Initial Study/Mitigated Negative Declaration

Water Line Replacement Under Pilarcitos Creek at Strawflower Village

Lead Agency and Applicant

Coastside County Water District
766 Main Street
Half Moon Bay, CA 94019
Contact: Mary Rogren

Public Review Draft | August 2021

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CEQA Consultant

WRA, Inc.
2169-G East Francisco Blvd
San Rafael, CA 94901
Contact: John Baas

Public Review Draft | August 2021

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ACRONYMS, ABBREVIATIONS, AND UNITS OF MEASURE

APE	Area of Potential Effects
BAAQMD	Bay Area Air Quality Management District
bgs	Below ground surface
BMP	Best Management Practices
BTU	British thermal unit
Cal Fire	California Department of Forestry and Fire Protection
Caltrans	California Department of transportation
CCC	California Coastal Commission
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife (formerly California Department of Fish and Game [CDFG])
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
CFGC	California Fish and Game Code
City	City of Half Moon Bay
CMP	Congestion Management Program
CNDDB	California Natural Diversity Database
CNEL	Community Noise Equivalent Level
CNPS	California Native Plant Society
Corps	United States Army Corps of Engineers
CUSD	Cabrillo Unified School District
CWA	Clean Water Act
dBA	A-weighted decibel scale
District	Coastside County Water District
DIP	Ductile iron pipe
DTSC	California Department of Toxic Substances Control
EECAP	Energy Efficiency Climate Action Plan
EKI	EKI Environment & Water, Inc.
EPA	U.S. Environmental Protection Agency
ESHA	Environmentally Sensitive Habitat Area
FESA	Federal Endangered Species Act
ft	Feet
GHG	Greenhouse gas
HDD	Horizontal directional drilling

HDPE	High-density polyethylene
L_{eq}	Equivalent energy noise level
LCP	Local Coastal Program
LOS	Loss of service
LUP	Land Use Plan
MGD	Million gallons per day
MND	Mitigated Negative Declaration
MRP	Municipial Regional Stormwater NPDES Permit
NAHC	Native American Heritage Commission
NAAQS	National Ambient Air Quality Standards
NWIC	Northwest Information Center
OHWM	Ordinary High Water Mark
PDR	Preliminary Design Report
ROW	Right-of-way
RWQCB	Regional Water Quality Control Board
7SR-1	Highway 1
SRA	State Responsibility Area
SWRCB	State Water Resources Control Board
TOB	Top of Bank
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VHFHSZ	Very High Fire Hazard Severity Zone
WPCP	Water Pollution Control Plan
WRA	WRA, Inc.

1.0 INTRODUCTION

1.0 INTRODUCTION

1.1 BACKGROUND

1. **Project Title:** Water Line Replacement under Pilarcitos Creek from Oak Avenue to Strawflower Village

2. **Lead Agency and Project Applicant:** Coastside County Water District
766 Main Street
Half Moon Bay, CA 94019

3. **Contact Person and Phone Number:** Mary Rogren – General Manager
(650) 726-4405
mrogren@coastsidewater.org

4. **Project Location:** City of Half Moon Bay, west of State Route 1 (SR-1) between Oak Avenue and Strawflower Village Shopping Center

5. **Parcel Numbers:** 056-300-150
056-300-210
056-141-950
056-141-970
056-040-999

1.2 PROPOSED PROJECT DESCRIPTION

Surrounding Land Uses and Setting

The proposed Project Area is located west of downtown Half Moon Bay (Figure 1) near an existing pedestrian bridge that crosses Pilarcitos Creek from San Mateo Road to the intersection of Pilarcitos Avenue and Oak Avenue south of the creek. Pilarcitos Creek is a coastal stream which extends approximately 14 miles from its headwaters in the western Santa Cruz Mountains through Pilarcitos Canyon and terminates in the Pacific Ocean at Half Moon Bay State Beach.

The north end of the proposed Project Area is on private property in the paved parking lot behind the Safeway store in the Strawflower Village shopping center (Figure 2). The south end of the proposed Project Area is in Oak Park along the north side of Oak Avenue, in the flat-lying, grassy area east of the bathroom and playground facilities. The park and the parcels include the creek riparian zone which are owned by the City of Half Moon Bay (City). Highway 1 (SR-1) is located approximately 350 ft east of the proposed Project Area, and multifamily residential housing occupy the areas to the south and west of the site.

Description of Project

The Coastside County Water District (District) is proposing to replace the water line under Pilarcitos Creek. The approximately 450-foot (ft)-long new pipeline would be installed using horizontal directional drilling (HDD) under the creek from the Strawflower Village Shopping Center to Oak Avenue, with staging areas in the back of the shopping center and in Oak Park extending down Pilarcitos Avenue to the south. The District is serving as the Project Applicant and California Environmental Quality Act (CEQA) Lead Agency.

Purpose and Need

The existing 8-inch pipeline crossing beneath the creek is one of only two pipelines supplying water to areas of the District south of the creek, including downtown Half Moon Bay. The existing pipe has reached the end of its useful life and a break underneath the creek bed would impair water delivery and could potentially damage the environment. A break in the water line would be difficult to detect, could cause potentially significant water loss, impair water quality, and cause liability to the District with potential fines from the U.S. Army Corps of Engineers (Corps), Regional Water Quality Control Board (RWQCB), or California Department of Fish and Wildlife (CDFW). The District completed an initial phase of water line replacement work in June 2017 that consisted of installing approximately 400 ft of 8-inch pipe within the Strawflower access road from SR-1 that ensures water supply to commercial customers in the event of a problem with the existing pipe under the creek.

Background

In 2016, the District considered attaching the new water line to the existing pedestrian bridge, which is owned and maintained by the City. Ultimately, the District decided instead to pursue HDD under the creek. This trenchless construction method would avoid potential impacts to the creek.

EKI Environment & Water, Inc. (EKI) prepared a Preliminary Design Report (PDR) for the proposed Project (EKI 2020) for the District to evaluate the feasibility of installing the new pipeline under the creek via HDD (Figure 3). Much of the Existing Conditions and Project Components sections that follow are based on the PDR.

Proposed Project Location and Size

The proposed Project is in the City of Half Moon Bay, San Mateo County, California, and would include portions of the Strawflower Village shopping center parking lot (APN 056-300-150) and Oak and Pilarcitos Avenues, as well as portions of the following APNs, adjacent to Pilarcitos Creek: 056-300-210, 056-040-999, 056-141-970 (Oak Avenue Park), and 056-141-950. The proposed Project is within Section 29 of Township 5 South, Range 5 West of the Mount Diablo Base and Meridian, as depicted in the Half Moon Bay U.S. Geological Survey (USGS) 7.5-minute topographic map. Specifically, the proposed Project Site consists of approximately 0.81 acres, including surface areas directly above the HDD pipeline as well as areas for staging and equipment laydown. APN 056-141-970 (Oak Avenue Park) is owned by the City, and all other portions of the proposed Project Area are either within utility easements or public road right-of-way (ROW).

Existing Conditions

The north end of the proposed creek crossing is on private property in the paved parking lot behind Safeway in the Strawflower Village shopping center. This parking lot is not heavily used due to its location behind the store. The parking lot is accessible from the east directly from San Mateo Road through the Strawflower Access Road, west of SR-1. The asphalt concrete surface across the parking lot is essentially flat. Thick, overgrown vegetation associated with Pilarcitos Creek riparian zone borders the parking lot to the south and west.

The south end of the proposed crossing is in Oak Park along the north side of Oak Avenue. The flat, grassy area is east of the bathroom and playground facilities near the pathway to the pedestrian bridge that crosses the creek to Strawflower Village. This park and the parcels in the creek riparian zone are owned by the City.

The existing ground surface elevations range between 42 ft on the north side and about 44 ft on the south side of the proposed crossing. The creek bed near the proposed centerline of the proposed crossing is ranges between elevations 27 and 29 ft.

Geologic maps describe subsurface soils encountered in the proposed Project Area as generally alluvial fan and stream terrace deposits (NRCS 2014). Geotechnical investigations conducted as part of the preliminary Project design observed very stiff to hard clay with sand to sandy clay to a depth of about 12 ft below ground surface (bgs) underlain by medium dense clayey sand to a depth of about 20 ft bgs. Underlying those soils are stiff lean clay to clayey silt to a depth of about 24.5 ft bgs and medium dense to dense clayey sand to very stiff sandy lean clay to a depth of about 27.5 ft bgs. Alternating layers of stiff clay and dense to very dense clayey sand and clayey sand with gravel are present to at least 50 ft bgs.

New Pipe Installation

HDD is a trenchless construction method whereby a pipe is installed in an arcing drill path to pass under a conflicting feature, such as Pilarcitos Creek (Figure 3 and Figure 4). HDD is typically a three-phase process. The first phase involves setting up a drill rig on one side of the crossing, in this case to the north behind the Safeway building, and drilling a pilot hole from a small entry pit in front of the rig. The entry pit contains drilling fluids. The bore begins with a vertical tangent to quickly gain depth, then arcs into a horizontal section under the creek, before following an upward path to the exit point. Another small pit at the exit point contains fluids to facilitate the reaming and pullback operations.

The second phase involves enlarging the pilot hole using reaming equipment to expand the diameter of the hole required for pipeline pullback, typically 1.5 times the pipe diameter. The larger borehole allows for the flow of drilling fluids around the pipe to reduce friction so the pipe can be pulled through. The pipe is delivered in sections, then butt-fused together so it is fully assembled before pullback begins. This process necessitates the large linear layout area along Pilarcitos Avenue.

The third phase involves pulling back the fully assembled pipe through the enlarged hole from the exit point back to the drill rig at the entry pit. Pullback is typically completed without interruption. Drilling mud, typically a mixture of water and bentonite or polymer, is used to remove the soil cuttings, support the walls of the borehole, and cool the cutting tools. Mixing systems are used to mix the drilling fluid additives with water to achieve the fluid properties appropriate for the site-specific geology. Separation plants are used to remove soil cuttings and recycle drilling fluids. All fluids are contained at the entry and exit pits. Spill facilities and equipment are stationed nearby to insure on-site fluid containment.

The new pipe would be sized to match the 8-inch inner diameter of the existing piping. The new pipe would be somewhat flexible, high-density polyethylene (HDPE). The pipe's working pressure would be approximately 100 pounds per square inch (psi) at the bottom of the proposed bore path (where pressure is the highest) and could accommodate increased working pressures up to approximately 150 psi. Because of the HDPE pipe thickness, a nominal 10-inch DR 11 HDPE would be used to meet the required 8-inch inner diameter and pressure class requirements.

For the open trench sections of the proposed Project that will connect the 10-inch HDPE crossing to the existing pipe on each side of the creek, 8-inch Class 52 ductile iron pipe (DIP) would be installed per the District's standards. HDPE adapters or mechanical joint fittings with the appropriate HDPE restraints would be used to connect the two pipe materials.

The new pipe would be installed with a 20-ft minimum depth of cover below the creek bed, equivalent to the depth of cover of the pipe previously installed as part of the District's El Granada Final Phase HDD crossing. This clearance below creeks minimizes the chance for fracking out drilling fluid. A frac-out can happen when drilling fluid escapes from the borehole to the surface, generally resulting in relatively small

puddles of mud on the ground. Geotechnical experts design the HDD crossing to avoid frac-outs, but contingency plans (such as portable containment and nearby vacuum trucks) are required in the event one occurs, to limit any potential environmental damage. The bore geometry also provides a depth of cover of approximately 15 ft below the lower sanitary sewer siphon that also crosses Pilarcitos Creek.

Open-trench construction on each side of the HDD crossing would connect to the existing 8-inch DIP water mains. The open trench sections would be Class 52 DIP, encased in polyethylene wrap, with a minimum 3 ft of cover per District standards. The connection north of the creek would be installed either by hot tap or cutting in a tee with a shutdown. The connection south of the creek would be installed by cutting in a new tee and valve cluster without loss of service.

The exit side open trench section would extend east on Oak Avenue to the existing 8-inch crossing near Pilarcitos Avenue. The new pipe would include valves and caps on each end along Oak Avenue to facilitate extending this line as part of the District's planned Pine Willow Oak Project. All water service laterals would remain connected to the existing 4-inch water main along Oak Avenue until the Pine Willow Oak Project is completed, at which point service laterals would be reconnected to the new 8-inch water main. The existing crossing would be cut and capped at each end and abandoned in place.

Project-related ground disturbance would only occur at the bore pits, which would be approximately 10 ft wide, 10 ft long, and 5 ft deep, and within the HDD alignment itself. The construction contractor would dispose of all materials off-site and out of the public ROW. No disposal or borrow sites would be part of the proposed Project.

Staging and Laydown Areas

A portion of Pilarcitos Avenue would be used as a laydown area to pre-fabricate the new pipe before pullback (Figure 4). Pilarcitos Avenue is a two-lane residential street with private residences located only on the west side. The east side of the street is undeveloped and does not contain any driveways between Oak Avenue and Willow Avenue (approximately 485 ft), so it is well suited for laying down and fabricating the pipe. An overhead electrical line runs along the east side of the street behind the back of walk.

An open-space conservation easement exists in Strawflower Shopping Center property (APN 056-300-150), which restricts development in the Pilarcitos Creek riparian zone and designates areas for permitted encroachments. The easement, however, explicitly exempts "the installation or repair of underground utility lines and septic systems" from the development restrictions. Vegetation removal would be limited to ornamental grass within the HDD exit pit at Oak Park.

Access

Access to and from the proposed Project Site for construction purposes would be via the local street network. Parking for worker vehicles would be either at the Safeway lot when working at the HDD Entry Staging Area or along Oak Avenue and Pilarcitos Avenue when working at the HDD Exit Staging Area or assembling the pipeline.

Utilities, Easements, and Rights-of-Way

The District would purchase permanent and temporary construction easements for the proposed Project. An encroachment permit with the City would also be required for the open trench section along Oak Avenue and the work area needed to fabricate the pipe string along Pilarcitos Avenue.

There are no overhead utilities in the proposed Project Area north of the creek. The District's existing 8-inch water main wraps around the Safeway in the parking lot to the Strawflower Access Road. A 2-inch

gas main and 3-inch electrical conduit run between the District's water line and the Safeway building. The 2-inch gas main extends parallel to the proposed crossing for approximately 150 ft, before it bends east towards SR-1. The proposed crossing maintains a horizontal clearance from the gas main of at least 13 ft, but the exact location of the gas main would be verified by the contractor before construction. A 12-inch sanitary sewer owned by the City runs southeast behind the Safeway in the parking lot to a manhole located in the vegetated area south of Safeway. From this manhole, parallel 6-inch and 4-inch sanitary sewer siphons run south under the creek to a manhole located along the southern bank of the creek. The proposed Project would cross these siphons approximately 25 ft south of the manhole north of the creek. At the proposed crossing location, the upper 4-inch siphon is assumed to have approximately 6.25 ft of cover and the deeper 6-inch siphon is assumed to have 7.25 ft of cover based on work done as part of preliminary Project design. The siphons are exposed above grade on the southern side of the creek bed.

The south end of the proposed crossing is in Oak Avenue Park along the north side of Oak Avenue, in the flat-lying, grassy area east of the bathroom and playground facilities. This park and the parcels in the creek riparian zone are owned by the City. There are no known underground or overhead utilities in the area of the park at the south end of the proposed crossing. A paved walking path with three small bridges runs north of the grassy area adjacent to the creek vegetation. A wire fence borders the creek vegetation to the south, north of the path. Due to the density of the brush, the creek bed has very limited accessibility from the south.

The pipe on the south end that connects to the new crossing would be installed in an open trench south to Oak Avenue and east in the Oak Avenue ROW, where it would connect to the existing 8-inch water main at Pilarcitos Avenue. Oak Avenue consists of a two-lane street with parallel parking spaces along each side. The south side of the street (across from the park) is occupied by private residences. Oak Street utilities include: a 2-inch gas main runs along the northern back of walk; a 6-inch sanitary sewer runs along the centerline of the street; an existing 4-inch water main runs between the sanitary sewer and the southern edge of pavement; and an overhead electrical line runs behind the back of walk on the south side of the street and extends east across Pilarcitos Avenue.

Construction Schedule and Equipment

It is anticipated that construction of the proposed project would require approximately two months. Work would be conducted between the hours of 7 a.m. and 6 p.m. Monday through Friday, 8 a.m. to 6 p.m. on Saturdays, and 10 a.m. to 6 p.m. on Sundays and holidays unless otherwise approved in writing by the City of Half Moon Bay Director of Public Works/City Engineer. Equipment used during construction will include an excavator, drill rig, mud mixing plant, and separation plant as well as vehicles necessary for transportation of equipment and employees.

Proposed Project Operations

No additional operations are anticipated beyond the current level for the existing pipeline and would include periodic inspections and maintenance as needed.

1.3 BEST MANAGEMENT PRACTICES

The construction contractor will be responsible for complying with all terms of the contract specifications and drawings. Best Management Practices (BMPs) to be identified in the contract specifications and drawings include, but are not limited to the following:

1) Identify locations of all existing underground lines in the proposed alignment and take necessary precautions to avoid damaging the pipelines or interfering with their service.

2) Maintain utility services in the proposed Project Area at all times, except for short term outages during construction work hours approved in advance by the District.

3) Minimize discharge of materials in storm water in accordance with the District's Storm Water Management and Discharge Rules and Regulations.

4) Use traffic cones, signs, lighted barricades, lights, and flagmen as described and specified in the Manual of Uniform Traffic Control Devices, current edition, California Supplement, Part 6 Temporary Traffic Control to provide for public safety and convenience during construction.

5) Maintain convenient access to driveways and streets near the work area unless otherwise approved by the City in advance.

6) Lane closure or traffic detours on City streets require prior approval of the City. The City will need to grant permission for excavation in the streets, typically in the form of an Encroachment Permit.

7) Cover, fence, and guard, as appropriate, open excavation and ditches across roadways and pedestrian pathways in such a manner as to permit safe traffic and pedestrian flow during hours when no work is being performed and to prevent accidents from people or animals falling into the trenches.

8) Restore all street, parkland, and natural surfaces to pre-disturbance conditions or better.

The contractor will also implement measures during construction to maintain safety, minimize impacts from hazardous materials spills, maintain emergency access, protect water quality, cultural and biological resources, and prevent fires, including:

1) Follow all safety and health requirements set forth by the Occupational Safety and Health Administration.

2) Hazardous materials will not be stored or used, such as for equipment maintenance, where they could affect nearby properties, or where they might enter the storm drain system.

3) All spills of oil and other hazardous materials will be immediately cleaned up and contained. Any hazardous materials cleaned up or used on-site will be properly disposed of at an approved disposal facility.

4) The District or its contractor will notify and coordinate with law enforcement and emergency service providers prior to the start of construction to ensure minimal disruption to service during construction.

5) Detours will be readily available at all times to allow emergency vehicles access around the work area.

6) Prepare a site-specific Water Pollution Control Plan (WPCP) to limit erosion and protect water quality surrounding the proposed Project Area.

The Bay Area Air Quality Management District (BAAQMD) recommends BMPs to ensure minimal impacts on regional air quality. The contractor will be responsible for implementing the following basic measures during construction:

1) All exposed soil surfaces (e.g., parking areas, staging areas, soil piles, graded areas) will be watered two times per day.

2) All haul trucks transporting soil, sand, or other loose material off-site will be covered.

3) All visible mud or dirt track-out onto adjacent public roads will be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.

4) All roadways, driveways, and sidewalks to be paved will be completed as soon as possible.

5) Idling times will be minimized either by shutting equipment off when not in use or reducing the maximum idling time to five minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]).

6) Clear signage will be provided for construction workers at all access points.

7) All construction equipment will be maintained and properly tuned in accordance with manufacturer's specifications, and all equipment will be checked by a certified visible emissions evaluator.

8) A publicly visible sign with the telephone number and person to contact at the lead agency regarding any dust complaints will be posted in or near the proposed Project Area. The contact person will respond to complaints and take corrective action within 48 hours. The Air District's phone number will also be visible to ensure compliance with applicable regulations.

1.4 OTHER PUBLIC AGENCIES WHOSE APPROVAL MAY BE REQUIRED

The information contained in this Initial Study will be used by the District (the CEQA Lead Agency) as it considers whether or not to approve the proposed Project. If the Project is approved, the Initial Study, as well as the associated Mitigated Negative Declaration (MND) would be used by the District and responsible and trustee agencies in conjunction with various approvals and permits. These actions include, but may not be limited to, the following approvals by the agencies indicated:

City of Half Moon Bay

- Encroachment Permit
- Grading Permit
- Utility Easement
- Coastal Development Permit

California Coastal Commission

- The California Coastal Commission (CCC) has the ability to review the Project through an appeal process, contingent on the City's approval of the Coastal Development Permit.

Sources: National Geographic, WRA | Prepared By: mweidenbach, 3/19/2021

Figure 1. Project and Staging Area Regional Location Map

CCWD Water Line Replacement
Under Pilarcitos Creek
Half Moon Bay, California

0 0.25 0.5 Miles

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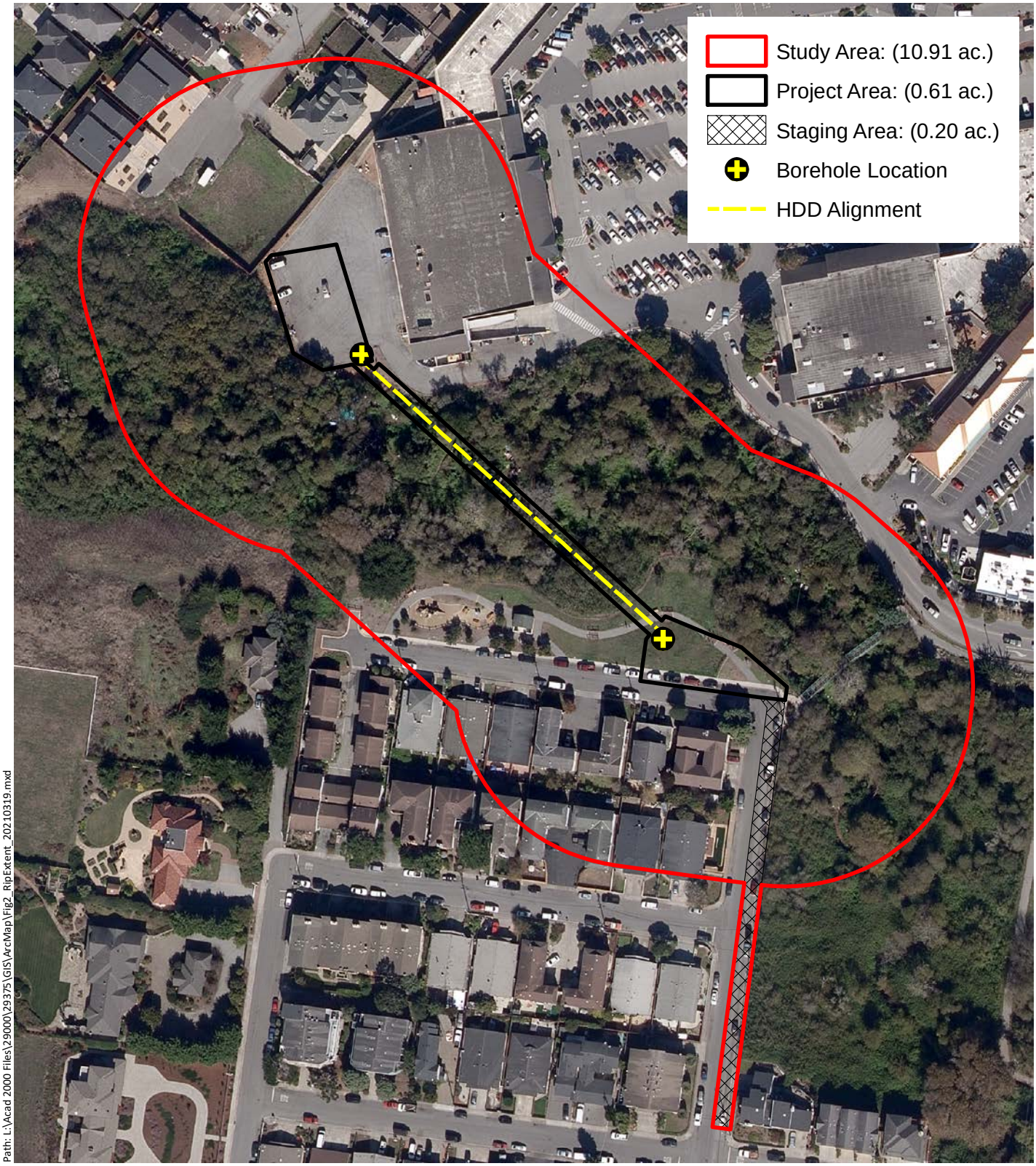

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Sources: EKI, WRA | Prepared By: mweidenbach, 3/19/2021

Figure 2. Project Components

CCWD Water Line Replacement
Under Pilarcitos Creek
Half Moon Bay, California

0 100 200 Feet

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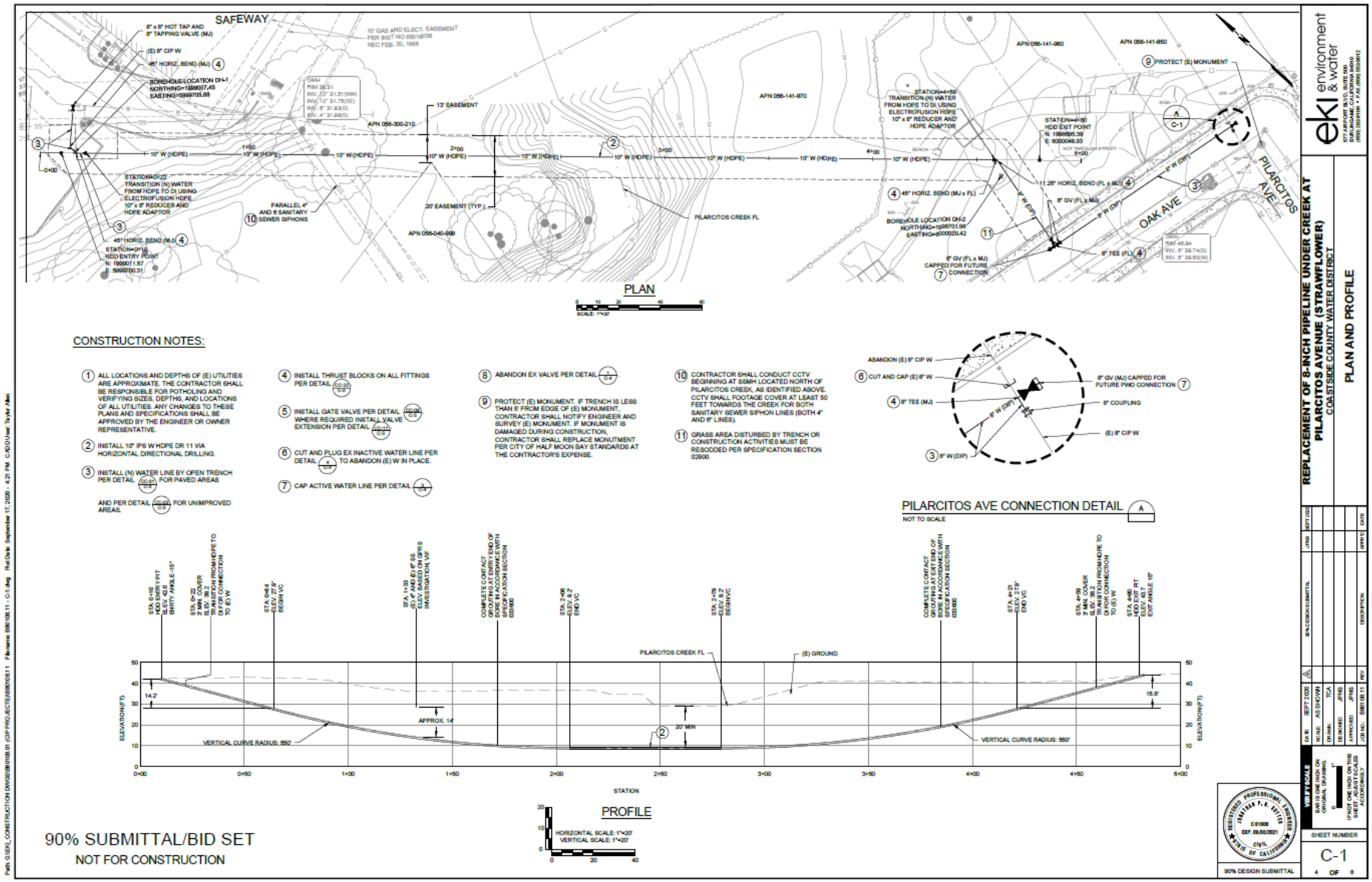

Figure 3. Site Plan and Profile

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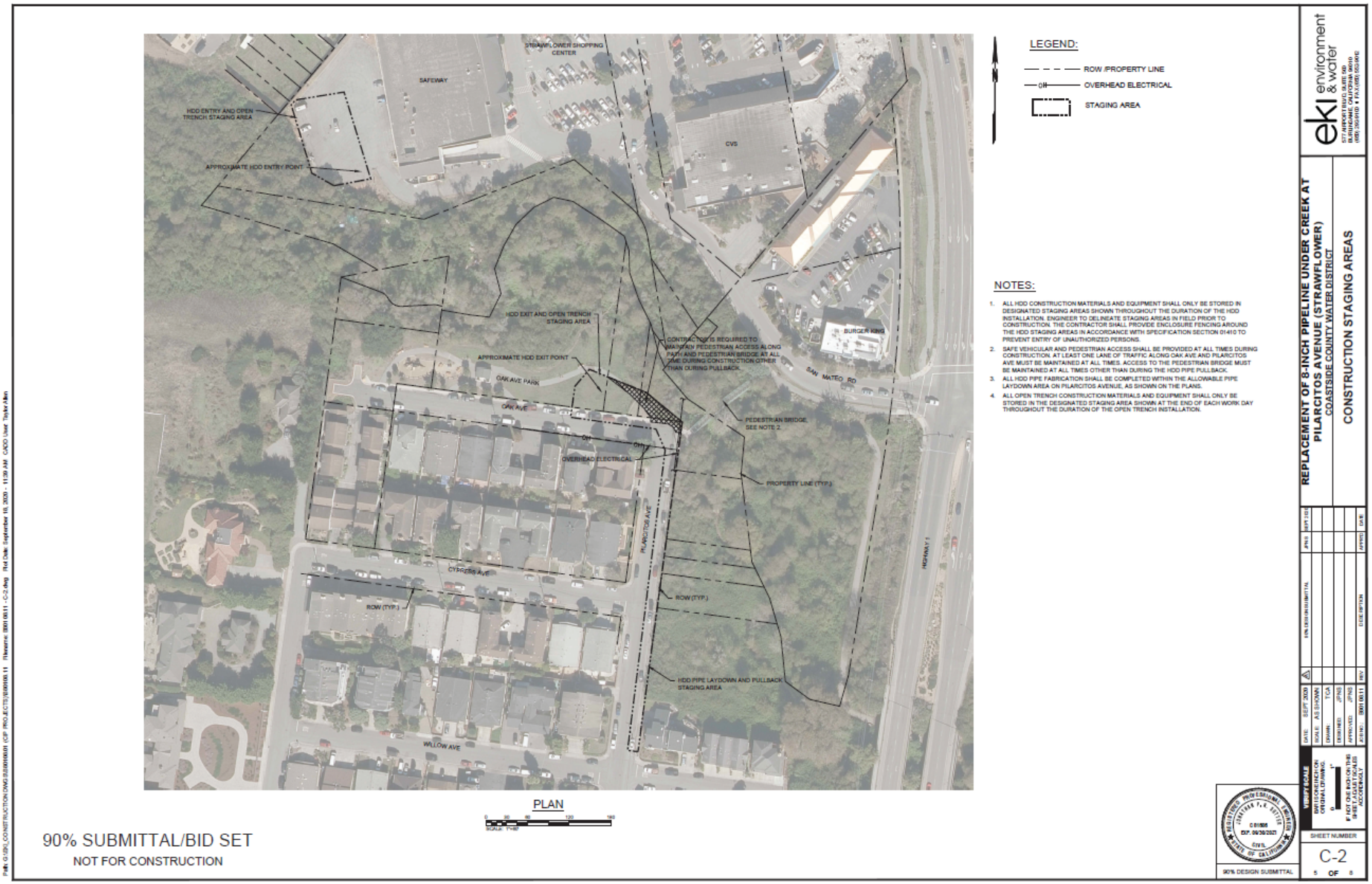

Figure 4. Construction Staging Areas

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Photo 5a: Bore entry staging area (beyond fire hydrant) behind Safeway in the Strawflower Shopping Center.

Photo 5b: Access from San Mateo Road through Strawflower Center to Bore entry staging area (left of Safeway).

Photo 5c: Bore entry location and tie-in to existing water line (under Fire Hydrant).

Figure 5. Photos from Strawflower Center of HDD Bore Entry Area

Photo 6a: Looking East from pathway in Oak Park over HDD Pullback Staging Area (to right of pathway).

Photo 6b: Looking Northwest across Pilarcitos Avenue near Oak over the pipe layout area to the Pedestrian Bridge over Pilarcitos Creek.

Photo 6c: Looking South on Pilarcitos Avenue along proposed pipe layout area.

Figure 6. Photos from Oak Park of HDD Pipe Layout and Pullback Areas

Photo 7a: View west overlooking Pilarcitos Creek and the dense vegetation surrounding it.

Photo 7b: Northeast view into Bridge Entrance from Pilarcitos Avenue.

Photo 7c: Southwest view into Bridge Entrance from San Mateo Road

Figure 7. Photos of Pedestrian Bridge Over Pilarcitos Creek

CCWD Water Line Replacement
Under Pilarcitos Creek
Half Moon Bay, California

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2.0 ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED

2.0 ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED

The environmental factors checked below (☒) would be potentially affected by this proposed Project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

☐ Aesthetics	☐ Greenhouse Gas Emissions	☐ Public Services
☐ Agriculture and Forestry Resources	☒ Hazards and Hazardous Materials	☐ Recreation
☐ Air Quality	☐ Hydrology/Water Quality	☒ Transportation
☒ Biological Resources	☐ Land Use/Planning	☒ Tribal Cultural Resources
☒ Cultural Resources	☐ Mineral Resources	☐ Utilities/Service Systems
☐ Energy	☒ Noise	☒ Wildfire
☐ Geology/Soils	☐ Population/Housing	☒ Mandatory Findings of Significance

3.0 DETERMINATION

3.0 DETERMINATION

On the basis of this initial evaluation:

☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☒ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the proposed project MAY have a significant effect on the environment, and in ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a "potentially significant" or "Potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier IER or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

Signature Date

Mary Rogren, General Manager
Printed Name

4.0 INITIAL STUDY CHECKLIST

4.0 INITIAL STUDY CHECKLIST

This section describes the existing environmental conditions in and near the project area and evaluates environmental impacts associated with the proposed project. The environmental checklist, as recommended in the CEQA Guidelines (Appendix G), was used to identify environmental impacts that could occur if the proposed project is implemented. The right-hand column in the checklist lists the source(s) for the answer to each question. The cited sources are identified at the end of this section.

Each of the environmental categories was fully evaluated, and one of the following four determinations was made for each checklist question:

- "No Impact" means that no impact to the resource would occur as a result of implementing the project.
- "Less than Significant Impact" means that implementation of the project would not result in a substantial and/or adverse change to the resource, and no mitigation measures are required.
- "Less than Significant with Mitigation Incorporated" means that the incorporation of one or more mitigation measures is necessary to reduce the impact from potentially significant to less than significant.
- "Potentially Significant Impact" means that there is either substantial evidence that a project-related effect may be significant, or, due to a lack of existing information, could have the potential to be significant.

Any potential impacts resulting from the proposed Project would be temporary in nature during the construction phase. Because the proposed Project is a replacement of an existing line, no operational impacts would occur from the proposed Project.

4.1 AESTHETICS

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Source
Except as provided in Public Resources Code Section 21099, would the project:					
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☒	☐	1
b) Substantially damage scenic resources, including, but not limited to trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒	4
c) In non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from publicly accessible vantage point). If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?	☐	☐	☒	☐	1
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☐	☒	1

Environmental Setting

The proposed Project Area does not consist of any features that would block any possible City-designated scenic views. SR-1, the nearest designated scenic highway, is located approximately 350 ft east of the proposed Project Area. SR-1 is an official state scenic highway from Santa Cruz to the southern City Limits of Half Moon Bay (Caltrans 2019). Existing land uses adjacent to the proposed Project Area consist of various multifamily residential properties, Oak Avenue Park, and a pedestrian bridge that crosses Pilarcitos Creek at the intersection between Oak Avenue and Pilarcitos Avenue. Residences and commercial uses have direct views of the proposed Project Area. Existing sources of nighttime light in the proposed Project Area include vehicle headlights, parking lot lights, and residential lighting. Existing sources of glare are mainly limited to automobile windshields and reflective building materials associated with residential and commercial uses. The City's Local Coastal Program/Land Use Plan (LCP/LUP) and Zoning Code includes policies and standards addressing visual resources in the City. Chapter 7, Visual Resources, of the LCP/LUP addresses the protection of views of scenic areas and visual resources visible from public roads and trails.

The LCP/LUP also includes a Visual Resource Overlay Map that identifies existing visual resources located throughout the City.

Discussion of Impacts

a) **Less than Significant Impact.** Scenic vistas include broad views of mountain ranges, ridgelines, the beach, and the ocean as viewed from a highway, park, or other public space, particularly those designated for the express purpose of viewing and sightseeing. A project would impact a scenic vista if it were to substantially change, introduce incompatible scenic elements, block, or remove a scenic vista.

Views from within Oak Park and the Strawflower Center are enclosed by existing vegetation so that broad scenic views are not available. According to the Visual Resources Overlay Map in the LCP/LUP, there are no designated shoreline access routes from or through the proposed Project Area. The proposed Project would not result in the construction of new buildings or other above-ground facilities on-site; all structures would be sub-surface and therefore would not introduce incompatible elements which could impact scenic vistas. Thus, impacts would be less than significant, and no further analysis is required.

b) **No Impact.** A significant impact may occur if scenic resources within a state scenic highway would be damaged or removed by a project. The proposed Project Area is not located within an officially designated state scenic highway. SR-1 is the nearest officially designated state scenic highway, located approximately 350 ft east of the proposed Project Area. Motorists are not able to view the proposed Project Area, as potential views from SR-1 are blocked by residential housing, commercial structures, and existing vegetation (Figure 8 and Figure 9).

c) **Less than Significant Impact.** A significant impact may occur if a project were to introduce visual elements that would be incompatible with the character of the project site and surrounding areas. The proposed Project is completely underground and would not introduce an incompatible visual element to the site or surrounding area. During the construction phase, the truck loading area behind Safeway and a portion of Oak Park would be disturbed to install the pipeline which would temporarily modify views from nearby residential properties and access roads. Views of the open trenches, pipe stored along Pilarcitos Avenue, construction equipment, and stockpiled soil would be visible for brief periods as segments of the pipeline are installed. The activities are typical of pipeline installation in developed areas and would not substantially degrade views of the existing setting. Once the pipeline is in place, views would be restored to the same as existing conditions. Therefore, the proposed Project would not significantly impact the visual character or quality of the site or surroundings and no further analysis is required.

d) **No Impact.** The proposed Project would not include any sources of light or daytime glare and long-term operation of the proposed Project would not add new sources of light or glare. Upon completion of construction the light and glare conditions at the proposed Project Area would be the same as the existing conditions and therefore there is no impact.

Figure 8. View from SR-1 looking west at Pilarcitos Creek bridge.

Figure 9. View from SR-1 looking west from south of San Mateo Road.

4.2 AGRICULTURE AND FORESTRY RESOURCES

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Source
In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland. Would the project:					
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒	5
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒	3
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?	☐	☐	☐	☒	3
d) Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☐	☒	1
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☐	☒	1,5

Environmental Setting

According to the San Mateo County Important Farmland Map (California Department of Conservation 2014), the proposed Project Area is designated as Urban and Built-Up Land. The City's LCP/LUP designates the site Residential – Medium Density and Commercial – General. The pipeline traverses land

zoned as Multiple Family Residential (R-3), Open Space – Conservation (OS-C), and Commercial General (C-G) (City of Half Moon Bay 2015).

The Williamson Act of 1965 allows local governments to enter into contract agreements with local landowners with the purpose of trying to limit specific parcels of land to agricultural or other related open space uses. The proposed Project Area does not contain any state designated agricultural lands or open space. The proposed Project Area is not subject to a Williamson Act Contract.

Discussion of Impacts

a-e) **No Impact.** The proposed Project Area is in an urban built-up state and does not contain any agricultural land. There are no agricultural or forestry resources within the proposed Project Area. There are no Prime, Unique, Statewide or Locally Important farmlands in the area. The proposed Project Area not under a Williamson Act Contract, nor is the Project zoned as forest land or timber production. The proposed Project would be confined to existing rights-of-way and therefore no impacts to agricultural or forestry resources are anticipated.

4.3 AIR QUALITY

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Source
Where available, the significance criteria established by the applicable air quality management district or air pollution control district may be relied upon to make the following determinations. Would the project:					
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☒	☐	1,16
b) Result in a cumulatively-considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or State ambient air quality standard?	☐	☐	☒	☐	1,16
c) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☒	☐	1,16
d) Result in other emissions such as those leading to odors adversely affecting a substantial number of people?	☐	☐	☒	☐	1,16

Environmental Setting

The proposed Project Area is in the San Francisco Bay Area air basin, where air quality is monitored and regulated by the BAAQMD. Ambient concentrations of key air pollutants have decreased considerably over the course of the last several decades. Air pollution is generated by anything that burns fuel (including but not limited to cars and trucks, construction equipment, backup generators, boilers and hot water heaters, barbeques and broilers, gas-fired cooking ranges and ovens, fireplaces, and wood-burning stoves), almost any evaporative emissions (including the evaporation of gasoline from service stations and vehicles, emissions from food as it is cooked, emissions from paints, cleaning solvents, and adhesives, etc.), and other processes (fugitive dust generated from roadways and construction activities, etc.).

A sensitive receptor is generally defined as a location where human populations, especially children, seniors, and sick persons, are located where there is a reasonable expectation of continuous human exposure to air pollutants. These typically include residences, hospitals, and schools. The site is surrounded by residential and commercial land uses.

The BAAQMD adopted the Final 2017 Clean Air Plan in April 2017. The plan updated the 2010 Clean Air Plan and includes strategies to reduce emissions of ozone precursors and emissions of fine particulate matter. The plan also provides a framework for long-term planning efforts to reduce greenhouse gas (GHG) emissions 40 percent below 1990 levels by 2030 and 80 percent below 1990 levels by 2050 (BAAQMD 2017).

The U.S. Environmental Protection Agency (EPA) has identified air pollutants that endanger public health and the environment, are widespread throughout the United States, and come from a variety of sources. These pollutants are called "criteria" air pollutants. National Ambient Air Quality Standards (NAAQS) have been established for each of them to meet specific public health and welfare standards. The EPA has established NAAQS for the following six criteria pollutants: ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, and lead. The California Air Resources Board has set California Ambient Air Quality Standards (CAAQS) for the same six pollutants, as well as four additional pollutants: sulfates, hydrogen sulfide, vinyl chloride, and visibility-reducing particles. The Bay Area is currently classified as "attainment" or "unclassifiable" with respect to every NAAQS except ozone and fine particulate matter ($PM_{2.5}$), for which it is still classified as "nonattainment." With respect to CAAQS, the Bay Area is currently classified as "nonattainment" for ozone, respiratory particulate matter smaller than 10 microns (PM_{10}), $PM_{2.5}$ (BAAQMD 2017).

Discussion of Impacts

a, b) ***Less Than Significant Impact.*** Construction activities would result in short-term increases in emissions from the use of heavy equipment that generates dust, exhaust, and tire-wear emissions; soil disturbance; materials used in construction; and construction traffic. Project construction would produce fugitive dust (PM_{10} and $PM_{2.5}$) during ground disturbance and would generate carbon monoxide, ozone precursors, and other emissions from vehicle and equipment operation. BMPs recommended by BAAQMD and identified above in the Project Description would be implemented during construction to minimize fugitive dust. All pipeline improvement activities would take place within existing roads in a developed community. Construction emissions would be relatively low and temporary, lasting approximately two months, and would not have long-term effects on air quality at the proposed Project Area, in the project vicinity, or within the Bay Area. Because of the small area of disturbance, temporary nature of the emissions, and implementation of construction measures, impacts on air quality would be less than significant and would comply with the Bay Area 2017 Clean Air Plan.

