal; install anchors using a drill w/ built-in vacuum or use wet-drilling methods to contain amount of asbestos traced from concrete pedestal	6	EA	$ 1,500.00	$ 9,000	
	Install CAL/OSHA compliant guardrail system around the (e) roof hatch	40	LF	$ 250.00	$ 10,000	
	Thermal & Moisture Protection					$ 19,000
	TOTAL DIRECT COST					$ 19,000
	General Conditions/General Requirements	20.0%				$3,800
	SUBTOTAL					$ 22,800
	General Contractor's Overhead & Profit	10.0%				$2,280
	SUBTOTAL					$ 25,080
	Historic Preservation Factor	5.0%				$1,254
	Design Contingency/Estimating Contingency	25.0%				$6,270
	SUBTOTAL					$ 32,604
	Escalation up to midpoint of construction (18 months from June 12, 2019 @ 4%/year)	6.0%				$1,956
	SUBTOTAL					$ 34,560
	Bonds	2.5%				$864
	TOTAL PROBABLE BID DAY CONSTRUCTION COST -ROOF FALL PROTECTION REPAIRS OPTION 2					$ 35,424

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		Estimate:	Conceptual
MOUNT UMUNHUM RADAR TOWER REPAIR		HCM Job Number:	2019-047
Los Gatos, CA		Date:	6/17/2019
WALL OPENING REPAIRS - OPTION 1		Revised:	7/11/2019
Hattin Construction Management, Inc.	AREA : SF	Estimator:	EEV/ARB

Div.	Description	Qty	Unit	Cost	Extension		Total
Description:	**Maintain in (e) configuration. Maintain all wall openings in their current configuration & adds a system to collect & discharge water that currently leaks through the opening**						
01	General Requirements						
	Included in the General Conditions below.						
	General Requirements					$	-
07	Thermal & Moisture Protection						
	Install a waterproofing membrane w/in the collection basin & up and over the perimeter curbs; extend the waterproofing through the beneath the opening closure plate including a metal flashing w/ a drip edge if possible	147	SF	15.00	2,205		
	Thermal & Moisture Protection					$	2,205
09	Finishes						
	Remove corrosion & paint steel frames at openings	410	LF	10.00	4,100		
	Finishes					$	4,100
15	Mechanical						
	Install water collection & drainage systems at each area of wall,openings where leakage occurs - assume 4" - 8" for most openings	140	LF	65.00	9,100		
	Extend collection basin a sufficient distance past opening jambs & towards the building interior to collect water; assume 2 - 4 feet for most opening	128	LF	25.00	3,200		
	Add drains & plumbing to the exterior storm drainage system on the east side of the building at the larger or more exposed locations, depending on the extent of actual water penetration at each opening, allow	65	LF	40.00	2,600		
	Mechanical					$	14,900
	TOTAL DIRECT COST					$	21,205
	General Conditions/General Requirements	20.0%					$4,241
	SUBTOTAL					$	25,446
	General Contractor's Overhead & Profit	10.0%					$2,545
	SUBTOTAL					$	27,991
	Historic Preservation Factor	5.0%					$1,400
	Design Contingency/Estimating Contingency	25.0%					$6,998
	SUBTOTAL					$	36,388
	Escalation up to midpoint of construction (18 months from June 12, 2019 @ 4%/year)	6.0%					$2,183
	SUBTOTAL					$	38,571
	Bonds	2.5%					$964
	TOTAL PROBABLE BID DAY CONSTRUCTION COST -WALL OPENING REPAIRS - OPTION 1					$	39,535

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		Estimate:	Conceptual
MOUNT UMUNHUM RADAR TOWER REPAIR		HCM Job Number:	2019-047
Los Gatos, CA		Date:	6/17/2019
WALL OPENING REPAIRS - OPTION 2		Revised:	7/11/2019
Hattin Construction Management, Inc.	AREA : SF	Estimator:	EEV/ARB