As discussed under items a), the proposed Project would result in minor construction-related emissions. It would not result in a cumulatively considerable net increase of any criteria pollutant. The proposed Project would cause short-term air quality impacts as a result of construction activities; however, it would not result in long-term or cumulatively considerable increases in air quality pollutant emissions for which the Bay Area is currently in non-attainment (ozone and particulate matter). Implementation of the BMPs included in the Project Description would ensure that the temporary increase in air pollutant emissions associated with construction activities would result in less than significant contributions to cumulative pollutant levels in the region.

c) **Less than Significant Impact.** The primary sensitive receptors in the vicinity are residents and, employees and customers of commercial development, which may include children, elderly people, or people with respiratory illnesses. Sensitive receptors located in close proximity to several locations along the construction area could be exposed to temporary air pollutants from construction activities, such as fugitive dust, ozone precursors, and carbon monoxide. The duration of construction activities would be limited. Basic construction measures recommended by BAAQMD, listed in the Project Description, would be implemented during construction to minimize air pollutants. New construction equipment has been subject to increasingly stringent emissions requirements at the Federal level (e.g., 40 CFR 89 and 1039), designated "Tier 1", "Tier 2", "Tier 3", etc.; older construction equipment is subject to potential retrofit requirements required by the California Code of Regulation (CCR; 13 CCR 2449, 13 CCR 2450-2466, and 17 CCR 93116). As a result, sensitive receptors in the vicinity of the proposed Project would not be exposed to substantial pollutant concentrations, and impacts would be less than significant.

d) **Less than Significant Impact.** Construction activities would involve the use of gasoline or diesel-powered equipment that emits exhaust fumes and would involve asphalt paving, which has a distinctive odor during application. Asphalt would conform to BAAQMD regulations governing asphalt (Regulation 8, Rule 15). These activities would take place intermittently throughout the workday, and the associated odors are expected to dissipate within the immediate vicinity of the work area. Persons near the construction work area may find these odors objectionable. However, the proposed Project would not include uses that have been identified by BAAQMD as potential sources of objectionable odors, such as restaurants, manufacturing plants, landfills, and agricultural and industrial operations. The infrequency of the emissions, rapid dissipation of the exhaust and other odors into the air, and short-term nature of the construction activities would result in less than significant odor impacts. Additionally, no odors would be emitted during operation of the proposed Project. The proposed Project would have a less than significant impact on sensitive receptors due to odors.

4.4 BIOLOGICAL RESOURCES

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Source
Would the project:					
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	☐	☒	☐	☐	1, 6, 11
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the California Department of Fish and Wildlife or U. S. Fish and Wildlife Service?	☐	☒	☐	☐	1, 6, 11
c) Have a substantial adverse effect on State or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☐	☒	☐	1, 11
d) Interfere substantially with the movement of any resident or migratory fish or wildlife species or with established native resident migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☐	☒	☐	1, 11
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☒	☐	7, 11

f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Conservation Community Plan, or other approved local, regional, or State habitat conservation plan?	☐	☐	☐	☒	1, 11

The following analysis of biological resources is based on a site assessment performed by WRA, Inc. on January 14, 2021.

Environmental Setting

Biological Communities in the Proposed Project Area

WRA, Inc. biologists conducted a site assessment on January 14, 2021. See Appendix A of the Biological Resources Evaluation for a list of observed or documented plant species within or near the proposed Project Area. Non-sensitive biological communities in the proposed Project Area include developed/disturbed areas (Figure 10). Two sensitive biological communities, or Environmentally Sensitive Habitat Areas (ESHA), occur in the proposed Project Area: a perennial stream and riparian corridor habitat. Figure 11 illustrates the extent of riparian habitat in the proposed Project Area.

The developed/disturbed areas include paved parking areas and sidewalks, road shoulders, and park lawns. Developed/disturbed areas within Oak Avenue Park include a portion of the paved walking trail and adjacent regularly mowed lawn area. An approximately 0.1-mile portion of the sidewalk and eastern side of Pilarcitos Avenue is included in the developed/ disturbed land cover.

Pilarcitos Creek, a perennial stream, extends through the proposed Project Area in an east-west direction. The creek channel, as delineated by ordinary high water mark (OHWM), is a water of the United States subject to the jurisdiction of the Corps under the Clean Water Act (CWA). The creek, as delineated by top of bank (TOB), would be considered as waters of the state subject to the jurisdiction of the RWQCB under the Porter-Cologne Act and California Department of Fish and Wildlife (CDFW) under the California Fish and Game Code (CFGC). The creek is also a potential ESHA subject to the jurisdiction of the CCC/Half Moon Bay LCP.

Within the proposed Project Area, riparian habitat along Pilarcitos Creek is dominated by red alder (*Alnus rubra*), Fremont cottonwood (*Populus fremontii*), red willow (Salix laevigata), and arroyo willow (*Salix lasiolepis*). This community meets the definition of red willow riparian forest Salix laevigata Woodland Alliance defined by Sawyer et al. (2009). In upland areas outside of the creek TOB, the understory was dominated by herbs and forbs including stinging nettle (*Urtica dioica*), cape ivy (*Delairea odorata*), Nasturtium (*Tropaeolum majus*), Himalayan blackberry (*Rubus armeniacus*), and California blackberry (*Rubus ursinus*).

The overstory consisted of more than 50 percent of riparian species including red alder, arroyo willow, and alder; accordingly, the vegetation within the proposed Project Area meets the CCC/Half Moon Bay LCP definition of riparian corridor. Riparian areas in the proposed Project Area could potentially be subject to the jurisdiction of the RWQCB, CDFW, and the CCC/Half Moon Bay LCP. Several trees in the proposed Project Area could meet the species and size requirements needed to be considered a "heritage tree" under Chapter 7.40, "Heritage Trees" (Tree Ordinance), of the City's Municipal Code. The Project will not impact any protected or non-protected trees within and adjacent to the Proposed Project Area.

Special-Status Species in the Proposed Project Area

Special-Status Plant Species

All of the 60 special-status plant species documented in the vicinity of the Proposed Project Area are unlikely or have no potential to occur in the Proposed Project Area due to lack of suitable habitat.

Special-Status Wildlife Species

Of the 41 special-status wildlife species known to occur in the vicinity of the proposed Project Area, 34 of these species are unlikely or have no potential to occur there (see Appendix A in the Biological Resources Evaluation). Species may have been considered unlikely to occur due to lack of available habitat or, in some cases, the distance of the proposed Project Area from documented occurrences. The special-status wildlife species discussed below have a potential to occur in the proposed Project Area.

Western pond turtle (*Actinemys marmorata*), CDFW Species of Special Concern. The western pond turtle is the only native freshwater turtle in California. This turtle is uncommon to common in suitable aquatic habitat throughout California, west of the Sierra-Cascade crest and Transverse Ranges. Western pond turtles inhabit annual and perennial aquatic habitats, such as coastal lagoons, lakes, ponds, marshes, rivers, and streams from sea level to 5,500 ft in elevation. Western pond turtles also occupy man-made habitats such as stock ponds, wastewater storage, percolation ponds, canals, and reservoirs. This species requires low-flowing or stagnant freshwater aquatic habitat with suitable basking structures, including rocks, logs, algal mats, mud banks, and sand. Warm, shallow, nutrient-rich waters are ideal as they support western pond turtle prey items, which include aquatic invertebrates and occasionally fish, carrion, and vegetation. Turtles require suitable aquatic habitat for most of the year; however, western pond turtles often occupy creeks, rivers, and coastal lagoons that become seasonally unsuitable. To escape periods of high-water flow, high salinity, or prolonged dry conditions, western pond turtles may move upstream and/or take refuge in vegetated, upland habitat for up to four months (Rathbun et al. 2002). Although upland habitat is utilized for refuging and nesting, this species preferentially utilizes aquatic and riparian corridors for movement and dispersal.

There have been no documented occurrences of this species within 5 miles of the Proposed Project Area (CDFW 2021). At the time of the January 14, 2021, site visit, the portion of Pilarcitos Creek within the Proposed Project Area was slow-moving, which is a positive attribute for turtles. It was shallow and clear, however, and did not provide aquatic escape habitat for turtles to evade predators. It is likely that during the rainy season, the creek would provide more aquatic escape habitat. The creek is also very entrenched through the Proposed Project Area, likely making it difficult for turtles to move to upland habitat for nesting or seasonal refuge. Western pond turtles are unlikely to nest in or adjacent to the Proposed Project Area, though it may occasionally move through or bask within the Proposed Project Area when there are appropriate water levels and sufficient sunlight passes through the tree canopy. Therefore, there is a moderate potential for this species to occur within the Proposed Project Area.

San Francisco garter snake (*Thamnophis sirtalis tetrataenia*), Federal Endangered, State Endangered, CDFW Fully Protected. Historically, San Francisco garter snake occurred in scattered wetland areas on the San Francisco Peninsula from approximately the San Francisco County line south along the eastern and western bases of the Santa Cruz Mountains, at least to the Upper Crystal Springs Reservoir, and along the coast south to Año Nuevo Point, San Mateo County, and Waddell Creek, Santa Cruz County. The preferred habitat of the San Francisco garter snake is a densely vegetated pond near an open hillside where they can sun themselves, feed, and find cover in rodent burrows; however, considerably less-ideal habitats can be successfully occupied. Temporary ponds and other seasonal freshwater bodies are also used. Emergent and bankside vegetation such as cattails (*Typha* spp.), bulrushes (*Scirpus* spp.) and spike rushes (*Juncus* spp.

and *Eleocharis* spp.) apparently are preferred and used for cover. The area between stream and pond habitats and grasslands or bank sides is used for basking, while nearby dense vegetation or water often provide escape cover. Snakes also use floating algal or rush mats, if available.

There are two significant components to San Francisco garter snake habitat: 1) ponds or suitable habitat that support California red-legged frog, American bullfrog (*Rana catesbeiana*), or the Pacific chorus frog (*Pseudacris regilla*) and 2) surrounding upland that supports Botta's pocket gopher *(Thomomys bottae)* or the California meadow vole *(Microtus californicus).* Ranid frogs are an obligate component of the San Francisco garter snake's diet (USFWS 2006).

San Francisco garter snake has been documented to occur within Pilarcitos Creek (CDFW 2021). There is not a substantial amount of emergent vegetation within the Proposed Project Area, but the snake may still move through and occasionally forage within aquatic habitat and uplands on-site. Based on habitat conditions and the close proximity of documented occurrences, there is a high potential for this species to occur, at least as a transient, within the Proposed Project Area.

California red-legged frog (*Rana draytonii*), Federal Threatened Species, CDFW Species of Special Concern. California red-legged frog is dependent on suitable aquatic, estivation, and upland habitat. During periods of wet weather, starting with the first rainfall in late fall, red-legged frogs disperse away from their estivation sites to seek suitable breeding habitat. Aquatic and breeding habitat is characterized by dense, shrubby, riparian vegetation and deep, still, or slow-moving water. Breeding occurs between late November and late April. California red-legged frog estivate (period of inactivity) during the dry months in small mammal burrows, moist leaf litter, incised stream channels, and large cracks in the bottom of dried ponds.

There are four physical and biological features that are considered to be essential for the conservation or survival of a species. The features for the California red-legged frog include aquatic breeding habitat; non-breeding aquatic habitat; upland habitat; and dispersal habitat (USFWS 2010).

Aquatic breeding habitat consists of low-gradient freshwater bodies, including natural and manmade (e.g., stock) ponds, backwaters within streams and creeks, marshes, lagoons, and dune ponds. It does not include deep water habitat, such as lakes and reservoirs. Aquatic breeding habitat must hold water for a minimum of 20 weeks in most years. This is the average amount of time needed for egg, larvae, and tadpole development and metamorphosis so that juveniles can become capable of surviving in upland habitats (USFWS 2010).

Aquatic non-breeding habitat may or may not hold water long enough for this species to hatch and complete its aquatic life cycle, but it provides shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult California red-legged frog. These waterbodies include plunge pools within intermittent creeks; seeps; quiet water refugia during high water flows; and springs of sufficient flow to withstand the summer dry period. The California red-legged frog can use large cracks in the bottom of dried ponds as refugia to maintain moisture and avoid heat and solar exposure (Alvarez 2004). Non-breeding aquatic features enable California red-legged frog to survive drought periods and disperse to other aquatic breeding habitat (USFWS 2010).

Upland habitats include areas within 300 ft of aquatic and riparian habitat and are comprised of grasslands, woodlands, and/or vegetation that provide shelter, forage, and predator avoidance. These upland features provide breeding, non-breeding, feeding, and sheltering habitat for juvenile and adult frogs (e.g., shelter, shade, moisture, cooler temperatures, a prey base, foraging opportunities, and areas for predator avoidance). Upland habitat can include structural features such as boulders, rocks, and organic debris (e.g., downed trees, logs), as well as small mammal burrows and moist leaf litter (USFWS 2010).

Dispersal habitat includes accessible upland or riparian habitats between occupied locations within 0.7 mile of each other that allow for movement between these sites. Dispersal habitat includes various natural and altered habitats such as agricultural fields, which do not contain barriers to dispersal. Moderate- to high-density urban or industrial developments, large reservoirs, and heavily traveled roads without bridges or culverts are considered barriers to dispersal (USFWS 2010). Although California red-legged frog is highly aquatic, this species has been documented to make overland movements of several hundred meters and up to one mile during a winter-spring wet season in Northern California (Bulger et al. 2003; Fellers and Kleeman 2007) and 2,860 meters (1.8 miles) in the central California coast (Rathbun and Schneider 2001). Frogs traveling along water courses can exceed these distances.

The portion of Pilarcitos Creek within the Proposed Project Area may provide suitable aquatic breeding and dispersal habitat for this species. The riparian canopy cover and low gradient, slow-moving intermittent creek are positive habitat attributes. This species is unlikely to use uplands within the Proposed Project Area, however, due to the highly entrenched banks around the creek, which are likely difficult for this frog to climb in most locations, and due to the highly developed area surrounding the Proposed Project Area. This species was documented directly adjacent to the Proposed Project Area in 2006 (CDFW 2021). Based on habitat conditions and the close proximity of documented occurrences, there is a high potential for this species to occur within the Proposed Project Area.

Steelhead - Central California Coast Distinct Population Segment (*Oncorhynchus mykiss irideus*), Federal Threatened. The Central California Coast Distinct Population Segment includes all naturally spawned populations of steelhead (and their progeny) in California streams from the Russian River to Aptos Creek, and the drainages of San Francisco and San Pablo Bays eastward to the Napa River (inclusive), excluding the Sacramento-San Joaquin River Basin.

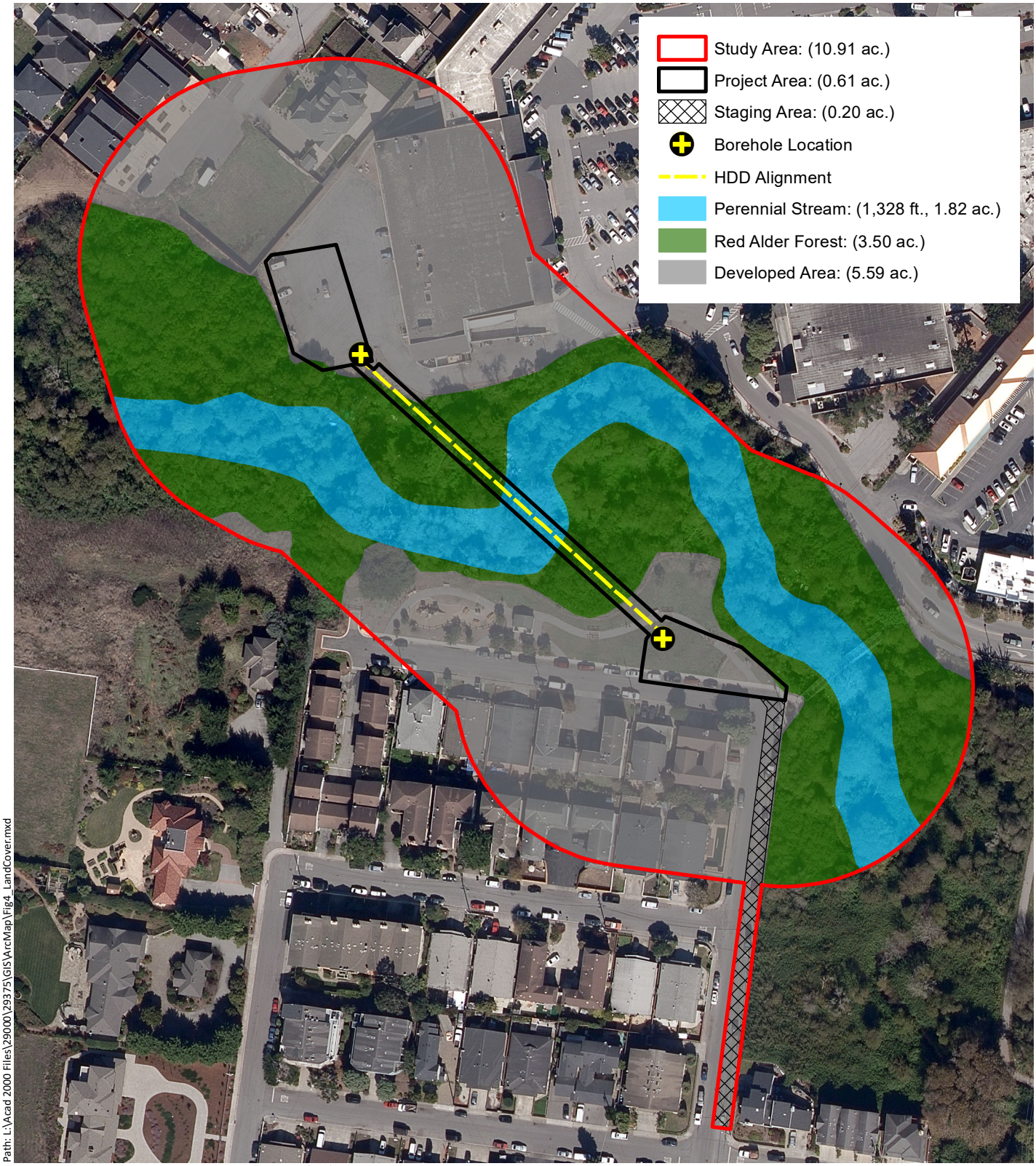
Steelhead typically migrate to marine waters after spending two years in freshwater, though they may stay up to seven. They then reside in marine waters for 2 or 3 years prior to returning to their natal stream to spawn as 4-or 5-year-olds. Steelhead adults typically spawn between December and June. In California, females typically spawn two times before they die. Preferred spawning habitat for steelhead is in perennial streams with cool to cold water temperatures, high dissolved oxygen levels, and fast flowing water. Abundant riffle areas (shallow areas with gravel or cobble substrate) for spawning and deeper pools with sufficient riparian cover for rearing are necessary for successful breeding.

This species has been observed within Pilarcitos Creek, and both adults and smolting juveniles likely pass through the Proposed Project Area on their way to or from breeding grounds. This species is likely to be present only seasonally when water levels allow fish passage, during migrations to spawning grounds further upstream, and during outmigration. Based on habitat characteristics and documented occurrences within Pilarcitos Creek, this species has a high potential to occur within the Proposed Project Area.

San Francisco dusky-footed woodrat (*Neotoma fuscipes annectens*), CDFW Species of Special Concern. This subspecies of the dusky-footed woodrat occurs in the Coast Ranges between San Francisco Bay and the Salinas River (Matocq 2002). Occupied habitats are variable and include forest, woodland, riparian areas, and chaparral. Woodrats feed on woody plants, but will also consume fungi, grasses, flowers, and acorns. Foraging occurs on the ground and in bushes and trees. This species constructs robust stick houses/structures in areas with moderate cover and a well-developed understory containing woody debris. Breeding takes place from December to September. Individuals are active year-round, and generally nocturnal.

This species has been documented 3.5 miles to the northeast in vegetated areas along state highway 35 (CDFW 2021). While not documented in urban Half Moon Bay, this species is generally present in the region and is known to create nests in densely vegetated areas including riparian areas. While no stick nest

structures were observed within the Proposed Project Area during the January 2021 site visit, conditions are potentially favorable for occupation by this species were they to disperse to the Proposed Project Area from generally more suitable habitats. Although impacts to the riparian area are not anticipated in the course of this Project, woodrat may establish nests adjacent to work areas and thus have moderate potential to occur.



Path: L:\Acad 2000 Files\29000\29375\GIS\ArcMap\Fig4_LandCover.mxd

Sources: EKI, WRA | Prepared By: SGillespie, 1/31/2021

Figure 10. Land Cover Types within the Project Area

CCWD Water Line Replacement
Under Pilarcitos Creek
Half Moon Bay, California

0 100 200 Feet

N

wra
ENVIRONMENTAL CONSULTANTS

Path: L:\Acad 2000 Files\29000\29375\GIS\ArcMap\Fig5_JurisFeatures.mxd

Sources: EKI, WRA | Prepared By: SGillespie, 1/31/2021

Figure 11. Potential Jurisdictional Features Located within the Project Area

CCWD Water Line Replacement
Under Pilarcitos Creek
Half Moon Bay, California

0 100 200 Feet

N

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Regulatory Setting

Sensitive Biological Communities

Sensitive biological communities include habitats that fulfill special functions or have special values, such as wetlands, streams, and riparian habitat. These habitats are regulated under federal regulations (such as the CWA, state regulations (such as the Porter-Cologne Act, CDFW Streambed Alteration Program, and CEQA), or local ordinances or policies (such as City or County Tree Ordinances, Special Habitat Management Areas, applicable LCPs, and General Plan Elements).

Waters of the United States Regulated by the U.S. Army Corps of Engineers

The Corps regulates "Waters of the United States" under Section 404 of the CWA. Waters of the United States are defined in the Code of Federal Regulations (CFR) as including the territorial seas, and waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, such as tributaries, lakes and ponds, impoundments of waters of the U.S., and wetlands (33 CFR 328.3). Potential wetland areas, according to the three criteria used to delineate wetlands as defined in the Corps Wetlands Delineation Manual (Environmental Laboratory 1987), are identified by the presence of (1) hydrophytic vegetation, (2) hydric soils, and (3) wetland hydrology. Unvegetated waters including lakes, rivers, and streams may also be subject to Section 404 jurisdiction and are characterized by an OHWM identified based on field indicators such as the lack of vegetation, sorting of sediments, and other indicators of flowing or standing water. The placement of fill material into Waters of the United States generally requires a permit from the Corps under Section 404 of the CWA.

Waters of the State Regulated by the Regional Water Quality Control Board

The term "Waters of the State" is defined by the Porter-Cologne Act as "any surface water or groundwater, including saline waters, within the boundaries of the state." The State Water Resources Control Board (SWRCB) and nine RWQCBs protect waters within this broad regulatory scope through many different regulatory programs. Waters of the State in the context of a CEQA Biological Resources evaluation include wetlands and other surface waters protected by the State Wetland Definition and Procedures for Discharges of Dredged or Fill Material to Waters of the State (SWRCB 2019). The SWRCB and RWQCB issue permits for the discharge of fill material into surface waters through the State Water Quality Certification Program, which fulfills requirements of Section 401 of the CWA and the Porter-Cologne Water Quality Control Act. Projects that require a CWAEPA permit are also required to obtain a Water Quality Certification. If a project does not require a federal permit but does involve discharge of dredge or fill material into surface waters of the State, the SWRCB and RWQCB may issue a permit in the form of Waste Discharge Requirements.

Sensitive Biological Communities Regulated by CDFW

Streams and lakes, as habitat for fish and wildlife species, are regulated by CDFW under Sections 1600-1616 of CFGC. Alterations to or work within or adjacent to streambeds or lakes generally require a 1602 Lake and Streambed Alteration Agreement. The term "stream", which includes creeks and rivers, is defined in the CCR as "a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports fish or other aquatic life [including] watercourses having a surface or subsurface flow that supports or has supported riparian vegetation" (14 CCR 1.72). The term "stream" can include ephemeral streams, dry washes, watercourses with subsurface flows, canals, aqueducts, irrigation ditches, and other means of water conveyance if they support aquatic life, riparian vegetation, or stream-dependent terrestrial wildlife. Riparian vegetation has been defined as "vegetation which occurs in and/or adjacent to a stream and is dependent on, and occurs because of, the stream itself" (CDFG 1994). Removal of riparian vegetation also requires a Section 1602 Lake and Streambed Alteration Agreement from CDFW.

The CDFW also ranks sensitive communities as "threatened" or "very threatened" and keeps records of their occurrences in its California Natural Diversity Database (CNDDB). CNDDB vegetation alliances are ranked 1 through 5 based on NatureServe's (2018) methodology, with those alliances ranked globally (G) or statewide (S) as 1 through 3 considered sensitive. Impacts to sensitive natural communities identified in local or regional plans, policies, or regulations or those identified by the CDFW or U.S. Fish and Wildlife Service (USFWS) must be considered and evaluated under CEQA (CCR Title 14, Div. 6, Chap. 3, Appendix G).

Sensitive Biological Communities Regulated by the California Coastal Commission and Half Moon Bay Local Coastal Program

The California Coastal Commission guidelines contain definitions for specific types of ESHAs, including wetlands, estuaries, streams and rivers, lakes, open coastal waters and coastal waters, riparian habitats, other resource areas, and special-status species and their habitats. The Half Moon Bay LCP defines sensitive habitat and coastal resource areas for conservation to include: sand dunes; marine habitats; sea cliffs; riparian areas; wetlands, coastal tidelands and marshes, lakes, ponds, and adjacent shore habitats; coastal or off-shore migratory bird nesting sites; areas used for scientific study, refuges, and reserves; habitats containing unique or rare and endangered species; rocky intertidal zones; coastal scrub communities; wild strawberry habitat; and archaeological resources. Any areas that may meet the definition of any ESHA as defined by the CCC guidelines or the Half Moon Bay LCP are considered sensitive in this document.

The boundaries of wetland areas regulated by the Corps and CCC/Half Moon Bay LCP are often not the same due to the differing goals of the respective regulatory programs and also because these agencies use different definitions for determining the extent of wetland areas. As previously described, the Corps requires that positive indicators for all three parameters, the presence of wetland hydrology, hydric soils, and a predominance of hydrophytic vegetation, be present for an area to meet the Corps' wetland definition. The CCC/Half Moon Bay LCP does not necessarily require that all three wetland indicators (wetland hydrology, hydric soils, and a predominance of hydrophytic vegetation) be present for an area to be determined to be a "wetland"; rather, the presence of only one of these three parameters could be sufficient for a positive wetland determination.

The City's LCP outlines permitted uses within specific ESHAs. Permitted uses within riparian corridors, such as the habitat associated with Pilarcitos Creek, include necessary water supply projects (City of Half Moon Bay 1993).

Special-Status Species

Special-status species include those plants and wildlife species that have been formally listed, are proposed as endangered or threatened, or are candidates for such listing under the federal Endangered Species Act (FESA) or California Endangered Species Act (CESA). These Acts afford protection to both listed and proposed species. In addition, CDFW Species of Special Concern and the National Marine Fisheries Service Species of Concern, which are species that face extirpation if current population and habitat trends continue, USFWS Birds of Conservation Concern, sensitive species included in USFWS Recovery Plans, and CDFW special-status invertebrates are all considered special-status species. Although CDFW Species of Special Concern generally have no special legal status, they are given special consideration under CEQA. In addition to regulations for special-status species, most birds in the United States, including non-status species, are protected by the Migratory Bird Treaty Act of 1918. Under this legislation, destroying active nests, eggs, and young is illegal.

Bat species designated as "High Priority" by the Western Bat Working Group qualify for legal protection under Section 15380(d) of the CEQA Guidelines. Species designated "High Priority" are defined as "imperiled or are at high risk of imperilment based on available information on distribution, status, ecology

and known threats" (WBWG 2020). Plant species on California Native Plant Society (CNPS) Lists 1 and 2 are also considered special-status plant species. Impacts to these species are considered significant according to CEQA (CNPS 2020).

Critical Habitat

Critical habitat is a term defined and used in the FESA as a specific geographic area that contains features essential for the conservation of a threatened or endangered species and that may require special management and protection. The FESA requires federal agencies to consult with the USFWS to conserve listed species on their lands and to ensure that any activities or projects they fund, authorize, or carry out will not jeopardize the survival of a threatened or endangered species. In consultation for those species with critical habitat, federal agencies must also ensure that their activities or projects do not adversely modify critical habitat to the point that it will no longer aid in the species' recovery. In many cases, this level of protection is similar to that already provided to species by the FESA "jeopardy standard." However, areas that are currently unoccupied by the species, but which are needed for the species' recovery, are protected by the prohibition against adverse modification of critical habitat.

Relevant Local Policies, Ordinances, Regulations

City of Half Moon Bay Heritage Tree Ordinance

Pursuant to Section 7.40 of the Half Moon Bay Municipal Code, a heritage tree is defined as a tree located on public or private property, exclusive of eucalyptus, with a trunk diameter of 12 inches or circumference of approximately 38 inches measured at 48 inches above ground level; a tree or stand of trees designated by City Council resolution to be heritage trees based on special historical, environmental, or aesthetic value; or any street tree located within the public right of way along the entire length of Main Street (City of Half Moon Bay 2020).

Discussion of Impacts

a) **Less than Significant with Mitigation Incorporated.** Special-status plant species would not be affected by project construction activities. The work areas do not support suitable habitat for special-status plant species known to occur in the vicinity of the proposed Project Area. Implementation of Mitigation Measure BIO-1 would limit all construction activities to designated areas at minimum 15 ft from the top of the creek bank. Impacts to special-status plant species would be less than significant.

Common and special-status wildlife, particularly nesting birds, may be exposed to noise and other disturbance during construction, but these activities are typical of urban environments and these species are usually acclimated to these types of disturbance. In addition to regulations for special-status species, most birds, including non-special-status species, are protected by the CFGC. Under this legislation, destroying active nests, eggs, and young is illegal. The primary potential for impacts to birds (both special-status and non-special-status) would be direct impacts (including physical impacts) to active bird nests during the breeding bird season (defined generally as February 1 to August 31). In addition, construction activities could result in noise and visual impacts associated with construction of the proposed project could result in: (1) nest abandonment; (2) loss of young; (3) reduced health and vigor of eggs and/or nestlings (resulting in reduced survival rates). However, implementation of Mitigation Measure BIO-2 would reduce such impacts to birds to a less-than-significant level.

It is not anticipated that HDD activities will affect the California red-legged frog, San Francisco garter snake, western pond turtle, bats, or steelhead. However, HDD does have the potential for

"frac-out", when pressure built up in the bore tunnel that can force drilling mud up through the ground and into the natural environment. Although it is unlikely, if frac-out occurs, it may affect habitat and potentially impact individuals of these species. California red-legged frogs, San Francisco garter snakes, and western pond turtles may inhabit aquatic habitat and the banks of Pilarcitos Creek within the proposed Project Area, and steelhead habitat includes aquatic features and the cover provided by riparian trees. These species may forage and disperse through the proposed Project Area. Implementation of Mitigation Measure BIO-3 would reduce such impacts to a less-than-significant level.

San Francisco dusky-footed woodrat has potential to occur in densely vegetated riparian areas of the Proposed Project Area. While no disturbance to these areas is anticipated as a result of HDD, any traversal of the riparian area could result in impacts to woodrat nests that may be present.

Mitigation Measure BIO-1: All vegetation removal, ground disturbance, and other construction activities shall occur at minimum 15 ft above the top of the creek bank to avoid low-lying mesic areas on the fringe of the creek.

Mitigation Measure BIO-2: Proposed Project activities shall occur between September 1 and February 14 in order to avoid potential impacts during the nesting season. If Project activities are conducted during the nesting season (February 15 – August 31), a pre-construction nesting bird survey shall be performed no more than 14 days prior to initial ground disturbance to avoid impacting active nests. If the survey identifies any active nests, an exclusion buffer shall be established for protection of the nest. Buffer distances shall vary based on species and conditions at the site, but typically range from 25 up to 500 ft. The buffer shall be maintained until all young have fledged or until the nest fails, or otherwise becomes inactive. Buffers may be reduced from established levels if supported with nest monitoring by a qualified biologist indicating that work activities are not adversely impacting the nest.

Mitigation Measure BIO-3: The following measures shall be implemented to avoid impacts to California red-legged frog, San Francisco garter snake, western pond turtle, and steelhead:

- The Project has been designed and shall be implemented in such a way to avoid and minimize the risk of spills and frac-outs, as evaluated in the Preliminary Design Report (Appendix F) for this Project. Although the risk of frac-outs was identified as low, the HDD contractor shall prepare a Frac-out and Surface Spill Prevention Plan, based on information contained in the HDD Specifications section 02413, prepared by EKI and dated April 2021. The Frac-out Plan shall be submitted to the City for approval prior to the issuance of the grading permit, and the contractor shall submit a letter signed by an authorized representative confirming that the plan will be followed during all HDD activity. The plan shall address the potential risks and modes of frac-outs and frac-out prevention and detection. The plan shall include a project description, including site description, existing conditions, relevant permit requirements, and HDD design and operations, and shall at a minimum include the following information.
    - Calculations of maximum allowable and minimum required drilling fluid pressures, and the critical downhole pressure that would cause hydrofracture.
    - Measures describing training of personnel regarding frac-out monitoring procedures, equipment, materials, and procedures in place for the prevention, containment, cleanup, and disposal of drilling fluids.
    - Pre-construction measures such as lining the entry pit with an impervious flexible membrane, creating an earth berm, or erecting silt fence around the drilling fluid

mixing and pumping areas, and erecting silt fences between the drilling staffing areas and sensitive areas.

- Identifying the personnel on site during the entire HDD installation process with responsibility for detecting whether surface returns have occurred and how they will conduct the monitoring.
- Monitoring of drilling pressures to ensure that they are maintained at a minimum level necessary to maintain fluid circulation and do not exceed those pressures that may penetrate the ground.
- Monitoring of fluid returns at the exit and entry pit to determine if fluid circulation has been lost.
- The Contractor shall measure and record the drilling fluid viscosity and density at least two times per shift or once every 150 feet of advancement, whichever is more frequent, with at least two hours between readings, using a calibrated Marsh funnel or rheometer/rotating viscometer, and a mud balance. These records shall be maintained and provided daily to the Engineer.

- Protocols to be followed if there is a loss of circulation or other indication of frac-out are described below.
  - Immediately respond to detection of a frac-out by stopping drilling operations and pulling back the drill head to relieve pressure.
  - Implement procedures to contain terrestrial returns (e.g., by an earth berm, installation of materials to contain the fluid, or other method).
  - Implement procedures to contain returns into a waterway or sensitive area (e.g., installation of sandbags or a standpipe or barrel tall enough to exceed the water level and sealed at the base).
  - Implement procedures for clean-up and disposal of frac-out materials.
  - Include an on-site materials list to manage and control drilling fluid surface releases, such as heavy weight plastic gravel filled and sealed bags, splash boards, 5-gallon hard plastic pails, wide heavy-duty push brooms, flat blade and round-nose shovels, silt fence and t-posts or straw bales, chicken wire or connecting material to tie off the perimeter of a dewatering structure, absorbent pads to use with plastic sheeting for placement beneath motorized equipment, straw wattles, portable pumps, hoses, vacuum trailers or trucks, silt fence or screens.
  - The performance standard for this mitigation measure is that if a frac-out event occurs cleanup, surveys, photographs, agency or consultant recommendations, and a mitigation plan shall be submitted to the city of Half Moon Bay and any permitting agencies within 30 days of the event. Measures taken might include habitat restoration efforts, or surveys of special status species to assess impacts of the frac-out event. The city and regulatory agencies shall inspect and approve any remedial actions taken by the Lead Agency to respond to the frac-out event.

Mitigation Measure BIO-4: To avoid impacts to the San Francisco dusky-footed woodrat, a pre-construction survey shall be conducted to search for stick nests in suitable habitats adjacent to the work area. Nest structures shall be avoided by Project work or access routes by a minimum of 5 ft. If avoidance is not feasible, the nest structure shall be dismantled by a qualified biologist. Nest material would be moved to suitable adjacent areas that shall not be disturbed. If young are encountered during the dismantling process, the material would be placed back on the nest and remain undisturbed for a minimum of two weeks to give the young enough time to mature and leave on their own accord. After the young have left the nest, the nest dismantling process would begin again.

b) **Less than Significant with Mitigation Incorporated.** Impacts to stream and riparian habitat in the proposed Project Area would be avoided by using HDD in the portion of the pipeline that crosses Pilarcitos Creek below the creek bed. As previously stated, HDD does have the potential for "frac-out", when pressure built up in the bore tunnel that can force drilling mud up through the ground and into the natural environment. Although it is unlikely, if frac-out occurs, it may affect sensitive stream and riparian habitat. There is also potential for soil disturbance or accidental release of materials that would impact stream and riparian habitats. As such, a Frac-Out Plan will be required for this project and will be prepared by the District prior to the issuance of a grading permit. The frac-out plan shall include prevention measures to minimize the potential for frac-out, frac-out detection methods, corrective and containment measures, clean-up response, and agency notification procedures.

In addition, the creek and associated riparian habitat may meet the definition of an ESHA as defined by the CCC guidelines or the Half Moon Bay LCP and would be considered sensitive. The Half Moon Bay LCP outlines permitted uses within specific ESHAs. Permitted uses within riparian corridors, such as the habitat associated with Pilarcitos Creek, include necessary water supply projects (City of Half Moon Bay 1993). Any permit requirements will be implemented by the project. Implementation of Mitigation Measure BIO-4 would reduce such impacts to a less-than-significant level.

Project activities would occur at minimum 15 ft from the TOB and outside of riparian habitat, except for walk-over bore tracking and monitoring activities using hand-held equipment. Implementation of Mitigation Measure BIO-5 would reduce such impacts to a less-than-significant level.

Mitigation Measure BIO-5: The following general avoidance measures shall be implemented in the vicinity of stream and riparian habitat:

- Plastic monofilament netting (erosion control matting or wrapping around wattles), or similar material in any form shall not be used on the Project in order to avoid entangling, strangling, or trapping California red-legged frog, San Francisco garter snake, or western pond turtle.

- Prior to the start of groundbreaking activities, all construction personnel shall receive training on special-status species and their habitats by a qualified biologist. The importance of these species and their habitat shall be described to all employees as well as the minimization and avoidance measures that are to be implemented as part of the Project. A list of trained personnel shall be maintained by the contractor and be made available for review by the USFWS and the CDFW upon request.

- No trash shall be deposited on the site during construction activities. All trash shall be placed in trash receptacles with secure lids stored in vehicles and removed nightly from the Proposed Project Area.

- Any fueling and maintenance of equipment shall be conducted off-site and at least 50 ft from any designated ESHA, which includes Pilarcitos Creek and the associated riparian vegetation adjacent to the creek.

- When working within 50 ft of sensitive areas (e.g., adjacent to riparian habitat), wildlife exclusion fencing shall be installed and maintained around the perimeter of work areas. Exclusion fencing shall enclose any staged materials, equipment staging areas, work areas or access routes. Fencing shall be placed in areas which would prevent San Francisco garter snake and California red-legged frog from entering equipment or materials overnight. Once work in that area has been completed, exclusion fencing shall be removed as soon as possible. Exclusion fencing shall additionally be of a size and material that will not cause entrapment of California red-legged frog.

- Construction activities shall not start until 30 minutes after sunrise and shall cease 30 minutes before sunset.

- No holes or trenches shall be left open overnight. Holes or trenches shall have at minimum escape ramps installed or be backfilled at the end of the day.

c) **Less than Significant.** Project activity will occur at minimum 15 ft from the TOB, except for walk-over bore tracking and monitoring activities using hand-held equipment, and thus will not affect federally protected wetlands as defined by Section 404 of the CWA.

d) **Less than Significant.** Pilarcitos Creek likely provides a local movement corridor for common wildlife species. However, impacts to this movement corridor due to project activities are anticipated to be minor and temporary in nature, and thus less than significant. Where the pipeline crosses Pilarcitos Creek it would be installed via HDD below the creek bed.

e) **Less than Significant.** The Half Moon Bay LCP outlines permitted uses within specific ESHAs. Permitted uses within riparian corridors, such as the habitat associated with Pilarcitos Creek, include necessary water supply projects (City of Half Moon Bay 2011). The City provides for the protection of "heritage trees", as defined above. The project is not expected to impact or require the removal of any trees, but if a tree must be removed or impacted, the project will comply with the City's tree ordinance.

f) **No Impact.** No state, regional, or federal habitat conservation plans or Natural Community Conservation Plans have been adopted for the proposed Project Area. An open-space conservation easement exists in Strawflower Shopping Center property (APN 056-300-150), which restricts development in the Pilarcitos Creek riparian zone and designates areas for permitted encroachments. The easement, however, explicitly exempts "the installation or repair of underground utility lines and septic systems" from the development restrictions.

4.5 CULTURAL RESOURCES

		Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Source
Would the Project:						
a)	Cause a substantial adverse change in the significance of a historical resource pursuant to Section 15064.5?	☐	☐	☒	☐	1,3,12
b)	Cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5?	☐	☒	☐	☐	1,3,12
c)	Disturb any human remains, including those interred outside of formal cemeteries?	☐	☒	☐	☐	3,12

This section examines the potential impacts of the proposed project on cultural resources. Tribal cultural resources are addressed in Section 4.18, *Tribal Cultural Resources*. For the purposes of this analysis, the term cultural resource is defined as follows:

> *Indigenous and historic-era sites, structures, districts, and landscapes, or other evidence associated with human activity considered important to a culture, a subculture, or a community for scientific, traditional, religious, or another reason. These resources include the following types of CEQA-defined resources: historical resources, archaeological resources, and human remains.*

The term indigenous, rather than prehistoric, is used in this section as a synonym for "Native American–related". This section relies on the information and findings presented in *Archaeological Survey Report, EKI CCWD Pilarcitos Creek Crossing* (Alta 2020). That report, provided in Appendix B of this report, details the results of the cultural resources study, which examined the environmental, ethnographic, and historic background of the proposed project site, emphasizing aspects of human occupation.

Environmental Setting

Native American Consultation

The Native American Heritage Commission (NAHC) was contacted via email to request a review of the Sacred Lands file and to request a list of Native American contacts in this area on February 16, 2020. The response letter dated February 24, 2020, by Sarah Fonseca (Cultural Resource Analyst) indicated that the search of the Sacred Lands File had a **positive** result. The NAHC response letter suggested that the lead agency contact the Ohlone tribe to provide further information regarding this result and to inquire about

any further consultation. The District is considered the responsible party to further conduct Native American consultation. Appendix B contains the results of the Native American communication.

Records Search

On February 18, 2020, Alex DeGeorgey, archaeologist with ALTA, conducted a records search (File Number 19-1414) at the Northwest Information Center (NWIC) located on the campus of Sonoma State University. The NWIC, an affiliate of the State of California Office of Historic Preservation, is the official state repository of archaeological and historical records and reports for an 18-county area that includes San Mateo County. The records search included a review of all study reports on file within a one-half mile radius of the project area. A search of cultural resources included a one- half mile radius. Sources consulted include archaeological site and survey base maps, survey reports, site records, historic General Land Office maps.

Included in the review were:

- *California Inventory of Historical Resources* (California Department of Parks and Recreation 1976)
- *California Historical Landmarks* for San Mateo County (CA-OHP 1990)
- California Points of Historical Interest (CA-OHP 1992)
- Historic Properties Directory Listing (CA-OHP April 2012)
- *Historic Properties Directory* includes the National Register of Historic Places (April 2012) of the California Historical Landmarks and California Points of Historical Interest

Review of historic registers and inventories indicate that no historical resources are present in the project area. No National Register-listed or eligible properties are located within the 0.5-mile visual area of the Area of Potential Effects (APE).

A review of archaeological site and survey maps at the NWIC reveal that 25 cultural resources studies have been conducted within a one-half mile radius of the current project area. Table 1 summarizes the most relevant studies to the project area. Approximately 20-percent of the one-half mile radius has been previously surveyed. Two survey reports have been conducted within the boundaries of the current project area: Cartier (1983) was conducted in support of the shopping center complex north of Pilarcitos Creek, which is also the location of the proposed entry bore pit and staging area; and another was prepared that covered the southern portion of the project area that includes the staging area and exit bore pit area (Clark 2005). As a result, the entire current project area has been previously surveyed; no cultural resources were identified as a result of these surveys.

Five cultural resources are present within the one-half mile records search radius. There are three prehistoric and one historic-era resources. No cultural resources are documented within project area. The four prehistoric and mixed-component sites identified are located along the banks of Pilarcitos Creek, both west and east of the proposed Project Area.

Historic Map Review

Review of historic maps of the area was completed to better understand the timing of development within the project area and recognize historic features. The following historic maps and references were reviewed as part of this investigation. Eight USGS topographic maps were consulted from 1902 to 1991. The review

of historic maps for this area indicated that no structures or development is evident until 1968, which depicts some residential development to the south of Oak Avenue. The 1991 USGS map depicts the shopping center development north of the river near the north end of the APE.

Field Survey

On May 6, 2020, Alta Archaeological Consulting staff archaeologist Sarah King Narasimha conducted a field survey of the entire APE. Project Maps and aerial imagery were used to correctly identify the project area. Ground surface visibility was extremely poor, less than 5% throughout the project area. A total of 8 shovel and boot scrapes were used to scrape the ground surface to expose mineral soils. The project area was surveyed using intensive pedestrian survey coverage with transects no greater than 10-meter intervals. The entire APE was surveyed including 2.5-acres of land. No resources were found as a result of this pedestrian survey. Digital photos were taken of the project area and surroundings (see Attachment C in the Archaeological Survey Report, Appendix B).

Summary of Cultural Resources Identification Efforts

Through background research, outreach to Native American representatives, and a field survey, no cultural resources were identified in the proposed project site. Therefore, no historical resources or unique archaeological resources, as defined by CEQA, appear to be present in the proposed project site.

Discussion of Impacts

a) **Less than Significant Impact.** Pursuant to State CEQA guideline 15064.5, record searches, field surveys, and research were conducted to determine the potential presence of historic resources as part of the Archaeological Survey Report (Alta 2020). The majority of the APE has undergone previous disturbance as a result of the development in the area for shopping centers and housing development. Although the project is located in an area that would have provided a platform for human occupation to gather and hunt, the area of physical disturbance is minor due to the HDD methods used for pipe installation. In addition, the entry pit for the HDD operation is being conducted in modern fill deposits that have very low archaeological potential; the exit pit would be excavated in soils that have encountered previous disturbance within the vertical excavation proposed, or about 5-ft, with the development of the park and the installation of Oak Avenue. Therefore, the project activities are not anticipated to cause a substantial adverse change in the significance of a historical resource as defined in § 15064.5 (Alta 2020). A less than significant impact would occur.

b, c) **Less than Significant with Mitigation Incorporated.** The proposed Project Area does not contain any known archaeological resources and has a low potential to contain buried cultural deposits or human remains based on past disturbances. However, the project could uncover such materials during construction. Despite the negative findings, the proximity to Pilarcitos Creek and the presence of archaeological sites upstream of the project APE, increases the probability of encountering additional evidence of prehistoric occupation along this riverine corridor. The contractor shall comply with California Health and Safety Code Section 7050.5 and California Public Resources Code Sections 5097.5, 5097.9 et seq., regarding the discovery and disturbance of cultural materials or human remains, should any be discovered during project construction.

Potential impacts on unknown buried cultural resources or human remains would be less than significant with compliance with Mitigation Measure CULT-1.

Mitigation Measure CULT-1: The District or its contractor shall conduct pre-work training so that in the event that soil disturbance uncovers buried archaeological deposits, workers are aware of what a buried deposit might look like and what they need to do.

In keeping with the CEQA guidelines, if previously unidentified cultural resources or archaeological remains are uncovered, work at the place of discovery shall be halted immediately until a qualified archaeologist can evaluate the finds (§15064.5 [f]). Prehistoric archaeological site indicators include but are not limited to obsidian and chert flakes and chipped stone tools; grinding and mashing implements (e.g., slabs and handstones, and mortars and pestles); bedrock outcrops and boulders with mortar cups; and locally darkened midden soils. Midden soils may contain a combination of any of the previously listed items with the possible addition of bone and shell remains, and fire affected stones. Historic period site indicators generally include fragments of glass, ceramic, and metal objects; milled and split lumber; and structure and feature remains such as building foundations and discrete trash deposits (e.g., wells, privy pits, dumps).

The following actions are promulgated in Public Resources Code 5097.98 and Health and Human Safety Code 7050.5 and pertain to the discovery of human remains. If human remains are encountered, excavation or disturbance of the location shall be halted in the vicinity of the find, and the county coroner and a qualified archaeologist must be notified immediately so that an evaluation can be performed. If the coroner determines the remains are Native American and prehistoric, the coroner shall contact the Native American Heritage Commission. The Native American Heritage Commission shall identify the person or persons believed to be most likely descended from the deceased Native American. The most likely descendent makes recommendations regarding the treatment of the remains with appropriate dignity.

4.6 ENERGY

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Source
Would the Project:					
a) Result in a potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?	☐	☐	☒	☐	1,3,12
b) Conflict with or obstruct a State or local plan for renewable energy or energy efficiency?	☐	☐	☐	☒	1,3,12

Environmental Setting

Energy usage is typically quantified using the British thermal unit (BTU). As a point of reference, the approximate amount of energy contained in common energy sources are as follows: gasoline, 115,000 BTUs per gallon; diesel, 138,500 BTUs per gallon; natural gas, 21,000 BTUs per pound; electricity, 3,414 BTUs per kilowatt-hour (kWh) (USDOE 2014a).

Total energy usage in California was 7,640.8 trillion BTUs in 2012, which equates to an average of 201 million BTUs per capita. Of California's total energy usage, the breakdown by sector is 39 percent transportation, 23 percent industrial, 19 percent residential, and 19 percent commercial. Petroleum satisfies 55 percent of California's energy demand, natural gas 32 percent, and electricity 12 percent. Coal fuel accounts for less than one percent of California's total energy demand. Electric power and natural gas in California are generally consumed by stationary users, whereas petroleum consumption is generally accounted for by transportation-related energy use (USDOE 2014b). The other sources are made up of renewable energy sources, which include wind and solar power, among other uses.

Given the nature of the proposed project, the main uses of energy would occur via construction vehicle fuel. These two sources of energy are discussed in further detail in the impacts discussion below.

Discussion of Impacts

a) **Less than Significant Impact.** The proposed project would require the use of diesel and other fuels for trucks and equipment during construction, and these activities would be short-term and completed as efficiently as possible for practical and financial reasons, among other considerations. In 2019, gasoline and diesel consumption for San Mateo County totaled to roughly 314 million gallons (San Mateo County 2021). Fuel consumption associated with the proposed project would mostly result from using an excavator, drill rig, mud mixing plant, separation plant, and worker vehicles. Furthermore, there would be no ongoing energy consumption in the operational phase of the proposed project in excess of the current baseline condition. Fuel consumption associated with the proposed project would therefore be negligible relative to the total fuel consumption in San Mateo County and construction and operation of the proposed project would not result in wasteful,

inefficient, or unnecessary consumption of energy resources. Therefore, impacts in this regard would be less than significant.

b) **No Impact.** The Proposed Project involves replacement of an existing water line, no additional energy would be required for the Project, and the Project would not conflict with state or local renewable energy or energy efficiency plans.

4.7 GEOLOGY AND SOILS

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Source
Would the Project:					
a) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:					
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☐	☒	3,15
ii) Strong seismic ground shaking?	☐	☐	☒	☐	3,15
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☒	☐	3,15
iv) Landslides	☐	☐	☒	☐	3,15
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☒	☐	1
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☒	☐	3,8
d) Be located on expansive soil, as defined in Table 18- 1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property?	☐	☐	☒	☐	3,8
e) Have soils incapable of adequately supporting the use	☐	☐	☐	☒	1

	of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?					
f)	Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	☒	1

Environmental Setting

Regional Geologic Setting

The proposed project is located in the San Francisco Bay Region on the edge of the Coastal Range Geomorphic Province in the eastern foothills of the Santa Cruz Mountains. The local topography is dominated by a series of west-to-southwest trending spur ridges separated by broad swales.

Three major active earthquake faults transect the San Francisco Bay Area trending northwest to southeast. The San Andreas Fault occurs approximately 5.4 miles east of the site. The San Gregorio Fault is located about 1.9 miles west of the site.

Soils and Seismicity

The proposed Project Area has relatively steep topography sloping down from adjacent development towards Pilarcitos Creek, an incised channel. Soils in the proposed Project Area are classified as Farallone coarse sandy loam, sloping, and Gullied land (alluvial soil material).

Farallone loam consists of well-drained, well drained soils that formed in alluvium derived from granitic rocks and is considered a hydric soil. Gullied land is a miscellaneous land type occurring near streams extending through certain soil types, including Farallone, and is considered a hydric soil (USDA 1991).

Significant earthquakes have occurred in this area and strong to violent ground-shaking in the proposed Project Area can be expected as a result of a major earthquake on one of the active faults in the region. The USGS has estimated that there is a 72% chance that a magnitude 6.7 or greater earthquake will occur in the San Francisco Bay Area before 2044. The probability of a 6.7 magnitude or greater earthquake occurring along individual faults was estimated to be 27.4% along the San Andreas Fault and 10% along the San Gregorio Fault (2014 Working Group on California Earthquake Probabilities 2015).

Liquefaction and Lateral Spreading

Liquefaction is the temporary transformation of loose, saturated granular sediments from a solid state to a liquefied state as a result of seismic ground shaking. In the process, the soil undergoes temporary loss of strength, which commonly causes ground displacement or ground failure to occur. Since saturated soils are a necessary condition for liquefaction, soil layers in area where the groundwater table is near the surface have higher liquefaction potential than those in which the water table is located at greater depths. The San Mateo County Hazards Mitigation maps indicate that the lowland areas of the City have a very low to low potential for liquefaction.

Discussion of Impacts

a-i) **No Impact.** The proposed Project Area is not located within a State of California designated Alquist-Priolo Earthquake Fault Zone (City of Half Moon Bay 1991). Earthquake fault zones are regulatory zones that encompass surface traces of active faults that have a potential for future surface fault rupture. The nearest faults to the proposed Project Area are the San Gregorio Fault Zone and the San Andreas Fault Zone, approximately 1.9 miles west and 5.4 miles east of the proposed Project Area, respectively. No faults cross through the proposed Project Area, and surface rupture associated with a fault is not anticipated in the City.

a-ii) **Less Than Significant Impact**. The proposed Project Area is within 5.4 miles of the San Andreas Fault Zone, one of the most seismically active faults in the world. During a major seismic event on the San Andreas Fault, there is the potential for strong ground shaking that could expose persons and property to undue risks. The proposed Project only involves replacing a water pipeline. It would not involve constructing buildings or other structures that would expose people to strong seismic ground shaking. The project would be designed, engineered, and constructed in conformance with standard engineering practices and California Building Code requirements. Compliance with these requirements would ensure the proposed Project Area would not expose persons or property to strong seismic ground shaking hazards. Impacts in this regard would be less than significant.

a-iii) **Less Than Significant Impact**. The potential liquefaction from seismic activity is considered moderate in the proposed Project Area based on the geologic units and flat topography. In addition, the project is subject to all California Building Code requirements for seismic conditions and would be designed to conform to all building requirements. Impacts associated with seismic ground failure, liquefaction and landslides would be less than significant.

a-iv) **Less Than Significant Impact**. The proposed Project Area contains flat relief, which precludes the possibility of landslides on-site. No impacts in this regard would occur.

b) **Less than Significant Impact.** Construction of the proposed project would involve ground disturbing activities that could potentially create erosion. Approximately 60 cubic yards of material would be disturbed during pipeline installation. The proposed project would be required to comply with the erosion control requirements stipulated in the National Pollution Discharge Elimination System (NPDES) Permit issued by the San Francisco Bay RWQCB. These requirements include the preparation and implementation of a WPCP that contains BMPs designed to control erosion, siltation, and contaminated runoff from construction sites. Typical BMPs include sandbags, detention basins, silt fencing, landscaping, hydroseeding, oil/water separators, storm drain inlet protection, street sweeping, and monitoring of water bodies. The preparation and implementation of the WPCP would ensure potential adverse erosion, siltation, and contamination impacts would not occur during short-term construction. Therefore, the proposed project's impacts would be less than significant.

c, d) **Less than Significant Impact.** The potential for geologic and soil hazards from unstable or expansive soils in the proposed Project Area is considered low based on the geologic units, soil types, and flat topography. The ground disturbance associated with the proposed project would cause soil disturbance, but these actions would not result in substantial changes in topography to ground surface relief features, geologic substructures, or unstable soil conditions, unique geologic or physical features. The proposed Project is subject to all Federal, State, and local regulations and standards for seismic conditions including the Uniform Building Code, California Edition and would be designed to conform to all building requirements. Therefore, the proposed projects impacts would not expose human life to hazards and be less than significant.

e) **No Impact.** The proposed Project does not involve construction of septic tanks or alternative wastewater disposal systems.

f) **No impact.** The proposed Project Area does not contain any known paleontological resources or sites or any unique geologic features.

4.8 GREENHOUSE GAS EMISSIONS

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Source
Would the Project:					
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☒	☐	1
b) Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☒	☐	1,16

Environmental Setting

Assembly Bill 32, adopted in 2006, established the Global Warming Solutions Act of 2006 which requires the State to reduce GHG emissions to 1990 levels by 2020. Senate Bill 97, adopted in 2007, required the Governor's Office of Planning and Research to develop CEQA guidelines "for the mitigation of greenhouse gas emissions or the effects of greenhouse gas emissions," and the Resources Agency certified and adopted the amendments to the guidelines on December 30, 2009.

GHGs are recognized by wide consensus among the scientific community to contribute to global warming/climate change and associated environmental impacts. The major GHGs released from human activity are carbon dioxide, methane, and nitrous oxide (Governor's Office of Planning and Research, 2008). The primary sources of GHGs are vehicles (including planes and trains), energy plants, and industrial and agricultural activities (such as dairies and hog farms).

San Mateo County adopted an Energy Efficiency Climate Action Plan (EECAP) in June of 2013. The EECAP is intended to streamline future environmental review of projects in San Mateo County by following CEQA Guidelines and meeting BAAQMD exceptions for a Qualified GHG Reduction Strategy. The EECAP proposes emission reduction measures designed to reduce emissions by 17 percent below 2005 emissions levels by 2020 and sets forth goals, policies, and actions in order to reach this target. Although the EECAP is not required by State law, the BAAQMD has concluded in its 2017 CEQA Guidelines that development projects that are consistent with a qualified Climate Action Plan would not result in significant climate change impacts under CEQA. The Climate Action Plan requires that new development projects must attain higher levels of energy efficiency while incorporating more sustainable design standards. The EECAP provides a Development Checklist to ensure new development projects are compliant with the standards outlined (San Mateo County 2013).

Discussion of Impacts

a) **Less than Significant Impact.** GHG emissions from the project would be produced from construction-related equipment emissions and operation of the pipeline components. GHG emissions associated with operation of the project would consist of GHG emissions from electricity consumption to move water through the system. Based on the nature of the project and short

duration of construction, GHG emissions resulting from construction activities would be both minor and temporary. Operational GHG emissions would be the same as existing conditions. While the project would have an incremental contribution to GHG emissions within the context of the City and region, the individual impact is considered less than significant.

b) **Less than Significant Impact.** The proposed project would not conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing GHG emissions. GHG emissions from off-road equipment and utility electrical usage are identified and planned for in the BAAQMD's 2017 Clean Air Plan as well as the BAAQMD's Source Inventory of Bay Area Greenhouse Gas Emissions (BAAQMD 2010 and 2017). A primary objective of the 2017 Clean Air Plan is to reduce greenhouse gas 40 percent below 1990 levels by 2030 and 80 percent below 1990 levels by 2050. Due to the period of relatively short construction activity, the proposed Project would generate emissions similar to existing conditions and, therefore, would not conflict with any applicable plans, policies, or regulations adopted for the purpose of reducing GHG emissions. Therefore, a less-than-significant impact would occur.

4.9 HAZARDS AND HAZARDOUS MATERIALS

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Source
Would the project:					
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☒	☐	1
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☒	☐	1
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☒	☐	1
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment	☐	☐	☒	☐	9
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or excessive noise for people residing or working in the project area?	☐	☐	☐	☒	1
f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☒	☐	1

g) Expose people or structures, either directly or indirectly, to a significant risk of loss, injury, or death involving wildland fires?	☐	☒	☐	☐	1, 15

Environmental Setting

A material is considered hazardous if it appears on a list of hazardous materials prepared by a federal, state, or local agency or if it has characteristics defined as hazardous by such an agency. A hazardous material is defined in Title 22 of the CCR as follows:

A substance or combination of substances which, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may either (1) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or (2) pose a substantial present or potential hazard to human health or environment when improperly treated, stored, transported, or disposed of or otherwise managed. (CCR, Title 22, Section 66261.10)

Chemical and physical properties cause a substance to be considered hazardous. Such properties include toxicity, ignitability, corrosivity, and reactivity (as defined in CCR, Title 22, Sections 66261.20-66261.24). The accidental release of hazardous materials into the environment could potentially contaminate soils, surface water, and groundwater supplies. Under Government Code Section 65962.5, the California Department of Toxic Substances Control (DTSC) maintains a list of hazardous substance sites. This list, referred to as the "Cortese List," includes CALSITE hazardous material sites, sites with leaking underground storage tanks, and landfills with evidence of groundwater contamination.

No hazardous substance sites from the Cortese List have been identified within the proposed Project Area. No hazardous material sites monitored by DTSC on the agency's EnviroStor database have been reported within one-quarter of a mile of the proposed Project Area (Department of Toxic Substances Control 2021).

Discussion of Impacts

a, b) **Less than Significant Impact.** Small amounts of hazardous materials would be used during construction activities for equipment maintenance (e.g., fuel and solvents). Use of hazardous materials would be limited to the construction phase and would comply with applicable local, state, and federal standards associated with the handling and storage of hazardous materials. Hazardous materials would not be stored or used, such as for equipment maintenance, where they could affect nearby land uses. Standard construction measures included in the project description will be implemented to contain any accidental spills of oil and other hazardous materials, and the contractor will be required to ensure that adequate materials are on hand to clean up any accidental spill that may occur. With implementation of these standard measures included in the project description, impacts associated with the use or accidental spill of hazardous materials would be less than significant.

c) **Less than Significant Impact.** The project site is approximately 0.25-mile of the La Costa Adult School, Manuel F. Cunha Intermediate School, and Hatch Elementary School. Although some hazardous materials would be used during construction, given required compliance with applicable state and federal regulations regarding the transport, use and storage of hazardous materials, a spill or accident would have a low potential to affect people at the school. Any spills will be cleaned up immediately, and all wastes and used spill control materials will be properly disposed of at approved disposal facilities. Impacts would be less than significant.

d) **Less than Significant Impact.** The proposed Project Area has not been identified as a hazardous material or clean-up site. If potentially contaminated soil or groundwater is encountered during project excavation work, standard construction measures included in the project description shall be implemented to handle and properly dispose of such materials, and the contractor would be required to ensure that adequate materials are on hand to manage and dispose of any potentially contaminated materials encountered during excavation. Any contaminated soil or groundwater encountered during excavation would be properly disposed of at approved disposal facilities. With implementation of these standard measures, potential impacts associated with encountering contaminated soil or groundwater, if any are encountered, would be less than significant.

e) **No Impact.** The proposed Project Area is not located near a public or private airport. The nearest airport is the Half Moon Bay Airport located approximately 4.5 miles from the proposed Project Area.

f) **Less than Significant Impact**. Construction activities would require temporary lane closures and detours around the work area. Emergency access to or evacuation from surrounding areas would not be restricted during construction because of the availability of detours, but minor delays may be experienced for access to or evacuation from the land uses adjacent to the work area. The trenches used to install pipe could be quickly covered in the event of an emergency to allow vehicles to drive through the work area, which would ensure the project does not prevent emergency access to the residences or conflict with an emergency response or evacuation plan. Detours will be readily available at all times to allow emergency vehicles access around the work area. With implementation of the traffic control measures included in the Project Description, impacts would be less than significant.

g. **Less than Significant Impact with Mitigation Incorporated.** Construction activities could temporarily increase the risk of a wildfire start compared to existing conditions. Wildfire risk near the proposed Project Area is pronounced due to the presence of dense vegetation in the project vicinity that could spread wildfire into nearby residential communities. During construction, the presence of motorized equipment on the proposed Project Area during the dry season may lead to a temporary increase in wildfire risk. This could create a significant impact if no mitigation measures were set forth.

Mitigation Measure HAZ-1: During construction activities, the construction contractor shall implement the following BMPs to prevent wildfire hazards:

- Staging areas, welding areas, or areas slated for development using spark producing equipment shall be cleared of dried vegetation or other materials that could serve as fire fuel. The contractor shall keep these areas clear of combustible materials in order to maintain a firebreak.
- No smoking, open flames, or welding shall be allowed in refueling or service areas.
- Service trucks shall be provided with fire extinguishers. A minimum of two fire extinguishers shall be kept on site during proposed project construction.
- Any construction equipment that normally includes a spark arrester shall be equipped with an arrester in good working order.

4.10 HYDROLOGY AND WATER QUALITY

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Source
Would the Project:					
a) Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or groundwater quality?	☐	☐	☒	☐	1
b) Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?	☐	☐	☐	☒	1
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or through the addition of impervious surfaces, in a manner which would:					
i.) Result in substantial erosion or siltation on- or off-site?	☐	☐	☒	☐	1
ii.) Substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	☐	☐	☒	☐	1
iii.) Create or contribute runoff which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☒	☐	1
iv.) Impede or redirect flood flows?	☐	☐	☒	☐	1
d) Result in flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?	☐	☐	☒	☐	1

e) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?	☐	☐	☒	☐	1

Environmental Setting

Hydrology in the project area is provided by precipitation and overland runoff from adjacent areas. Precipitation for Half Moon Bay was below normal during the 2019 rainy season, defined as October 1 to March 31. During the 2019 rainy season, precipitation was below normal in October, November, and February, with December, January, and March, above normal levels of precipitation (NRCS 2021).

According to the RWQCB's Water Quality Control Plan for the San Francisco Basin, the proposed Project Area is located in the San Mateo Coastal Basin. The proposed Project Area is covered with mostly pervious surfaces, with drainage flowing into existing street culverts. According to the Federal Emergency Management Agency Federal Insurance Rate Maps, the majority of the proposed Project Area is in flood zone X, which is outside the 100-year floodplain (FEMA 2011). Construction activities would be maintained outside of a 15-foot buffer from the creek top of bank.

Pursuant to Section 402 of the CWA and the Porter-Cologne Water Quality Control Act, municipal stormwater discharges in the City (the City is part of the San Mateo Countywide Stormwater Pollution Prevention Program) are regulated under the San Francisco Bay Region Municipal Regional Stormwater National Pollutant Discharge Elimination System (NPDES) Permit (MRP), Order No. R2-2015-0049 as amended by Order No. R2-2019-0004, NPDES Permit No. CAS612008, adopted November 19, 2015. The MRP is overseen by the San Francisco Bay Regional Water Quality Control Board.

Discussion of Impacts

a) **Less than Significant Impact.** Construction activities would require ground disturbance consisting of two bore pits measuring approximately 10 ft long by 10 ft wide by 5 ft deep. Soil removed from the bore pits would be temporarily stockpiled within the proposed Project Area, and, if not properly controlled, soil particles and other materials could be carried in stormwater runoff to downstream drainage facilities, which could degrade water quality in Pilarcitos Creek. Standard construction measures identified in the project description and recommended by the San Mateo Countywide Water Pollution Prevention Program would be implemented during periods of rain to minimize pollutants carried from the proposed Project Area in runoff. The project would comply with terms of the San Francisco Bay Region Municipal Regional Stormwater National Pollutant Discharge Elimination System Permit. Water quality impacts during construction would be less than significant.

b) **No Impact.** The project would not require use of groundwater supplies or affect groundwater recharge in the area. Implantation of the project would not interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level. No impacts would occur.

c.i-iv) **Less than Significant Impact.** The proposed project would not permanently alter the course of a stream or river, nor would it add substantial impervious surface. The proposed project would not change the existing operation and maintenance activities and therefore these phases of the project would not have an impact on hydrology and water quality. The proposed project would not result in an increase in impermeable surfaces or an increase in runoff compared to existing conditions. The proposed project would not cause a substantial change to the erosion and accretion patterns

long-term because the water line replacement would not alter the existing drainage pattern of the area. Temporary construction impacts related to runoff from grading and cut and fill activities could occur and create a significant impact if not addressed. Proposed project design features, compliance with the San Mateo Countywide Water Pollution Prevention Program, and the City regulations requiring construction BMPs and a NPDES permit for all non-stormwater discharge to the City stormwater system would ensure impacts from runoff would remain less than significant. The proposed project would not add impervious surface or impede flood flows. Both construction and operationally related impacts in these areas would be less than significant.

d, e) ***Less than Significant Impact.*** The proposed project would not have other water quality or groundwater sustainability impacts beyond those discussed above under items a) and b). The proposed Project Area is not located in a tsunami inundation area or seiche zone. The proposed project would comply with the San Mateo Countywide Water Pollution Prevention Program. There would be no operational impacts, and construction impacts would be less than significant.

4.11 LAND USE AND PLANNING

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Source
Would the Project:					
a) Physically divide an established community?	☐	☐	☐	☒	1
b) Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☒	☐	3

Environmental Setting

The proposed Project Area is in a developed area of the City. Existing land uses adjacent to the proposed Project Area consist of commercial and residential development. The proposed Project Area largely follows existing roads and their associated rights-of-way and includes an approximately 110-foot reach of Pilarcitos Creek and portions of Oak Avenue, and Pilarcitos Avenue. The City's General Plan/LCP, adopted in 1993 with various subsequent chapter amendments, provides policies and implementation strategies for management of the resources and land uses in the City, and the City Codes provide restrictions and requirements to protect resources and comply with local, state, and federal laws. No habitat conservation plans have been adopted for the area.

Regulatory Setting

City of Half Moon Bay Local Coastal Program and Land Use Plan

On April 15, 2021, the California Coastal Commission (CCC) certified the updated Half Moon Bay Local Coastal Program (LCP). The Half Moon Bay Land Use Policies and Map constitute the Land Use Plan (LUP) of the LCP. The Zoning Code (Title 18 of the Municipal Code, including Chapter 18.20, which regulates Coastal Development Permits) together with the Zoning District Map constitutes the Implementation Plan of the LCP. The next step is to update the Implementation Plan to ensure consistency with the updated LUP. At this time, the City has not completed the update of the zoning code. Consequently, in some cases there may be inconsistencies between the older zoning code regulations and the newly amended LUP policies. If inconsistencies between updated policies and zoning code regulations occur, the updated LUP takes precedence over the zoning code. The primary goal of the LCP is to ensure that the local government's land use plans, zoning ordinances, zoning maps, and implemented actions meet the requirements of the provisions and polices of the California Coastal Commission's (CCC) Coastal Act at the local level. Coastal Resource Conservation Standards are described in Chapter 6 of the LUP and Chapter 18.38 of the LCP Municipal Code and define sensitive habitat and coastal resource areas for conservation to include: sand dunes; marine habitats; sea cliffs; riparian areas; wetlands, coastal tidelands and marshes, lakes, ponds, and adjacent shore habitats; coastal or off-shore migratory bird nesting sites; areas used for scientific study, refuges, and reserves; habitats containing unique or rare and endangered species; rocky intertidal zones; coastal scrub communities; wild strawberry habitat; and archaeological resources. Marine and water resources (including riparian habitats).

Policy 1-3: Where there are conflicts between the policies set forth in the Coastal Land Use element and other elements of the City's General Plan or existing ordinances, on balance, the policies of this Coastal Land Use Element shall take precedence.

Policy 3-4: (a) Permit only resource- dependent or other uses which will not have a significant adverse impact in sensitive habitats.

(b) In all sensitive habitats require that all permitted uses comply with U.S. Fish and Wildlife and State Department Fish and Game regulations.

Policy 3-9: (a) Within corridors, permit only the following uses: (1) education and research, (2) consumptive uses as provided for in the Fish and Game Code and Title 14 of the California Administrative Code, (3) fish and wildlife management activities, (4) trails and scenic overlooks on public lands(s), and (5) necessary water supply projects.

Policy 3-11: (a) For all perennial watercourses (i.e., Pilarcitos Creek, Frenchmans Creek, Arroyo Leon, and Arroyo Cañada Verde west of Highway 1) and certain intermittent watercourses (i.e., Kehoe Watercourse and Wavecrest Arroyo): buffer zones shall extend a minimum of 50 feet from the outer limit of the riparian vegetation or 100 feet from the top of bank, whichever is greater.

(b) For all other intermittent and ephemeral watercourses with riparian vegetation (e.g., Roosevelt Creek, the riparian corridor in the northwestern area of Ocean Colony, and Arroyo Cañada Verde east of Highway 1): buffer zones shall extend a minimum of 35 feet from the outer limit of riparian vegetation or the top of bank, whichever is greater.

Policy 10-1: After certification of the LCP, the City shall require a permit from any public utility, government agency, or special district wishing to undertake development in the City, with the exceptions of State Universities and Colleges and development on public trust lands or tidelands as described in section 30519(b) of the California Coastal Act.

Policy 10-2: As a condition of permit approval, special districts, public utilities, and other government agencies shall conform to the City's zoning ordinance and the policies of this plan.

Policy 10-9: The City will support an increase in the water supply or capacity which will prove for, but not exceed, the amount needed to support build-out of the Land Use Plan of the City and County within the Coastside County Water District.

Policy 10-10: The City shall support phased development of water supply facilities (chiefly pumping stations and water treatment) so as to minimize the financial burden on existing residents and avoid growth-inducing impacts, so long as adequate capacity is provided to meet City needs in accordance with the phased development policies (including expected development to the year 2000) and allocations for the floriculture uses.

Policy 10-11: The City will support expansion of water supplies by those sources and methods which produces the highest quality water available to the area in order to assure the highest possible quality to horticulture. All such supplies shall, at minimum, meet potable water standards for domestic use and highest practicable quality for floriculture.

Discussion of Impacts

a) **No Impact.** The project involves construction of an underground water pipeline and utility infrastructure primarily along existing right-of-way in an urban area. The project would not physically divide an established community. No impact would occur.

b) **Less Than Significant Impact**. A proposed project would have a significant impact if it were to conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, LCPs, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect. The proposed project is subject to several local policies, plans, and regulations, as described above. These proposed project actions would not conflict with the City's General Plan/LCP or other applicable plans or policies.

The proposed project is consistent with Water Supply Policies in the City's LCP, including Policies 10-9, 10-10, and 10-11. It replaces an existing water transmission pipeline and therefore does not increase or expand the water supply available to the District. The new pipe would be sized to match the 8-inch inner diameter of the existing piping. Impacts would be less than significant.

4.12 MINERAL RESOURCES

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Source
Would the Project:					
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒	3
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?	☐	☐	☐	☒	3

Environmental Setting

The State Surface Mining and Reclamation Act of 1975 requires the State Geologist to classify mineral areas in the state, and the State Mining and Geology Board to designate mineral deposits of regional or statewide significance. No locally important mineral resources are designated in the City's General Plan (City of Half Moon Bay 1991). The proposed Project Area is located in a developed parcel of land within the City, adjacent to Pilarcitos Creek and otherwise surrounded by existing development.

Discussion of Impacts

a, b) **No Impact.** The proposed Project Area is not in or adjacent to any important mineral resource areas. Furthermore, the development of the proposed project would not preclude future excavation of oil or minerals should such extraction become viable. As such, there would be no loss of availability of known mineral resources and no impact to mineral resources.

4.13 NOISE

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Source
Would the project result in:					
a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☒	☐	☐	1,3,14
b) Generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☒	☐	1
c) For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒	1

Environmental Setting

Basics of Noise

Sound is described in terms of loudness and pitch. The standard unit for measuring loudness is the decibel (dB), which is quantified on a logarithmic scale. The human ear is not equally sensitive to a given sound level at all pitches. A special pitch-dependent rating scale has been devised to relate noise to human sensitivity. The A-weighted decibel scale (dBA) provides this compensation by approximating the sensitivity of the human ear.

Noise is typically defined as unwanted sound. A typical noise environment consists of a base of steady background noise from many distant and indistinguishable noise sources. Superimposed on this background noise is sound from individual local sources, which may be intermittent or continuous. Several rating scales have been developed to analyze the adverse effect of noise on people. Since environmental noise fluctuates over time, these scales consider that the effect of noise upon people is dependent on the energy of noise itself as well as time of day. Noise scales that are applicable to this analysis are as follows:

L_{eq} – An L_{eq}, or equivalent energy noise level, is the average acoustic energy content of noise for a stated period of time. The L_{eq} of a time-varying noise and that of a steady noise are the same if they deliver the

same acoustic energy to the ear during exposure. For evaluating community impacts, this rating scale does not vary, regardless of whether the noise occurs during the day or the night.

CNEL – The Community Noise Equivalent Level is a 24-hour average L_{eq} with a 5 dBA "weighting" during the hours of 7:00 P.M. to 10:00 P.M. and a 10 dBA "weighting" added to noise during the hours of 10:00 P.M. to 7:00 A.M. to account for noise sensitivity in the evening and nighttime, respectively. The logarithmic effect of these additions is that a 60 dBA 24-hour L_{eq} would result in a measurement of 66.7 dBA CNEL.

For residential uses, environmental noise levels are generally considered low when the CNEL is below 60 dBA, moderate in the 60 to 70 dBA range, and high above 70 dBA (Governor's Office of Planning and Research 2003) Noise levels greater than 85 dBA can cause temporary or permanent hearing loss. Examples of low daytime levels are isolated, natural settings with noise levels as low as 20 dBA and quiet suburban residential streets with noise levels around 40 dBA. Noise levels above 45 dBA at night can disrupt sleep. Examples of moderate level noise environments are urban residential or semi-commercial areas (typically 55 to 60 dBA) and commercial locations (typically 60 dBA). People may consider louder environments adverse, but most will accept the higher levels associated with noisier urban residential or residential-commercial areas (60 to 75 dBA) or dense urban or industrial areas (65 to 80 dBA).

It is widely accepted that in the community noise environment the average healthy ear can barely perceive CNEL noise level changes of 3 dBA. CNEL changes from 3 to 5 dBA may be noticed by some individuals who are extremely sensitive to changes in noise. A 5 dBA CNEL increase is readily noticeable, while the human ear perceives a 10 dBA CNEL increase as a doubling of sound.

Noise levels from a particular source generally decline as distance to the receptor increases. Other factors, such as the weather and reflecting or barriers, also help intensify or reduce the noise level at any given location. A commonly used rule of thumb for roadway noise is that for every doubling of distance from the source, the noise level is reduced by about 3 dBA at acoustically "hard" locations (i.e., the area between the noise source and the receptor is nearly complete asphalt, concrete, hard-packed soil, or other solid materials) and 4.5 dBA at acoustically "soft" locations (i.e., the area between the source and receptor is normal earth or has vegetation, including grass). Noise from stationary or point sources is reduced by about 6 to 7.5 dBA for every doubling of distance at acoustically hard and soft locations, respectively. Noise levels are also generally reduced by 1 dBA for each 1,000 ft of distance due to air absorption. Noise levels may also be reduced by intervening structures; generally, a single row of buildings between the receptor and the noise source reduces the noise level by about 5 dBA, while a solid wall or berm reduces noise levels by 5 to 10 dBA. The normal noise attenuation within residential structures with open windows is about 17 dBA, while the noise attenuation with closed windows is about 25 dBA (National Cooperative Highway Research Program 1971).

Noise Environment

The City's Noise Ordinance limits construction hours to 7 a.m. to 6 p.m. Monday through Friday; 8 a.m. to 6 p.m. Saturdays; and 10 a.m. to 6 p.m. Sundays and holidays. However, the District will voluntarily limit construction to the hours of 8 a.m. to 6 p.m. Monday through Friday. The Director of Public Works/City Engineer may grant exemptions. Noise in the proposed Project Area and vicinity is primarily from commercial development, residences, and vehicular traffic along roads. The nearest sensitive noise receptors are the businesses in the Strawflower Village Shopping Center and the residences along Oak Avenue and Pilarcitos Avenue.

Discussion of Impacts

a) **Less than Significant with Mitigation Incorporated.** In the long term, the proposed project would not generate any noise. The proposed project would not change the existing operation and maintenance activities and therefore these phases of the project would not have an impact on temporary increases in ambient noise. Water line replacement would maintain existing infrastructure and habitat and would not introduce any new noise-generating land uses.

During construction, the proposed project would require the use of motorized equipment such as a mini excavator, a pumper truck, and a portable drill rig. The City has not adopted construction noise impact thresholds, but rather requires that all construction be completed during weekdays between 7 a.m. and 6 p.m., on Saturdays between 8 a.m. and 6 p.m., and on Sundays and holidays between 10 a.m. and 6 p.m. unless otherwise approved in writing by the City Director of Public Works/City Engineer. The proposed project would comply with these working hours. Municipal Code Section 8-1.08. There are two residences located less than 50 ft away from proposed project work activities and staging, without topography or other obstacles to buffer the noise from this equipment. Construction equipment would generate temporary noise in excess of 75 dBA at these residences. This level of noise is generally considered high for residential areas. As noted above, the City does not have an established noise level limit. Nonetheless, to minimize construction-related noise, Mitigation Measure NOISE-1 requires use of proper muffling equipment and prohibits unnecessary vehicle idling, among other noise-reducing procedures. Furthermore, construction would be limited to weekday, daytime hours, resulting in minimal disturbance to nearby residents. With implementation of Mitigation Measure NOISE-1, adherence to construction work windows, and due to the short-term nature of the impacts (construction is anticipated to be completed in 20 workdays), the proposed project would not result in a substantial temporary or permanent increase in ambient noise in excess of established standards. Impacts would be less than significant with mitigation incorporated.

Mitigation Measure NOISE–1: The District shall incorporate the following practices, in addition to those listed in the project description, into the construction documents to be implemented by the project contractor:

- Construction hours shall be limited to 7 a.m. to 6 p.m. Monday through Friday; 8 a.m. to 6 p.m. Saturdays; and 10 a.m. to 6 p.m. Sundays and holidays unless otherwise approved in writing by the City Director of Public Works/City Engineer.

- Notify businesses, residences, and noise-sensitive land uses adjacent to construction sites of the construction schedule in writing. Designate the District's construction manager as responsible for responding to any local complaints about construction noise. The construction manager shall determine the cause of the noise complaints (for example starting too early, or a bad muffler) and institute reasonable measures to correct the problem. Conspicuously post a telephone number for the construction manager at the construction site.

- Maximize the physical separation between noise generators and noise receptors. Such separation includes, but is not limited to, the following measures:

    - Use heavy-duty mufflers for stationary equipment and barriers around particularly noisy areas of the site or around the entire site;

    - Use shields, impervious fences, or other physical sound barriers to inhibit transmission of noise to sensitive receptors;

  - Locate stationary equipment to minimize noise impacts on the community; and
  - Minimize backing movements of equipment.

- Use quiet construction equipment whenever possible.
- Impact equipment (e.g., jack hammers and pavement breakers) shall be hydraulically or electrically powered wherever possible to avoid noise associated with compressed air exhaust from pneumatically-powered tools. Compressed air exhaust silencers shall be used on other equipment. Other quieter procedures, such as drilling rather than using impact equipment, shall be used whenever feasible.
- Prohibit unnecessary idling of internal combustion engines.

b) **Less than Significant Impact.** Ground-borne vibration is typically associated with blasting operations, the use of pile drivers, and large-scale demolition activities, none of which are anticipated for the construction or operation of the proposed project. As such, no excessive ground-borne vibrations would be generated by the proposed project and these impacts would be less than significant.

c) **No Impact.** The nearest airport to the proposed Project Area is Half Moon Bay Airport, located approximately 4.5 miles to the northwest. This distance precludes the possibility of the proposed Project Area being adversely exposed to aviation noise. No impacts in this regard would occur.

4.14 POPULATION AND HOUSING

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Source
Would the Project:					
a) Induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☒	1
b) Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒	1

Environmental Setting

Half Moon Bay is located on the Pacific Coast approximately 28 miles south of San Francisco and lies within the westernmost portion of San Mateo County. According to the 2015-2023 Housing Element the population of Half Moon dropped from 11,842 to 11,228 between 2000 and 2011 (City of Half Moon Bay 2015b) U.S. Census data estimated populations of 11,324 in 2010 and 12,932 in 2019 (USCB 2020) Half Moon Bay has approximately 4,429 housing units with an average household size of 2.8 persons (Dyett & Bhattia 2014).

Discussion of Impacts

a, b) **No Impact.** The project would not alter the location, distribution, density, or growth rate of the population and would not result in direct or indirect impacts to population growth. As the project replaces existing pipeline infrastructure with no material increase in capacity, it would not have any impact on population and housing.

4.15 PUBLIC SERVICES

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Source
Would the Project:					
a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which would cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:					
i) Fire protection?	☐	☒	☐	☐	1
ii) Police protection?	☐	☒	☐	☐	1
iii) Schools?	☐	☐	☐	☒	1
iv) Parks?	☐	☐	☐	☒	1
v) Other public facilities?	☐	☐	☐	☒	1

Environmental Setting

Fire Protection

The City utilizes fire protection from the Coastside Fire Protection District and law enforcement services through the San Mateo County Sheriff's Department. The Coastside Fire Protection District serves the communities of City, the unincorporated areas of Half Moon Bay and the unincorporated communities of Miramar, El Granada, Princeton-by-the-Sea, Moss Beach, and Montara with three stations, one of which is located within Half Moon Bay. The station is located approximately 1.2 miles southeast of the proposed Project Area.

Police Protection

Law enforcement services in the City are provided through a contract with the San Mateo County Sheriff's office. The closest substation to the proposed Project Area is located approximately 0.1 mile southeast of the proposed Project Area.

Schools

The project falls within the Cabrillo Unified School District (CUSD). The CUSD provides public education to roughly 3200 students in four elementary, one middle and two high schools in the City. The project site is approximately 0.25-mile from the La Costa Adult School, Manuel F. Cunha Intermediate School, and Hatch Elementary School.

Parks

The proposed Project Area is adjacent to Oak Avenue Park which is a neighborhood park comprised of grassy area, picnic tables, and restrooms. Construction would temporarily affect use of an open area in Oak Park and restoration of those park facilities is part of the project. Provisions for access to the City owned bridge across Pilarcitos Creek would also be made, through temporary closure of that access would be required during the short-lived (one day) pipe-pulling processes.

Other Public Facilities

The proposed Project Area is located approximately 0.5 miles northwest of Half Moon Bay Public Library and approximately 0.24 miles northwest of San Mateo Coastside Clinic.

Discussion of Impact

a.i-ii) **Less than Significant with Mitigation Incorporated.** Given the proposed project would not permanently increase the existing residential or employment population in the City, it would not result in a long-term increase in the demand for public services or require construction of new governmental facilities. The purpose of the project is to improve water system infrastructure. Therefore, no impacts related to schools, parks or other public facilities would occur. However, there is the potential for construction activities to slow emergency response times. Implementation of Mitigation Measure TRAFFIC-1 would reduce potentially significant impacts related to Fire Protection District and Sheriff Department response times to a less-than-significant levels.

a.iii-v) **No Impact.** Given the proposed project would not permanently increase the existing residential or employment population in the City, the proposed project would not result in a long-term increase in the demand for public services such as schools, parks, or other public facilities or require construction of new facilities. No impact would occur.

4.16 RECREATION

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Source
Would the Project:					
a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒	1
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	☒	1

Environmental Setting

The proposed Project Area is adjacent to Oak Avenue Park which is a neighborhood park comprised of grassy area, picnic tables, and restrooms. Project construction would temporarily affect use of an open area in Oak Park; however, restoration of those park facilities is part of the proposed project. Provisions for access to the City owned bridge across Pilarcitos Creek would also be made, through temporary closure of that access would be required during the short-lived (one day) pipe-pulling processes.

Discussion of Impacts

a, b) **No Impact.** Given the proposed project would not permanently increase the existing residential or employment population in the City, the project would not affect recreational facilities or increase the use of nearby recreational facilities. The purpose of the project is to improve the water infrastructure system and it does not include recreational facilities or require the construction or expansion of recreational facilities. No Impacts would occur.

4.17 TRANSPORTATION

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Source
Would the Project:					
a) Conflict with a program plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle, and pedestrian facilities?	☐	☐	☒	☐	1
b) Conflict or be inconsistent with CEQA Guidelines § 15064.3(b)?	☐	☐	☒	☐	1
c) Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☒	☐	1
d) Result in inadequate emergency access?	☐	☒	☐	☐	1

Discussion of Impacts

a) ***Less than Significant Impact.*** Construction traffic (equipment and materials transport and daily worker traffic) would slightly increase traffic on local roads during the temporary construction phase of the proposed project. Temporary construction traffic would be limited to equipment delivery and material transport, and a few employee vehicles on a daily basis. The temporary construction-related traffic would not result in a noticeable increase in traffic on local roads and is not expected to reduce the level of service (LOS) for local intersections. Large vehicles transporting equipment and materials to the proposed Project Area could cause slight delays for travelers as the construction vehicles stop to unload. Temporary lane closures could also require motorists to detour around the proposed Project Area or expect delays while traveling through the proposed Project Area. Welding of the HDPE pipe will occur in the HDD staging area along the east side of Pilarcitos Avenue until 24-hours prior to pullback. Pilarcitos Avenue will not be blocked except for brief periods of equipment movement or materials delivery. Traffic control measures described in the project description would be in place during the construction phase to alert motorists to potential delays and identify detour routes, as described in the project description. With these measures and the temporary nature of construction-related traffic, impacts on traffic would be less than significant.

b) ***Less than Significant Impact.*** A significant impact may occur if the adopted California Department of Transportation (Caltrans) and San Mateo County Congestion Management Agency thresholds for a significant project impact would be exceeded. To address the increasing public concern that traffic congestion is impacting the quality of life and economic vitality of the State of California,

the Congestion Management Program (CMP) was enacted by Proposition 111. The CMP designated a transportation network including all State highways and some arterials within the County to be monitored by local jurisdictions. If the LOS standard deteriorates on the CMP network, then local jurisdictions must prepare a deficiency plan to be in conformance with the CMP program.