Div.	Description	Qty	Unit	Cost	Extension		Total
Description:	Selective Ventilation & Closure of Openings. Evaluate the ventilation requirements for the building and & install louvers where needed for ventilation , & replaces the steel plates at the other openings w/ water tight infills that do not necessarily match the historic appearance & configuration of the building						
01	General Requirements						
	Included in the General Conditions below.						
	General Requirements					$	-
05	Metals						
	Remove all steel plates at wall openings	348	SF	5.00	1,740		
	Metals					$	1,740
08	Openings						
	Install ventilation louvers w/ animal screens where needed for ventilation	118	SF	85.00	10,030		
	Openings					$	10,030
09	Finishes						
	Infill openings that are not required for ventilation w/ concrete, light gauge metal framing and stucco, or steel plates to create watertight assemblies, assume light gauge framing & stucco	230	SF	25.00	5,750		
	Finishes					$	5,750
15	Mechanical						
	Evaluate building ventilation & hazardous materials requirements to determine appropriate treatment for each wall & overall ventilation of the building, assume total exterior walls	100	HRS	150.00	15,000		
	Mechanical					$	15,000
	TOTAL DIRECT COST					$	32,520
	General Conditions/General Requirements	20.0%					$6,504
	SUBTOTAL					$	39,024
	General Contractor's Overhead & Profit	10.0%					$3,902
	SUBTOTAL					$	42,926
	Historic Preservation Factor	5.0%					$2,146
	Design Contingency/Estimating Contingency	25.0%					$10,732
	SUBTOTAL					$	55,804
	Escalation up to midpoint of construction (18 months from June 12, 2019 @ 4%/year)	6.0%					$3,348
	SUBTOTAL					$	59,153
	Bonds	2.5%					$1,479
	TOTAL PROBABLE BID DAY CONSTRUCTION COST -WALL OPENING REPAIRS - OPTION 2					$	60,631

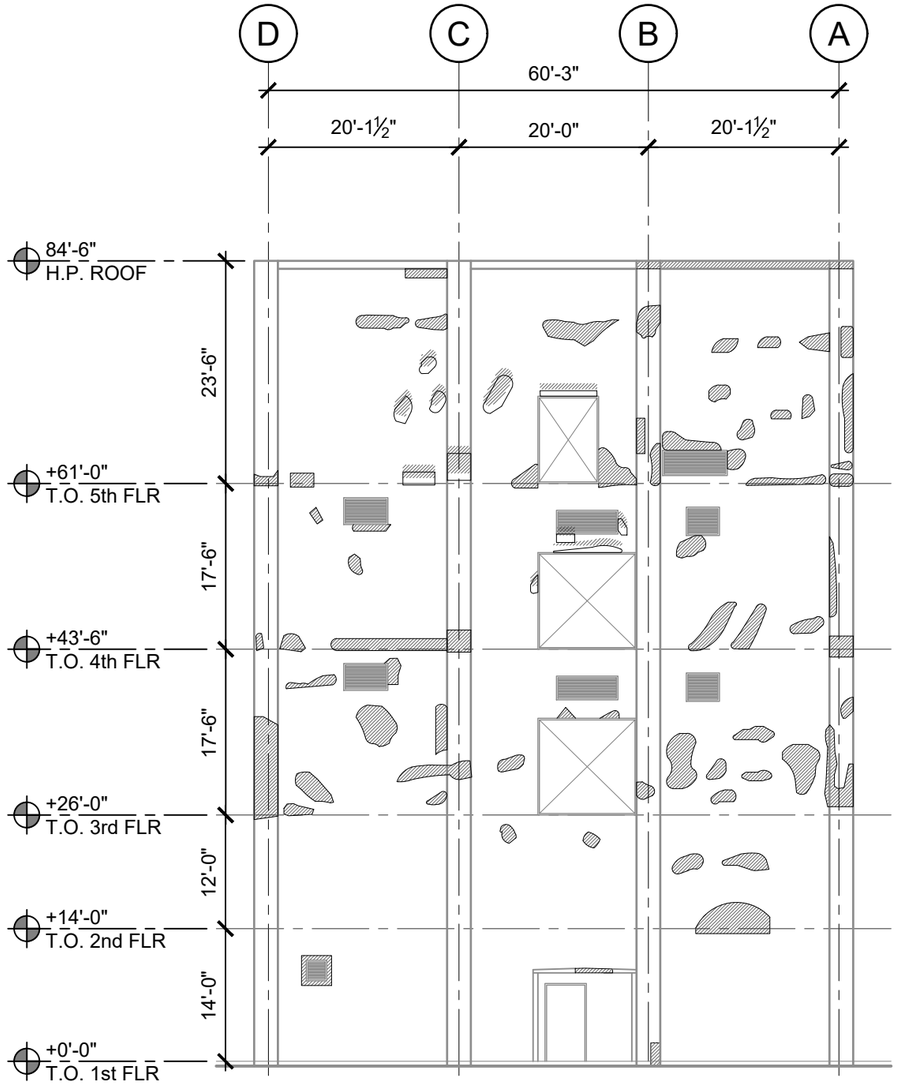
MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		Estimate:	Conceptual
MOUNT UMUNHUM RADAR TOWER REPAIR		HCM Job Number:	2019-047
Los Gatos, CA		Date:	6/17/2019
WALL OPENING REPAIRS - OPTION 3		Revised:	7/11/2019
Hattin Construction Management, Inc.	AREA : SF	Estimator:	EEV/ARB