As discussed above, the proposed project would not permanently increase traffic on local roads or highways to a level that would affect intersection LOS. The proposed project would not result in long-term traffic increases. Impacts would be less than significant.

c) ***Less than Significant Impact.*** A significant impact may occur if a project were to include a new roadway design, introduce a new land use or permanent project features into an area with specific transportation requirements and characteristics that have not been previously experienced in that area, or if project access or other features were designed in such a way as to create hazardous conditions. The project would not involve new road construction or activities that could increase hazards due to a design feature or incompatible uses. Upon completion, the project would return all roadways to existing conditions. Adequate sight distance would be available for motorists to access and depart the proposed Project Area. Impacts would be less than significant.

d) ***Less than Significant with Mitigation Incorporated.*** Construction activities would require temporary lane closures and detours around the work area. Minor delays may be experienced for emergency access to the residences adjacent to the work area. Detours would be available throughout the construction period in the event of an emergency to allow vehicles to drive around the work area. The trenches used to install pipe could be quickly covered in the event of an emergency to allow vehicles to drive through the work area, which would ensure the project does not prevent emergency access to nearby properties. This is a short-term construction related impact that would cease upon project completion. Implementation of Mitigation Measures TRAFFIC-1 would reduce this impact to less than significant.

Mitigation Measure TRAFFIC-1:

- Local emergency services shall be notified prior to construction to inform them that traffic delays may occur, and also of the proposed construction schedule.
- The District shall require the contractor to provide for passage of emergency vehicles through the proposed Project Area at all times.
- The District shall require the contractor to maintain access to all residences during project construction.

4.18 TRIBAL CULTURAL RESOURCES

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Source
Would the Project:					
a) Cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:	☐	☒	☐	☐	1
i) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k)?	☐	☒	☐	☐	1
ii) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resources Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe?	☐	☒	☐	☐	1

This section examines the potential impacts of the proposed project on tribal cultural resources. Much of the background context and methods used for the analysis of potential impacts from the proposed project on tribal cultural resources and cultural resources are the same.

For the purposes of this analysis, the term *tribal cultural resource* is defined as follows:

Sites, features, places, cultural landscapes, sacred places, and objects with cultural value

to a California Native American tribe that are listed, or determined to be eligible for listing, in the National Register, California Register, or a local register of historical resources.

The term indigenous, rather than prehistoric, is used in this section as a synonym for "Native American–related". This section relies on the information and findings presented in *Archaeological Survey Report, EKI CCWD Pilarcitos Creek Crossing* (Alta 2020). That report, provided in Appendix B, details the results of the cultural resources study, which examined the environmental, ethnographic, and historic background of the proposed project site, emphasizing aspects of human occupation.

Environmental Setting

Native American Consultation

The NAHC was contacted via email to request a review of the Sacred Lands file and to request a list of Native American contacts in this area on February 16, 2020. The response letter dated February 24, 2020, by Sarah Fonseca (Cultural Resource Analyst) indicated that the search of the Sacred Lands File had a **positive** result. The NAHC response letter suggested that the lead agency contact the Ohlone tribe to provide further information regarding this result and to inquire about any further consultation. The District is considered the responsible party to further conduct Native American consultation. Attachment B contains the results of the Native American communication.

Records Search

On February 18, 2020, Alex DeGeorgey, archaeologist with ALTA, conducted a records search (File Number 19-1414) at the NWIC located on the campus of Sonoma State University. The NWIC, an affiliate of the State of California Office of Historic Preservation, is the official state repository of archaeological and historical records and reports for an 18-county area that includes San Mateo County. The records search included a review of all study reports on file within a one-half mile radius of the project area. A search of cultural resources included a one- half mile radius. Sources consulted include archaeological site and survey base maps, survey reports, site records, historic General Land Office maps.

Included in the review were:

- California Inventory of Historical Resources (California Department of Parks and Recreation 1976)
- California Historical Landmarks for San Mateo County (CA-OHP 1990)
- California Points of Historical Interest (CA-OHP 1992)
- Historic Properties Directory Listing (CA-OHP April 2012)
- Historic Properties Directory includes the National Register of Historic Places (April 2012) of the California Historical Landmarks and California Points of Historical Interest

Review of historic registers and inventories indicate that no historical resources are present in the project area. No National Register listed or eligible properties are located within the 0.5-mile visual area of the APE.

A review of archaeological site and survey maps at the NWIC reveal that 25 cultural resources studies have been conducted within a one-half mile radius of the current project area. Table 1 summarizes the most relevant studies to the project area. Approximately 20-percent of the one-half mile radius has been

previously surveyed. Two survey reports have been conducted within the boundaries of the current project area: Cartier (1983) was conducted in support of the shopping center complex north of Pilarcitos Creek, which is also the location of the proposed entry bore pit and staging area; and another was prepared that covered the southern portion of the project area that includes the staging area and exit bore pit area (Clark 2005). As a result, the entire current project area has been previously surveyed; no cultural resources were identified as a result of these surveys.

Five cultural resources are present within the one-half mile records search radius. There are three prehistoric and one historic-era resources. No cultural resources are documented within project area. The four prehistoric and mixed-component sites identified are located along the banks of Pilarcitos Creek, both west and east of the proposed Project Area.

Historic Map Review

Review of historic maps of the area was completed to better understand the timing of development within the project area and recognize historic features. The following historic maps and references were reviewed as part of this investigation. Eight USGS topographic maps were consulted from 1902 to 1991. The review of historic maps for this area indicated that no structures or development is evident until 1968, which depicts some residential development to the south of Oak Avenue. The 1991 USGS map depicts the shopping center development north of the river near the north end of the APE.

Field Survey

On May 6, 2020, Alta Archaeological Consulting staff archaeologist Sarah King Narasimha conducted a field survey of the entire APE. Project Maps and aerial imagery were used to correctly identify the project area. Ground surface visibility was extremely poor, less than 5% throughout the project area. A total of 8 shovel and boot scrapes were used to scrape the ground surface to expose mineral soils. The project area was surveyed using intensive pedestrian survey coverage with transects no greater than 10-meter intervals. The entire APE was surveyed including 2.5-acres of land. No resources were found as a result of this pedestrian survey. Digital photos were taken of the project area and surroundings (see Attachment C in Appendix B, Archaeological Survey Report).

Summary of Tribal Cultural Resources Identification Efforts

Through outreach to Native American representatives, background research, and a field survey, no tribal cultural resources, including any archaeological resources or human remains that may qualify as tribal cultural resources, were identified in the proposed project site. Therefore, no tribal cultural resources, as defined by CEQA, appear to be present in the proposed project site.

Regulatory Setting

California Environmental Quality Act

CEQA (codified at PRC Section 21000 *et seq.*) is the principal statute governing environmental review of proposed projects occurring in California. CEQA requires lead agencies to determine whether a project would have a significant effect on the environment, including a significant effect on tribal cultural resources. Under CEQA (PRC Section 21084.1), a project that may cause a substantial adverse change in the significance of a tribal cultural resource is a project that may have a significant effect on the environment.

Assembly Bill 52 and Tribal Cultural Resources

AB 52, enacted in September 2014, recognizes that California Native American Tribes have expertise with regard to their tribal history and practices. The law established a new category of cultural resources, tribal cultural resources, in CEQA to consider tribal cultural values when determining the impacts of proposed projects on cultural resources (PRC Section 21080.3.1, 21084.2, and 21084.3). PRC Section 21074(a) defines a tribal cultural resource as any of the following:

- Sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a California Native American tribe that are either of the following:
    - included or determined to be eligible for inclusion in the California Register; or
    - included in a local register of historical resources, as defined in PRC Section 5020.1(k).
- A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of [PRC] Section 5024.1. In applying these criteria, the lead agency would consider the significance of the resource to a California Native American tribe.

A cultural landscape that meets the criteria of PRC Section 21074(a) is also a tribal cultural resource if the landscape is geographically defined in terms of the size and scope. A historical resource as described in PRC Section 21084.1, a unique archaeological resource as defined in PRC Section 21083.2, or a non-unique archaeological resource as defined in PRC Section 21083.2 may also be a tribal cultural resource under CEQA if it meets the criteria identified in PRC Section 21074(a).

AB 52 requires CEQA lead agencies to analyze the impacts of proposed projects on tribal cultural resources separately from impacts on archaeological resources (PRC Section 21074 and 21083.09) because archaeological resources have cultural values beyond their ability to yield data important to prehistory or history. AB 52 also defines tribal cultural resources in a new section of the PRC (Section 21074; see above). Lead agencies must engage in additional consultation with California Native American Tribes (PRC Section 21080.3.1, 21080.3.2, and 21082.3).

The provisions of AB 52 apply to proposed projects for which a notice of preparation or notice of negative declaration/mitigated negative declaration was filed on or after July 1, 2015. As such, AB 52 applies to the proposed project.

California Register of Historical Resources

The California Register is "an authoritative listing and guide to be used by State and local agencies, private groups, and citizens in identifying the existing historical resources of the State and to indicate which resources deserve to be protected, to the extent prudent and feasible, from substantial adverse change" (PRC Section 5024.1[a]). The criteria for eligibility for the California Register are based upon the criteria for listing on the National Register (PRC Section 5024.1[b]). Certain resources are determined by the statute to be automatically included in the California Register, including California properties formally determined eligible for, or listed in, the National Register.

To be eligible for the California Register, a cultural resource must be significant at the local, State, and/or federal level under one or more of the following four criteria:

1. Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;

2. Is associated with the lives of persons important in our past;

3. Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or

4. Has yielded, or may be likely to yield, information important in prehistory or history.

A resource eligible for the California Register must be of sufficient age and retain enough of its historic character or appearance (integrity) to convey the reason for its significance. Additionally, the California Register consists of resources that are listed automatically and those that must be nominated through an application and public hearing process. The California Register automatically includes the following:

- California properties listed on the National Register and those formally Determined Eligible for the National Register;
- California Registered Historical Landmarks from No. 770 onward; and
- Those California Points of Historical Interest that have been evaluated by the California Office of Historic Preservation and have been recommended to the State Historical Commission for inclusion on the California Register.

Other resources that may be nominated to the California Register include:

- Historical resources with a significance rating of Category 3 through 5 (those properties identified as eligible for listing in the National Register, the California Register, and/or a local jurisdiction register);
- Individual historic resources;
- Historic resources contributing to historic districts; and
- Historic resources designated or listed as local landmarks, or designated under any local ordinance, such as an historic preservation overlay zone.

California Public Resources Code Section 5097

PRC Section 5097.99, as amended, states that no person shall obtain or possess any Native American artifacts or human remains that are taken from a Native American grave or cairn. Any person who knowingly or willfully obtains or possesses any Native American artifacts or human remains is guilty of a felony, which is punishable by imprisonment. Any person who removes, without authority of law, any such items with an intent to sell or dissect or with malice or wantonness is also guilty of a felony which is punishable by imprisonment.

California Native American Historic Resource Protection Act

The California Native American Historic Resources Protection Act of 2002 imposes civil penalties, including imprisonment and fines up to $50,000 per violation, for persons who unlawfully and maliciously excavates upon, removes, destroys, injures, or defaces a Native American historic, cultural, or sacred site that is listed or may be listed in the California Register.

California Health and Safety Code § 7050.5

HSC Section 7050.5 protects human remains by prohibiting the disinterring, disturbing, or removing of human remains from any location other than a dedicated cemetery. PRC Section 5097.98 (and reiterated in CCR Section 15064.59[e]) also identifies steps to follow in the event of the accidental discovery or recognition of any human remains in any location other than a dedicated cemetery.

Discussion of Impacts

a, a.i-ii) **Less than Significant Impact with mitigation incorporated.** The proposed project would not change the existing operation and maintenance activities and therefore these phases of the project would not have an impact on tribal cultural resources. Outreach to Native American representatives, background research, and a field survey conducted for the proposed project identified no tribal cultural resources, as defined in PRC Section 21074, in the proposed project site. Therefore, the proposed project is not anticipated to impact any tribal cultural resources.

Although the proposed project is not anticipated to impact any tribal cultural resources, there remains the possibility that previously unrecorded archaeological deposits, including human remains, are present in the proposed project site. If such deposits are present and were found to qualify as tribal cultural resources, as defined in PRC Section 21074, any impacts of the proposed project on the resource would be potentially significant. The contractor shall comply with California Health and Safety Code Section 7050.5 and California Public Resources Code Sections 5097.5, 5097.9 et seq., regarding the discovery and disturbance of cultural materials or human remains, should any be discovered during project construction. Such potentially significant impacts would be reduced to less-than-significant with implementation of Mitigation Measure CULT-1.

4.19 UTILITIES AND SERVICE SYSTEMS

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Source
Would the Project:					
a) Require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage, electric power, natural gas, or telecommunication facilities, the construction or relocation of which could cause significant environmental effects?	☐	☐	☐	☒	1
b) Have sufficient water supplies available to serve the Project and reasonably foreseeable future development during normal, dry, and multiple dry years?	☐	☐	☐	☒	1
c) Result in a determination by the wastewater treatment provider which serves or may serve the Project that it has adequate capacity to serve the Project's Projected demand in addition to the provider's existing commitments?	☐	☐	☐	☒	1
d) Generate solid waste in excess of State or local standards, or in excess of the capacity or local infrastructure, or otherwise impair the attainment of solid waste reduction goals?	☐	☐	☒	☐	1
e) Comply with federal, State, and local management and reduction statutes and regulations related to solid waste?	☐	☐	☒	☐	1

Environmental Setting

The following information on the utilities and service systems that serve the proposed Project Area is from the Existing Conditions Report (Dyett & Bhattia, 2014) prepared as part of the City's General Plan update planning process.

Potable Water

The water distribution system in the project area is owned and operated by the District, which also serves part of the unincorporated area of San Mateo County, including Princeton-by-the-Sea, Miramar, and El Granada. The District's water supply sources include Pilarcitos Lake, Upper Crystal Springs Reservoir, Pilarcitos Well Field, and Denniston Creek. The primary water supply is purchased from the San Francisco Public Utilities Commission (Pilarcitos Lake and Upper Crystal Springs Reservoir), and other supplies (about 28 percent) are Infiltration Well water from the District's Pilarcitos well field and surface water and groundwater from the District's Denniston Project. Water is delivered to the system through one of two treatment plants: the Denniston Water Treatment Plant near Half Moon Bay Airport and the Nunes Water Treatment Plant in Half Moon Bay. The water distribution system consists of 11 treated water storage tanks, which have a combined storage capacity of 8.1 million gallons, and over 100 miles of transmission and distribution pipelines (CCWD 2021a, 2021b)

Wastewater Treatment

Sanitary sewer service is provided to the proposed Project Area by the City for transporting sewage flows and by Sewer Authority Mid-Coastside for treating and disposing the sewage. The City's existing sanitary sewer system consists of approximately 37 miles of sewer mains, approximately 3,100 laterals, and three lift stations (City of Half Moon Bay 2010). The wastewater treatment plant's current capacity is 4.0 million gallons per day (MGD) in Average Dry Weather Flow (ADWF). The 2008 Sewer System Management Plan indicates the treatment plant's current ADWF is 1.5 MGD (SAM 2014; Dyett and Bhattia 2014).

Stormwater Drainage

Stormwater drainage in the City is conveyed through the City's creeks and drainages into Half Moon Bay. Stormwater from the proposed Project Area drains into Pilarcitos Creek.

Solid Waste and Recycling

Allied Waste Services is Half Moon Bay's franchised hauler, providing residential curbside collection of recyclables and green waste (yard waste), and commercial collection for recyclables. The majority of the city's solid waste is directed to the Corinda Los Trancos Sanitary Landfill (known as Ox Mountain), which is a Class III disposal facility located at 12310 San Mateo Road (State Route 92). As of July 2013, engineering estimates provided by the landfill operator, Republic Services, indicated that the facility's remaining disposal capacity was approximately 26.5 years. Based on the current rate of all disposal at this site from all jurisdictions, the facility's projected closure date is estimated to occur in 2038 (Dyett & Bhattia 2014).

Discussion of Impacts

a, b, c) **No Impact.** Potable water will be used during the construction as a component of the drilling mud used to remove soil cuttings, support the walls of the borehole, and cool the cutting tools. Operation of the pipeline would not generate wastewater or consume potable water. The project would not alter stormwater drainage because once the new pipeline is installed, the project area would be recontoured to preconstruction conditions. As a result, the project would have no impacts related to 1) exceedance of wastewater treatment requirements; 2) physical impacts from new storm drainage facilities; 3) water supply; and 4) wastewater treatment capacity.

d, e) **Less than Significant Impact.** The project would generate a small quantity of soil spoils and solid waste from HDD tunneling, but all generated waste would be properly disposed or recycled in a nearby landfill or approved disposal facility with capacity to receive the waste. Any materials used

during construction would be properly disposed of in accordance with federal, state, and local regulations. The California Integrated Waste Management Board Solid Waste Information System (SWIS) indicates solid waste from the City is landfilled at the Ox Mountain Sanitary Landfill, located two miles northeast of Half Moon Bay. Impacts in this regard would be less than significant.

4.20 WILDFIRE

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Source
If located in or near State Responsibility Areas or lands classified as very high fire hazard severity zones, would the Project:					
a) Substantially impair an adopted emergency response plan or emergency evacuation plan?	☐	☒	☐	☐	1
b) Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose Project occupants to pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire?	☐	☒	☐	☐	1
c) Require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary on ongoing impacts to the environment?	☐	☐	☒	☐	1
d) Expose people or structures to significant risks, including downslope or downstream flooding or landslides, as result of runoff, post-fire slope instability, or drainage changes?	☐	☐	☒	☐	1

Environmental Setting

In order to quantify potential risk of wildfires, the California Department of Forestry and Fire Protection (Cal Fire) has developed a Fire Hazard Severity Scale that utilizes three criteria to evaluate and designate potential fire hazards in wildland areas. The criteria are fuel loading (vegetation), fire weather (winds, temperatures, humidity levels and fuel moisture contents), and topography (degree of slope). The project is not within a State Responsibility Area (SRA) nor is it located within land classified as a Very High Fire Hazard Severity Zone (VHFHSZ). However, it is located approximately 0.6 miles northwest of a SRA ranked as a High Fire Hazard Severity Zone and Local Responsibility Area classified as a VHFHSZ (Cal Fire 2021).

Discussion of Impacts

a) **Less than Significant with Mitigation Incorporated.** The proposed Project Area is between a residential neighborhood to the south and a commercial development to the north. The residential streets are, therefore, designed to accommodate minimal through-traffic. Oak Avenue and Pilarcitos Avenue are two-lane streets with street parking on both sides. The east side of Pilarcitos Avenue would be used as a laydown area to pre-fabricate the new pipe before pullback. During construction hours, it is possible that on-site construction equipment could temporarily obstruct emergency response in the event of an evacuation or should emergency vehicles require passage, creating a potentially significant impact. Mitigation Measure TRAFFIC-1 requires notification of emergency service providers 72 hours prior to the start of construction and compliance with the City recommended traffic BMPs during construction, minimizing the risk of obstructing emergency access. The mitigation measure would ensure that the project remains compliant with the Local Hazard Mitigation Plan which serves as the emergency response and evacuation plan in the City. The proposed project would, therefore, not lead to physical modification or obstruction of emergency response infrastructure such as communication systems or roadways. As such, the proposed project would not impair implementation of or physically interfere with implementation of an emergency response or evacuation plan in a VHFHSZ, and impacts would be less than significant with mitigation incorporated.

b) **Less than Significant with Mitigation Incorporated.** Fire risk within and adjacent to the proposed Project Area is pronounced due to the presence of dense vegetation in the creek bed and on adjoining parcels. This risk is further exacerbated by the presence of narrow residential roadways that could slow down evacuation procedures in the event of a fire. The proposed project would not increase fire risk in the operational phase, as no new structures or fuel sources would be introduced to the proposed Project Area and the proposed project would not draw new people who would be exposed to fire risk to the area.

In the short-term, the presence of motorized equipment during the dry season may lead to a small, temporary increase in fire risk. This would have the potential to cause a significant impact if a fire were to start in the creek bed and spread to other areas unchecked. Mitigation Measure HAZ-1 requires that the contractor remove potential fuel sources such as dried vegetation and requires provision of fire extinguishers for service trucks, among other fire risk-reducing measures. This mitigation measure would ensure that impact potential is abated. With implementation of Mitigation Measure HAZ-1, the proposed project would not exacerbate wildfire risks, and thereby expose proposed project occupants to pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire. Impacts would accordingly be less than significant with mitigation incorporated.

c) **Less than Significant.** The proposed project would not require installation of any infrastructure that may exacerbate fire risk such as power lines or utilities; nor would it require installation of infrastructure intended to reduce wildfire risk or facilitate emergency response such as rods, fuel breaks, or emergency water sources. The proposed project is a water line replacement, which would not have any long-term impact on wildfire risk. Short-term increases in wildfire risk during construction would not be sufficiently severe or occur over a long enough period to require installation of risk attenuating infrastructure. As the proposed project would not require installation or maintenance of associated infrastructure that may exacerbate fire risk or result in temporary or ongoing environmental impacts, there would be a less than significant impact.

d) **Less than Significant.** The proposed project would not change the existing operation and maintenance activities and therefore these phases of the project would not have an impact on wildfire. Thus, impacts would be less than significant.

4.21 MANDATORY FINDINGS OF SIGNIFICANCE

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Source
a) Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?	☐	☒	☐	☐	1
b) Does the project have impacts that are individually limited, but cumulatively-considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of the past projects, the effects of other current projects, and the effects of probable future projects)?	☐	☒	☐	☐	1
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☒	☐	1

Discussion of Impacts

a) **Less than Significant with Mitigation Incorporated**. The incorporation of the mitigation measures included in Section IV (Biological Resources) would reduce potential impacts to a less-than-significant levels. The proposed Project Area does not contain any resource listed in, or determined to be eligible by, the State Historical Resource Commission and does not contain a resource included in a local register of historic resources or identified as significant in a historical resource survey. Additionally, the proposed Project Area does not contain any object, building, structure, site, area, place, record, or manuscript that a lead agency determined to be historically significant or significant in the architectural, engineering, scientific, economic, agricultural,

educational, social, political, military, or cultural annals of California. However, cultural resources could potentially be uncovered during construction. Mitigation measures CULT-1 would reduce potential impacts to a less-than-significant level.

b) **Less Than Significant Impact with Mitigation Incorporated**. Cumulatively considerable means that the incremental effects of an individual project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects. The analysis within this Initial Study demonstrates that the project would not have any individually limited, but cumulatively considerable impacts. As presented in the analysis in Biological Resources, Cultural Resources, Hazards and Hazardous Materials, Noise, Public Services, and Transportation/Traffic sections, any potentially significant impacts would be less than significant after mitigation. Due to the limited scope of direct physical impacts to the environment associated with construction, the project's impacts are project-specific in nature. Consequently, the project will create a less than significant cumulative impact with respect to all environmental issues.

c) **Less than Significant Impact.** With implementation of the various construction measures and BMPs included in the proposed project description, the proposed Project would not result in substantial adverse effects to human beings, either directly or indirectly.

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5.0 REFERENCES

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6.0 REPORT PREPARATION

6.0 REPORT PREPARATION

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APPENDIX A – BIOLOGICAL RESOURCES EVALUATION

Biological Resources Evaluation

Coastside County Water District Water Line Replacement Under Pilarcitos Creek Project

Half Moon Bay, San Mateo County, California

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WRA #29375
Revised June 2021

wra
ENVIRONMENTAL CONSULTANTS

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Steven Cognac – Plant Biologist
Sundaran Gillespie – GIS Analyst

DEFINITIONS

Study Area: The area throughout which the assessment was performed, inclusive of approximately 10.91 acres spanning across portions of the following parcel numbers (APNs): 056-300-150, 056-300-210, 056-040-999, 056-141-970, and 056-141-950. The Study Area includes a 200-foot buffer around the Project Area.

Project Area: The area encompassing the 0.61-acre proposed Water Line Replacement under Pilarcitos Creek Project.

LIST OF ACRONYMS

BRE	Biological Resources Evaluation
CCC	California Coastal Commission
CCR	California Code of Regulations
CCWD	Coastside County Water District
CDFW	California Department of Fish and Wildlife
CESA	California Endangered Species Act
CEQA	California Environmental Quality Act
CFGC	California Fish and Game Code
CFP	California Fully Protected Species
CFR	Code of Federal Regulations
City	City of Half Moon Bay
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
Corps	U.S. Army Corps of Engineers
CRLF	California Red-legged Frog
CSRL	California Soils Resources Lab
CWA	Clean Water Act
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
ESA	Federal Endangered Species Act
ESHA	Environmentally Sensitive Habitat Area
HDD	Horizontal Directional Drilling
HDPE	High-density Polyethylene
LCP	Local Coastal Program
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation & Management
MBTA	Migratory Bird Treaty Act
NCCP	Natural Community Conservation Plan
NMFS	National Marine Fisheries Service
NPPA	California Native Plant Protection Act
NRCS	Natural Resource Conservation Service
NWPL	National Wetland Plant List
OHWM	Ordinary High Water Mark
PRC	Public Resources Code
psi	Pounds Per Square Inch
Rank	California Rare Plant Ranks
RWQCB	Regional Water Quality Control Board
SFGS	San Francisco Garter Snake
SSC	Species of Special Concern
SWRCB	State Water Resource Control Board
TOB	Top of Bank
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

WBWG	Western Bat Working Group
WPT	Western Pond Turtle
WRA	WRA, Inc.

1.0 INTRODUCTION

On January 14, 2021, WRA, Inc. (WRA) conducted a Biological Resources Evaluation (BRE) at the site of the proposed Coastside County Water District (CCWD) Water Line Replacement under Pilarcitos Creek Project (Project), located in Half Moon Bay, San Mateo County, California (Figure 1, Appendix A). An approximately 10.91-acre Study Area was evaluated, including an approximately 0.61-acre Project Area. The Project involves installation of an approximately 450-foot long pipeline using horizontal directional drilling (HDD), with approximately 50 feet under Pilarcitos Creek. The HDD line would pass beneath Pilarcitos Creek and associated riparian habitat.

1.1 Overview and Purpose

This report provides an assessment of biological resources within the Study Area. This report describes the results of the site visit, which assessed the Study Area for the (1) potential to support special-status plant or wildlife species and (2) presence of other sensitive biological resources protected by local, state, or federal laws and regulations. The regulatory framework of this BRE is provided in Section 2.0 of this report. The methods used in the assessment are described in Section 3.0, and the results of the site visit are presented in Section 5.0. A summary of potential impacts to sensitive habitats and species and recommended avoidance, minimization, and mitigation measures is provided in Section 6.0.

The purpose of the site visit and report is to identify, describe, and map any sensitive habitats, including riparian and wetland areas or other Environmental Sensitive Habitat Area (ESHA), and "rare, threatened, or endangered" species, which may occur in the Study Area. WRA performed the biological resources evaluation in accordance with the City of Half Moon Bay (City) Local Coastal Program (LCP), including Section 18.38.035 of the Zoning Code LCP Implementation Plan (City of Half Moon Bay 2011) and Chapter 3 of the Land Use Plan (LUP, City of Half Moon Bay 1993). This report also contains an evaluation of potential impacts to special-status species or ESHAs that may occur as a result of the proposed Project and potential mitigation measures to compensate for those impacts. This assessment is based on information available at the time of the study and on site conditions that were observed on the dates the site was visited. Conclusions are based on currently available information used in combination with the professional judgement of the biologists completing this study.

1.2 Project Description

The Project involves installation of approximately 450 linear feet of 8-inch water supply pipeline at minimum 20 feet under the bed of Pilarcitos Creek using HDD. The pipeline would extend from the Strawflower Village Shopping Center in the north to Oak Avenue and Oak Avenue Park in the south. HDD is a trenchless construction method whereby a pipe is installed in an arcing drill path to pass under a conflicting feature, such as Pilarcitos Creek. HDD is typically a three-phase process. The first phase involves setting up a drill rig on one side of the crossing and drilling a pilot hole from a small entry pit in front of the rig. The entry pit contains drilling fluids comprised of a mixture of water and bentonite clay. The bore begins with a vertical tangent to quickly gain depth, then arcs into a horizontal section under the creek, before following an upward path to the exit point. Another small pit at the exit point contains fluids to facilitate the reaming and pullback operations.

The second phase involves enlarging the pilot hole using reaming equipment to expand the diameter of the hole required for pipeline pullback, typically 1.5 times the pipe diameter. The larger borehole allows for the flow of drilling fluids around the pipe to reduce friction so the pipe can be pulled through. The

pipe is delivered in sections, then butt-fused together so it is fully assembled before pullback begins. This process necessitates the large linear staging area along Pilarcitos Avenue.

The third phase involves pulling back the fully assembled pipe through the enlarged hole from the exit point back to the drill rig at the entry pit. Pullback is typically completed without interruption. Drilling mud, typically a mixture of water and bentonite or polymer, is used to remove the soil cuttings, support the walls of the borehole, and cool the cutting tools. Mixing systems are used to mix the drilling fluid additives with water to achieve the fluid properties appropriate for the site-specific geology. On-site separation plants are used to remove soil cuttings and recycle drilling fluids. All fluids are contained at the entry and exit pits. Spill facilities and equipment are stationed nearby to insure on-site fluid containment.

The new pipe would be sized to match the 8-inch inner diameter of the existing piping. The new pipe would be somewhat flexible, high-density polyethylene (HDPE). The pipe's working pressure would be approximately 100 pounds per square inch (psi) at the bottom of the proposed bore path (where pressure is the highest) and could accommodate increased working pressures up to approximately 150 psi. The new pipe would be installed at minimum 20 feet below the creek bed.

HDD activities would occur at minimum 20 feet below the bed of Pilarcitos Creek and associated riparian habitat. All equipment, staging, and the entry and exit pits would be located above the top of bank (TOB) and outside the riparian corridor. Temporary foot traffic would occur within the riparian corridor and below the TOB to check the alignment of the HDD. Erosion controls would be maintained throughout the duration of construction activities. The approximate duration of HDD work is two weeks, including mobilization and demobilization.

2.0 REGULATORY BACKGROUND

The following sections explain the regulatory context of the biological evaluation, including applicable laws and regulations that were applied to the field investigations and analysis of potential Project impacts.

The California Environmental Quality Act (CEQA) provides protections for particular vegetation types defined as sensitive by the California Department of Fish and Game (CDFW), and aquatic communities protected by laws and regulations administered by the U.S. Army Corps of Engineers (Corps), State Water Resources Control Board (SWRCB), and Regional Water Quality Control Boards (RWQCB). The laws and regulations that provide protection for these resources are summarized below.

2.1 Sensitive Natural Communities:

Sensitive natural communities include habitats that fulfill special functions or have special values, such as wetlands, streams, and riparian habitat. These habitats are regulated under federal regulations (such as the Clean Water Act [CWA]), state regulations (such as the Porter-Cologne Act, Section 1600 of the California Fish and Game Code (CFGC)), and local ordinances or policies (such as City or County Tree Ordinances, Special Habitat Management Areas, applicable LCPs, and General Plan Elements).

Sensitive natural communities also include habitats that fulfill special functions or have special values. Natural communities considered sensitive are those identified in local or regional plans, policies, regulations, or by the CDFW. CDFW ranks sensitive communities as "threatened" or "very threatened" (CDFW 2020; CDFW 2021) and keeps records of their occurrences in its California Natural Diversity

Database (CNDDB; CDFW 2021). CNDDB vegetation alliances are ranked 1 through 5 based on NatureServe's (2021) methodology, with those alliances ranked globally (G) or statewide (S) as 1 through 3 considered sensitive. Impacts to sensitive natural communities identified in local or regional plans, policies, or regulations or those identified by the CDFW or U.S. Fish and Wildlife Service (USFWS) must be considered and evaluated under CEQA (CCR Title 14, Div. 6, Chap. 3, Appendix G). In addition, this general class includes oak woodlands that are protected by local ordinances under the Oak Woodlands Protection Act. Recommended avoidance and minimization measures for impacts to these communities are discussed in Section 6 of this report.

2.2 Federal Jurisdiction over Wetlands and Non-Wetland Waters

Section 404 of the CWA gives the Environmental Protection Agency (EPA) and the Corps regulatory and permitting authority regarding discharge of dredged or fill material into "navigable waters of the United States." Section 502(7) of the CWA defines "navigable waters" as "waters of the United States, including territorial seas." The Navigable Waters Protection Rule: Definition of ''Waters of the United States'' published April 21, 2020, and effective June 22, 2020 (Federal Register Vol. 85, No. 77), provides the final rule defining the scope of waters federally regulated under the CWA. Section 328 of Chapter 33 in the Code of Federal Regulations (CFR) defines the term "waters of the United States" as it applies to the jurisdictional limits of the authority of the Corps under the CWA. The definition of "waters of the United States" in 33 CFR 328.3 is:

(1) The territorial seas and traditional navigable waters;
(2) Perennial and intermittent tributaries that contribute surface water flow to such waters;
(3) Certain lakes, ponds, and impoundments of jurisdictional waters;
(4) Wetlands adjacent to other jurisdictional waters.

The Navigable Waters Protection Rule clarifies that the following are not considered waters of the U.S.:

(a) Groundwater, including groundwater drained through subsurface drainage systems;
(b) Ephemeral features that flow only in direct response to precipitation, including ephemeral streams, swales, gullies, rills, and pools;
(c) Diffuse stormwater runoff and directional sheet flow over upland;
(d) Ditches that are not traditional navigable waters, tributaries, or that are not constructed in adjacent wetlands, subject to certain limitations.
(e) Prior converted cropland;
(f) Artificially irrigated areas that would revert to upland if artificial irrigation ceases;
(g) Artificial lakes and ponds that are not jurisdictional impoundments and that are constructed or excavated in upland or non-jurisdictional waters;
(h) Water-filled depressions constructed or excavated in upland or in non-jurisdictional waters incidental to mining or construction activity, and pits excavated in upland or in non-jurisdictional waters for the purpose obtaining fil, sand, or gravel;
(i) Stormwater control features constructed or excavated in upland or in non-jurisdictional waters to convey, treat, infiltrate, or store stormwater run-off;
(j) Groundwater recharge, water reuse, and wastewater recycling structures constructed or excavated in upland or in non-jurisdictional waters;
(k) Waste treatment systems.

Wetlands. Wetlands are defined in 33 CFR 328.3 (b) as:

> *…those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.*

The basis for determining whether a given area is a wetland for the purposes of Section 404 of the CWA is outlined in the Corps *Wetlands Delineation Manual* (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Delineation Manual* for the respective region (Arid West or Western Mountains and Valleys for California). As defined in 33 CFR 328.4 (c), the extent of federal jurisdiction within wetlands is defined as extending to the limit of the wetland as determined using the methods outlined in the manuals.

Non-Wetland Waters. The limit of federal jurisdiction in non-tidal non-wetland waters extends to the OHWM which is defined in 33 CFR 328.3 (e) as:

> *...that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impresses on the bank, shelving, changes in the characteristics of the soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.*

2.3 State Jurisdiction over Wetlands and Non-Wetland Waters

2.3.1 State and Regional Water Quality Control Boards

The Porter-Cologne Water Quality Control Act gives the SWRCB authority to regulate discharge of dredged or fill material that may affect the quality of "waters of the state". "Waters of the State" are defined broadly as:

> *any surface water or groundwater, including saline waters, within the boundaries of the state.*

The SRWQCB and nine RWQCBs protect waters within this broad regulatory scope through many different regulatory programs. Waters of the State in the context of a CEQA Biological Resources Evaluation include wetlands and other surface waters protected by the *State Wetland Definition and Procedures for Discharges of Dredged or Fill Material to Waters of the State*. In April 2019 the SWRCB adopted the State Wetland Policy, which provides a State wetland definition, procedures and requirements for regulation of the discharge of dredge or fill material to wetlands and non-wetland waters of the State. The State Wetland Policy also includes exemptions from regulation of dredge and fill discharges for certain types of wetland and waters features, as well as for certain classes of activities, such as activities covered by an existing RWQCB or SWRCB Order. The state wetland definition that became effective May 28, 2020 is similar to, but slightly different from that used by the Corps:

> *An area is wetland if, under normal circumstances, (1) the area has continuous or recurrent saturation of the upper substrate caused by groundwater, or shallow surface water, or both; (2) the duration of such saturation is sufficient to cause anaerobic conditions in the upper substrate; and (3) the area's vegetation is dominated by hydrophytes or the area lacks vegetation.*

The State Wetland Definition and Procedures utilize existing Corps delineation procedures (Environmental Laboratory 1987, (U.S. Army Corps of Engineers (Corps) 2008). According to the State Wetland Policy, the SWRCB and RWQCBs generally rely on the Corps for verification of wetland and waters as part of an aquatic resource report. Any potential wetland area not identified in a report verified by the Corps is required to be delineated using Corps methods for consideration as a state wetland and verification by SWRCB or RWQCB staff. Some features mapped as non-wetland waters under the Corps wetland definition may be considered wetlands under the State definition.

This report identifies wetlands and non-wetland waters according to the Corps definitions and criteria, consistent with the State Wetland Policy's reliance of these criteria. This report also recognizes that some non-wetland waters features may meet the wetland definition of the State Wetland Policy. Regardless of how they are defined, wetlands and non-wetland waters deemed jurisdictional may be regulated by the RWQCB and/or SWRCB under the State Wetland Policy.

2.3.2 California Department of Fish and Wildlife

Streams and lakes, as habitat for fish and wildlife species, are regulated by CDFW under Sections 1600-1616 of CFGC. Alterations to or work within or adjacent to streambeds or lakes generally require a 1602 Lake and Streambed Alteration Agreement. The term "stream", which includes creeks and rivers, is defined in the California Code of Regulations (CCR) as "a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports fish or other aquatic life [including] watercourses having a surface or subsurface flow that supports or has supported riparian vegetation" (14 CCR 1.72). The term "stream" can include ephemeral streams, dry washes, watercourses with subsurface flows, canals, aqueducts, irrigation ditches, and other means of water conveyance if they support aquatic life, riparian vegetation, or stream-dependent terrestrial wildlife (CDFG 1994). Riparian vegetation has been defined as "vegetation which occurs in and/or adjacent to a stream and is dependent on, and occurs because of, the stream itself" (CDFG 1994). Removal of riparian vegetation also requires a Section 1602 Lake and Streambed Alteration Agreement from CDFW.

2.4 California Coastal Commission / Half Moon Bay Local Coastal Program

On April 15, 2021, the California Coastal Commission (CCC) certified the updated Half Moon Bay LCP. The Half Moon Bay Land Use Policies and Map constitute the LUP of the LCP. The Zoning Code (Title 18 of the Municipal Code, including Chapter 18.20, which regulates Coastal Development Permits) together with the Zoning District Map constitutes the Implementation Plan of the LCP. The next step is to update the Implementation Plan to ensure consistency with the updated LUP. At this time, the City has not completed the update of the zoning code. Consequently, in some cases there may be inconsistencies between the older zoning code regulations and the newly amended LUP policies. If inconsistencies between updated policies and zoning code regulations occur, the updated LUP takes precedence over the zoning code. The primary goal of the LCP is to ensure that the local government's land use plans, zoning ordinances, zoning maps, and implemented actions meet the requirements of the provisions and polices of the CCC Coastal Act at the local level. Coastal Resource Conservation Standards are described in Chapter 6 of the LUP and Chapter 18.38 of the Municipal Code and define sensitive habitat and coastal resource areas for conservation to include: sand dunes; marine habitats; sea cliffs; riparian areas; wetlands, coastal tidelands and marshes, lakes, ponds, and adjacent shore habitats; coastal or off-shore migratory bird nesting sites; areas used for scientific study, refuges, and reserves; habitats containing unique or rare and endangered

species; rocky intertidal zones; coastal scrub communities; wild strawberry habitat; and archaeological resources.

2.4.1 California Coastal Commission/Local Coastal Program Jurisdiction over Wetlands

The Coastal Act and LCP regulate the diking, filling, or dredging of wetlands within the coastal zone. Section 30121 of the Coastal Act defines "wetlands" as land "which may be covered periodically or permanently with shallow water and include saltwater marshes, freshwater marshes, open or closed brackish water marshes, swamps, mudflats, and fens." In addition, the Half Moon Bay LCP defines "wetlands" as an area where the water table is at, near, or above the land surface long enough to bring about the formation of hydric soils or to support the growth of plants, which normally are found to grow in water or wet ground. Wetlands do not include vernally wet areas where the soils are not hydric. The 1981 CCC Statewide Interpretive Guidelines state that hydric soils and hydrophytic vegetation "are useful indicators of wetland conditions," but the presence or absence of hydric soils and/or hydrophytes alone are not necessarily determinative when the CCC identifies wetlands under the Coastal Act.

The boundaries of areas regulated by the Corps and CCC/LCP are often not the same due to the differing goals of the respective regulatory programs and because these agencies use different definitions for determining the extent of wetland areas. For example, the Corps requires that positive indicators for the presence of wetland hydrology, hydric soils, and a predominance of hydrophytic vegetation be present for an area to meet the Corps' wetland definition. The CCC does not necessarily require that all three wetland indicators (wetland hydrology, hydric soils, and a predominance of hydrophytic vegetation) be present for an area to be determined to by a "wetland"; rather, the presence of hydric soils in the absence of a predominance of hydrophytes (or vice versa) could be sufficient for a positive wetland determination.

2.4.2 The California Coastal Commission Environmentally Sensitive Habitat Area Definition

The CCC defines an ESHA as follows:

> "*Environmentally sensitive habitat area" means any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments.*"

The CCC Guidelines contain definitions for specific types of ESHAs, including: wetlands, estuaries, streams and rivers, lakes, open coastal waters and coastal waters, riparian habitats, other resource areas, and special-status species and their habitats. For the purposes of this report, WRA has taken into consideration any areas that may meet the definition of any ESHA defined by the CCC guidelines or the Half Moon Bay LCP.

2.4.3 Half Moon Bay Buffer Zones

Applicable Half Moon Bay LUP policies establish buffer zones around riparian corridors as follows.

> *(a)) For all perennial watercourses (i.e. Pilarcitos Creek, Frenchmans Creek, Arroyo Leon, and Arroyo Cañada Verde west of Highway 1) and certain intermittent watercourses (i.e.*

Kehoe Watercourse and Wavecrest Arroyo): buffer zones shall extend a minimum of 50 feet from the outer limit of the riparian vegetation or 100 feet from the top of bank, whichever is greater.

(b) For all other intermittent and ephemeral watercourses with riparian vegetation (e.g. Roosevelt Creek, the riparian corridor in the northwestern area of Ocean Colony, and Arroyo Cañada Verde east of Highway 1): buffer zones shall extend a minimum of 35 feet from the outer limit of riparian vegetation or the top of bank, whichever is greater.

Permitted uses within buffer zones include education and research, consumptive uses as provided for in the CFGC, fish and wildlife management activities, trails and scenic overlooks on public lands, and necessary water supply projects.

2.4.4 Coastal Development Permit Exemption

Half Moon Bay Municipal Code Section §18.20.030.2 exempts projects from Coastal Development Permit requirements if they do not result in an addition to, or expansion of an existing facility. Sections 18.20.030.3 (a) and (c) specifically exempt utility projects. No Coastal Development Permit is required if the project entails installation, maintenance, and minor alteration of utilities that do not increase capacity or are required to restore service to prevent service outages. However, pursuant to PRC §13252(3), exempt projects may not include the following activities within 50 feet of environmentally sensitive habitat areas and 20 feet from coastal waters or streams: the placement or removal of rip-rap, rocks, sand, beach materials or any other form of solid materials; or, the use of mechanized equipment. Therefore, the Project does not qualify for a Coastal Development Permit exemption because it involves the placement or removal of solid material or the use of mechanized equipment within 50 feet of environmentally sensitive habitat areas (see Section 6.1).

2.5 Special-status Species

Endangered and Threatened Plants, Fish, and Wildlife. Specific species of plants, fish, and wildlife species may be designated as threatened or endangered by the federal Endangered Species Act (ESA), or the California Endangered Species Act (CESA). Specific protections and permitting mechanisms for these species differ under each of these acts, and a species' designation under one law does not automatically provide protection under the other.

The ESA (16 USC 1531 et seq.) is implemented by the USFWS and the National Marine Fisheries Service (NMFS). The USFWS and NMFS maintain lists of "endangered" and "threatened" plant and animal species (referred to as "listed species"). "Proposed" or "candidate" species are those that are being considered for listing, and are not protected until they are formally listed as threatened or endangered. Under the ESA, authorization must be obtained from the USFWS or NMFS prior to take of any listed species. Take under the ESA is defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Take under the ESA includes direct injury or mortality to individuals, disruptions in normal behavioral patterns resulting from factors such as noise and visual disturbance, and impacts to habitat for listed species. Actions that may result in "take" of an ESA-listed species may obtain a permit under ESA Section 10, or via the interagency consultation described in ESA Section 7. Federally listed plant species are only protected when take occurs on federal land.

The ESA also provides for designation of critical habitat, which are specific geographic areas containing physical or biological features “essential to the conservation of the species”. Protections afforded to designated critical habitat apply only to actions that are funded, permitted, or carried out by federal agencies. Critical habitat designations do not affect activities by private landowners if there is no other federal agency involvement.

The CESA (California Fish and Game Code 2050 et seq.) prohibits a "take" of any plant and animal species that the California Fish and Game Commission determines to be an endangered or threatened species in California. CESA regulations include take protection for threatened and endangered plants on private lands, as well as extending this protection to “candidate species” which are proposed for listing as threatened or endangered under CESA. The definition of a "take" under CESA ("hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill") only applies to direct impact to individuals, and does not extend to habitat impacts or harassment. CDFW may issue an Incidental Take Permit under CESA to authorize take if it is incidental to otherwise lawful activity and if specific criteria are met. Take of these species is also authorized if the geographic area is covered by a Natural Community Conservation Plan (NCCP), as long as the NCCP covers that activity.

Fully Protected Species and Designated Rare Plant Species. This category includes specific plant and wildlife species that are designated in the CFGC as protected even if not listed under CESA or the ESA. Fully Protected Species includes specific lists of birds, mammals, reptiles, amphibians, and fish designated in CFGC. Fully protected species may not be taken or possessed at any time. No licenses or permits may be issued for take of fully protected species, except for necessary scientific research and conservation purposes. The definition of "take" is the same under the California Fish and Game Code and the CESA. By law, CDFW may not issue an Incidental Take Permit for Fully Protected Species. Under the California Native Plant Protection Act (NPPA), CDFW has listed 64 “rare” or “endangered” plant species, and prevents “take”, with few exceptions, of these species. CDFW may authorize take of species protected by the NPPA through the Incidental Take Permit process, or under a NCCP.

Special Protections for Nesting Birds and Bats. The federal Bald and Golden Eagle Protection Act provides relatively broad protections to both of North America’s eagle species (bald [*Haliaeetus leucocephalus*] and golden eagle [*Aquila chrysaetos*)] that in some regards are similar to those provided by the ESA. In addition to regulations for special-status species, most native birds in the United States, including non-status species, have baseline legal protections under the Migratory Bird Treaty Act of 1918 and CFGC, i.e., sections 3503, 3503.5 and 3513. Under these laws/codes, the intentional harm or collection of adult birds as well as the intentional collection or destruction of active nests, eggs, and young is illegal. For bat species, the Western Bat Working Group (WBWG) designates conservation status for species of bats, and those with a high or medium-high priority are typically given special consideration under CEQA.

Essential Fish Habitat. The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) provides for conservation and management of fishery resources in the U.S., administered by NMFS. This Act establishes a national program intended to prevent overfishing, rebuild overfished stocks, ensure conservation, and facilitate long-term protection through the establishment of Essential Fish Habitat (EFH). EFH consists of aquatic areas that contain habitat essential to the long-term survival and health of fisheries, which may include the water column, certain bottom types, vegetation (e.g. eelgrass (*Zostera* spp.)), or complex structures such as oyster beds. Any federal agency that authorizes, funds, or undertakes action that may adversely affect EFH is required to consult with NMFS.

Species of Special Concern, Movement Corridors, and Other Special Status Species under CEQA. To address additional species protections afforded under CEQA, CDFW has developed a list of special species as "a general term that refers to all of the taxa the CNDDB is interested in tracking, regardless of their legal or protection status." This list includes lists developed by other organizations, including for example, the Audubon Watch List Species, the Bureau of Land Management Sensitive Species, and USFWS Birds of Special Concern. Plant species on the California Native Plant Society (CNPS) Rare and Endangered Plant Inventory (Inventory) with California Rare Plant Ranks (Rank) of 1 and 2, as well as some with a Rank of 3, are also considered special-status plant species and must be considered under CEQA. Some Rank 3 species and all Rank 4 species are typically only afforded protection under CEQA when such species are particularly unique to the locale (e.g., range limit, low abundance/low frequency, limited habitat) or are otherwise considered locally rare. Some species listed in the *Rare, Unusual and Significant Plants of Alameda and Contra Costa Counties (web application)* (Lake 2021) are considered sensitive (see Section 2.2). Additionally, any species listed as sensitive within local plans, policies and ordinances are likewise considered sensitive. Movement and migratory corridors for native wildlife (including aquatic corridors) as well as wildlife nursery sites are given special consideration under CEQA.

3.0 ASSESSMENT METHODOLOGY

On January 14, 2021, WRA biologists visited the Study Area to map vegetation, aquatic communities, unvegetated land cover types, document plant and wildlife species present, and evaluate habitat on site, including ESHA, for the potential to support special status species as defined by CEQA. Prior to the site visit, WRA biologists reviewed literature resources and performed database searches to assess the potential for sensitive biological communities (e.g., wetlands) and special-status species (e.g., endangered plants), including:

- Soil Survey San Mateo Area, California (USDA 1961; CSRL 2021)
- Half Moon Bay 7.5-minute quadrangle (USGS 2018)
- Contemporary aerial photographs (Google 2021)
- Historical aerial photographs (Historical Aerials 2020)
- National Wetlands Inventory (USFWS 2021a)
- California Aquatic Resources Inventory (SFEI 2017)
- California Natural Diversity Database (CNDDB; CDFW 2021)
- California Native Plant Society Electronic Inventory (CNPS 2020a)
- A Manual of California Vegetation Online (CNPS 2020b)
- Consortium of California Herbaria (CCH 2020)
- USFWS Information for Planning and Consultation (USFWS 2021b)
- CDFW Publication, California Bird Species of Special Concern in California (Shuford and Gardali 2008)
- CDFW and University of California Press publication California Amphibian and Reptile Species of Special Concern (Thomson et al. 2016)
- A Field Guide to Western Reptiles and Amphibians (Stebbins 2003)
- Preliminary Descriptions of the Terrestrial Natural Communities (Holland 1986)
- California Natural Community List (CDFW 2018)

Database searches (i.e., CNDDB, CNPS, IPaC) focused on the Half Moon Bay and surrounding five USGS 7.5-minute quadrangles for special-status plants and wildlife.

Following the remote assessment, WRA biologists completed a field review over the course of one day to document: (1) land cover types (e.g., terrestrial communities, aquatic resources, ESHA), (2) existing conditions and to determine if such provide suitable habitat for any special-status plant or wildlife species, and (3) if and what type of aquatic natural communities (e.g., wetlands) are present.

3.1 Vegetation Communities and Other Land Cover Types

During the site visit, WRA evaluated the species composition and area occupied by distinct vegetation communities, aquatic communities, and other land cover types. Mapping of these classifications utilized a combination of aerial imagery and ground surveys. In most instances, communities are characterized and mapped based on distinct shifts in plant assemblage (vegetation), and follow the California Natural Community List (CDFW 2018), Preliminary Descriptions of the Terrestrial Natural Communities of California (Holland 1986), and A Manual of California Vegetation, Online Edition (CNPS 2020b). Vegetation alliances (natural communities) with a CDFW Rank of 1 through 3 (globally critically imperiled (S1/G1), imperiled (S2/G2), or vulnerable (S3/G3), were evaluated as sensitive as part of this evaluation (CDFG 2010).

The site was delineated for the presence of wetlands and other aquatic resources on January 14, 2021 according to the methods described in the *U.S. Army Corps of Engineers Wetlands Delineation Manual* ("Corps Manual"; Environmental Laboratory 1987), the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West* ("Arid West/Western Mountains and Valleys Supplement"; Corps 2008), and A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States (Lichvar and McColley 2008). Areas meeting these indicators were mapped as aquatic resources and categorized using the vegetation community classification methods described above. Aquatic communities which are mapped in the NMFS Essential Fish Habitat Mapper (NMFS 2021), or otherwise meet criteria for designation as Essential Fish Habitat are indicated as such in the community description below in Section 5.1. The presence of riparian habitat was evaluated based on woody plant species meeting the definition of riparian provided in *A Field Guide to Lake and Streambed Alteration Agreements, Section 1600-1607, California Fish and Game Code* (CDFG 1994) and based on best professional judgement of biologists completing the field surveys.

3.2 Wetland Delineation Methodology

WRA biologists performed a delineation of aquatic resources within the Study Area on January 14, 2021. Prior to conducting the evaluation, WRA reviewed the literature resources listed above. In addition, LIDAR data were reviewed to plan the site visit and as a reference during the site visit. During the on-site evaluation, WRA followed the methods outlined in the Corps Wetlands Delineation Manual (Environmental Laboratory 1987), the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Arid West Supplement; Corps 2008), and A Field Guide to the Identification of the Ordinary High Water Mark in the Arid West Region of the Western United States ("OHWM Guide"; Lichvar and McColley 2008).

Data on vegetation, hydrology, and soils were collected during the evaluation and recorded. Potentially jurisdictional wetlands were identified and their boundaries mapped using the Routine Method described in the Corps Manual. The jurisdictional limits of non-wetland waters under Section 404 of the CWA were mapped based on a combination of field indicators described in the OHWM Guide. Where direct access to the OHWM and TOB was not feasible, the location was hand drawn in the field on aerial photographs with LIDAR for subsequent digitizing in ArcGIS. The total acreage of potential jurisdictional waters was

measured digitally using ArcGIS software. Indicators described in the Corps Manual that were used to make wetland or waters determinations in the Study Area and are summarized below.

Routine Method. WRA followed the Routine Method to evaluate the Study Area for the presence or absence of indicators of the three wetland parameters described in the Corps Manual and Arid West Supplement. Prior to conducting the evaluation, available reference materials listed above were reviewed. Data on vegetation, hydrology, and/or soils were collected at sample points within potential wetland communities and adjacent upland areas. Except in cases of atypical or problematic wetland situations, sample points that lacked one or more indicators were considered to be upland.

3.2.1 Waters of the United States

The Study Area was evaluated for the presence of wetlands and non-wetland waters.

Wetlands

The Corps has defined the term "wetlands" as follows:

> *…those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.*

The basis for determining whether a given area is a wetland for the purposes of Section 404 of the CWA is outlined in the Corps Manual and Arid West Supplement. As defined in 33 CFR 328.4 (c), the extent of federal jurisdiction within wetlands is defined as extending to the limit of the wetland as determined using the methods outlined in the manuals.

The three parameters listed in the Corps Manual that are used to determine the presence of wetlands are: (1) hydrophytic vegetation, (2) wetland hydrology, and (3) hydric soils. According to the Corps Manual:

> *"...[E]vidence of a minimum of one positive wetland indicator from each parameter (hydrology, soil, and vegetation) must be found in order to make a positive wetland delineation."*

Vegetation. Plant species observed in the Study Area were identified using the Jepson eFlora (Jepson Flora Project 2021). Plants were assigned a wetland indicator status according to the National Wetland Plant List (NWPL; Lichvar 2012).

Hydrology. The Corps jurisdictional wetland hydrology criterion is satisfied if an area is inundated or saturated for a period sufficient to create anoxic soil conditions during the growing season (a minimum of 14 consecutive days in the Arid West region). Evidence of wetland hydrology can include primary indicators, such as visible inundation or saturation, drift deposits, oxidized root channels, and salt crusts, or secondary indicators such as the FAC-neutral test, presence of a shallow aquitard, or crayfish burrows.

Soils. Soils formed over long periods of time under wetland (anaerobic) conditions often possess characteristics that indicate they meet the definition of hydric soils. Hydric soils can have a hydrogen sulfide (rotten egg) odor, low chroma matrix color, generally designated 0, 1, or 2, used to identify them as hydric, presence of redox concentrations, gleyed or depleted matrix, or high organic matter content.

The Natural Resource Conservation Service defines a hydric soil as follows:

> *"A hydric soil is a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part."*
>
> Federal Register July 13, 1994,
> U.S. Department of Agriculture, NRCS

The Arid West Supplement provides a list of 23 of these hydric soil indicators that are known to occur in the Arid West region.

Non-wetland Waters

The Study Area was also evaluated for the presence of "non-wetland waters". Non-wetland waters subject to Corps jurisdiction include lakes, rivers, and perennial or intermittent streams. Corps jurisdiction of non-wetland waters in non-tidal areas extends to the OHWM, defined as:

> *The term "ordinary high water mark" means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impresses on the bank, shelving, changes in the characteristics of the soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.*
>
> Federal Register Vol. 51, No. 219,
> Part 328.3 (d). November 13, 1986.

Non-wetland waters are identified in the field by the presence of a defined river or streambed, a bank, and evidence of the flow of water, or by the absence of emergent vegetation in ponds or lakes. Assessment of the OHWM followed the OHWM Guide.

3.2.2 Waters of the State

State and Regional Water Quality Control Board

The SWRCB and RWQCB have not established a formal wetland definition nor have they developed a wetland delineation protocol; however, these agencies generally adhere to the same delineation protocol set forth by the Corps (U.S. Army Corps of Engineers, Environmental Laboratory 1987). Therefore, the methods used to determine potential Waters of the State were the same as those described above for potential Waters of the U.S. Potential SWRCB and RWQCB jurisdiction along streams in the Study was mapped to the TOB elevation and inclusive of adjacent riparian vegetation.

California Department of Fish and Wildlife

CDFW jurisdiction over lakes and streams extends to the TOB of the stream, or the edge of riparian

vegetation as determined by edge of dripline, whichever is further. Areas of potential CDFW jurisdiction under sections 1600-1616 of the CFGC were identified in the field.

3.2.3 California Coastal Commission/Local Coastal Program Jurisdiction

The Study Area is within the City LCP boundaries; potential wetlands, waters, and riparian areas and will be analyzed in accordance with the LCP definitions.

Wetlands

The Coastal Act defines wetlands as:

> *Wetland means lands within the Coastal Zone which may be covered periodically or permanently with shallow water and include saltwater marshes, freshwater marshes, open or closed brackish water marshes, swamps, mudflats, and fens.*
>
> Public Resources Code Section 30121)

The Half Moon Bay LUP defines wetlands as:

> *Wetlands shall be defined according to the single-parameter definition in Section 30121 of the Coastal Act and Section 13577(b) of the Coastal Commission's Regulations. Wetlands shall include land where the water table is at, near, or above the land surface long enough to promote the formation of hydric soils or to support the growth of hydrophytes. Wetlands may also include land where vegetation is lacking and soil is poorly developed or absent as a result of frequent and drastic fluctuations of surface water levels, wave action, water flow, turbidity or high concentrations of salts or other substances in the substrate. Such wetlands can be recognized by the presence of surface water or saturated substrate at some time during each year and their location within, or adjacent to, vegetated wetlands or deep-water habitats.*

CCC Administrative Regulations (Section 13577 (b)) provides a more explicit definition:

> *Wetlands are lands where the water table is at, near, or above the land surface long enough to promote the formation of hydric soils or to support the growth of hydrophytes, and shall also include those types of wetlands where vegetation is lacking and soil is poorly developed or absent as a result of frequent or drastic fluctuations of surface water levels, wave action, water flow, turbidity or high concentrations of salt or other substance in the substrate. Such wetlands can be recognized by the presence of surface water or saturated substrate at some time during each year and their location within, or adjacent to, vegetated wetlands or deepwater habitats.*

The CCC has considered this definition as requiring the observation of one diagnostic feature of a wetland such as wetland hydrology, dominance by wetland vegetation (hydrophytes), or presence of hydric soils as a basis for asserting jurisdiction under the Coastal Act.

In addition to the above definition, the *Statewide Interpretive Guidelines for Identifying and Mapping Wetlands and Other Wet Environmentally Sensitive Habitat Areas* (CCC ZP Hymanson 1981) provide technical criteria for use in identifying and delineating wetlands and other ESHAs within the Coastal Zone.

The technical criteria presented in the guidelines are based on the Coastal Act definition and indicate that wetland hydrology is the most important parameter for determining a wetland, recognizing that:

> *… the single feature that most wetlands share is soil or substrata that is at least periodically saturated with or covered by water, and this is the feature used to describe wetlands in the Coastal Act. The water creates severe physiological problems for all plants and animals except those that are adapted for life in water or in saturated soil, and therefore only plants adapted to these wet conditions (hydrophytes) could thrive in these wet (hydric) soils. Thus, the presence or absence of hydrophytes and hydric soils make excellent physical parameters upon which to judge the existence of wetland habitat areas for the purposes of the Coastal Act, but they are not the sole criteria.*

The Technical Criteria requires that saturation of soil in a wetland must be at or near the surface continuously for a period of time. The meaning of "at or near the surface" generally is considered to be approximately one-foot from the surface or less (the root zone), and the saturation must be continuously present for a period of time (generally more than two weeks) in order to create the necessary soil reduction (anaerobic) processes that create wetland conditions. For example, water from rain during a storm that causes saturation near the surface but then evaporates or infiltrates to 18 inches or deeper below the surface shortly after the storm does not meet the generally accepted criteria for wetland hydrology.

The presence of wetland classified plants or the presence of hydric soils (generally referred to as the "one parameter approach") can be used to identify an area as being a wetland in the Coastal Zone. There is correlation between the presence of wetland plants, wetland hydrology, and/or hydric soils occurring together, especially in natural undisturbed areas, and in many cases where one of these parameters is found (e.g., wetland plants) the other parameters will also occur. But there are situations which can result in the presence of wetland classified plants without there being wetland conditions, and these areas are not wetlands. Where these situations occur, the delineation study must carefully scrutinize whether the wetland classified plants that are present are growing there as hydrophytes in reducing (anaerobic) conditions caused by the presence of wetland hydrology or are there for some other (non-wetland) reason. Examples may include wetland-classified plants which are also salt-tolerant (e.g., alkali heath) and may be responding to either wetland conditions or saline soil conditions, but not necessarily both, and deep-rooted trees (e.g., willows) which are able to tap into deep groundwater sources and can grow in dry surface soils, but are also found in wetland conditions where surface water is present.

Hydric soils can also occur in upland areas especially in areas where historic disturbances may have exposed substratum or in densely vegetated grasslands (mollisols). Similarly, the delineation must determine if the hydric soil indicators are a result of frequent anaerobic conditions or if they are the result of non-wetland conditions.

The Coastal Act uses a broad wetland definition in which the presence of any one of the wetland parameters may indicate presence of a wetland. The CCC presumes that the area is a wetland if one of the wetland parameters is present. However, there may be exceptions to this presumption if there is strong positive evidence of upland conditions, as opposed to negative evidence of wetland conditions. Positive evidence of upland hydrology might be the observation that a given area saturates only ephemerally following significant rainfall, that the soil is very permeable with no confining layer, or that the land is steep and drains rapidly. Positive evidence of upland conditions should be obtained during the wet season. Based on these facts, this biological resource evaluation identified areas within the Study

Area that had wetland plants, hydric soils, or wetland hydrology indicators. Soils, hydrology, and vegetation were examined on January 14, 2021 at locations within the Study Area that had the potential to meet the LCP's wetland definition.

All areas meeting at least one parameter are depicted on the jurisdictional delineation map as red alder forest.

Streams

A stream is a natural watercourse as designated by a solid line or dash and three dots symbol shown on the USGS map most recently published, or any well-defined channel with distinguishable bed and bank that shows evidence of having contained flowing water as indicated by scour or deposit of rock, sand, gravel, soil, or debris (CCC ZP Hymanson 1981). Prior to visiting the site, WRA reviewed the most recent USGS map for the Study Area.

Riparian Corridors

The Half Moon Bay LCP definition of "riparian corridors" is:

> *Riparian corridors are defined on the ground by an association of native, and in some cases non-native, plant and animal species within or adjacent to a watercourse that contribute to the function or distinction of the riparian habitat. Boundaries of riparian corridors are determined by the limit of riparian vegetation or top of bank, or other confining topography, whichever is greater. The limit of riparian vegetation is determined by the drip line of riparian canopy trees or the limit of riparian shrubs or herbaceous vegetation.*

The LCP establishes a mandatory riparian buffer zone extending 50 feet outward from the limit of riparian vegetation on perennial streams. During the January 14, 2021 site visit, WRA made a rapid assessment of the dominant vegetation along the drainage course located within and adjacent to the Study Area. The dripline of vegetation along Pilarcitos Creek within the Study Area boundary was mapped using a hand-held GPS unit and aerial photography.

3.3 Special-status Species

Potential occurrence of special-status species in the Project Area was evaluated by first determining which special-status species occur in the vicinity of the Project Area through a literature and database review as described above. Presence of suitable habitat for special-status species was evaluated during the site visit based on physical and biological conditions of the site, as well as the professional expertise of the investigating biologists. The potential for each special-status species to occur in the Study Area was then determined according to the following criteria:

- No Potential. Habitat on and adjacent to the site is clearly unsuitable for the species requirements (foraging, breeding, cover, substrate, elevation, hydrology, plant community, site history, disturbance regime).

- Unlikely. Few of the habitat components meeting the species requirements are present, and/or the majority of habitat on and adjacent to the site is unsuitable or of very poor quality. The species is not likely to be found on the site.

- Moderate Potential. Some of the habitat components meeting the species requirements are present, and/or only some of the habitat on or adjacent to the site is unsuitable. The species has a moderate probability of being found on the site.

- High Potential. All of the habitat components meeting the species requirements are present and/or most of the habitat on or adjacent to the site is highly suitable. The species has a high probability of being found on the site.

- Present. Species is observed on the site or has been recorded (i.e. CNDDB, other reports) on the site in the recent past.

If a more thorough assessment was deemed necessary, a targeted or protocol-level assessment or survey was conducted or recommended as a future study. If a special-status species was observed during the site visit, its presence was recorded and discussed below in Section 5.3. If designated critical habitat is present for a species, the extent of critical habitat present and an evaluation of critical habitat elements is provided as part of the species discussions below.

4.0 ECOLOGICAL SETTING

The approximately 0.61-acre Project Area consists of the proposed limit-of-work for the Project. The approximately 10.91-acre Study Area includes the Project Area, a 200-foot buffer around the Project Area, and a Staging Area. The Study Area is located in the City of Half Moon Bay in San Mateo County and crosses Pilarcitos Creek, a USGS blue-line stream. The Study Area includes a portion of the Strawflower Village shopping center parking lot (APN 056-300-150) to the north and Oak and Pilarcitos Avenues to the south, as well as portions of the following APNs, adjacent to Pilarcitos Creek: 056-300-210, 056-040-999, 056-141-970 (Oak Avenue Park), and 056-141-950. The Project Area is owned by the City, and all other staging and equipment laydown areas are either within utility easements or City-owned road right-of-way. Additional detailed of the local setting are below.

4.1 Soils and Topography

The existing ground surface elevations range between 42 feet on the north side and about 44 feet on the south side of the proposed crossing. The creek bed near the proposed centerline of the crossing ranges between 27 and 29 feet above sea level. According to the *Soil Survey San Mateo Area* (USDA 1961) and California Soil Resource Lab's (CSRL) online soil viewer (CSRL 2021), the Study Area is underlain by eight soil mapping units: Denison clay loam (nearly level), Denison loam (sloping), Farallone coarse sandy loam (gently sloping), Farallone coarse sandy loam (moderately steep, eroded), Farallone Coarse sandy loam (nearly level), Farallone Coarse sandy loam (sloping, eroded), Farallone loam (nearly level), and Gullied land (alluvial soil material). These soil series are described below and depicted in Figure 3, Appendix A.

DENISON Series: The Denison series consists of very deep, moderately well drained soils developed from moderately fine textured granitic alluvium. Denison soils are have a limited distribution and occur on low terraces adjacent to the coast in central California. These soils have slow to medium runoff, slow permeability, and slopes ranging from 0 to 15 percent.

FARALLONE Series: The Farallone series consists of very deep, well drained soils, nearly level to moderately steep soils and recent fans and flood plains. The soils have formed in alluvium that was

derived mainly from granitic rocks. The vegetation in uncultivated areas is mainly coyote brush, bush lupine, and there are willows and other hydrophytic vegetation along drainageways.

GULLIED LAND: This miscellaneous land type occurs near streams that extend through areas of Botella, Farallone, and Soquel soil series. Relief along streams range from gently sloping to sloping. These areas are prone to streambank cutting and are usually heavily vegetated by woody plants.

4.2 Climate and Hydrology

The Study Area is located in the coastal region of San Mateo County. The average monthly maximum temperature in the area is 67 degrees Fahrenheit, while the average monthly minimum temperature is 45 degrees Fahrenheit. Predominantly, precipitation falls as rainfall between November and March with an annual average precipitation of 27 inches.

The local watershed is Arroyo Leon (HUC 12: 180500060201) and the regional watershed is the San Francisco Coastal South (HUC 8: 18050006). The Study Area is located in the lower portion of the Arroyo Leon watershed. Pilarcitos Creek (also called Arroyo Leon) is a USGS blue-line perennial stream in the Study Area (USGS 2018). Detailed descriptions of aquatic resources are provided in Section 5.1 below.

4.3 Land-use

The north side of the Study Area consists of a paved parking lot behind Safeway in the Strawflower Village shopping center. The area along the proposed pipeline alignment is a heavily vegetated riparian corridor with trees, shrubs, understory vines, and Pilarcitos Creek. Active homeless encampments are present within the corridor. The south staging area is within Oak Park along the north side of Oak Avenue. The area consists of mowed lawn, paved and gravel walking paths, paved asphalt along Oak Avenue, and landscaped areas. Detailed plant community descriptions are included in Section 5.1 below. Surrounding land uses include residential development to south, a shopping center to the north, Pilarcitos Creek riparian corridor and Route 1 to the east, and Pilarcitos Creek riparian corridor and agriculture to the west (Google 2021).

5.0 ASSESSMENT RESULTS

5.1 Vegetation Communities and Other Land Cover

WRA observed three land cover types within the Study Area: developed area, red alder forest, and perennial stream. Land cover types within the Study Area are illustrated on Figure 4, Appendix A. The non-sensitive land cover types in the Study Area include developed, while the sensitive communities include red alder forest and perennial stream. The Project Area and HDD construction methodology have been intentionally chosen to avoid impacts to Pilarcitos Creek and associated riparian corridor. Table 1 below lists all vegetation communities and land cover types observed within the Study Area. A list of species observed during the site visit is included in Appendix B. Photographs of the Study Area are included in Appendix C.

TABLE 1. VEGETATION COMMUNITY AND LAND COVER TYPES

COMMUNITY/LAND COVERS	SENSITIVE STATUS	RARITY RANKING	ACRES WITHIN STUDY AREA
Terrestrial Community/Land Cover			

TABLE 1. VEGETATION COMMUNITY AND LAND COVER TYPES

COMMUNITY/LAND COVERS	SENSITIVE STATUS	RARITY RANKING	ACRES WITHIN STUDY AREA
Developed Area	N	None	5.59
Red Alder Forest	Y	G5/S4	3.50
Aquatic Resources			
Perennial Stream	Y	None	1.82

5.1.1 Terrestrial Land Cover

Developed Area (no vegetation alliance). CDFW Rank: Not Sensitive. Developed area consists of paved surfaces, buildings, mowed lawn, and ornamental landscaping. Vegetation in developed areas includes planted trees and horticultural varietals. Woody vegetation is sparse and consists of Monterey cypress (*Hesperocyparis macrocarpa,* NL), toyon (*Heteromeles arbutifolia*, NL), strawberry tree (*Arbutus unedo*, NL), Ngaio tree (*Myoporum laetum*, FACU), and other landscape varietals. Herbaceous species in mowed areas appeared to be dominated by non-native annual species at the time of the site visit; however, due to the January assessment timing and mowing schedule, not all species were readily identifiable. Observed common species included Italian ryegrass (*Festuca perennis*, FAC), slim oat (*Avena barbata*, NL), foxtail barley (*Hordeum murinum*, FACU), and forb seedlings including bristly ox-tongue (*Helminthotheca echioides*, FAC), poison hemlock (*Conium maculatum*, FAC), and wild geranium (*Geranium dissectum*, NL). This community is not considered sensitive under CEQA or the LCP.

Red Alder Forest (*Alnus rubra* Forest Alliance). CDFW Rank: Sensitive. Red alder forest is known from the central California coast, northern California coast, and Klamath mountain regions along the coastline. This vegetation community occurs both as riparian and upland stands located along stream and river backwaters, banks, flood plains, mouths, terraces, and slopes of all aspects (CNPS 2021b).

Red alder forest is mapped in the Study Area according to CNPS (2021b) as having red alder (*Alnus rubra*, FAC) greater than 50 percent relative cover in the tree canopy. Red alder forest in the Study Area is situated along the banks and floodplain of a perennial stream, but were in upland positions (i.e. hydric soil and wetland hydrology indicators absent). The overstory is dominated by red alder with occasional co- to sub-dominant stands of red willow (*Salix laevigata*, FACW). The sub-canopy ranges from dense thickets of red willow and arroyo willow (*Salix lasiolepis*, FACW) with scattered individuals of blackwood acacia (*Acacia melanoxylon*, NL), Ngaio tree, and cottonwood (*Populus fremontii* ssp. *fremontii*, FAC) to open understory dominated by herbaceous vegetation. Understory cover is dense to open and dominated by vines including Cape ivy (*Delairea odorata*, FAC), garden nasturtium (*Tropaeolum majus*, UPL), stinging nettle (*Urtica dioica*, FAC), California blackberry (*Rubus ursinus*, FAC), and English ivy (*Hedera helix*, FACU).

Red alder forest has a sensitivity ranking of G5S4 indicating that it is secure both globally and locally in California; however, because this habitat occurs as a riparian community, it is regulated by the CDFW and RWQCB and is therefore considered sensitive under CEQA. As more than 50 percent of riparian overstory consisted of riparian species; the riparian community is regulated under the Coast Act / City LCP and are therefore considered an ESHA. Accordingly, a 50-foot LCP buffer around this riparian community is displayed on Figure 5, Appendix A.

5.1.2 Aquatic Resources

Perennial Stream. (No vegetation alliance). CDFW Rank: Sensitive. Pilarcitos Creek is a perennial stream that occupies approximates 1,328 linear feet (1.82 acre) of the Study Area. The creek is confined within a well-defined meandering channel within a heavily vegetated riparian corridor. Within the Study Area, the creek flows east to west and enters the Pacific Ocean outside the Study Area approximately 1-mile west. The creek was flowing at the time of the site visit and had a substrate consisting of sand and fine bed material. Perennial stream was mapped where indicators of OHWM were observed, such as evidence of flow, bed and bank, scour, sediment sorting, wrack, and absence of vegetation. Where vegetation occurs below OHWM, it is generally sparse and consists of watercress (*Nasturtium officinale*, OBL) and garden nasturtium. Vegetation between OHWM and TOB is typically sparse, consisting of vine species including Cape ivy and garden nasturtium. All perennial stream mapped in the Study Area are regulated by the Corps, RWQCB, CCC/LCP, and CDFW.

5.2 Summary of Potentially Jurisdictional Features

A delineation of the Study Area was conducted concurrently with the site visit on January 14, 2021. Areas mapped as potential jurisdictional features include non-wetland waters (perennial stream) and red alder forest. Areas subject to Corps, RWQCB, CDFW, and CCC/LCP jurisdiction are summarized in Table 2 and shown in Figure 5, Appendix A. No delineation data sheets are included as no potentially jurisdictional wetlands were observed within the Study Area. Potentially jurisdictional natural communities are discussed in greater detail above in Section 3.

TABLE 2. JURISDICTIONAL FEATURES WITHIN THE STUDY AREA

JURISDICTION	FEATURE	PROJECT AREA (ACRE/LINEAR FEET)	STUDY AREA ACRE/LINEAR FEET)
Corps Section 404	Perennial Stream (based on OHWM	0.02 / 28	0.90 / 1,328
	CORPS TOTAL	**0.02 / 28**	**0.90 / 1,328**
RWQCB Section 401	Perennial Stream (based on TOB)	0.04 / 28	1.82 /1,328
	Riparian Corridor	0.12 / NA	3.39 / NA
	RWQCB TOTAL	**0.16 / 28**	**5.21 / 1,328**
CDFW Section 1602	Perennial Stream (based on TOB)	0.04 / 28	1.82 /1,328
	Riparian Corridor	0.12 / NA	3.39 / NA
	CDFW TOTAL	**0.16 / 28**	**5.21 / 1,328**
CCC / LCP	Perennial Stream (based on TOB)	0.04 / 28	1.82 /1,328
	Riparian Corridor and LCP Buffer	0.43 / NA	3.39 / NA
	CCC / LCP TOTAL	**0.47 / 28**	**5.21 / 1,328**

5.3 Special-status Species

5.3.1 Special-status Plants

Based upon a review of the resource databases listed in Section 3, 60 special-status plant species have been documented in the vicinity of the Study Area. Appendix D summarizes the potential for occurrence of each of these special-status plant species to occur in the Study Area. All plant species observed in the Study Area during the site visit are included in Appendix B. No special-status plant species were determined to have a moderate or high potential to occur within the Study Area. All special-status plants are unlikely or have no potential to occur within the Study Area for one or more of the following reasons:

- Edaphic (soil) conditions (e.g., sand, sandstone, serpentine) necessary to support the special-status plant species are not present in the Study Area;
- Associated natural communities (e.g., grassland, coastal scrub, chaparral, coastal bluff/dune, marsh, redwood forest) necessary to support the special-status plant species are not present in the Study Area; or
- Land use history and contemporary management (e.g., human activity) has degraded the localized habitat necessary to support the special-status plant species.

5.3.2 Special-status Wildlife

Based upon a review of the resources and databases given in Section 3, seven special-status wildlife species have been documented, or have potential to occur in the vicinity of the Study Area. Appendix D summarizes the potential for each of these species to occur in the Study Area.

The special-status wildlife species discussed below have a moderate or high potential to occur in the Study Area. The remaining species documented to occur in the vicinity of the Study Area have no potential or are unlikely to occur due to a lack of suitable habitat components (such as tidal salt marsh, marine environments, sand or dunes, caves, mines, or abandoned buildings) or the Study Area is outside of the known distribution of the species.

San Francisco dusky-footed woodrat (*Neotoma fuscipes annectens*), CDFW Species of Special Concern. This subspecies of the dusky-footed woodrat occurs in the Coast Ranges between San Francisco Bay and the Salinas River (Matocq 2002). Occupied habitats are variable and include forest, woodland, riparian areas, and chaparral. Woodrats feed on woody plants, but will also consume fungi, grasses, flowers and acorns. Foraging occurs on the ground and in bushes and trees. This species constructs robust stick houses/structures in areas with moderate cover and a well-developed understory containing woody debris. Breeding takes place from December to September. Individuals are active year-round, and generally nocturnal.

This species has been documented 3.5 miles to the northeast in vegetated areas along state highway 35 (CDFW 2021). While not documented in urban Half Moon Bay, this species is generally present in the region and is known to create nests in densely vegetated areas including riparian areas. While no stick nest structures were observed within the Study area during the January 2021 site visit, conditions are potentially favorable for occupation by this species were they to disperse to the Study Area from generally

more suitable habitats. Although impacts to the riparian area are not anticipated in the course of this Project, woodrat may establish nests adjacent to work areas and thus have moderate potential to occur.

San Francisco (salt marsh) common yellowthroat (*Geothlypis trichas sinuosa*), CDFW Species of Special Concern. This subspecies of the common yellowthroat is found in freshwater marshes, coastal swales, riparian thickets, brackish marshes, and saltwater marshes. Their breeding range extends from Tomales Bay in the north, Carquinez Strait to the east, and Santa Cruz County to the south. This species requires thick, continuous cover such as tall grasses, tule patches, or riparian vegetation down to the water surface for foraging and prefers willows for nesting. Dense patches of willow within the Study Area may provide suitable nesting habitat for this species. Additionally, this species has been documented to occur less than 1 mile from the Study Area (California Department of Fish and Wildlife (CDFW) 2021). Therefore, there is a high potential for this species to nest and forage within the Study Area.

White-tailed kite (*Elanus leucurus*). CDFW Fully Protected Species. The white-tailed kite is resident in open to semi-open habitats throughout the lower elevations of California, including grasslands, savannahs, woodlands, agricultural areas and wetlands. Vegetative structure and prey availability seem to be more important habitat elements than associations with specific plants or vegetative communities (Dunk 1995). Nests are constructed mostly of twigs and placed in trees, often at habitat edges. Nest trees are highly variable in size, structure, and immediate surroundings, ranging from shrubs to trees greater than 150 feet tall (Dunk 1995). This species preys upon a variety of small mammals, as well as other vertebrates and invertebrates.

This species is commonly present along the California coast, and can be observed foraging in grassland areas in the vicinity of the Study Area (Shuford and Gardali 2008). Small trees are present adjacent to open spaces nearby that could provide nesting habitat for this species. Foraging opportunities are common in shoreline grasslands and marshes. Thus, this species has a moderate potential to occur.

Western pond turtle (WPT, *Actinemys marmorata*), CDFW Species of Special Concern. The western pond turtle (WPT) is the only native freshwater turtle in California. This turtle is uncommon to common in suitable aquatic habitat throughout California, west of the Sierra-Cascade crest and Transverse Ranges. WPT inhabits annual and perennial aquatic habitats, such as coastal lagoons, lakes, ponds, marshes, rivers, and streams from sea level to 5,500 feet in elevation. WPT also occupies man-made habitats such as stock ponds, wastewater storage, percolation ponds, canals, and reservoirs. This species requires low-flowing or stagnant freshwater aquatic habitat with suitable basking structures, including rocks, logs, algal mats, mud banks, and sand. Warm, shallow, nutrient-rich waters are ideal as they support WPT prey items, which include aquatic invertebrates and occasionally fish, carrion, and vegetation. Turtles require suitable aquatic habitat for most of the year; however, WPT often occupy creeks, rivers, and coastal lagoons that become seasonally unsuitable. To escape periods of high water flow, high salinity, or prolonged dry conditions, WPT may move upstream and/or take refuge in vegetated, upland habitat for up to four months (Rathbun et al. 2002). Although upland habitat is utilized for refuging and nesting, this species preferentially utilizes aquatic and riparian corridors for movement and dispersal.

There have been no documented occurrences of this species within 5 miles of the Study Area (CDFW 2021). At the time of the January 14, 2021 site visit, the portion of Pilarcitos Creek within the Study Area was slow-moving, which is a positive attribute for turtles. It was shallow and clear, however, and did not provide aquatic escape habitat for turtles to evade predators. It is likely that during the rainy season, the creek would provide more aquatic escape habitat. The creek is also very entrenched through the Study Area, likely making it difficult for turtles to move to upland habitat for nesting or seasonal refuge. WPT is

unlikely to nest in or adjacent to the Study Area, though it may occasionally move through or bask within the Study Area when there are appropriate water levels and sufficient sunlight passes through the tree canopy. Therefore, there is a moderate potential for this species to occur within the Study Area.

San Francisco garter snake (SFGS, *Thamnophis sirtalis tetrataenia*), Federal Endangered, State Endangered, CDFW Fully Protected. Historically, San Francisco garter snake (SFGS) occurred in scattered wetland areas on the San Francisco Peninsula from approximately the San Francisco County line south along the eastern and western bases of the Santa Cruz Mountains, at least to the Upper Crystal Springs Reservoir, and along the coast south to Año Nuevo Point, San Mateo County, and Waddell Creek, Santa Cruz County. The preferred habitat of the SFGS is a densely vegetated pond near an open hillside where they can sun themselves, feed, and find cover in rodent burrows; however, considerably less-ideal habitats can be successfully occupied. Temporary ponds and other seasonal freshwater bodies are also used. Emergent and bankside vegetation such as cattails (*Typha* spp.), bulrushes (*Scirpus* spp.) and spike rushes (*Juncus* spp. and *Eleocharis* spp.) apparently are preferred and used for cover. The area between stream and pond habitats and grasslands or bank sides is used for basking, while nearby dense vegetation or water often provide escape cover. Snakes also use floating algal or rush mats, if available.

There are two significant components to SFGS habitat: 1) ponds or suitable habitat that support California red-legged frog (CRLF), American bullfrog (*Rana catesbeiana*), or the Pacific chorusfrog (*Pseudacris regilla*) and 2) surrounding upland that supports Botta's pocket gopher *(Thomomys bottae)* or the California meadow vole *(Microtus californicus).* Ranid frogs are an obligate component of the SFGS's diet (USFWS 2006).

SFGS has been documented to occur within Pilarcitos Creek (CDFW 2021). There is not a substantial amount of emergent vegetation within the Study Area, but the snake may still move through and occasionally forage within aquatic habitat and uplands on-site. Based on habitat conditions and the close proximity of documented occurrences, there is a high potential for this species to occur, at least as a transient, within the Study Area.

California red-legged frog (*Rana draytonii;* CRLF), Federal Threatened Species, CDFW Species of Special Concern. California red-legged frog (CRLF) is dependent on suitable aquatic, estivation, and upland habitat. During periods of wet weather, starting with the first rainfall in late fall, red-legged frogs disperse away from their estivation sites to seek suitable breeding habitat. Aquatic and breeding habitat is characterized by dense, shrubby, riparian vegetation and deep, still or slow-moving water. Breeding occurs between late November and late April. CRLF estivate (period of inactivity) during the dry months in small mammal burrows, moist leaf litter, incised stream channels, and large cracks in the bottom of dried ponds.

There are four physical and biological features that are considered to be essential for the conservation or survival of a species. The features for the CRLF include: aquatic breeding habitat; non-breeding aquatic habitat; upland habitat; and dispersal habitat (USFWS 2010).

Aquatic breeding habitat consists of low-gradient fresh water bodies, including natural and manmade (e.g. stock) ponds, backwaters within streams and creeks, marshes, lagoons, and dune ponds. It does not include deep water habitat, such as lakes and reservoirs. Aquatic breeding habitat must hold water for a minimum of 20 weeks in most years. This is the average amount of time needed for egg, larvae, and tadpole development and metamorphosis so that juveniles can become capable of surviving in upland habitats (USFWS 2010).

Aquatic non-breeding habitat may or may not hold water long enough for this species to hatch and complete its aquatic life cycle, but it provides shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult CRLF. These waterbodies include plunge pools within intermittent creeks; seeps; quiet water refugia during high water flows; and springs of sufficient flow to withstand the summer dry period. The CRLF can use large cracks in the bottom of dried ponds as refugia to maintain moisture and avoid heat and solar exposure (Alvarez 2004). Non-breeding aquatic features enable CRLF to survive drought periods, and disperse to other aquatic breeding habitat (USFWS 2010).

Upland habitats include areas within 300 feet of aquatic and riparian habitat and are comprised of grasslands, woodlands, and/or vegetation that provide shelter, forage, and predator avoidance. These upland features provide breeding, non-breeding, feeding, and sheltering habitat for juvenile and adult frogs (e.g., shelter, shade, moisture, cooler temperatures, a prey base, foraging opportunities, and areas for predator avoidance). Upland habitat can include structural features such as boulders, rocks and organic debris (e.g. downed trees, logs), as well as small mammal burrows and moist leaf litter (USFWS 2010).

Dispersal habitat includes accessible upland or riparian habitats between occupied locations within 0.7 mile of each other that allow for movement between these sites. Dispersal habitat includes various natural and altered habitats such as agricultural fields, which do not contain barriers to dispersal. Moderate- to high-density urban or industrial developments, large reservoirs, and heavily traveled roads without bridges or culverts are considered barriers to dispersal (USFWS 2010). Although CRLF is highly aquatic, this species has been documented to make overland movements of several hundred meters and up to one mile during a winter-spring wet season in Northern California (Bulger et al. 2003; Fellers and Kleeman 2007) and 2,860 meters (1.8 miles) in the central California coast (Rathbun and Schneider 2001). Frogs traveling along water courses can exceeded these distances.