Div.	Description	Qty	Unit	Cost	Extension		Total
Description:							
	Restore to original appearance. Similar to Option 2 except that louvers, sheet metal hoods, & aluminum windows are installed to match the general appearance & configuration of original openings as shown in Figure 1, but upgrade the weather protection where feasible						
01	General Requirements						
	Included in the General Conditions below.						
	General Requirements					$	-
05	Metals						
	Remove all steel plates at wall openings; optionally (e) plates can remain where additional ventilation is not needed where hoods are to be installed	230	SF	5.00	1,150		
	Metals					$	1,150
07	Thermal & Moisture Protection						
	Install sheet metal hoods at the louvered openings to provide improved resistance to wind-driven rainventilation louvers w/ animal screens where needed for ventilation	44	LF	100.00	4,400		
	Thermal & Moisture Protection					$	4,400
08	Openings						
	Install ventilation louvers w/ animal screens similar in appearance & configuration to original hoods, adapted to meet the current ventilation requirements	118	SF	85.00	10,030		
	Openings					$	10,030
09	Finishes						
	Install (n) watertight permanent infill panels similar in appearance to the original hollow core metal panels to fully close off access openings that originally had removable hollow metal panels for equipment access	230	SF	50.00	11,500		
	Finishes					$	11,500
15	Mechanical						
	Evaluate building ventilation & hazardous materials requirements to determine appropriate treatment for each wall & overall ventilation of the building, assume total exterior walls	100	HRS	150.00	15,000		
	Coordinate locations for ventilation louvers & hoods w/ configuration of historic openings, allow	10	LOC	250.00	2,500		
	Mechanical					$	17,500
	TOTAL DIRECT COST					$	44,580
	General Conditions/General Requirements	20.0%					$8,916
	SUBTOTAL					$	53,496
	General Contractor's Overhead & Profit	10.0%					$5,350
	SUBTOTAL					$	58,846
	Historic Preservation Factor	5.0%					$2,942
	Design Contingency/Estimating Contingency	25.0%					$14,711
	SUBTOTAL					$	76,499

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT		Estimate:	Conceptual
MOUNT UMUNHUM RADAR TOWER REPAIR		HCM Job Number:	2019-047
Los Gatos, CA		Date:	6/17/2019
WALL OPENING REPAIRS - OPTION 3		Revised:	7/11/2019
Hattin Construction Management, Inc.	AREA : SF	Estimator:	EEV/ARB