The portion of Pilarcitos Creek within the Study Area may provide suitable aquatic breeding and dispersal habitat for this species. The riparian canopy cover and low gradient, slow-moving intermittent creek are positive habitat attributes. This species is unlikely to use uplands within the Study Area, however, due to the highly entrenched banks around the creek, which are likely difficult for this frog to climb in most locations, and due to the highly developed area surrounding the Study Area. This species was documented directly adjacent to the Study Area in 2006 (CDFW 2021). Based on habitat conditions and the close proximity of documented occurrences, there is a high potential for this species to occur within the Study Area.

Steelhead - Central California Coast DPS (*Oncorhynchus mykiss irideus*), Federal Threatened. The Central California Coast DPS includes all naturally spawned populations of steelhead (and their progeny) in California streams from the Russian River to Aptos Creek, and the drainages of San Francisco and San Pablo Bays eastward to the Napa River (inclusive), excluding the Sacramento-San Joaquin River Basin.

Steelhead typically migrate to marine waters after spending two years in freshwater, though they may stay up to seven. They then reside in marine waters for 2 or 3 years prior to returning to their natal stream to spawn as 4-or 5-year-olds. Steelhead adults typically spawn between December and June. In California, females typically spawn two times before they die. Preferred spawning habitat for steelhead is in perennial streams with cool to cold water temperatures, high dissolved oxygen levels, and fast flowing water. Abundant riffle areas (shallow areas with gravel or cobble substrate) for spawning and deeper pools with sufficient riparian cover for rearing are necessary for successful breeding.

This species has been observed within Pilarcitos Creek, and both adults and smolting juveniles likely pass through the Study Area on their way to or from breeding grounds. This species is likely to be present only seasonally when water levels allow fish passage, during migrations to spawning grounds further upstream, and during outmigration. Based on habitat characteristics and documented occurrences within Pilarcitos Creek, this species has a high potential to occur within the Study Area.

5.4 Wildlife Corridors and Native Wildlife Nursery Sites

The Study Area falls within an essential connectivity area identified by the California Essential Habitat Connectivity Project, and is classified in the "least permeable" category (CalTrans 2010; CDFW 2021). The stream and associated riparian corridor, which runs through the Study Area may serve as a small-scale habitat corridor. The riparian corridor may allow wildlife to move between habitats, or into small patches of nearby undeveloped uplands. While this corridor is narrow and actively traversed by homeless people, it still serves to link these smaller, potentially core habitats, fulfilling the criteria as a wildlife corridor.

6.0 POTENTIAL IMPACTS AND MITIGATION EVALUATION

The CCWD proposes to construct a new water pipeline under Pilarcitos Creek as part of upgrades to their water supply infrastructure. Preliminary cross-section and plan view drawings are provided in Appendix E. The entire 450-foot-long pipeline would be installed using HDD and avoid all impacts to sensitive natural communities. The limits of work are shown in relation to sensitive natural communities and LCP buffer areas in the Study Area in Appendix A, Figures 4 and 5. The following sections provide an evaluation of potential impacts to sensitive habitats and species and recommended avoidance, minimization, and mitigation measures.

6.1 Sensitive Natural Communities and Land Cover Types

Pilarcitos Creek and its riparian corridor is within the Study Area; however, outside the limit of disturbance due to the proposed HDD construction method. Thus, no direct impacts are anticipated to occur to potential ESHAs or areas subject to the regulatory jurisdiction of the Corps, RWQCB, or CDFW. The Project will pass through the 50-foot LCP buffer zone for riparian habitat surrounding perennial streams; however, the City LCP permits necessary water supply projects in these zones (Appendix A, Figure 5). The Project will require a coastal development permit because it involves the placement or removal of solid material or the use of mechanized equipment within the 50-foot buffer zone.

Although no direct impacts to potential ESHAs or other jurisdictional areas are anticipated, HDD does have the potential for "frac-out", where pressure built up in the bore tunnel can force drilling mud up through the ground and into the natural environment. The Project has been specifically designed to minimize the risk of frac-outs, as described in Section 4.1.5 and Appendix E of the Preliminary Design Report (Appendix F). Although it is unlikely, if frac-out occurs, it may affect sensitive ESHA communities.

To avoid impacts to sensitive ESHA communities, the following best management practices are recommended in addition to the Mitigation Measures in Section 6.5.

- Implement best management practices to prevent erosion of soils, runoff, and sedimentation, and to prevent discharge of toxic substances;

- Minimize soil disturbance in the riparian corridor and the 50-foot buffer zone around the riparian corridor. This will reduce the impact to existing soils and vegetation that will remain as natural habitat and reduce the potential for soil erosion; and

- Solid materials, including wood, masonry/rock, glass, paper, or other materials should not be stored in the 50-foot riparian buffer zone outside exclusion fencing. Solid waste materials should be properly disposed of off-site. Fluid materials, including concrete, wash water, fuels, lubricants, or other fluid materials used during construction should not be disposed of on-site and should be stored or confined as necessary to prevent spillage into natural habitats. If a spill of such materials occurs, the area should be cleaned and contaminated materials disposed of properly. The affected area should be restored to its natural condition.

6.2 Special-Status Plant Species

Of the 60 special-status plant species known to occur in the vicinity of the Study Area, none were determined to have a moderate or high potential to occur in the Study Area. No additional special-status plant surveys are recommended.

6.3 Special-Status Wildlife Species

Of the 41 special-status wildlife species known to occur within the vicinity of the Study Area, seven species were determined to have a moderate or high potential to occur within the Study Area. Recommended mitigation measures to avoid take of these species are included in Section 6.5.

6.3.1 Special-status and Non-special-status Nesting Birds

This assessment determined that two special-status bird species may nest within the Study Area (San Francisco common yellowthroat and white-tailed kite). In addition, common native bird species protected by the MBTA as well as CFGC sections 3503 and 3503.5 may nest within the Study Area. Mitigation Measure BIO-2 (see Section 6.5) is recommended to avoid impacts to special-status bird species and birds protected under the MBTA or CFGC.

6.3.2 California Red-legged Frog, San Francisco Garter Snake, Western Pond Turtle, and Steelhead

It is not anticipated that HDD activities will affect CRLF, SFGS, WPT, or steelhead. However, as discussed previously, HDD does have the potential for frac-out. Although it is unlikely, if frac-out occurs, it may affect habitat and potentially individuals of these species. California red-legged frog, WPT and SFGS are likely to inhabit aquatic habitat and the banks of Pilarcitos Creek within the Study Area, and steelhead habitat includes aquatic features and the cover provided by riparian trees, in-channel root wads and debris, and emergent vegetation (to the extent that it occurs). These species may forage and disperse through the Study Area; CRLF may also breed in and adjacent to the Study Area. Recommended mitigation measures to avoid take of CRLF, WPT, SFGS and steelhead are included in Section 6.5.

6.3.3 San Francisco Dusky-footed Woodrat

San Francisco dusky-footed woodrat has potential to occur in densely vegetated riparian areas of the Study Area. While no disturbance to these areas is anticipated as a result of HDD, any traversal of the

riparian area could result in impacts to and woodrat nests that may be present. Recommended mitigation measures to avoid impacts to San Francisco dusky-footed woodrat are included in Section 6.5.

6.4 Wildlife Corridors

While the Study Area is classified as a "less permeable" wildlife corridor, planned Project activities will not impact the riparian area or any other nearby natural habitat. Impacts will be highly localized to paved or landscaped areas. Waterways that could provide fish passage will additionally not be impacted or obstructed, as the planned HDD will occur underneath the stream bed. Because no work is planned in the stream or riparian habitat, no impacts to wildlife corridors are anticipated.

6.5 Mitigation Measures

MM BIO-1: Vegetation Removal. All vegetation removal, ground disturbance, and other construction activities shall occur at minimum 15 feet above the top of the creek bank to avoid low-lying mesic areas on the fringe of the creek.

MM BIO-2: Nesting Birds. All proposed Project activities shall occur between September 1 and February 14 in order to avoid potential impacts during the nesting season. If Project activities are conducted during the nesting season (February 15 – August 31), a pre-construction nesting bird survey shall be performed no more than 14 days prior to initial ground disturbance to avoid impacting active nests. If the survey identifies any active nests, an exclusion buffer shall be established for protection of the nest. Buffer distances shall vary based on species and conditions at the site, but typically range from 25 feet to 500 feet. The buffer shall be maintained until all young have fledged or until the nest fails, or otherwise becomes inactive. Buffers may be reduced from established levels if supported with nest monitoring by a qualified biologist indicating that work activities are not adversely impacting the nest.

MM BIO-3: Frac-out Plan. The Project has been designed and shall be implemented in such a way to avoid and minimize the risk of spills and frac-outs, as evaluated in the Preliminary Design Report (Appendix F) for this Project. Although the risk of frac-outs was identified as low, the HDD contractor shall prepare a Frac-out and Surface Spill Prevention Plan, based on information contained in the HDD Specifications section 02413, prepared by EKI and dated April 2021. The Frac-out Plan shall be submitted to the City for approval prior to the issuance of the grading permit, and the contractor shall submit a letter signed by an authorized representative confirming that the plan will be followed during all HDD activity. The plan shall address the potential risks and modes of frac-outs and frac-out prevention and detection. The plan shall include a project description, including site description, existing conditions, relevant permit requirements, and HDD design and operations, and shall at a minimum include the following information.

- Calculations of maximum allowable and minimum required drilling fluid pressures, and the critical downhole pressure that would cause hydrofracture.
- Measures describing training of personnel regarding frac-out monitoring procedures, equipment, materials, and procedures in place for the prevention, containment, cleanup, and disposal of drilling fluids.
- Pre-construction measures such as lining the entry pit with an impervious flexible membrane, creating an earth berm, or erecting silt fence around the drilling fluid mixing and pumping areas, and erecting silt fences between the drilling staffing areas and sensitive areas.

- Identifying the personnel on site during the entire HDD installation process with responsibility for detecting whether surface returns have occurred and how they will conduct the monitoring.
- Monitoring of drilling pressures to ensure that they are maintained at a minimum level necessary to maintain fluid circulation and do not exceed those pressures that may penetrate the ground.
- Monitoring of fluid returns at the exit and entry pit to determine if fluid circulation has been lost.
- The Contractor shall measure and record the drilling fluid viscosity and density at least two times per shift or once every 150 feet of advancement, whichever is more frequent, with at least two hours between readings, using a calibrated Marsh funnel or rheometer/rotating viscometer, and a mud balance. These records shall be maintained and provided daily to the Engineer.

Protocols to be followed if there is a loss of circulation or other indication of frac-out are described below.

- Immediately respond to detection of a frac-out by stopping drilling operations and pulling back the drill head to relieve pressure.
- Implement procedures to contain terrestrial returns (e.g., by an earth berm, installation of materials to contain the fluid, or other method).
- Implement procedures to contain returns into a waterway or sensitive area (e.g., installation of sandbags or a standpipe or barrel tall enough to exceed the water level and sealed at the base).
- Implement procedures for clean-up and disposal of frac-out materials.
- Include an on-site materials list to manage and control drilling fluid surface releases, such as heavy weight plastic gravel filled and sealed bags, splash boards, 5-gallon hard plastic pails, wide heavy-duty push brooms, flat blade and round-nose shovels, silt fence and t-posts or straw bales, chicken wire or connecting material to tie off the perimeter of a dewatering structure, absorbent pads to use with plastic sheeting for placement beneath motorized equipment, straw wattles, portable pumps, hoses, vacuum trailers or trucks, silt fence or screens.
- The performance standard for this mitigation measure is that if a frac-out event occurs cleanup, surveys, photographs, agency or consultant recommendations, and a mitigation plan shall be submitted to the city of Half Moon Bay and any permitting agencies within 30 days of the event. Measures taken might include habitat restoration efforts, or surveys of special status species to assess impacts of the frac-out event. The city and regulatory agencies shall inspect and approve any remedial actions taken by the Lead Agency to respond to the frac-out event.

MM BIO-4: Dusky-footed Woodrat. To avoid impacts to the San Francisco dusky-footed woodrat, a pre-construction survey shall be conducted to search for stick nests in suitable habitats adjacent to the work area. Nest structures shall be avoided by Project work or access routes by a minimum of 5 feet. If avoidance is not feasible, the nest structure shall be dismantled by a qualified biologist. Nest material would be moved to suitable adjacent areas that shall not be disturbed. If young are encountered during the dismantling process, the material would be placed back on the nest and remain undisturbed for a minimum of two weeks to give the young enough time to mature and leave on their own accord. After the young have left the nest, the nest dismantling process would begin again.

MM BIO-5: General Avoidance Measures in Riparian and Stream Areas. To avoid impacts to riparian and stream areas, the following measures shall be implemented.

- Plastic monofilament netting (erosion control matting or wrapping around wattles), or similar material in any form shall not be used on the Project in order to avoid entangling, strangling, or trapping CRLF, SFGS, or WPT.

- Prior to the start of groundbreaking activities, all construction personnel shall receive training on special-status species and their habitats by a qualified biologist. The importance of these species and their habitat shall be described to all employees as well as the minimization and avoidance measures that are to be implemented as part of the Project. A list of trained personnel shall be maintained by the contractor and be made available for review by the USFWS and the CDFW upon request.

- No trash shall be deposited on the site during construction activities. All trash shall be placed in trash receptacles with secure lids stored in vehicles and removed nightly from the Study Area.

- Any fueling and maintenance of equipment shall be conducted off-site and at least 50 feet from any designated ESHA.

- When working within 50 feet of sensitive areas (e.g. adjacent to riparian habitat), wildlife exclusion fencing shall be installed and maintained around the perimeter of work areas. Exclusion fencing shall enclose any staged materials, equipment staging areas, work areas or access routes. Fencing shall be placed in areas which would prevent SFGS and CRLF from entering equipment or materials overnight. Once work in that area has been completed, exclusion fencing shall be removed as soon as possible. Exclusion fencing shall additionally be of a size and material that will not cause entrapment of CRLF.

- Construction activities shall not start until 30 minutes after sunrise, and should cease 30 minutes before sunset.

- No holes or trenches shall be left open overnight. Holes or trenches shall have at minimum escape ramps installed, or be backfilled at the end of the day.

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APPENDIX A – FIGURES

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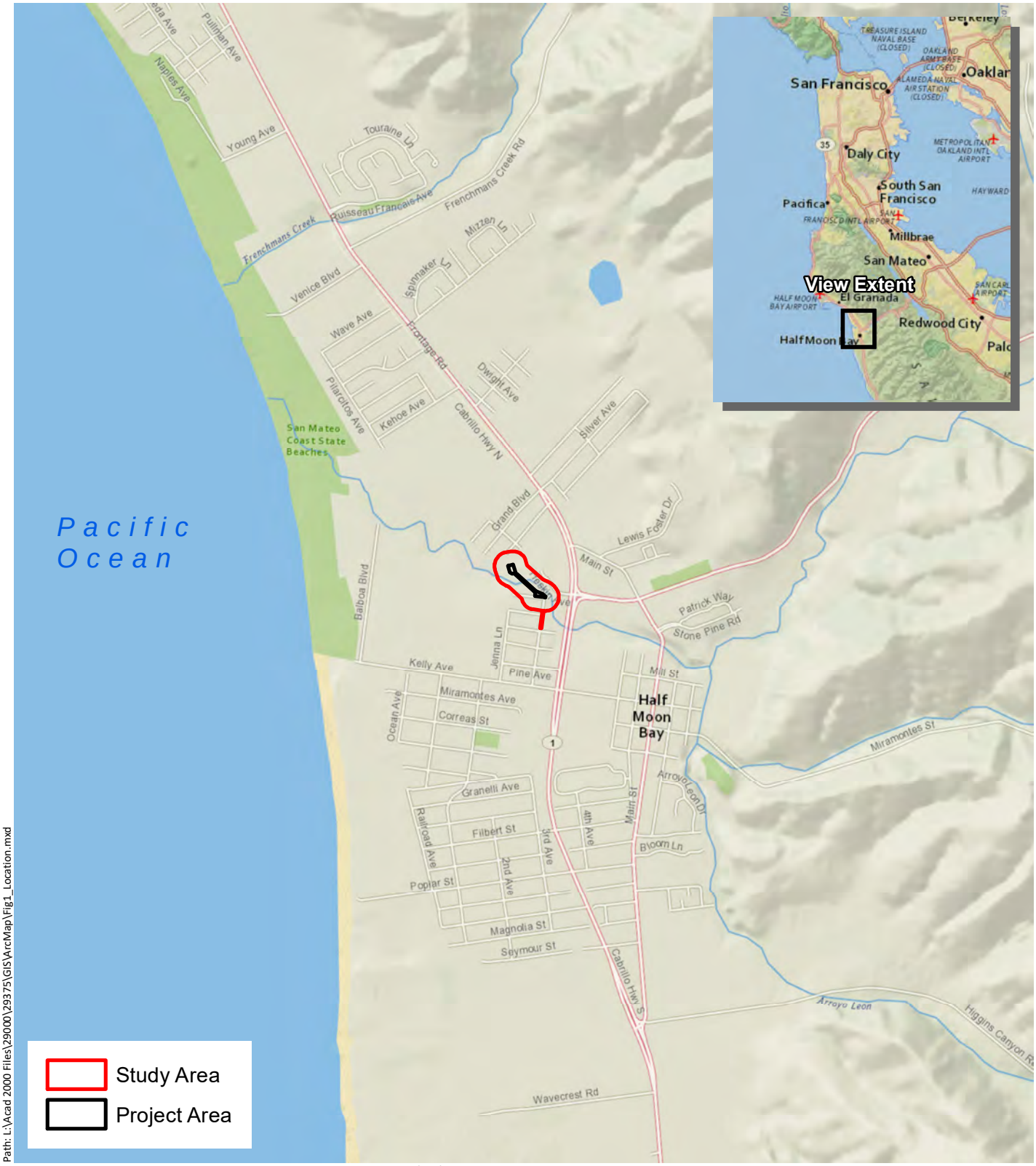

Sources: National Geographic, WRA | Prepared By: SGillespie, 1/31/2021

Figure 1. Study Area Regional Location Map

CCWD Water Line Replacement
Under Pilarcitos Creek
Half Moon Bay, California

0 0.25 0.5 Miles

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Sources: EKI, WRA | Prepared By: SGillespie, 1/31/2021

Figure 2. Aerial Site Map

CCWD Water Line Replacement
Under Pilarcitos Creek
Half Moon Bay, California

0 100 200 Feet

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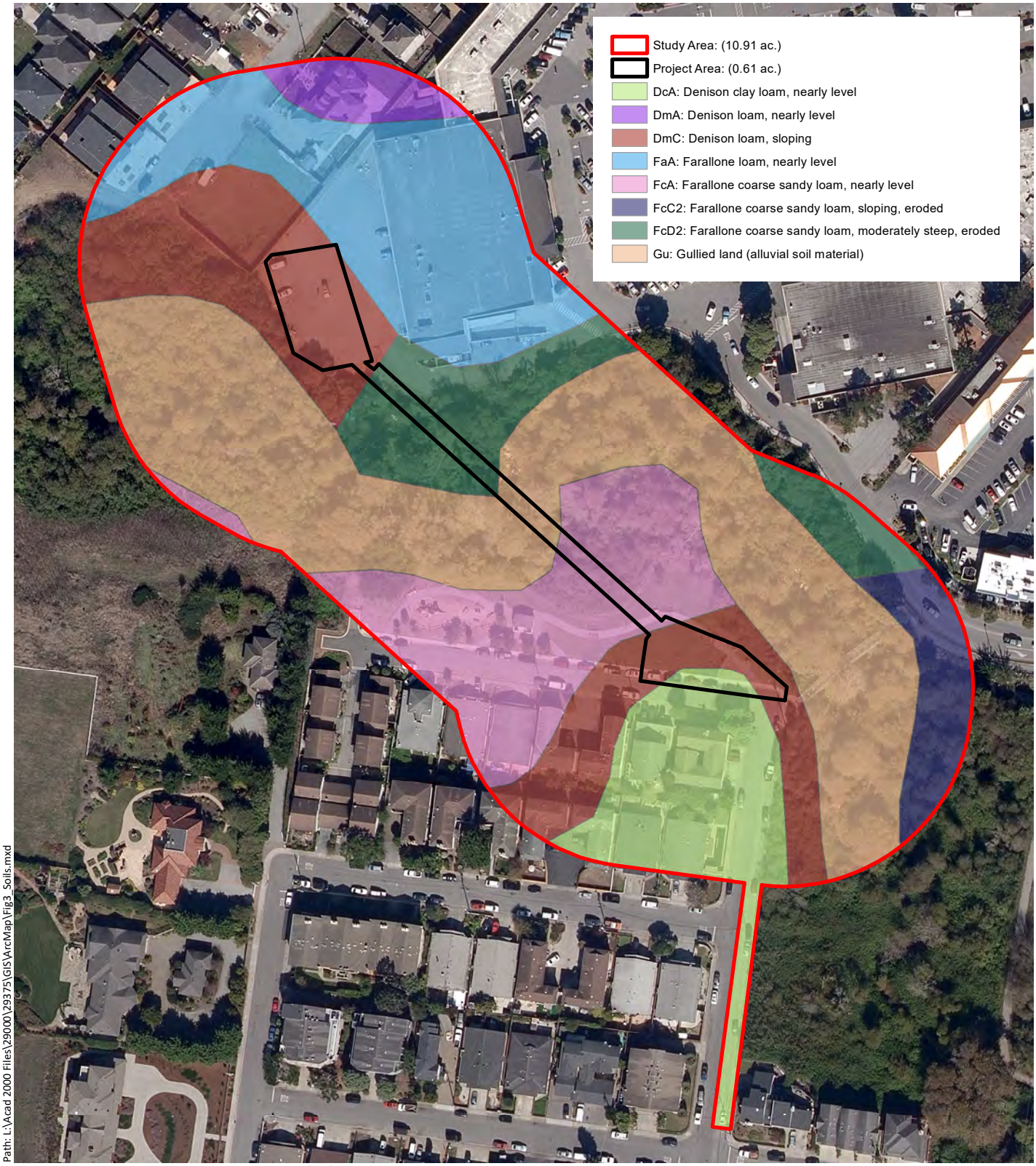

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Sources: EKI, WRA | Prepared By: SGillespie, 1/31/2021

Figure 3. Soils within the Study Area

CCWD Water Line Replacement
Under Pilarcitos Creek
Half Moon Bay, California

0 100 200 Feet

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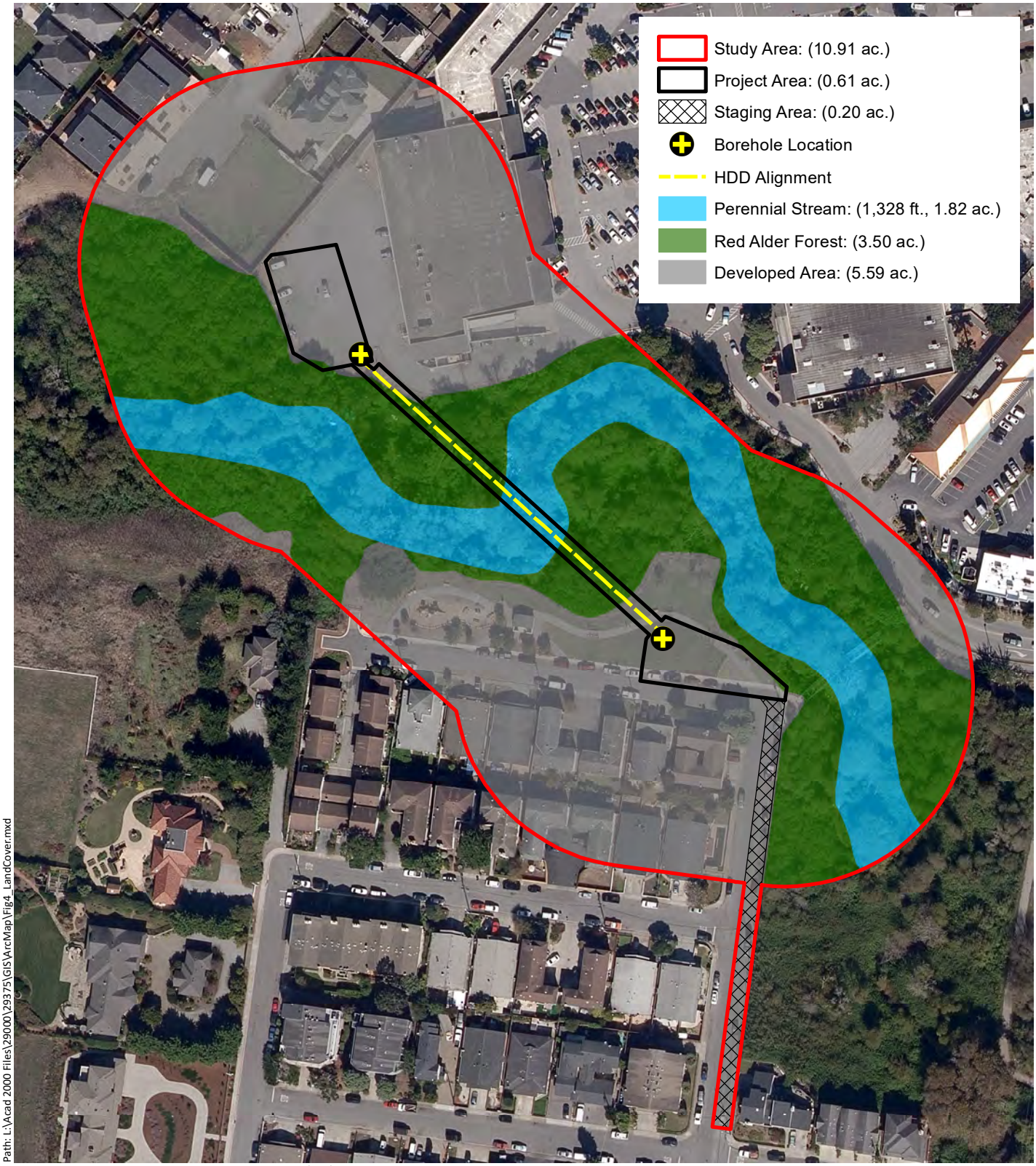

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Sources: EKI, WRA | Prepared By: SGillespie, 1/31/2021

Figure 4. Land Cover Types within the Study Area

CCWD Water Line Replacement
Under Pilarcitos Creek
Half Moon Bay, California

0 100 200 Feet

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Sources: EKI, WRA | Prepared By: SGillespie, 1/31/2021

Figure 5. Potential Jurisdictional Features Located within the Study Area

CCWD Water Line Replacement
Under Pilarcitos Creek
Half Moon Bay, California

0 100 200 Feet

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APPENDIX B – SPECIES DOCUMENTED WITHIN AND AROUND THE STUDY AREA

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Appendix B.1. Plant species observed during January 14, 2021 site visit.

Scientific Name	Common Name	Origin	Form	Rarity Status[1]	CAL-IPC Status[2]	Wetland Status[3] (AW 2018)
Plants						
Acacia melanoxylon	Blackwood acacia	non-native (invasive)	tree	-	Limited	-
Alnus rubra	Red alder	native	tree, shrub	-	-	FACW
Arctotheca prostrata	Prostrate cape weed	non-native (invasive)	annual, perennial herb	-	Moderate	-
Avena barbata	Slim oat	non-native (invasive)	annual, perennial grass	-	Moderate	-
Bromus diandrus	Ripgut brome	non-native (invasive)	annual grass	-	Moderate	-
Carduus pycnocephalus ssp. pycnocephalus	Italian thistle	non-native (invasive)	annual herb	-	Moderate	-
Conium maculatum	Poison hemlock	non-native (invasive)	perennial herb	-	Moderate	FACW
Convolvulus arvensis	Field bindweed	non-native	perennial herb, vine	-	-	-
Cortaderia jubata	Andean pampas grass	non-native (invasive)	perennial grass	-	High	FACU
Delairea odorata	Cape ivy	non-native (invasive)	perennial herb	-	High	FAC
Equisetum arvense	Common horsetail	native	fern	-	-	FAC
Erodium botrys	Big heron bill	non-native	annual herb	-	-	FACU
Festuca perennis	Italian rye grass	non-native (invasive)	annual, perennial grass	-	Moderate	FAC
Foeniculum vulgare	Fennel	non-native (invasive)	perennial herb	-	High	-
Geranium dissectum	Wild geranium	non-native (invasive)	annual herb	-	Limited	-
Helminthotheca echioides	Bristly ox-tongue	non-native (invasive)	annual, perennial herb	-	Limited	FAC
Hesperocyparis	Monterey cypress	native	tree	Rank	-	-

Scientific Name	Common Name	Origin	Form	Rarity Status[1]	CAL-IPC Status[2]	Wetland Status[3] (AW 2018)
macrocarpa				1B.2*		
Hirschfeldia incana	Short-podded mustard	non-native (invasive)	perennial herb	-	Moderate	-
Hordeum murinum	Foxtail barley	non-native (invasive)	annual grass	-	Moderate	FACU
Morella californica	California wax myrtle	native	shrub	-	-	FACW
Myoporum laetum	Ngaio tree	non-native (invasive)	tree, shrub	-	Moderate	FACU
Nasturtium officinale	Watercress	native	perennial herb (aquatic)	-	-	OBL
Oxalis pes-caprae	Bermuda buttercup	non-native (invasive)	perennial herb	-	Moderate	-
Plantago lanceolata	Ribwort	non-native (invasive)	perennial herb	-	Limited	FAC
Populus fremontii ssp. fremontii	Cottonwood	native	tree	-	-	FAC
Raphanus sativus	Wild radish	non-native (invasive)	annual, biennial herb	-	Limited	-
Rubus armeniacus	Himalayan blackberry	non-native (invasive)	shrub	-	High	FAC
Rubus ursinus	California blackberry	native	vine, shrub	-	-	FAC
Salix laevigata	Red willow	native	tree	-	-	FACW
Salix lasiandra	Pacific willow	native	tree	-	-	FACW
Toxicodendron diversilobum	Poison oak	native	vine, shrub	-	-	FACU
Tropaeolum majus	Garden nasturtium	non-native	annual herb, vine	-	-	UPL
Urtica dioica	Stinging nettle	native	perennial herb	-	-	FAC
Vitis californica	California wild grape	native	vine, shrub	-	-	FACU

All species identified using the *Jepson eFlora* [Jepson Flora Project (eds.) 2021]; nomenclature follows *Jepson eFlora* [Jepson Flora Project (eds.) 2021]
*Special-status only within its native range. The Study Area is outside of the native range of this species.

[1]Rarity Status: The CNPS Inventory of Rare and Endangered Plants (CNPS 2021)

FE:	Federal Endangered
FT:	Federal Threatened
SE:	State Endangered
ST:	State Threatened
SR:	State Rare
Rank 1A:	Plants presumed extinct in California
Rank 1B:	Plants rare, threatened, or endangered in California and elsewhere
Rank 2:	Plants rare, threatened, or endangered in California, but more common elsewhere
Rank 3:	Plants about which we need more information – a review list
Rank 4:	Plants of limited distribution – a watch list

[2]Invasive Status: California Invasive Plant Inventory (Cal-IPC 2021)

High:	Severe ecological impacts; high rates of dispersal and establishment; most are widely distributed ecologically.
Moderate:	Substantial and apparent ecological impacts; moderate-high rates of dispersal, establishment dependent on disturbance; limited-moderate distribution ecologically
Limited:	Minor or not well documented ecological impacts; low-moderate rate of invasiveness; limited distribution ecologically
Assessed:	Assessed by Cal-IPC and determined to not be an existing current threat

[3]Wetland Status: National List of Plant Species that Occur in Wetlands, California – Arid West (Lichvar et al. 2016)

OBL:	Almost always found in wetlands;
FACW:	Usually found in wetlands
FAC:	Equally found in wetlands and uplands
FACU:	Usually not found in wetlands
UPL:	Almost never found in wetlands
NL:	Not listed, assumed almost never found in wetlands
NI:	No information; not factored during wetland delineation

Appendix B.2. Wildlife species observed during January 14, 2021 site visit.

Scientific Name	Common Name	Conservation Status
Birds		
Haemorhous mexicanus	House Finch	None
Thryomanes bewickii	Bewicke's wren	None
Melozone crissalis	California towhee	None
Setophaga townsendi	Townsend's warbler	None
Setophaga coronata	Yellow-rumped warbler	None
Sturnus vulgaris	European starling	None
Corvus brachyrhynchos	American crow	None
Buteo lineatus	Red-shouldered hawk	None
Calypte anna	Anna's hummingbird	None
Regulus calendula	Ruby-crowned kinglet	None
Zonotrichia leucophrys	White-crowned sparrow	None
Poecile rufescens	Chestnut-backed chickadee	None

APPENDIX C – -SITE PHOTOGRAPHS

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Photo 1. Red alder forest within the Study Area. View from the north side of Pilarcitos Creek looking south.

Photo 2. Pilarcitos Creek within the Study Area. Creek banks are vegetated with garden nasturtium.

Photo 3. View of existing landscaped and paved area within the Study Area. Photograph shows the approximate location of the south staging area and borehole location for the Project.

Photo 4. View of the existing paved lot behind Safeway within the Study Area. Photograph shows the approximate location of the north staging area and borehole location for the Project..

APPENDIX D – SPECIAL-STATUS SPECIES POTENTIAL TABLE

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Appendix D. Potential for Special-Status Plant and Wildlife Species to Occur in the Study Area. List compiled from the California Department of Fish and Wildlife (CDFW) Natural Diversity Database (2021), U.S. Fish and Wildlife Service (USFWS) Species Lists (2021), and California Native Plant Society (CNPS) Electronic Inventory (2021) searches of the 6 Quad Search centered on the Half Moon Bay USGS 7.5-minute quadrangle.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
Plants				
San Mateo thorn-mint *Acanthomintha duttonii*	FE, SE, Rank 1B.1	Chaparral, valley and foothill grassland. Elevation ranges from 160 to 985 feet (50 to 300 meters). Blooms Apr-Jun.	**No Potential.** Suitable habitat not present within Study Area. Study Area is out of the species elevation range.	No further actions are recommended.
Blasdale's bent grass *Agrostis blasdalei*	Rank 1B.2	Coastal bluff scrub, coastal dunes, coastal prairie. Elevation ranges from 0 to 490 feet (0 to 150 meters). Blooms May-Jul.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal scrub, coastal prairie, or coastal dunes.	No further actions are recommended.
Franciscan onion *Allium peninsulare var. franciscanum*	Rank 1B.2	Cismontane woodland, valley and foothill grassland. Elevation ranges from 170 to 1000 feet (52 to 305 meters). Blooms (Apr)May-Jun.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as woodland or grassland.	No further actions are recommended.
bent-flowered fiddleneck *Amsinckia lunaris*	Rank 1B.2	Coastal bluff scrub, cismontane woodland, valley and foothill grassland. Elevation ranges from 5 to 1640 feet (3 to 500 meters). Blooms Mar-Jun.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as woodland or grassland.	No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
coast rockcress *Arabis blepharophylla*	Rank 4.3	Broadleafed upland forest, coastal bluff scrub, coastal prairie, coastal scrub. Elevation ranges from 5 to 3610 feet (3 to 1100 meters). Blooms Feb-May.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal scrub, coastal prairie, or upland forest.	No further actions are recommended.
Anderson's manzanita *Arctostaphylos andersonii*	Rank 1B.2	Broadleafed upland forest, chaparral, north coast coniferous forest. Elevation ranges from 195 to 2495 feet (60 to 760 meters). Blooms Nov-May.	**No Potential.** Suitable habitat not present within Study Area. Study Area is out of the species elevation range.	No further actions are recommended.
Montara manzanita *Arctostaphylos montaraensis*	Rank 1B.2	Chaparral (maritime), coastal scrub. Elevation ranges from 260 to 1640 feet (80 to 500 meters). Blooms Jan-Mar.	**No Potential.** Suitable habitat not present within Study Area. Study Area is out of the species elevation range.	No further actions are recommended.
Kings Mountain manzanita *Arctostaphylos regismontana*	Rank 1B.2	Broadleafed upland forest, chaparral, north coast coniferous forest. Elevation ranges from 1000 to 2395 feet (305 to 730 meters). Blooms Dec-Apr.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as chaparral or upland forest.	No further actions are recommended.
ocean bluff milk-vetch *Astragalus nuttallii var. nuttallii*	Rank 4.2	Coastal bluff scrub, coastal dunes. Elevation ranges from 5 to 395 feet (3 to 120 meters). Blooms Jan-Nov.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal scrub or coastal dunes.	No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
coastal marsh milk-vetch *Astragalus pycnostachyus var. pycnostachyus*	Rank 1B.2	Coastal dunes (mesic), coastal scrub, marshes and swamps (coastal salt, streamsides). Elevation ranges from 0 to 100 feet (0 to 30 meters). Blooms (Apr)Jun-Oct.	**Unlikely.** Suitable habitat not present within the Study Area. Areas within the Study Area that are considered mesic are frequently disturbed and dominated by non-native invasive plant species.	No further actions are recommended.
Brewer's calandrinia *Calandrinia breweri*	Rank 4.2	Chaparral, coastal scrub. Elevation ranges from 30 to 4005 feet (10 to 1220 meters). Blooms (Jan)Mar-Jun.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal scrub or chaparral.	No further actions are recommended.
Oakland star-tulip *Calochortus umbellatus*	Rank 4.2	Broadleafed upland forest, chaparral, cismontane woodland, lower montane coniferous forest, valley and foothill grassland. Elevation ranges from 325 to 2295 feet (100 to 700 meters). Blooms Mar-May.	**No Potential.** Suitable habitat not present within Study Area. Study Area is out of the species elevation range.	No further actions are recommended.
johnny-nip *Castilleja ambigua var. ambigua*	Rank 4.2	Coastal bluff scrub, coastal prairie, coastal scrub, marshes and swamps, valley and foothill grassland, vernal pools margins. Elevation ranges from 0 to 1425 feet (0 to 435 meters). Blooms Mar-Aug.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal scrub, coastal prairie, marsh, or grassland.	No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
pappose tarplant *Centromadia parryi ssp. parryi*	Rank 1B.2	Chaparral, coastal prairie, meadows and seeps, marshes and swamps (coastal salt), valley and foothill grassland (vernally mesic). Elevation ranges from 0 to 1380 feet (0 to 420 meters). Blooms May-Nov.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as seeps, marsh, or grassland.	No further actions are recommended.
Point Reyes bird's-beak *Chloropyron maritimum ssp. palustre*	Rank 1B.2	Marshes and swamps (coastal salt). Elevation ranges from 0 to 35 feet (0 to 10 meters). Blooms Jun-Oct.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as marsh or swamp.	No further actions are recommended.
San Francisco Bay spineflower *Chorizanthe cuspidata var. cuspidata*	Rank 1B.2	Coastal bluff scrub, coastal dunes, coastal prairie, coastal scrub. Elevation ranges from 5 to 705 feet (3 to 215 meters). Blooms Apr-Jul(Aug).	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal scrub, coastal prairie, or coastal dunes.	No further actions are recommended.
Franciscan thistle *Cirsium andrewsii*	Rank 1B.2	Broadleafed upland forest, coastal bluff scrub, coastal prairie, coastal scrub. Elevation ranges from 0 to 490 feet (0 to 150 meters). Blooms Mar-Jul.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal scrub, coastal prairie, upland forest, or coastal dunes.	No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
Crystal Springs fountain thistle *Cirsium fontinale var. fontinale*	FE, SE, Rank 1B.1	Chaparral (openings), cismontane woodland, meadows and seeps, valley and foothill grassland. Elevation ranges from 145 to 575 feet (45 to 175 meters). Blooms (Apr)May-Oct.	**No Potential.** Suitable habitat not present within Study Area. Study Area is out of the species elevation range.	No further actions are recommended.
San Francisco collinsia *Collinsia multicolor*	Rank 1B.2	Closed-cone coniferous forest, coastal scrub. Elevation ranges from 95 to 820 feet (30 to 250 meters). Blooms (Feb)Mar-May.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coniferous forest or coastal scrub.	No further actions are recommended.
clustered lady's-slipper *Cypripedium fasciculatum*	Rank 4.2	Lower montane coniferous forest, north coast coniferous forest. Elevation ranges from 325 to 7990 feet (100 to 2435 meters). Blooms Mar-Aug.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coniferous forest.	No further actions are recommended.
mountain lady's-slipper *Cypripedium montanum*	Rank 4.2	Broadleafed upland forest, cismontane woodland, lower montane coniferous forest, north coast coniferous forest. Elevation ranges from 605 to 7300 feet (185 to 2225 meters). Blooms Mar-Aug.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coniferous forest or woodland.	No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
western leatherwood *Dirca occidentalis*	Rank 1B.2	Broadleafed upland forest, closed-cone coniferous forest, chaparral, cismontane woodland, north coast coniferous forest, riparian forest, riparian woodland. Elevation ranges from 80 to 1395 feet (25 to 425 meters). Blooms Jan-Mar(Apr).	**Unlikely.** Potentially suitable riparian habitat is present within the Study Area, and this species is known from the region. However, all potentially suitable habitat within the Study Area is heavily disturbed and dominated by non-native invasive plant species. The nearest documented occurrence is 5-miles north on Montara Mountain.	No further actions are recommended.
California bottle-brush grass *Elymus californicus*	Rank 4.3	Broadleafed upland forest, cismontane woodland, north coast coniferous forest, riparian woodland. Elevation ranges from 45 to 1540 feet (15 to 470 meters). Blooms May-Aug(Nov).	**Unlikely.** Potentially suitable riparian habitat is present within the Study Area, and this species is known from the region. However, all potentially suitable habitat within the Study Area is heavily disturbed and dominated by non-native invasive plant species.	No further actions are recommended.
San Mateo woolly sunflower *Eriophyllum latilobum*	FE, SE, Rank 1B.1	Cismontane woodland (often serpentine, on roadcuts), coastal scrub, lower montane coniferous forest. Elevation ranges from 145 to 1085 feet (45 to 330 meters). Blooms May-Jun.	**No Potential.** The Study Area lacks serpentine habitat not present within Study Area. The Study Area does not include areas characterized as coniferous forest, coastal scrub, or woodland.	No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
San Francisco wallflower *Erysimum franciscanum*	Rank 4.2	Chaparral, coastal dunes, coastal scrub, valley and foothill grassland. Elevation ranges from 0 to 1805 feet (0 to 550 meters). Blooms Mar-Jun.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal dunes, coastal scrub, or grassland	No further actions are recommended.
Hillsborough chocolate lily *Fritillaria biflora var. ineziana*	Rank 1B.1	Cismontane woodland, valley and foothill grassland. Elevation ranges from 490 to 490 feet (150 to 150 meters). Blooms Mar-Apr.	**No Potential.** Suitable habitat not present within Study Area. Study Area is out of the species elevation range.	No further actions are recommended.
Marin checker lily *Fritillaria lanceolata var. tristulis*	Rank 1B.1	Coastal bluff scrub, coastal prairie, coastal scrub. Elevation ranges from 45 to 490 feet (15 to 150 meters). Blooms Feb-May.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal prairie or coastal scrub.	No further actions are recommended.
fragrant fritillary *Fritillaria liliacea*	Rank 1B.2	Cismontane woodland, coastal prairie, coastal scrub, valley and foothill grassland. Elevation ranges from 5 to 1345 feet (3 to 410 meters). Blooms Feb-Apr.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal scrub or grassland.	No further actions are recommended.
San Francisco gumplant *Grindelia hirsutula var. maritima*	Rank 3.2	Coastal bluff scrub, coastal scrub, valley and foothill grassland. Elevation ranges from 45 to 1310 feet (15 to 400 meters). Blooms Jun-Sep.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal scrub or grassland.	No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
short-leaved evax *Hesperevax sparsiflora var. brevifolia*	Rank 1B.2	Coastal bluff scrub (sandy), coastal dunes, coastal prairie. Elevation ranges from 0 to 705 feet (0 to 215 meters). Blooms Mar-Jun.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal prairie or coastal scrub.	No further actions are recommended.
Marin western flax *Hesperolinon congestum*	FT, ST, Rank 1B.1	Chaparral, valley and foothill grassland. Elevation ranges from 15 to 1215 feet (5 to 370 meters). Blooms Apr-Jul.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as chaparral or grassland.	No further actions are recommended.
Kellogg's horkelia *Horkelia cuneata var. sericea*	Rank 1B.1	Closed-cone coniferous forest, chaparral (maritime), coastal dunes, coastal scrub. Elevation ranges from 30 to 655 feet (10 to 200 meters). Blooms Apr-Sep.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as chaparral, coniferous forest, or coastal scrub.	No further actions are recommended.
Point Reyes horkelia *Horkelia marinensis*	Rank 1B.2	Coastal dunes, coastal prairie, coastal scrub. Elevation ranges from 15 to 2475 feet (5 to 755 meters). Blooms May-Sep.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal prairie or coastal scrub.	No further actions are recommended.
coast iris *Iris longipetala*	Rank 4.2	Coastal prairie, lower montane coniferous forest, meadows and seeps. Elevation ranges from 0 to 1970 feet (0 to 600 meters). Blooms Mar-May.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal prairie, coniferous forest, or seeps.	No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
perennial goldfields *Lasthenia californica ssp. macrantha*	Rank 1B.2	Coastal bluff scrub, coastal dunes, coastal scrub. Elevation ranges from 15 to 1705 feet (5 to 520 meters). Blooms Jan-Nov.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal prairie or coastal scrub.	No further actions are recommended.
serpentine leptosiphon *Leptosiphon ambiguus*	Rank 4.2	Cismontane woodland, coastal scrub, valley and foothill grassland. Elevation ranges from 390 to 3705 feet (120 to 1130 meters). Blooms Mar-Jun.	**No Potential.** Suitable habitat not present within Study Area. Study Area is out of the species elevation range.	No further actions are recommended.
coast yellow leptosiphon *Leptosiphon croceus*	SS, Rank 1B.1	Coastal bluff scrub, coastal prairie. Elevation ranges from 30 to 490 feet (10 to 150 meters). Blooms Apr-Jun.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal prairie or coastal scrub.	No further actions are recommended.
rose leptosiphon *Leptosiphon rosaceus*	Rank 1B.1	Coastal bluff scrub. Elevation ranges from 0 to 330 feet (0 to 100 meters). Blooms Apr-Jul.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal prairie or coastal scrub.	No further actions are recommended.
Crystal Springs lessingia *Lessingia arachnoidea*	Rank 1B.2	Cismontane woodland, coastal scrub, valley and foothill grassland. Elevation ranges from 195 to 655 feet (60 to 200 meters). Blooms Jul-Oct.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as woodland, grassland, or coastal scrub.	No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
woolly-headed lessingia *Lessingia hololeuca*	Rank 3	Broadleafed upland forest, coastal scrub, lower montane coniferous forest, valley and foothill grassland. Elevation ranges from 45 to 1000 feet (15 to 305 meters). Blooms Jun-Oct.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as woodland, grassland, coniferous forest, or coastal scrub.	No further actions are recommended.
coast lily *Lilium maritimum*	Rank 1B.1	Broadleafed upland forest, closed-cone coniferous forest, coastal prairie, coastal scrub, marshes and swamps (freshwater), north coast coniferous forest. Elevation ranges from 15 to 1560 feet (5 to 475 meters). Blooms May-Aug.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as woodland, coastal prairie, marsh, coniferous forest, or coastal scrub.	No further actions are recommended.
Ornduff's meadowfoam *Limnanthes douglasii ssp. ornduffii*	Rank 1B.1	Meadows and seeps. Elevation ranges from 30 to 65 feet (10 to 20 meters). Blooms Nov-May.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as meadows or seeps.	No further actions are recommended.
San Mateo tree lupine *Lupinus arboreus var. eximius*	Rank 3.2	Chaparral, coastal scrub. Elevation ranges from 295 to 1805 feet (90 to 550 meters). Blooms Apr-Jul.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as chaparral or coastal scrub.	No further actions are recommended.
Indian Valley bush-mallow *Malacothamnus aboriginum*	Rank 1B.2	Chaparral, cismontane woodland. Elevation ranges from 490 to 5575 feet (150 to 1700 meters). Blooms Apr-Oct.	**No Potential.** Suitable habitat not present within Study Area. Study Area is out of the species elevation range.	No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
arcuate bush-mallow *Malacothamnus arcuatus*	Rank 1B.2	Chaparral, cismontane woodland. Elevation ranges from 45 to 1165 feet (15 to 355 meters). Blooms Apr-Sep.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as chaparral or cismontane woodland.	No further actions are recommended.
Davidson's bush-mallow *Malacothamnus davidsonii*	Rank 1B.2	Chaparral, cismontane woodland, coastal scrub, riparian woodland. Elevation ranges from 605 to 3740 feet (185 to 1140 meters). Blooms Jun-Jan.	**Unlikely.** Potentially suitable riparian habitat is present within the Study Area, and this species is known from the region. However, all potentially suitable habitat within the Study Area is heavily disturbed and dominated by non-native invasive plant species.	No further actions are recommended.
Hall's bush-mallow *Malacothamnus hallii*	Rank 1B.2	Chaparral, coastal scrub. Elevation ranges from 30 to 2495 feet (10 to 760 meters). Blooms (Apr)May-Sep(Oct).	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as chaparral or coastal scrub.	No further actions are recommended.
marsh microseris *Microseris paludosa*	Rank 1B.2	Closed-cone coniferous forest, cismontane woodland, coastal scrub, valley and foothill grassland. Elevation ranges from 15 to 1165 feet (5 to 355 meters). Blooms Apr-Jun(Jul).	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as cismontane woodland, coniferous forest, or coastal scrub.	No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
woodland woolythreads *Monolopia gracilens*	Rank 1B.2	Broadleafed upland forest (openings), chaparral (openings), cismontane woodland, north coast coniferous forest (openings), valley and foothill grassland. Elevation ranges from 325 to 3935 feet (100 to 1200 meters). Blooms (Feb)Mar-Jul.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as cismontane woodland, coniferous forest, grassland, or coastal scrub.	No further actions are recommended.
Dudley's lousewort *Pedicularis dudleyi*	SR, Rank 1B.2	Chaparral (maritime), cismontane woodland, north coast coniferous forest, valley and foothill grassland. Elevation ranges from 195 to 2955 feet (60 to 900 meters). Blooms Apr-Jun.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as cismontane woodland, coniferous forest, grassland, or coastal scrub.	No further actions are recommended.
white-rayed pentachaeta *Pentachaeta bellidiflora*	FE, SE, Rank 1B.1	Cismontane woodland, valley and foothill grassland (often serpentine). Elevation ranges from 110 to 2035 feet (35 to 620 meters). Blooms Mar-May.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as cismontane woodland, coniferous forest, grassland, or coastal scrub.	No further actions are recommended.
Choris' popcornflower *Plagiobothrys chorisianus var. chorisianus*	Rank 1B.2	Chaparral, coastal prairie, coastal scrub. Elevation ranges from 5 to 525 feet (3 to 160 meters). Blooms Mar-Jun.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal scrub, coastal prairie, or chaparral.	No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
Oregon polemonium *Polemonium carneum*	Rank 2B.2	Coastal prairie, coastal scrub, lower montane coniferous forest. Elevation ranges from 0 to 6005 feet (0 to 1830 meters). Blooms Apr-Sep.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal scrub, coastal prairie, or coniferous forest.	No further actions are recommended.
Hickman's cinquefoil *Potentilla hickmanii*	FE, SE, Rank 1B.1	Coastal bluff scrub, closed-cone coniferous forest, meadows and seeps (vernally mesic), marshes and swamps (freshwater). Elevation ranges from 30 to 490 feet (10 to 149 meters). Blooms Apr-Aug.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal scrub, marsh, or coniferous forest.	No further actions are recommended.
Lobb's aquatic buttercup *Ranunculus lobbii*	Rank 4.2	Cismontane woodland, north coast coniferous forest, valley and foothill grassland, vernal pools. Elevation ranges from 45 to 1540 feet (15 to 470 meters). Blooms Feb-May.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as cismontane woodland, coniferous forest, grassland, or coastal scrub.	No further actions are recommended.
chaparral ragwort *Senecio aphanactis*	Rank 2B.2	Chaparral, cismontane woodland, coastal scrub. Elevation ranges from 45 to 2625 feet (15 to 800 meters). Blooms Jan-Apr(May).	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal scrub, chaparral, or cismontane woodland.	No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
Scouler's catchfly *Silene scouleri ssp. scouleri*	Rank 2B.2	Coastal bluff scrub, coastal prairie, valley and foothill grassland. Elevation ranges from 0 to 1970 feet (0 to 600 meters). Blooms (Mar-May)Jun-Aug(Sep).	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal scrub, coastal prairie, or grassland.	No further actions are recommended.
San Francisco campion *Silene verecunda ssp. verecunda*	Rank 1B.2	Coastal bluff scrub, chaparral, coastal prairie, coastal scrub, valley and foothill grassland. Elevation ranges from 95 to 2115 feet (30 to 645 meters). Blooms (Feb)Mar-Jun(Aug).	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as cismontane woodland, coniferous forest, grassland, or coastal scrub.	No further actions are recommended.
saline clover *Trifolium hydrophilum*	Rank 1B.2	Marshes and swamps, valley and foothill grassland (mesic, alkaline), vernal pools. Elevation ranges from 0 to 985 feet (0 to 300 meters). Blooms Apr-Jun.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as marsh or grassland. No vernal pools are present within or adjacent to the Study Area.	No further actions are recommended.
San Francisco owl's-clover *Triphysaria floribunda*	Rank 1B.2	Coastal prairie, coastal scrub, valley and foothill grassland. Elevation ranges from 30 to 525 feet (10 to 160 meters). Blooms Apr-Jun.	**No Potential.** Suitable habitat not present within Study Area. The Study Area does not include areas characterized as coastal scrub, coastal prairie, or grassland.	No further actions are recommended.
Wildlife				