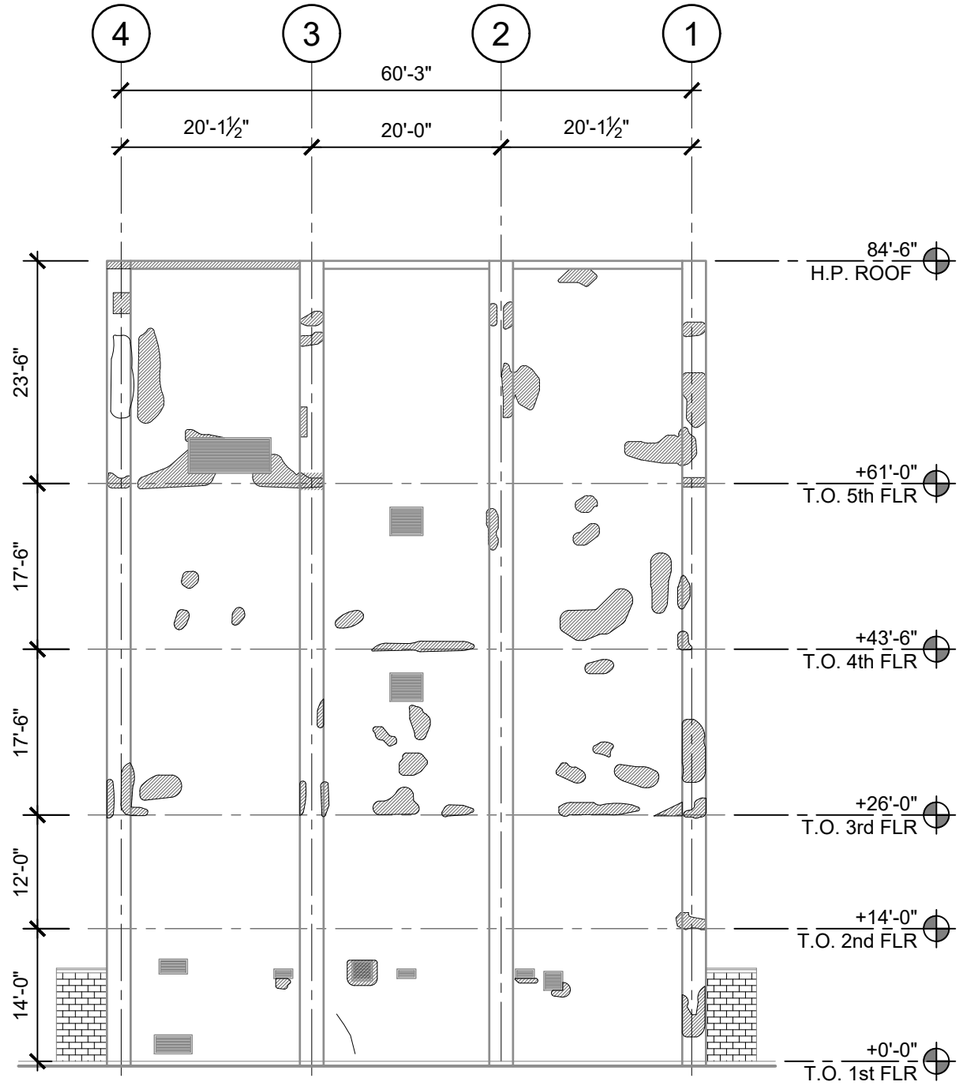
Div.	Description	Qty	Unit	Cost	Extension	Total
Description:						
	Restore to original appearance. Similar to Option 2 except that louvers, sheet metal hoods, & aluminum windows are installed to match the general appearance & configuration of original openings as shown in Figure 1, but upgrade the weather protection where feasible					
	Escalation up to midpoint of construction (18 months from June 12, 2019 @ 4%/year)	6.0%				$4,590
	SUBTOTAL				$	81,089
	Bonds	2.5%				$2,027
	TOTAL PROBABLE BID DAY CONSTRUCTION COST -WALL OPENING REPAIRS - OPTION 3				$	83,116

APPENDIX C: RESULTS OF EXTERIOR WALLS SURVEY



1 WEST ELEVATION

SCALE: 1/16" = 1'-0"



2 SOUTH ELEVATION

SCALE: 1/16" = 1'-0"

0 1/2" 1"

THIS SHEET PLOTS FULL SIZE AT 11x17 (INCHES)

WJE ENGINEERS ARCHITECTS MATERIALS SCIENTISTS

Wiss, Janney, Elstner Associates, Inc.
2915 Premiere Parkway, Suite 100
Duluth, Georgia 30097
770.923.9822 tel | 770.232.9044 fax
www.wje.com