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
Mammals				
fringed myotis *Myotis thysanodes*	WBWG	Associated with a wide variety of habitats including mixed coniferous-deciduous forest and redwood/sequoia groves. Buildings, mines, and large snags are important day and night roosts.	**No Potential.** No abandoned buildings, mines, rock outcrops or other suitable cavernous features are present. No large snags or conifer forest is present. The absence of such habitat features precludes the species from the Study Area.	No further recommendations.
hoary bat *Lasiurus cinereus*	WBWG	Prefers open forested habitats or habitat mosaics, with access to trees for cover and open areas or habitat edges for feeding. Roosts in dense foliage of medium to large trees. Feeds primarily on moths. Requires water.	**Unlikely.** Vegetation within the Study Area is primarily riparian in nature, which does not support the thermoregulatory needs of this species.	No further recommendations.
pallid bat *Antrozous pallidus*	SSC, WBWG	Occupies a variety of habitats at low elevation including grasslands, shrublands, woodlands, and forests. Most common in open, dry habitats with rocky areas for roosting.	**No Potential.** No suitable trees, snags, mines, rock formations, or abandoned buildings are present to support roosting.	No further recommendations.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
Townsend's big-eared bat *Corynorhinus townsendii*	SSC, WBWG	Primarily found in rural settings in a wide variety of habitats including oak woodlands and mixed coniferous-deciduous forest. Day roosts highly associated with caves and mines. Building roost sites must be cave like. Very sensitive to human disturbance.	**Unlikely.** No caves or mines are present, and the Study Area has high levels of disturbance from Pacific Coast Highway, therefore the Study Area does not contain suitable roost habitat.	No further recommendations.
San Francisco dusky-footed woodrat *Neotoma fuscipes annectens*	SSC	Typically occurs in forest habitats of moderate canopy and moderate to dense understory. Also found in chaparral habitats.	**Moderate Potential.** Although no nests were identified during the site visit, the Study Area contains dense riparian understory that could be used by this species as nesting habitat.	See section 5.3.2 for further discussion of this species, and section 6.3 for associated recommended mitigation.
American badger *Taxidea taxus*	SSC	Most abundant in drier open stages of most shrub, forest, and herbaceous habitats, with friable, uncultivated soils. Prey on burrowing rodents.	**No Potential.** The Study Area does not contain suitable grassland habitat for this species and it is not contiguous with occupied habitat. High development and disturbance levels preclude badger from the Study Area.	No further recommendations.
southern sea otter *Enhydra lutris nereis*	FT, CFP, MMC SSC, SMC LCP	Nearshore marine environments from about Año Nuevo, San Mateo County. To Point Sal, Santa Barbara County. Needs canopies of giant kelp and bull kelp for rafting and feeding. Prefers rocky substrates with abundant invertebrates.	**No Potential.** The Study Area does not contain ocean habitat required to support this species.	No further recommendations.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
Steller (=Northern) sea lion *Eumetopias jubatus*	FD, MMC SSC	Breeds on Año Nuevo, San Miguel and Farallon islands, Point Saint George, and Sugarloaf. Hauls-out on islands and rocks. Needs haul-out and breeding sites with unrestricted access to water, near aquatic food supply and with no human disturbance.	**No Potential.** The Study Area does not contain ocean habitat required to support this species.	No further recommendations.
Guadalupe fur seal *Arctocephalus townsendi*	FT, ST, CFP, SMC LCP	Breed on Isla de Guadalupe off the coast of Mexico, occasionally found on San Miguel, San Nicolas, and San Clemente islands. Prefers shallow, nearshore island water with cool and sheltered rocky areas for haul-outs.	**No Potential.** The Study Area does not contain open ocean, or beach habitat which is used by the species.	No further recommendations.
Birds				
burrowing owl *Athene cunicularia*	SSC	Open, dry annual or perennial grasslands, deserts, and scrublands characterized by low-growing vegetation. Subterranean nester, dependent upon burrowing mammals, most notably, the California ground squirrel.	**No Potential.** The Study Area does not contain suitable burrows, and no ground squirrels were observed within or adjacent to the Study Area; all adjacent grassy areas are landscaped. Additionally, dense riparian trees and vegetation block the views of owls, making the habitat unsuitable for nesting.	No further recommendations.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
white-tailed kite *Elanus leucurus*	CFP	Year-long resident of coastal and valley lowlands. Preys on small diurnal mammals and occasional birds, insects, reptiles, and amphibians.	**Moderate Potential.** While continual anthropogenic disturbances are present nearby, this species typically nests in close proximity to human activities and has ample foraging areas within nearby open spaces.	See section 5.3.2 for further discussion of this species, and section 6.3 for associated recommended mitigation.
California black rail *Laterallus jamaicensis coturniculus*	ST, CFP, SMC LCP	Year-round resident in marshes (saline to freshwater) with dense vegetation within four inches of the ground. Prefers larger, undisturbed marshes that have an extensive upper zone and are close to a major water source. Extremely secretive and cryptic.	**No Potential.** No marsh habitats are present within the Study Area to support this species.	No further recommendations.
California least tern *Sternula antillarum browni*	FE, SE, CFP, SMC LCP	Summer resident along the coast from San Francisco Bay south to northern Baja California; inland breeding also very rarely occurs. Nests colonially on barren or sparsely vegetated areas with sandy or gravelly substrates near water, including beaches, islands, and gravel bars. In San Francisco Bay, has also nested on salt pond margins.	**No Potential.** No sand bar, mud flat, or other open areas are present within the Study Area to support this species.	No further recommendations.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
California Ridgway's (clapper) rail *Rallus obsoletus obsoletus*	FE, SE, CFP	Year-round resident in tidal marshes of the San Francisco Bay estuary. Requires tidal sloughs and intertidal mud flats for foraging, and dense marsh vegetation for nesting and cover. Typical habitat features abundant growth of cordgrass and pickleweed. Feeds primarily on molluscs and crustaceans.	**No Potential.** The Study Area is outside the known range of this species. No salt marsh is present to support the species.	No further recommendations.
California brown pelican *Pelecanus occidentalis californicus*	FD, SD, CFP, SMC LCP	Nests colonially on coastal islands of small to moderate size, which afford immunity from attack by ground-dwelling predators. Does not breed north of the Channel Islands. Winter visitor and post-breeding disperser to San Francisco Bay region.	**No Potential.** The Study Area does not contain coastal island habitat and is out of the breeding range for this species.	No further recommendations.
marbled murrelet *Brachyramphus marmoratus*	FT, SE	Breed in old-growth redwood stands containing platform-like branches along the coast. Winters in coastal waters.	**No Potential.** The Study Area and vicinity do not contain suitable old growth redwood or fir trees to support nesting by this species.	No further recommendations.
short-tailed albatross *Diomedea albatrus*	FE	Nests on Japanese islands. Very rare winter visitor to offshore California waters.	**No Potential.** The Study Area is outside the typical breeding range for this species. The Study Area does not contain offshore islands required for nesting by the species.	No further recommendations.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
western snowy plover *Charadrius alexandrinus nivosus*	FT, SSC, RP	Federal listing applies only to the Pacific coastal population. Found on sandy beaches, salt pond levees, and shores of large alkali lakes. Requires sandy, gravelly, or friable soils for nesting.	**No Potential.** There is no sand, dune or beach habitat present within the Study Area to support nesting by the species.	No further recommendations.
Alameda song sparrow *Melospiza melodia pusillula*	SSC	Year-round resident in tidal-influenced marshes along the eastern and southern portions of San Francisco Bay.	**No Potential.** The Study Area does not contain tidal marsh habitat used for nesting by this species. The Study Area is also outside of the typical range occupied by this species.	No further recommendations.
Saltmarsh common yellowthroat *Geothlypis trichas sinuosa*	SSC	Resident of San Francisco bay region fresh and salt-water marshes. Requires thick, continuous cover down to water surface for foraging, tall grasses, tule patches, willows for nesting.	**Moderate Potential.** While marsh habitats are not present within the Study Area, the dense riparian vegetation could provide a nesting substrate for this species.	See section 5.3.2 for further discussion of this species, and section 6.3 for associated recommended mitigation.
great blue heron *Ardea herodias*	breeding colonies protected by CDFW	Year-round resident. Nests colonially or semi-colonially in tall trees and on cliffs, also sequestered terrestrial substrates. Breeding sites usually in close proximity to foraging areas: marshes, lake margins, tidal flats, and rivers. Forages primarily on fishes and other aquatic prey, also smaller terrestrial vertebrates.	**Unlikely.** Rookeries for this species require large trees adjacent to waterbodies with sufficient access to forage fishes in order to provide food for the colony. No suitable waterbodies are present to support a colony of this species. The species may be observed individually foraging.	No further recommendations.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
Reptiles and Amphibians				
Western pond turtle *Actinemys [Emys] marmorata*	SSC	Occurs in perennial ponds, lakes, rivers and streams with suitable basking habitat (mud banks, mats of floating vegetation, partially submerged logs) and submerged shelter.	**Moderate Potential.** Although steep channel morphology likely precludes WPT from using the Study Area as a breeding site due to the difficulty of reaching upland areas, WPT may use aquatic portions of Pilarcitos Creek for travelling between other locations.	See section 5.3.2 for further discussion of this species, and section 6.3 for associated recommended mitigation.
San Francisco garter snake *Thamnophis sirtalis tetrataenia*	FE, SE, CFP	Vicinity of freshwater marshes, ponds, and slow moving streams in San Mateo County and extreme northern Santa Cruz County. Prefers dense cover and water depths of at least one foot.	**Moderate Potential.** This species has been documented in coastal areas near the Study Area. A ranid frog prey base is likely present within the Study Area, and the stream appears slow moving enough to provide suitable habitat for this aquatic species.	See section 5.3.2 for further discussion of this species, and section 6.3 for associated recommended mitigation.
California tiger salamander *Ambystoma californiense*	FE/FT, ST, RP	Populations in Santa Barbara and Sonoma counties currently listed as endangered; threatened in remainder of range. Inhabits grassland, oak woodland, ruderal and seasonal pool habitats. Adults are fossorial and utilize mammal burrows and other subterranean refugia. Breeding occurs primariiy in vernal pools and other seasonal water features.	**No Potential.** The Study Area is outside of the known range for this species.	No further recommendations.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
Santa Cruz black salamander *Aneides flavipunctatus niger*	SSC	Climbing salamanders of the genus *Aneides* frequent damp woodlands and are usually found hiding under various debris (i.e. bark, woodrat nests, logs). The Santa Cruz black salamander exists south of the San Francisco Bay and was only recently recognized as a separate and protected species. Santa Cruz black salamander is highly sedentary, preferring to stay hidden under riparian debris.	**Unlikely.** This species is generally present in forested environments or woodlands, which are not present within the Study Area.	No further recommendations.
California giant salamander *Dicamptodon ensatus*	SSC	Occurs in the north-central Coast Ranges. Moist coniferous and mixed forests are typical habitat; also uses woodland and chaparral. Adults are terrestrial and fossorial, breeding in cold, permanent, or semi-permanent streams. Larvae usually remain aquatic for over a year.	**No Potential.** The habitat does not contain true forest habitat, and is surrounded by significant barriers to dispersal in the form of roads and human development. The nearest occurrence is approximately 4.2 miles away in a headwater stream (CDFW 2021).	No further recommendations.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
California red-legged frog *Rana draytonii*	FT, SSC	Associated with quiet perennial to intermittent ponds, stream pools, and wetlands with adjacent upland habitat containing refugia. Prefers shorelines with extensive vegetation. Documented to disperse through upland habitats after rains.	**High Potential.** This species has been documented within 0.1 mile of the Study Area. Although extensive emergent vegetation is not present, Pilarcitos Creek is perennial and provides sufficient hydroperiod for larval development.	See section 5.3.2 for further discussion of this species, and section 6.3 for associated recommended mitigation.
foothill yellow-legged frog *Rana boylii*	SC, SSC	Found in or adjacent to rocky streams in a variety of habitats. Prefers partly-shaded, shallow streams and riffles with a rocky substrate; requires at least some cobble-sized substrate for egg-laying. Needs at least 15 weeks to attain metamorphosis. Feeds on both aquatic and terrestrial invertebrates.	**No Potential.** Pilarcitos creek within the Study Area does not have a rocky substrate that is typical of habitat for this species.	No further recommendations.
Fish				
tidewater goby *Eucyclogobius newberryi*	FE, SSC	Brackish water habitats along the California coast from Agua Hedionda Lagoon, San Diego County to the mouth of the Smith River. Found in shallow lagoons and lower stream reaches, they need fairly still but not stagnant water and high oxygen levels.	**No Potential.** There is no lagoon habitat present within the Study Area.	No further recommendations.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
Delta smelt *Hypomesus transpacificus*	FT, SE, RP	Lives in the Sacramento-San Joaquin estuary in areas where salt and freshwater systems meet. Occurs seasonally in Suisun Bay, Carquinez Strait and San Pablo Bay. Seldom found at salinities > 10 ppt; most often at salinities < 2 ppt.	**No Potential.** The Study Area is outside of the species known range.	No further recommendations.
longfin smelt *Spirinchus thaleichthys*	ST, RP	Found in open waters of estuaries, mostly in the middle or bottom of the water column. This species prefers salinities of 15 to 30 ppt, but can be found in completely freshwater to almost pure seawater.	**No Potential.** The Study Area is not within the known distribution of this species.	No further recommendations.
steelhead, Central California Coast ESU *Oncorhynchus mykiss irideus*	FT	Occurs from the Russian River south to Soquel Creek and Pajaro River. Also in San Francisco and San Pablo Bay Basins. Adults migrate upstream to spawn in cool, clear, well-oxygenated streams. Juveniles remain in fresh water for 1 or more years before migrating downstream to the ocean.	**High Potential.** Steelhead have been documented in Pilarcitos Creek, and may use the Study Area as a passage between the ocean and breeding grounds.	See section 5.3.2 for further discussion of this species, and section 6.3 for associated recommended mitigation.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
Invertebrates				
San Bruno elfin butterfly *Callophrys mossii bayensis*	FE, SMC LCP	Inhabits coastal mountainous areas with grassy ground cover, mainly in the vicinity of San Bruno Mountain, San Mateo County. Colonies are located on steep, north-facing slopes within the fog belt. Larval host plant is *Sedum spathulifolium*.	**No Potential.** The Study Area is outside of this species known range and does not contain suitable rocky outcrops or north facing terrain to support the host plant.	No further recommendations.
Myrtle's silverspot butterfly *Speyeria zerene myrtleae*	FE	Foggy, coastal dunes and hills of the Point Reyes Peninsula.	**No Potential.** The Study Area is outside of this species known range	No further recommendations.
Monarch butterfly *Danaus plexippus*	Winter roosts protected by CDFW	Winter roost sites located in wind-protected tree groves (Eucalyptus, Monterey pine, cypress), with nectar and water sources nearby. Winter roosts monitored by CDFW.	**Unlikely.** The Study Area does not contain groves of larger trees that are typical of roost sites of this species, or that would provide suitable wind block or thermoregulation.	No further recommendations.
Mission blue butterfly *Plebejus icarioides missionensis*	FE	Inhabits grasslands of the San Francisco peninsula. Three larval host plants: *Lupinus albifrons*, *L. variicolor*, and *L. formosus*, of which *L. albifrons* is favored.	**No Potential.** The Study Area does not contain conditions for the establishment of the host plant for this species.	No further recommendations.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
Bay checkerspot butterfly *Euphydryas editha bayensis*	FT, RP	Restricted to native grasslands on outcrops of serpentine soil in the vicinity of San Francisco Bay. *Plantago erecta* is the primary host plant; *Orthocarpus densiflorus* and *O. purpurscens* are the secondary host plants.	**No Potential.** The Study Area lacks serpentine soils, which precludes the presence of species-specific host plants required to sustain a population.	No further recommendations.
San Francisco tree lupine moth *Grapholita edwardsiana*	SMC LCP	Occurs only on sandy northern peninsula sites. Tree lupine (*Lupinus arboreus*) host the larvae of this species. This species is addressed in the San Mateo County LCP.	**No Potential.** The Study Area does not contain sandy habitats or the larval host plant for this species.	No further recommendations.
California brackish water snail *Tryonia imitator*	SMC LCP	Occurs in brackish water, such as Pescadero Marsh.	**No Potential.** There is no brackish water habitat in the Study Area.	No further recommendations.
globose dune beetle *Coelus globosus*	SMC LCP	Inhabits California's coastal dune system.	**No Potential.** The Study Area does not contain sandy or dune habitats required by this species.	No further recommendations.

*** Key to status codes:**

FE	Federal Endangered
FT	Federal Threatened
FD	Federal Delisted
SE	State Endangered
ST	State Threatened
SD	State Delisted
RP	Species for which a recovery plan has been published
Rank 1B.1	CNPS Rank 1B.1: Rare, threatened, or endangered in California and elsewhere (seriously threatened in California)
Rank 1B.2	CNPS Rank 1B.2: Rare, threatened, or endangered in California and elsewhere (moderately threatened in California)
Rank 2B.2	CNPS Rank 2B.2: Rare, threatened, or endangered in California, but more common elsewhere (moderately threatened in California)
Rank 3.2	CNPS Rank 3.2: Plants about which more information is needed - A review list (moderately threatened in California)
Rank 4.2	CNPS Rank 4.2: Plants of limited distribution - A watch list (moderately threatened in California)
Rank 4.3	CNPS Rank 4.3: Plants of limited distribution - A watch list (not very threatened in California)
SSC	CDFW Species of Special Concern
CFP	CDFW Fully Protected Animal
WBWG	Western Bat Working Group (High or Medium) Priority species
MMC SSC	Marine Mammal Commission Species of Special Concern
SMC LCP	San Mateo County Local Coastal Plan Covered Species

**** Key to Potential for Occurrence:**

No Potential. Habitat on and adjacent to the site is clearly unsuitable for the species requirements (foraging, breeding, cover, substrate, elevation, hydrology, plant community, site history, disturbance regime).

Unlikely. Few of the habitat components meeting the species requirements are present, and/or the majority of habitat on and adjacent to the site is unsuitable or of very poor quality. The species is not likely to be found on the site.

Moderate Potential. Some of the habitat components meeting the species requirements are present, and/or only some of the habitat on or adjacent to the site is unsuitable. The species has a moderate probability of being found on the site.

High Potential. All of the habitat components meeting the species requirements are present and/or most of the habitat on or adjacent to the site is highly suitable. The species has a high probability of being found on the site.

Present. Species was observed on the site or has been recorded (i.e. CNDDB, other reports) on the site recently.

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APPENDIX E– PROJECT PLANS AND CROSS-SECTIONS

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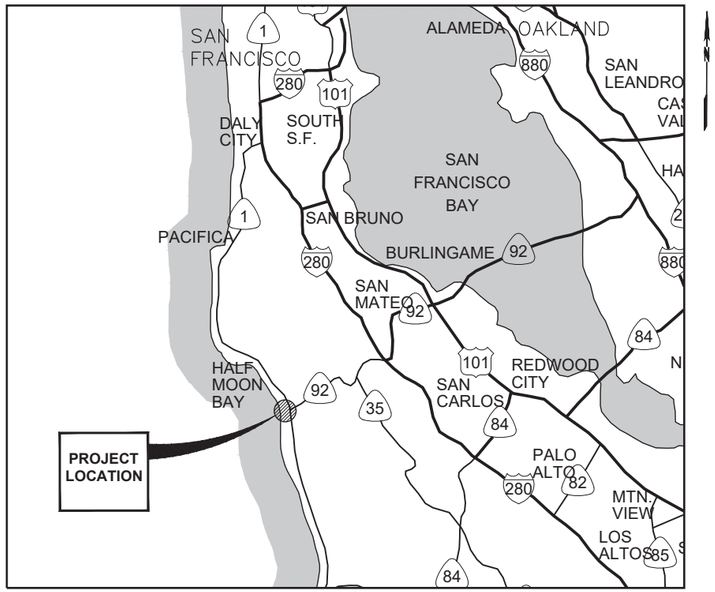
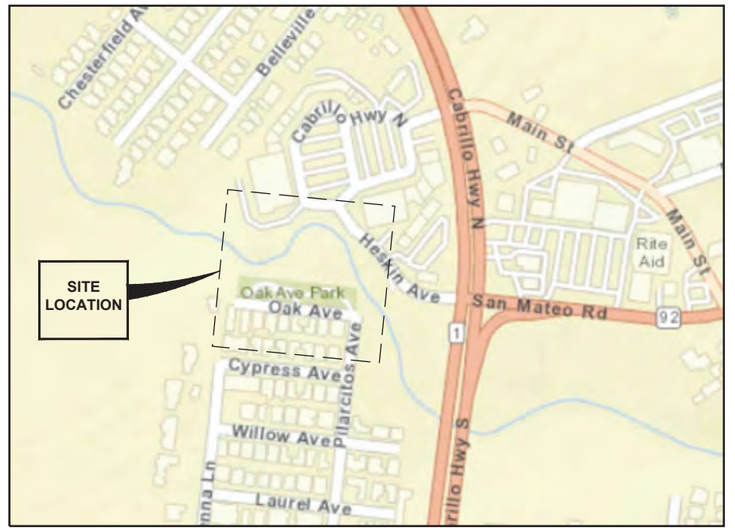
REPLACEMENT OF 8-INCH PIPELINE UNDER PILARCITOS CREEK AT PILARCITOS AVENUE (STRAWFLOWER)

COASTSIDE COUNTY WATER DISTRICT
HALF MOON BAY, CA
CIP 18-01

MARCH 2021



LOCATION MAP
NO SCALE



VICINITY MAP
NO SCALE

SHEET INDEX

100% SUBMITTAL/BID SET

NOT FOR CONSTRUCTION

Know what's below. Call before you dig.

California and Nevada
Call Two Working Days Before You Dig!
811/800-277-2600

REGISTERED PROFESSIONAL ENGINEER
JONATHAN P. N. SUTTER
C 81606
EXP. 09/30/2021
CIVIL
STATE OF CALIFORNIA

100% DESIGN SUBMITTAL

ekl environment & water
2001 JUNIPERO SERRA BOULEVARD, SUITE 300
DALY CITY, CALIFORNIA 94014
(650) 292-9100 • FAX (650) 552-9012

REPLACEMENT OF 8-INCH PIPELINE UNDER CREEK AT PILARCITOS AVENUE (STRAWFLOWER)
COASTSIDE COUNTY WATER DISTRICT

TITLE SHEET, LOCATION MAP, AND DRAWING LIST

	DATE	APPRD
100% DESIGN SUBMITTAL	JPNS	MAR 2021

DESCRIPTION | REV

DATE: MAR 2021
SCALE: AS SHOWN
DRAWN: TCA
DESIGNED: JPNS
APPROVED: JPNS
JOB NO.: B80108.11

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SHEET NUMBER
G-1
1 OF 8

Path: \\ekiconsult.com\go\cad\EKI_CONSTRUCTION DWGS\B80108.01 (CIP PROJECTS)\B80108.11 Filename: B80108.11 - G1 To G3.dwg Plot Date: March 30, 2021 - 10:39 AM CADD User: Taylor Allen

GENERAL NOTES

1. EXISTING UTILITIES SHOWN ON THESE PLANS ARE BASED ON AVAILABLE INFORMATION AND ARE NOT GUARANTEED TO BE EITHER ACCURATE NOR COMPLETE. EXISTING UTILITY MAINS ARE SHOWN; NOT ALL LATERALS FOR EXISTING UTILITIES ARE SHOWN. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY EXACT UTILITY LOCATION. THIS VERIFICATION SHALL BE COORDINATED BY THE CONTRACTOR WITH THE APPROPRIATE UTILITY COMPANY AS REQUIRED. FIELD VERIFY BY POTHOLING AND PHYSICALLY EXPOSING THE LOCATION AND ELEVATION OF ALL EXISTING UNDERGROUND UTILITY SYSTEMS AND INDIVIDUAL SERVICES CROSSING THE ALIGNMENT OF THE NEW WATER LINE AS PART OF THE POTHOLING REPORT DESCRIBED IN THE SPECIFICATIONS. CALL U.S.A. (UNDERGROUND SERVICE ALERT) FOR UTILITY LOCATION AT LEAST 48 HOURS BEFORE DIGGING. PHONE 1-800-227-2600 (OR DIAL 811).
2. CONTRACTOR MAY DEVIATE FROM PROPOSED WATER MAIN ALIGNMENT ONLY WITH PRIOR WRITTEN APPROVAL FROM THE DISTRICT. THE CONTRACTOR SHALL FIELD VERIFY THE LOCATION AND ELEVATION OF ALL EXISTING UNDERGROUND UTILITIES AND SERVICES THAT CROSS OR PARALLEL THE NEW WATER LINES OR THAT MAY BE WITHIN THE INFLUENCE OF CONSTRUCTION ACTIVITIES INCLUDING DEWATERING, EXCAVATING, SHORING AND BACKFILLING ACTIVITIES. CONTRACTOR SHALL SUBMIT POTHOLING RECORDS TO OWNER PRIOR TO CONSTRUCTION AND ON RECORD DRAWINGS.
3. PROTECT ALL EXISTING UTILITIES DURING CONSTRUCTION. DAMAGE TO EXISTING UTILITIES RESULTING FROM THE CONTRACTOR'S CONSTRUCTION ACTIVITIES SHALL BE REPAIRED BY THE CONTRACTOR, AT THE CONTRACTOR'S EXPENSE.
4. CONTRACTOR'S WORK INCLUDES ALL INCIDENTAL AND APPURTENANT WORK NECESSARY TO PROVIDE A COMPLETE AND FULLY-FUNCTIONING FACILITY. NO ADDITIONAL COMPENSATION WILL BE ALLOWED FOR ANY ACTIVITIES OTHER THAN THOSE LISTED IN THE BID SCHEDULE WITHOUT AN AUTHORIZED CHANGE ORDER.
5. THE CONTRACTOR SHALL PROVIDE ALL MATERIALS, LABOR, EQUIPMENT, APPURTENANCES, AND APPARATUS NOT SPECIFICALLY MENTIONED ON THE PLANS OR SPECIFICATIONS, BUT WHICH ARE NECESSARY TO COMPLETE THE CONTRACTED WORK AND PROVIDE A FULLY-FUNCTIONING INSTALLATION READY FOR FULL-TIME OPERATION.
6. THE CONTRACTOR SHALL SUPPLY AND MAINTAIN SANITARY FACILITIES FOR WORKERS AND VISITORS AT THE CONSTRUCTION SITE. SERVICE AT LEAST TWICE WEEKLY. CONTRACTOR SHALL COMPLY WITH ALL STATE AND COUNTY ORDERS RELATED TO COVID-19.
7. THE CONTRACTOR SHALL SATISFY ITSELF AS TO THE EXISTING CONDITIONS PRIOR TO BIDDING THE PROJECT.
8. ALL EXCESS EXCAVATED MATERIAL SHALL BECOME THE PROPERTY OF THE CONTRACTOR AND SHALL BE HANDLED, TRANSPORTED, AND DISPOSED FROM THE SITE IN ACCORDANCE WITH LAWS AND REGULATIONS AT THE CONTRACTOR'S EXPENSE. CONTRACTOR MAY ASSUME, FOR BIDDING PURPOSES ONLY, THAT EXCAVATED SOIL IS NON-HAZARDOUS. HOWEVER, SUCH ASSUMPTION DOES NOT RELIEVE CONTRACTOR'S FULL AND COMPLETE RESPONSIBILITY FOR COMPLYING WITH LAWS AND REGULATIONS, INCLUDING CHARACTERIZATION OF EXCESS MATERIAL FOR MANAGEMENT AND DISPOSAL. CONTRACTOR SHALL PROMPTLY NOTIFY AND CONFER WITH ENGINEER IF ANY EVIDENCE OF SOIL CONTAMINATION IS OBSERVED.
9. SAWCUT LINES SHALL BE DETERMINED BY THE WIDTH OF THE TRENCH AND DISTRICT STANDARD DETAILS OR AS SHOWN ON THE DRAWINGS.
10. UNLESS OTHERWISE SHOWN ALL NEW PIPES SHALL HAVE A MINIMUM COVER OF 36 INCHES.
11. THE CONTRACTOR SHALL RESTORE ALL DAMAGED, REMOVED, OR OTHERWISE DISTURBED WALLS, FENCES, SERVICES, UTILITIES, IMPROVEMENTS, OR FEATURES OF WHATEVER NATURE DUE TO CONTRACTOR WORK AT NO ADDITIONAL COST TO THE OWNER. UNLESS OTHERWISE NOTED, ALL PAVEMENT, GUTTERS, WALKS, FENCES AND OTHER SURFACE IMPROVEMENTS THAT ARE DISTURBED OR DAMAGED BY CONSTRUCTION SHALL BE RESTORED TO ORIGINAL CONDITIONS BY CONTRACTOR, AT THE CONTRACTOR'S EXPENSE.
12. CONCRETE OR OTHER GUTTER REMOVED FOR TRENCHING IN STREETS SHALL BE REPLACED IN KIND. WHEN BRICK GUTTER OR CONCRETE GUTTER AND/OR CURB IS REMOVED FOR INSTALLATION OF SERVICE CONNECTION AND/OR WATER MAIN, REMOVE AND REPLACE IN KIND.
13. CONTRACTOR SHALL PROVIDE A MINIMUM OF 12" VERTICAL CLEARANCE AT CROSSINGS BETWEEN PROPOSED WATER MAINS AND ALL UTILITIES.
14. CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONTRACTOR SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS.
15. WORK IN THE CITY OF HALF MOON BAY RIGHT-OF-WAY SHALL CONFORM TO THE CITY OF HALF MOON BAY STANDARD CONSTRUCTION SPECIFICATIONS AND DETAILS.
16. AT CONNECTIONS TO EXISTING BURIED PIPE, CONTRACTOR SHALL EXPOSE THE EXISTING PIPE AND VERIFY LOCATIONS, INVERT, MATERIALS, AND DIMENSIONS. THE CONTRACTOR SHALL FURNISH ALL NECESSARY COUPLINGS, FITTINGS, APPURTENANCES, TOOLS, AND LABOR TO COMPLETE THE CONNECTIONS WHETHER SPECIFICALLY INDICATED ON THE DRAWINGS OR NOT, AT NO ADDITIONAL COST TO THE OWNER.
17. INSTALL AND MAINTAIN TEMPORARY SILT FENCING ALONG THE PERIMETER OF THE WORK AREA ADJACENT TO THE CREEK BANK AS SHOWN ON PLANS. NO PROJECT ACTIVITIES SHALL BE PERMITTED IN THE AREA BETWEEN THE SILT FENCE AND THE CREEK, EXCEPT FOR FOOT TRAFFIC RELATED TO HDD GUIDANCE ACTIVITIES. ALL CONSTRUCTION ACTIVITIES SHALL COMPLETELY AVOID IMPACTS TO RIPARIAN VEGETATION IN ACCORDANCE WITH SPECIFICATION SECTION 01410.
18. THRUST BLOCKS SHALL BE CONSTRUCTED AT ALL BENDS, TEES, REDUCERS, VALVES, BLIND FLANGES, CAPS, AND PLUGS PER DISTRICT STANDARDS WHETHER OR NOT THEY ARE SPECIFICALLY SHOWN ON THE PLANS.
19. THE CONTRACTOR SHALL COMPLY WITH THE PROVISIONS OF THE SAN MATEO COUNTY AND CITY OF HALF MOON BAY MUNICIPAL REGIONAL PERMIT (MRP) NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT AND SHALL FOLLOW STORM WATER BEST MANAGEMENT PRACTICES AS SPECIFIED IN THE CITY OF HALF MOON BAY STANDARD SPECIFICATIONS & PROJECT SPECIFICATIONS.
20. FOR LANE CLOSURES, THE CONTRACTOR SHALL PROVIDE A TRAFFIC CONTROL PLAN AND OBTAIN APPROVAL FROM THE PERMITTING AGENCIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL PROVIDE FLAG PEOPLE, CONES, AND/OR BARRICADES, AS NECESSARY TO CONTROL TRAFFIC AND PREVENT HAZARDOUS CONDITIONS, PER THE CALIFORNIA DEPARTMENT OF TRANSPORTATION STANDARD PLANS, SPECIFICATION, AND MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, LATEST EDITIONS.
21. THE CONTRACTOR SHALL CONTROL DUST AT ALL TIMES AND SWEEP THE STREETS AS OFTEN AS NECESSARY DURING CONSTRUCTION, AS REQUIRED BY THE OWNER REPRESENTATIVE.
22. ALL PAVEMENT MARKING AND STRIPING DAMAGED DURING CONSTRUCTION SHALL BE REPLACED BY THE CONTRACTOR IN ACCORDANCE WITH CITY OF HALF MOON BAY STANDARDS, & PROJECT SPECIFICATIONS, AS DIRECTED BY ENGINEER.
23. NO TRENCHES OR HOLES IN THE PUBLIC RIGHT OF WAY SHALL BE LEFT OPEN OVERNIGHT; USE STEEL PLATING OR HOT-MIX ASPHALT AS REQUIRED TO PROTECT OPEN EXCAVATIONS OVERNIGHT.
24. WHEN UTILITY CONFLICTS ARE ENCOUNTERED, INSTALL WATER LINE ABOVE OR BELOW EX UTILITY PER DETAIL 2 / C-4. WATER LINE SHALL BE INSTALLED ABOVE SANITARY SEWER, UNLESS APPROVED IN ADVANCE BY ENGINEER.
25. ALL WORK SHALL BE PERFORMED WITHIN THE LIMITS OF THE PERMANENT AND TEMPORARY EASEMENTS AND THE CITY OF HALF MOON BAY ROW AS SHOWN ON THE DRAWINGS.