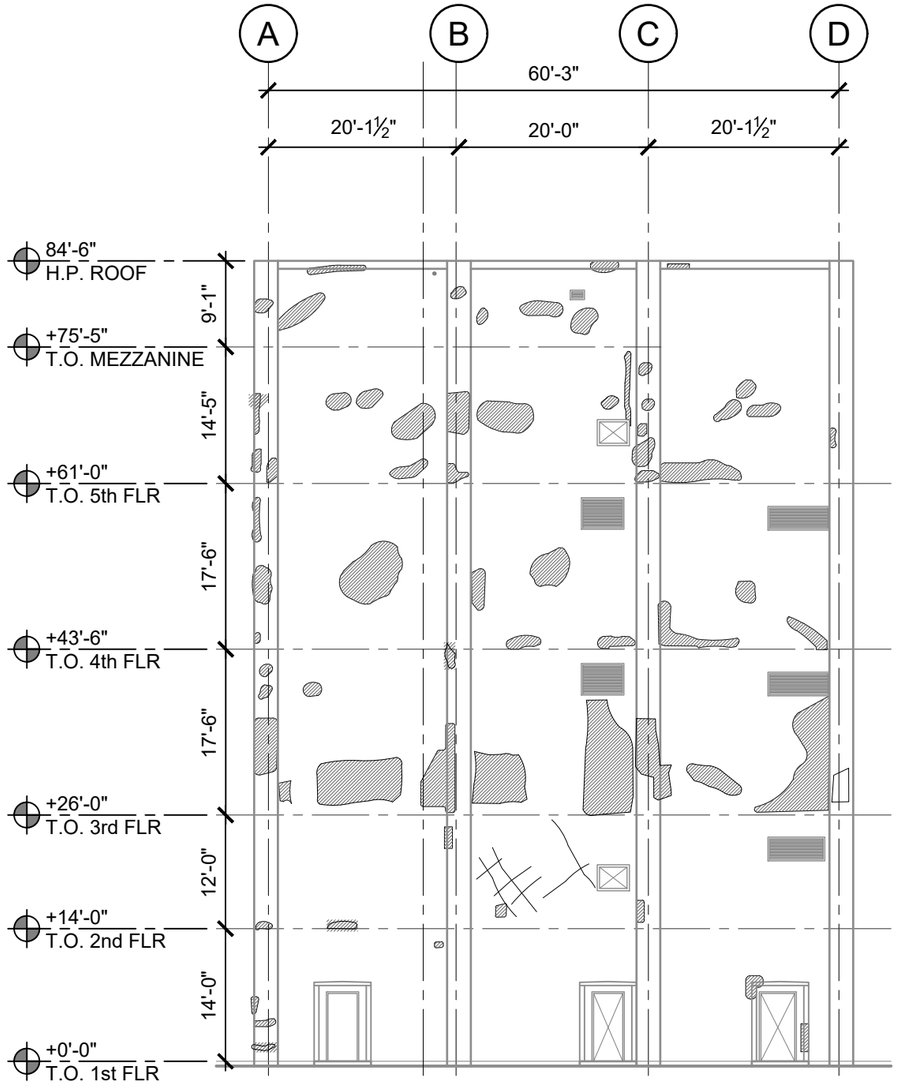
Project
MOUNT UMUNHUM RADAR TOWER
Project Address, Proj City, ST ZIP

Sheet Title
ELEVATION 1 & 2

Proj. No.	2018.0484.0
Date	Value
Drawn	QAG
Checked	BEK
Scale	As Noted

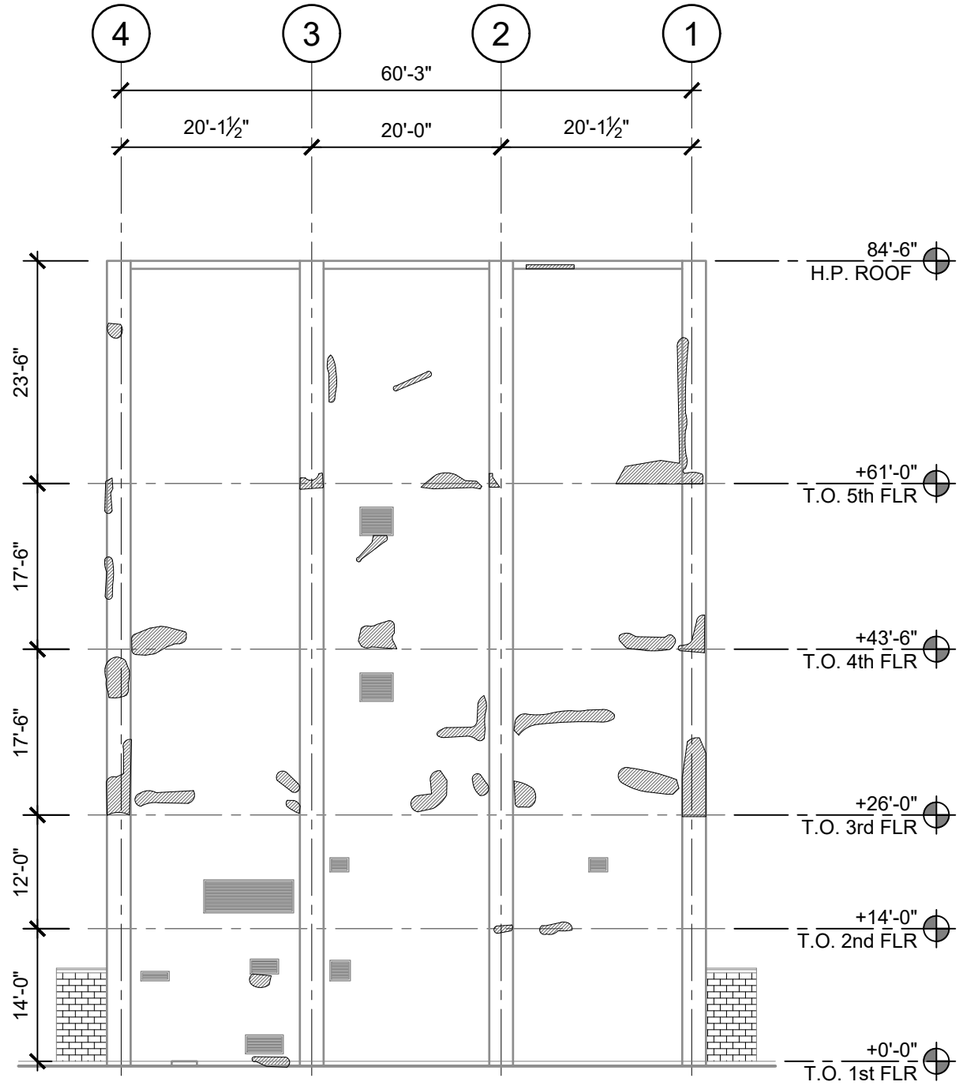
Sheet No. 1

Plotted: 7/15/2019 4:55 PM by Gregoire, Quentin File Name: P:\2018\2018.0xxx\2018.0484.0 - MOUNT UMUNHUM RADAR TOWER (BEK)\5 Construction Documents\1 Drawings\Sheets\2018_0484_0-S5.dwg



1 EAST ELEVATION

SCALE: 1/16" = 1'-0"



2 NORTH ELEVATION

SCALE: 1/16" = 1'-0"

0 1/2" 1"

THIS SHEET PLOTS FULL SIZE AT 11x17 (INCHES)

WJE ENGINEERS ARCHITECTS MATERIALS SCIENTISTS

Wiss, Janney, Elstner Associates, Inc.
2915 Premiere Parkway, Suite 100
Duluth, Georgia 30097
770.923.9822 tel | 770.232.9044 fax
www.wje.com

Project
MOUNT UMUNHUM RADAR TOWER
Project Address, Proj City, ST ZIP

Sheet Title
ELEVATION 3 & 4

Proj. No.	2018.0484.0
Date	Value
Drawn	QAG
Checked	BEK
Scale	As Noted

Sheet No. 2

Plotted: 7/15/2019 4:56 PM by Gregoire, Quentin File Name: P:\2018\2018.0xxx\2018.0484.0 - MOUNT UMUNHUM RADAR TOWER (BEK)\5 Construction Documents\1 Drawings\Sheets\2018_0484_0-S6.dwg