100% SUBMITTAL/BID SET

NOT FOR CONSTRUCTION

ABBREVIATIONS

APPROX.	APPROXIMATE
APN	ASSESSOR'S PARCEL NUMBER
CB	CATCH BASIN
CIP	CAST IRON PIPE
CO	CLEANOUT
DIP	DUCTILE IRON PIPE
DR	DIMENSION RATIO
(E)	EXISTING
ELEV.	ELEVATION
FL	FLANGE
FH	FIRE HYDRANT
G	GAS
GPRS	GENERAL PACKET RADIO SERVICE
GV	GATE VALVE
HDD	HORIZONTAL DIRECTIONAL DRILLING
HDPE	HIGH DENSITY POLYTHENE
HORIZ	HORIZONTAL
IN.	INCHES
INV	INVERY
MH	MANHOLE
MIN	MINIMUM
MJ	MECHANICAL JOINT
(N)	NEW
NTS	NOT TO SCALE
PL	PLASTIC
ROW	RIGHT-OF-WAY
SD	STORM DRAIN
SSMH	SANITARY SEWER MANHOLE
SPEC(S)	SPECIFICATION(S)
SS	SANITARY SEWER
STA.	STATION
TYP.	TYPICAL
VC	VERTICAL CURVE
VCP	VITRIFIED CLAY PIPE
VIF	VERIFY IN FIELD
W	WATER
WM	WATER METER

REFERENCE SYMBOLS

XX / XXX — DETAIL DESIGNATION (NUMBERS); SHEET DRAWN ON

DETAIL 1 — DETAIL DESIGNATION (NUMBERS)
SCALE: X" = XX'

GENERAL LEGEND

EXISTING

- BACKFLOW PREVENTER
- BENCHMARK
- BOLLARD
- CLEAN OUT
- CONTOUR (45)
- CURB
- DOOR
- DRAIN INLET
- ELECTRIC METER/BOX
- ELECTROLIER
- ELEVATION W/ DESCRIPTION (× 40.77 EP)
- NATURAL GROUND SHOT (× 42.9)
- FIRE HYDRANT
- FOUND MONUMENT
- FOUND MONUMENT IN WELL
- GUY WIRE
- IRRIGATION VALVE (IRR)
- SANITARY SEWER MANHOLE (S)
- SIGN
- STREET/SITE LIGHT PULL BOX
- TREES
- UNDERGROUND UTILITY LINE LABEL AND DIRECTION
- UTILITY POLE
- WALL
- GEOTECHNICAL BOREHOLE LOCATION

BOUNDARY LINES
- ADJACENT PROPERTY LINE
- CENTER LINE
- EASEMENT LINE
- PROPERTY LINE
- RIGHT OF WAY LINE

HARDSCAPE LINES
- BACK OF CURB
- FACE OF CURB
- FLOWLINE
- LIP OF GUTTER
- SIDEWALK/CONCRETE

MISCELLANEOUS LINES
- BUILDING OUTLINE
- FENCE, CHAIN-LINK (X — X)
- FENCE, METAL (HEIGHT NOTED)
- FENCE, WOOD (HEIGHT NOTED)

UTILITY LINES
- GAS LINE (G — G)
- OVERHEAD (OH — OH)
- SANITARY SEWER (SS — SS)
- WATER (W — W)

PROPOSED / DESCRIPTION

PROPOSED	DESCRIPTION
◉	HDD ENTRY/EXIT LOCATION
8" W (DIP)	8" DUCTILE IRON PIPE WATER LINE
10" W (HDPE)	10" HDPE WATER LINE
⋈	GATE VALVE
⌐	WATER LINE CAP OR PLUG
◀	REDUCER
#	COUPLING

REGISTERED PROFESSIONAL ENGINEER — JONATHAN P. N. SUTTER — C 81606 EXP. 09/30/2021 CIVIL — STATE OF CALIFORNIA

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2001 JUNIPERO SERRA BOULEVARD, SUITE 300
DALY CITY, CALIFORNIA 94014
(650) 296-9100 • FAX (650) 552-9012

REPLACEMENT OF 8-INCH PIPELINE UNDER CREEK AT PILARCITOS AVENUE (STRAWFLOWER)
COASTSIDE COUNTY WATER DISTRICT

NOTES, ABBREVIATIONS, AND LEGEND

REV	DESCRIPTION	APPRVD	DATE
1	100% DESIGN SUBMITTAL	JPNS	MAR 2021

DATE: MAR 2021
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DRAWN: TCA
DESIGNED: JPNS
APPROVED: JPNS
JOB NO.: B80108.11

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SHEET NUMBER
G-2
2 OF 8

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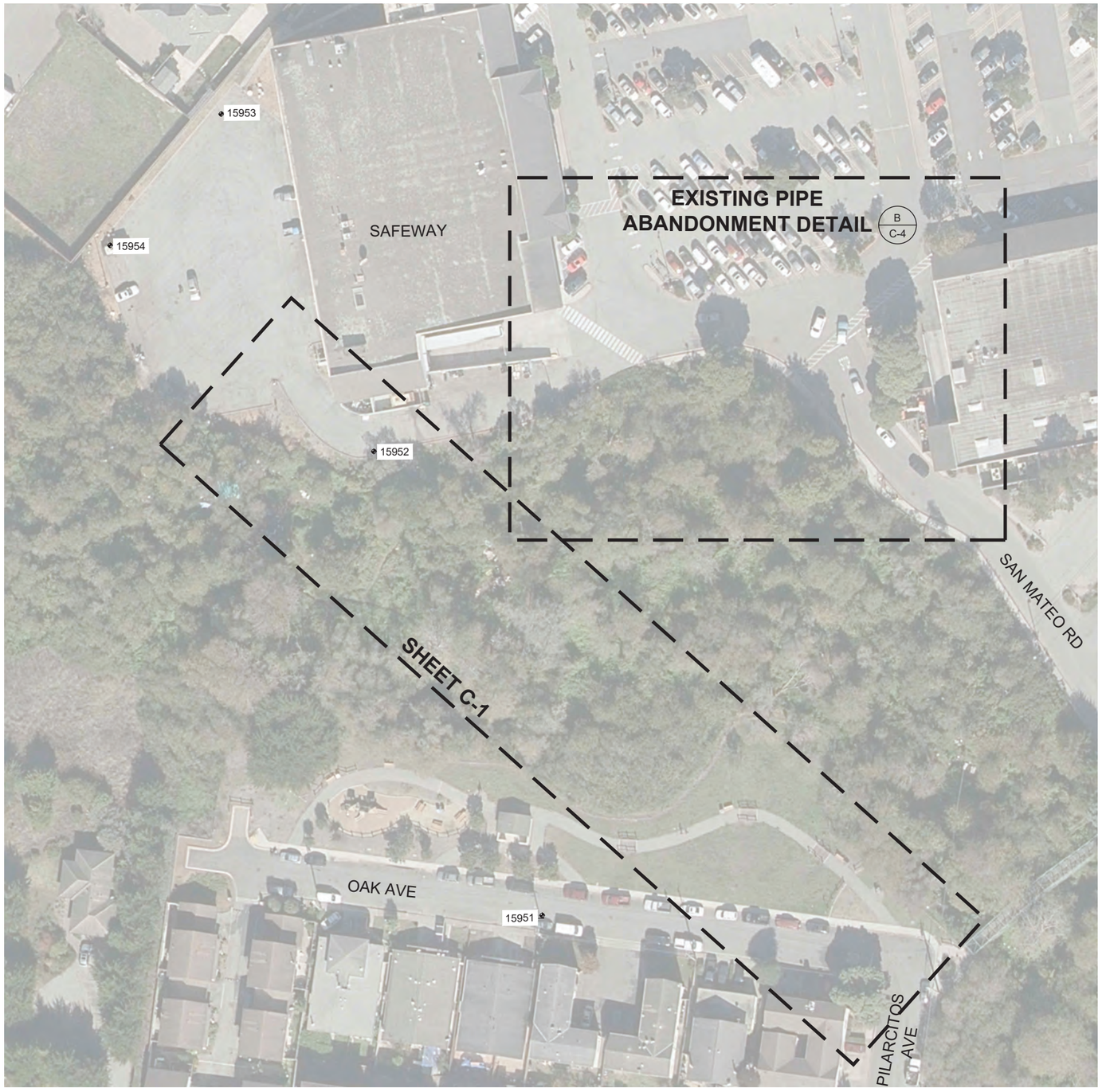

SURVEY CONTROL NOTES

HORIZONTAL DATUM
NORTH AMERICAN DATUM OF 1983 (NAD83).

COORDINATE SYSTEM
COORDINATES SHOWN HEREON ARE GROUND AND BASED ON THE CALIFORNIA COORDINATE SYSTEM OF 1983 (CCS83), ZONE III.

VERTICAL DATUM
NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

PROJECT BENCHMARK (NGS BM DESINATION F 1239)
BENCH MARK DISK SET IN A RETAINING WALL OR CONCRETE LEDGE OF CULVERT HEADWALL AT THE SOUTHEAST CORNER OF THE JUNCTION OF STATE HIGHWAY 1 AND KELLY AVENUE, IN THE TOP AND 0.9 FOOT NORTH OF THE SOUTH END OF THE EAST CONCRETE HEADWALL OF 24 INCH PIPE CULVERT $\frac{\text{NE}}{\text{TS}}$, 31 FEET EAST FO THE CENTER LINE OF THE AVENUE, 7 FEET NORTH OF STEEL LIGHT POLE "D 3036" AND ABOUT 1/2 FOOT LOWER THEN THE HIGHWAY.
ELEVATION = 62.78' (NAVD 88)

LOCAL BM
PT 15951 BEING MAG NAIL SET IN AC APPROXIMATELY 237' NORTHWEST ALONG OAK AVENUE FROM THE INTERSECTION WITH PILARCITOS AVENUE, 18' NORTH OF A POWER POLE.
ELEVATION = 40.53' (NAVD 88)

BASIS OF BEARINGS
THE BEARING BETWEEN POINTS 15951 TO 15953 BEING N 21° 49'10" W.

CONTROL POINT TABLE			
POINT NUMBER	NORTHING	EASTING	DESCRIPTION
15951	1998663.97	5999899.24	SET GCP
15952	1998971.41	5999787.74	SET GCP
15953	1999195.00	5999686.63	SET GCP
15954	1999107.95	5999613.01	SET GCP

UTILITY NOTES

PHYSICAL ITEMS SHOWN ON THIS SURVEY ARE LIMITED TO THOSE SURFACE ITEMS VISIBLE AS OF THE DATE OF THIS SURVEY. SUBSURFACE OBJECTS, IF ANY, ARE NOT SHOWN, WITH THE EXCEPTION OF UNDERGROUND UTILITY LINES. NO WARRANTY IS IMPLIED AS TO THE EXACT LOCATION OF THESE LINES OR AS TO THE COMPLETENESS OF THE UTILITY INFORMATION SHOWN HEREON. SAID SUBSURFACE OBJECTS MAY INCLUDE, BUT ARE NOT LIMITED TO, CONCRETE FOOTINGS, SLABS, SHORING, STRUCTURAL PILES, UTILITY VAULTS, PIPING, UNDERGROUND TANKS, ADDITIONAL UNDERGROUND UTILITY LINES, TELECOMMUNICATION LINES, FIBER OPTIC LINES AND ANY OTHER SUBSURFACE STRUCTURES OR FACILITIES NOT REVEALED BY A SURFACE INSPECTION ON THE DATE THAT THE FIELD WORK FOR THIS SURVEY WAS PERFORMED. FIELD WORK WAS PERFORMED ON SEPTEMBER 26 AND OCTOBER 10, 2019.

MONUMENT NOTES

PRIOR TO COMMENCEMENT OF ANY CONSTRUCTION ON THIS SITE, IT IS ADVISED THAT ALL INVOLVED PARTIES REVIEW SECTION 8771 AND SECTION 8725 OF THE BUSINESS AND PROFESSIONS CODE AND SECTION 605 OF THE CALIFORNIA PENAL CODE TO ENSURE THAT MONUMENT CONSERVATION HAS BEEN PROPERLY ADDRESSED.

SURVEY NOTES

THE SURVEY WAS CONDUCTED BY O'DELL ENGINEERING, INC. BETWEEN SEPTEMBER AND NOVEMBER 2019.

KEY MAP AND CONTROL POINTS

SCALE: 1"=40'

0 20 40 80 120
SCALE: 1"=40'

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REPLACEMENT OF 8-INCH PIPELINE UNDER CREEK AT PILARCITOS AVENUE (STRAWFLOWER)
COASTSIDE COUNTY WATER DISTRICT

KEY MAP, CONTROL POINTS, AND SURVEY NOTES

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1	100% DESIGN SUBMITTAL	JPNS	MAR 2021

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JONATHAN P. N. SUTTER
C 81606
EXP. 09/30/2021
CIVIL
STATE OF CALIFORNIA

100% DESIGN SUBMITTAL

SHEET NUMBER
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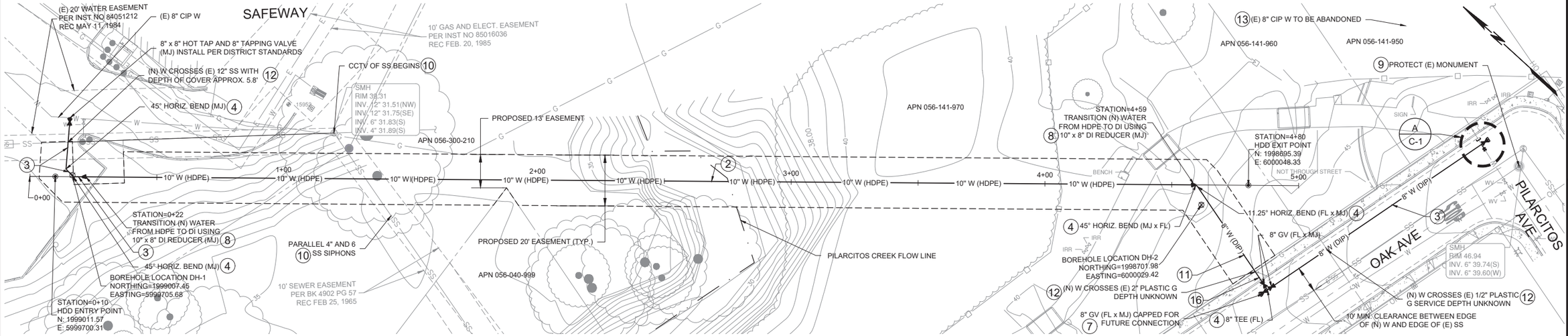
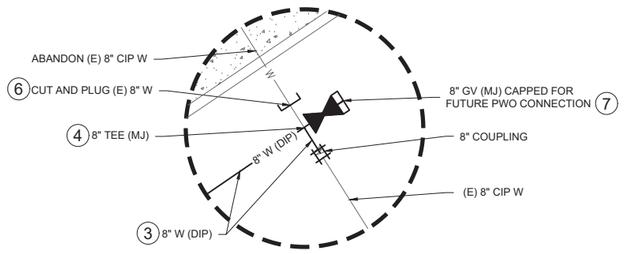


PLAN

SCALE: 1"=20'

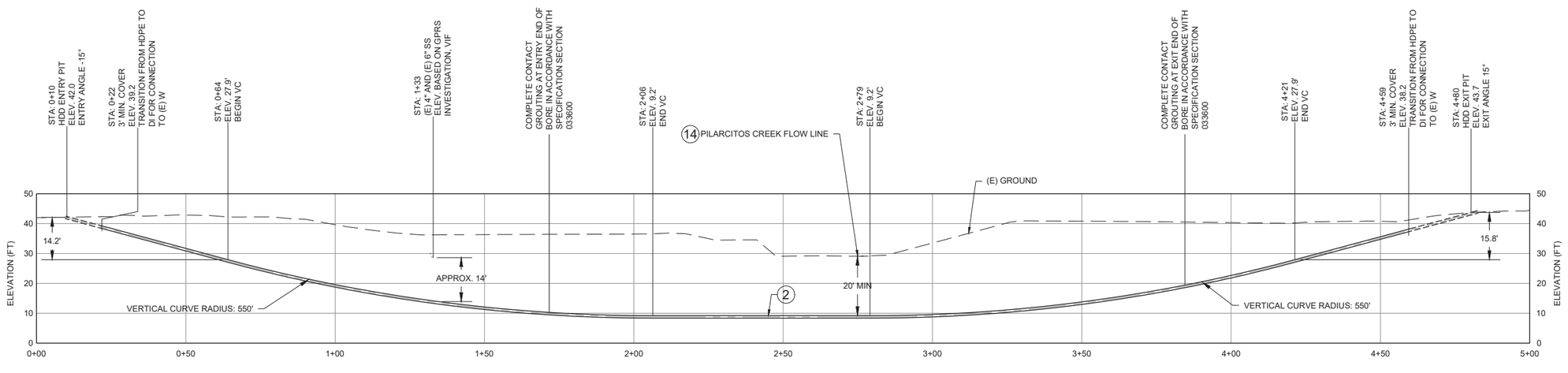
CONSTRUCTION NOTES:

1. ALL LOCATIONS AND DEPTHS OF (E) UTILITIES ARE APPROXIMATE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR POTHOLING AND VERIFYING SIZES, DEPTHS, AND LOCATIONS OF ALL UTILITIES. ANY CHANGES TO THESE PLANS AND SPECIFICATIONS SHALL BE APPROVED BY THE ENGINEER OR OWNER REPRESENTATIVE.
2. INSTALL 10" W HDPE VIA HORIZONTAL DIRECTIONAL DRILLING.
3. INSTALL (N) WATER LINE BY OPEN TRENCH PER DETAIL CC-01/C-3 FOR PAVED AREAS AND PER DETAIL CC-03/C-3 FOR UNIMPROVED AREAS.
4. INSTALL THRUST BLOCKS ON ALL FITTINGS PER DETAIL CC-22/C-3
5. INSTALL GATE VALVE PER DETAIL CC-09/C-3 WHERE REQUIRED INSTALL VALVE EXTENSION PER DETAIL CC-11/C-3.
6. CUT AND PLUG EX INACTIVE WATER LINE PER DETAIL 4/C-4 TO ABANDON (E) W IN PLACE.
7. CAP ACTIVE WATER LINE PER DETAIL 3/C-4.
8. CONTRACTOR SHALL INSTALL REDUCER ANCHOR BLOCK PER DETAIL 1/C-4.
9. PROTECT (E) MONUMENT. IF TRENCH IS LESS THAN 5' FROM EDGE OF (E) MONUMENT, CONTRACTOR SHALL NOTIFY ENGINEER AND SURVEY (E) MONUMENT. IF MONUMENT IS DAMAGED DURING CONSTRUCTION, CONTRACTOR SHALL REPLACE MONUTMENT PER CITY OF HALF MOON BAY STANDARDS AT THE CONTRACTOR'S EXPENSE.
10. PRIOR TO AND AFTER HDD INSTALLATION, CONTRACTOR SHALL CONDUCT CCTV INSPECTIONS OF THE (E) 4" AND 6" SS SIPHONS PER SPECIFICATION SECTION 02732. CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING DAMAGE TO THE SS SIPHONS CAUSED BY HDD OPERATIONS AT THE CONTRACTORS EXPENSE.
11. RETAIN EXISTING VEGETATION AS PRACTICABLE. TURF AREA DISTURBED BY TRENCH OR CONSTRUCTION ACTIVITIES SHALL BE REPLACED PER SPECIFICATION SECTION 02900. CONTRACTOR SHALL COORDINATE TURF AND SPRINKLER REPAIR WITH CITY PUBLIC WORKS STAFF AND THAT THE CONTRACTOR IS RESPONSIBLE FOR ANY REPAIRS TO CITY SPRINKLERS AND TURF AREAS.
12. CONTRACTOR SHALL POTHOLE ALL EXISTING UTILITIES THAT CROSS THE (N) W ALIGNMENT AND PROVIDE POTHOLE DATA TO THE DISTRICT PRIOR TO CONSTRUCTION.
13. FOR ABANDONMENT OF THE (E) W ON THE NORTHERN SIDE SEE DETAIL B/C-4.
14. CONTRACTOR SHALL CONFIRM THALWEG OF CREEK ALONG HDD ALIGNMENT PRIOR TO BEGINNING CONSTRUCTION. IF THALWEG IS DIFFERENT THAN SHOWN ON PLANS CONTRACTOR SHALL INFORM ENGINEER.
16. SIDEWALK, CURB AND GUTTER SHALL BE RESTORED PER CITY OF HALF MOON BAY STANDARD DETAIL SI-3/C-3.



PILARCITOS AVE CONNECTION DETAIL (A)

NOT TO SCALE



PROFILE

HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=20'

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COASTSIDE COUNTY WATER DISTRICT

PLAN AND PROFILE

	DATE	DESCRIPTION	APPRD
1	MAR 2021	100% DESIGN SUBMITTAL	JPNS

DATE: MAR 2021
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JONATHAN P. N. SUTTER
C 81606
EXP. 09/30/2021
CIVIL
STATE OF CALIFORNIA

100% DESIGN SUBMITTAL

SHEET NUMBER
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PLAN

0 30 60 120 180

SCALE: 1"=60'

LEGEND:

- ROW /PROPERTY LINE
- OH — OVERHEAD ELECTRICAL
- SILT FENCE
- APPROX. FLOW LINE OF PILARCITOS CREEK
- STAGING AREA

NOTES:

1. ALL HDD CONSTRUCTION MATERIALS AND EQUIPMENT SHALL ONLY BE STORED IN DESIGNATED STAGING AREAS SHOWN ON THIS PLAN UNLESS OTHERWISE ARRANGED BY THE CONTRACTOR. ENGINEER TO DELINEATE STAGING AREAS IN FIELD PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL PROVIDE ENCLOSURE FENCING AROUND THE HDD STAGING AREAS IN ACCORDANCE WITH SPECIFICATION SECTION 01410 TO PREVENT ENTRY OF UNAUTHORIZED PERSONS.
2. SAFE VEHICULAR AND PEDESTRIAN ACCESS SHALL BE PROVIDED AT ALL TIMES DURING CONSTRUCTION. AT LEAST ONE LANE OF TRAFFIC ALONG OAK AVE AND PILARCITOS AVE MUST BE MAINTAINED AT ALL TIMES. ACCESS TO THE PEDESTRIAN BRIDGE MUST BE MAINTAINED AT ALL TIMES OTHER THAN DURING THE HDD PIPE PULLBACK.
3. ALL HDD PIPE FABRICATION SHALL BE COMPLETED WITHIN THE ALLOWABLE PIPE LAYDOWN AREA ON PILARCITOS AVENUE, AS SHOWN ON THE PLANS.
4. ALL OPEN TRENCH CONSTRUCTION MATERIALS AND EQUIPMENT SHALL ONLY BE STORED IN THE DESIGNATED STAGING AREA SHOWN AT THE END OF EACH WORK DAY THROUGHOUT THE DURATION OF THE OPEN TRENCH INSTALLATION.
5. AT NO TIME MAY THE CONTRACTORS OPERATIONS IMPEDE WITH THE STRAWFLOWER SHOPPING CENTER'S OPERATIONS.
6. THE CONTRACTOR SHALL INSTALL BARRIERS OR FENCING AS NEEDED TO KEEP THE PUBLIC OUT OF OAK AVENUE PARK WORK AREA AND MAINTAIN SAFE ACCESS TO THE PEDESTRIAN WALKWAYS AND BRIDGE AT ALL TIMES OTHER THAN DURING THE HDD PIPE PULLBACK.

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COASTSIDE COUNTY WATER DISTRICT

CONSTRUCTION STAGING AREAS

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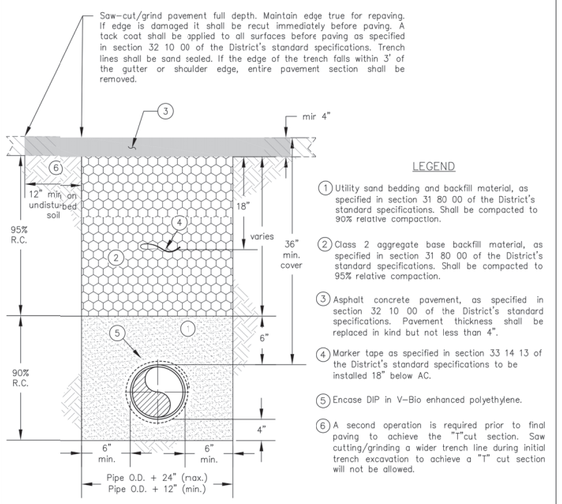


LEGEND

1. Utility sand bedding and backfill material, as specified in section 31 80 00 of the District's standard specifications. Shall be compacted to 90% relative compaction.
2. Class 2 aggregate base backfill material, as specified in section 31 80 00 of the District's standard specifications. Shall be compacted to 95% relative compaction.
3. Asphalt concrete pavement, as specified in section 32 10 00 of the District's standard specifications. Pavement thickness shall be replaced in kind but not less than 4".
4. Marker tape as specified in section 33 14 13 of the District's standard specifications to be installed 18" below AC.
5. Encase DIP in V-Bio enhanced polyethylene.
6. A second operation is required prior to final paving to achieve the "T"cut section. Saw cutting/grinding a wider trench line during initial trench excavation to achieve a "T" cut section will not be allowed.

Note:
Replace existing tracer wire if damaged during trenching operation.

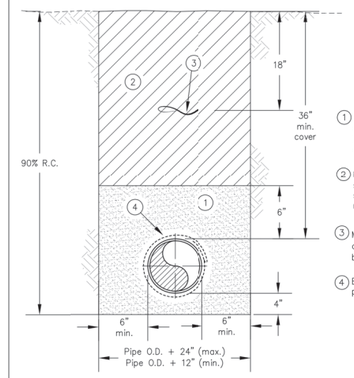
TRENCH SECTION - TYPE A PAVED SURFACES

REV. 05/2018

COASTSIDE COUNTY WATER DISTRICT
766 MAIN STREET
HALF MOON BAY, CA

Approved by:
David Dickson, General Manager

STD. NO. CC-01



LEGEND

1. Utility sand bedding and backfill material, as specified in section 31 80 00 of the District's standard specifications. Shall be compacted to 90% relative compaction.
2. Native backfill material, as specified in section 31 80 00 of the District's standard specifications. Shall be compacted to 95% relative compaction.
3. Marker tape as specified in section 33 14 13 of the District's standard specifications to be installed 18" below AC.
4. Encase DIP with V-Bio enhanced polyethylene.

Note:
Replace existing tracer wire if damaged during trenching operation.

TRENCH SECTION - TYPE C UNIMPROVED AREA

REV. 05/2018

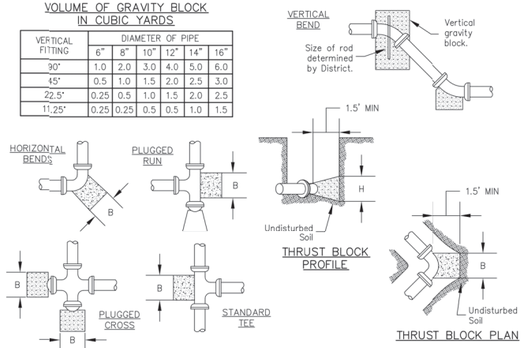
COASTSIDE COUNTY WATER DISTRICT
766 MAIN STREET
HALF MOON BAY, CA

Approved by:
David Dickson, General Manager

STD. NO. CC-03

VOLUME OF GRAVITY BLOCK IN CUBIC YARDS

VERTICAL FITTING	DIAMETER OF PIPE					
	6"	8"	10"	12"	14"	16"
90°	1.0	2.0	3.0	4.0	5.0	6.0
45°	0.5	1.0	1.5	2.0	2.5	3.0
22.5°	0.25	0.5	1.0	1.5	2.0	2.5
11.25°	0.25	0.25	0.5	0.5	1.0	1.5



DIMENSIONS OF THRUST BLOCKS IN FEET

HORIZONTAL FITTING	DIAMETER OF PIPE											
	6"		8"		10"		12"		14"		16"	
	B	H	B	H	B	H	B	H	B	H	B	H
90°	1'-9"	1'-9"	2'-3"	2'-3"	2'-9"	2'-9"	3'-3"	3'-3"	3'-9"	3'-9"	4'-3"	4'-3"
45°	1'-0"	1'-0"	1'-6"	1'-6"	2'-0"	2'-0"	2'-6"	2'-6"	3'-0"	3'-0"	3'-6"	3'-6"
22.5°	1'-0"	0'-6"	1'-0"	0'-8"	1'-6"	0'-8"	1'-6"	1'-0"	1'-6"	1'-6"	2'-0"	1'-6"
11.25°	1'-0"	0'-6"	1'-0"	0'-6"	1'-0"	0'-6"	1'-0"	0'-8"	1'-8"	0'-8"	1'-5"	1'-0"
PLUG/TEE	1'-3"	1'-3"	1'-9"	1'-9"	2'-3"	2'-3"	2'-9"	2'-9"	3'-3"	3'-3"	3'-9"	3'-9"

NOTES:
1. Use 2,000 psi high early strength concrete.
2. All thrust blocks and gravity blocks shall bear against undisturbed earth.
3. Encased DI pipe in 8 mil. linear low-density polyethylene film.
4. Maintain a minimum clearance of 2" between the thrust block reinforcing steel and pipe.
5. Concrete not to extend beyond the face of the bell.
6. Thrust block shall encompass at least one-half of the outside diameter of the pipe.
7. Flanges, bolts, and nuts shall be kept clear of concrete.
8. Dimensions above include use of mechanical restraints on pipe.
9. If groundwater is presented, thrust block dimensions shall be determined by the District.
10. Thrust block dimensions shall be doubled if used on non-restrained connections.

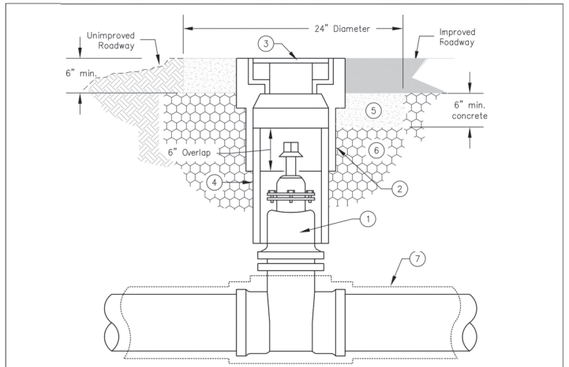
THRUST RESTRAINT - THRUST BLOCK DETAILS

REV. 05/2018

COASTSIDE COUNTY WATER DISTRICT
766 MAIN STREET
HALF MOON BAY, CA

Approved by:
David Dickson, General Manager

STD. NO. CC-22



LEGEND

1. Gate valve, Mueller No. A-2362 with Type 316 SS bolts and nuts, and 2" square bronze operation nut. Steam seal shall be O-ring type. Valve stem shall be made of ASTM B98-C66100/H02 (Everdur) bar stock mcterial; EPDM rubber; machined release groove below operating nut; and stuffing box aligned with the direction of the pipe. If coating on gate valve is damaged during the installation, it should be repaired using Mueller Epoxy Kit No. 280089 to the satisfaction of the District. Valve shall be set plumb.
2. Traffic valve box, Christy Concrete No. G05TBOX.
3. Cast iron traffic cover inscribed "WATER", Christy Concrete No. G05CT.
4. SDR 35 PVC pipe riser - 8" minimum diameter.
5. 2,000 psi high early strength. Asphalt shall be placed on top of concrete collar, same day.
6. Backfill material, aggregate base per road surface, see Detail CC-01.
7. Encase DIP in V-Bio enhanced polyethylene. Wrap excess film with 10-mil pipe taps.

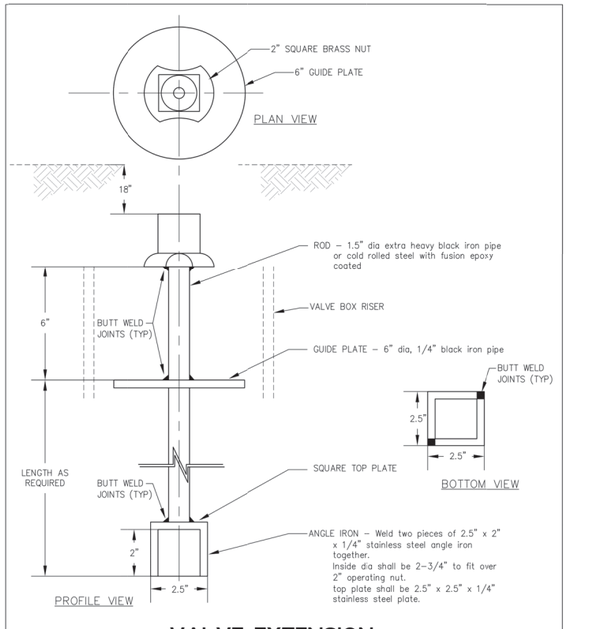
GATE VALVE ASSEMBLY

REV. 05/2018

COASTSIDE COUNTY WATER DISTRICT
766 MAIN STREET
HALF MOON BAY, CA

Approved by:
David Dickson, General Manager

STD. NO. CC-09



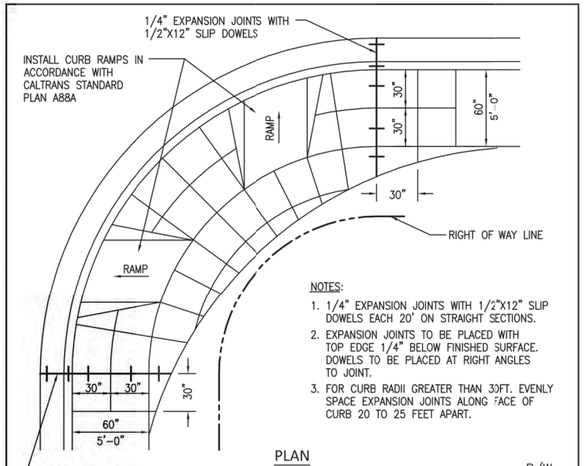
VALVE EXTENSION

REV. 05/2018

COASTSIDE COUNTY WATER DISTRICT
766 MAIN STREET
HALF MOON BAY, CA

Approved by:
David Dickson, General Manager

STD. NO. CC- 11



CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY: PEYKAN ABBASSI, P.E., CITY ENGINEER
DATE: JULY 19, 2016

SIDEWALK DETAIL (MONOLITHIC)

STD. DETAIL No. SI-3

100% SUBMITTAL/BID SET
NOT FOR CONSTRUCTION

eki environment & water
2001 JUNIPERO SERRA BOULEVARD, SUITE 300
DALY CITY, CALIFORNIA 94014
(650) 292-9100 • FAX (650) 552-9012

REPLACEMENT OF 8-INCH PIPELINE UNDER CREEK AT PILARCITOS AVENUE (STRAWFLOWER)
COASTSIDE COUNTY WATER DISTRICT

CONSTRUCTION DETAILS 1

DESCRIPTION	DATE
100% DESIGN SUBMITTAL	MAR 2021

DATE: MAR 2021
SCALE: AS SHOWN
DRAWN: TCA
DESIGNED: JPNS
APPROVED: JPNS
JOB NO.: B80108.11

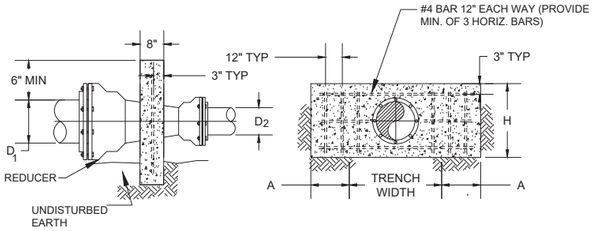
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

REGISTERED PROFESSIONAL ENGINEER
JONATHAN P. N. SUTTER
C 81606
EXP. 09/30/2021
CIVIL
STATE OF CALIFORNIA

100% DESIGN SUBMITTAL

SHEET NUMBER
C-3
6 OF 8

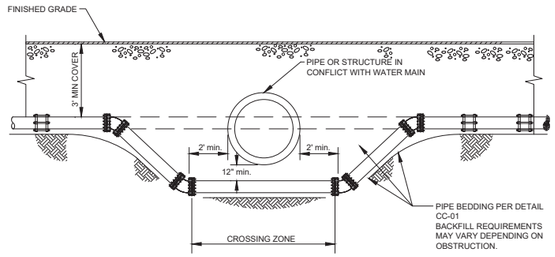
Path: \\ekiconsult.com\go\cad\EKI_CONSTRUCTION DWGS\B80108.01 (CIP PROJECTS)\B80108.11 Filename: B80108.11 - C-3 To C-5.dwg Plot Date: March 30, 2021 - 10:42 AM CADD User: Taylor Allen



ANCHOR BLOCK FOR REDUCERS

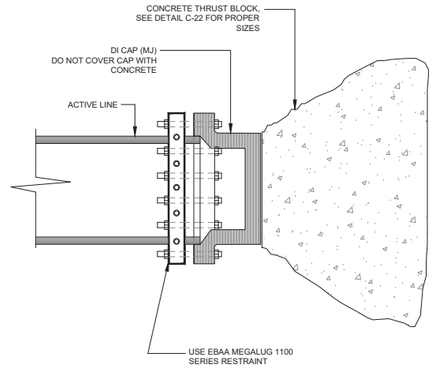
REDUCER SIZE D_1 X D_2	H (FT.)	A (FT.)
20" X 16"	3.0	3.5
16" X 12"	2.5	3.0
16" X 10"	3.0	3.5
16" X 8"	4.0	3.5
16" X 6"	4.5	3.5
12" X 10"	1.5	2.0
12" X 8"	2.0	2.5
12" X 6"	2.0	3.5
10" X 8"	1.5	2.0
8" X 6"	1.0	2.0
8" X 4"	1.0	3.0
6" X 4"	1.0	1.5

REDUCER ANCHOR BLOCK 1
NTS

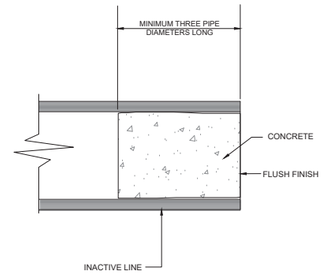


NOTES:
1. ALL BENDS SHALL BE 45° OR 22-1/2° FITTINGS, AS REQUIRED FOR PROPER HORIZONTAL SEPARATION.
2. ALL MECHANICAL JOINTS SHALL BE PROVIDED WITH APPROVED JOINT RESTRAINT DEVICES, "MEGALUGS" BY EBBA, OR EQUAL.
3. THRUST BLOCKS ARE REQUIRED AT ALL BENDS, TEES AND VALVES IN ACCORDANCE WITH STANDARD DETAIL CC-22
4. NEW WATER MAINS SHALL NOT BE INSTALLED IN THE SAME TRENCH AS, AND SHALL BE AT LEAST 10 FT. HORIZONTALLY FROM AND ONE FOOT VERTICALLY ABOVE, ANY PARALLEL SANITARY SEWER LINE. WATER MAIN SHALL BE ENCAPSOLATED WITH CONCRETE OR CDF IF CROSSING UNDER SANITARY SEWER LINE.
5. NEW WATER MAINS SHALL BE INSTALLED AT LEAST 4 FEET HORIZONTALLY FROM, AND ONE FOOT VERTICALLY ABOVE, ANY PARALLEL STORM DRAINAGE PIPELINE. WATER MAIN SHALL BE ENCAPSOLATED WITH CONCRETE OR CDF IF CROSSING UNDER STORM DRAINAGE PIPELINE.
6. IF CROSSING A SANITARY OR STORM DRAINAGE PIPELINE, A NEW WATER MAIN SHALL BE CONSTRUCTED NO LESS THAN 45 DEGREES TO AND AT LEAST ONE FOOT ABOVE THAT PIPELINE. NO CONNECTION JOINTS SHALL BE MADE IN THE WATER MAIN WITHIN EIGHT HORIZONTAL FEET OF THE SANITARY OR STORM DRAINAGE PIPELINE.
7. NEW WATER MAINS SHALL NOT BE INSTALLED WITHIN 100 HORIZONTAL FEET OF THE NEAREST EDGE OF ANY SANITARY LANDFILL, WASTEWATER DISPOSAL POND, OR HAZARDOUS WASTE DISPOSAL SITE, OR WITHIN 25 FEET OF THE NEAREST EDGE OF ANY CESSPOOL, SEPTIC TANK, SEWAGE LEACH FIELD, SEEPAGE PIT, UNDERGROUND HAZARDOUS MATERIALS.

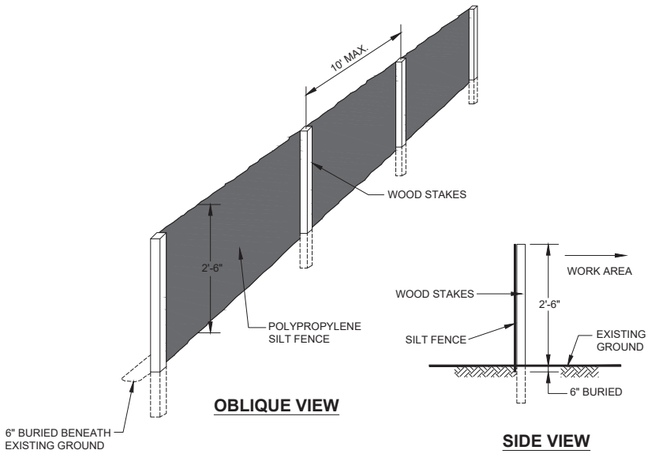
UTILITY CROSSING 5
NTS



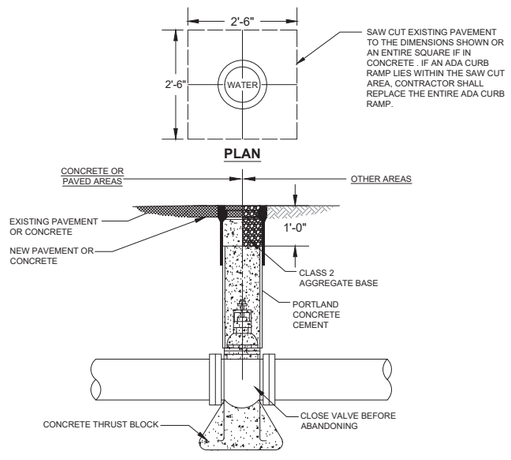
CAP ACTIVE LINE 3
NTS



PLUG INACTIVE LINE 4
NTS

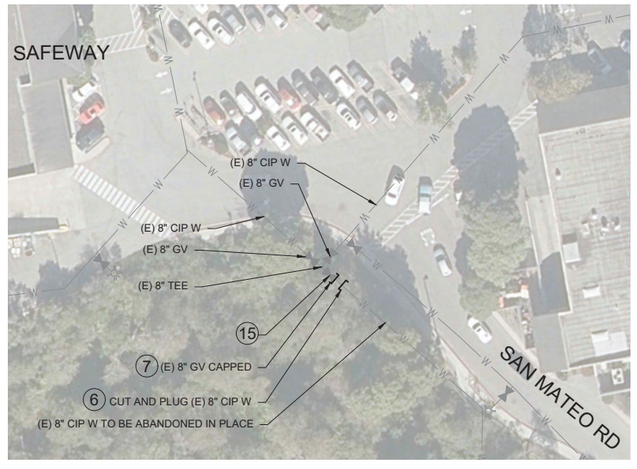


TEMPORARY SILT FENCE 5
NTS



NOTES:
1. REMOVE VALVE BOX AND LID.
2. FILL RISER WITH PORTLAND CEMENT CONCRETE TO 12" BELOW GRADE FOR UNIMPROVED AREAS, TO THE BOTTOM OF EXISTING PAVEMENT FOR PAVED AREAS, AND TO THE SURFACE FOR CONCRETE AREAS.
3. REPAIR SURFACE IN KIND FOR PAVED OR CONCRETE AREAS. REPLACE TOPSOIL IN UNPAVED AREAS.

VALVE ABANDONMENT 6
NTS



SAN MATEO RD WATER LINE ABANDONMENT B
SCALE: 1"=40'

CONSTRUCTION NOTES:

6 CUT AND PLUG EX INACTIVE WATER LINE PER DETAIL 4/C-4 TO ABANDON (E) W IN PLACE.

7 CAP ACTIVE WATER LINE PER DETAIL 3/C-4

15 ABANDON (E) W VALVE PER DETAIL 6/C-4.

NOTE: SEE KEY MAP ON SHEET G-3 FOR LOCATION.

100% SUBMITTAL/BID SET

NOT FOR CONSTRUCTION

REGISTERED PROFESSIONAL ENGINEER — JONATHAN P. N. SUTTER — C 81606 EXP. 09/30/2021 — CIVIL — STATE OF CALIFORNIA

100% DESIGN SUBMITTAL

ekI environment & water
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DALY CITY, CALIFORNIA 94014
(650) 292-9100 • FAX (650) 552-9012

REPLACEMENT OF 8-INCH PIPELINE UNDER CREEK AT PILARCITOS AVENUE (STRAWFLOWER)
COASTSIDE COUNTY WATER DISTRICT

CONSTRUCTION DETAILS 2

	DATE	DESCRIPTION	APPRD
1	MAR 2021	100% DESIGN SUBMITTAL	JPNS

DATE: MAR 2021
SCALE: AS SHOWN
DRAWN: TCA
DESIGNED: JPNS
APPROVED: JPNS
JOB NO.: B80108.11

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SHEET NUMBER
C-4
7 OF 8

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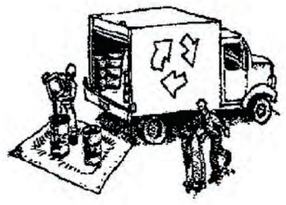
SAN MATEO COUNTYWIDE
Water Pollution Prevention Program
Clean Water. Healthy Community.

Construction Best Management Practices (BMPs)

Construction projects are required to implement the stormwater best management practices (BMP) on this page, as they apply to your project, all year long.

Materials & Waste Management



Non-Hazardous Materials

- ❑ Berm and cover stockpiles of sand, dirt or other construction material with tarps when rain is forecast or if not actively being used within 14 days.
- ❑ Use (but don't overuse) reclaimed water for dust control.

Hazardous Materials

- ❑ Label all hazardous materials and hazardous wastes (such as pesticides, paints, thinners, solvents, fuel, oil, and antifreeze) in accordance with city, county, state and federal regulations.
- ❑ Store hazardous materials and wastes in water tight containers, store in appropriate secondary containment, and cover them at the end of every work day or during wet weather or when rain is forecast.
- ❑ Follow manufacturer's application instructions for hazardous materials and be careful not to use more than necessary. Do not apply chemicals outdoors when rain is forecast within 24 hours.
- ❑ Arrange for appropriate disposal of all hazardous wastes.

Waste Management

- ❑ Cover waste disposal containers securely with tarps at the end of every work day and during wet weather.
- ❑ Check waste disposal containers frequently for leaks and to make sure they are not overfilled. Never hose down a dumpster on the construction site.
- ❑ Clean or replace portable toilets, and inspect them frequently for leaks and spills.
- ❑ Dispose of all wastes and debris properly. Recycle materials and wastes that can be recycled (such as asphalt, concrete, aggregate base materials, wood, gyp board, pipe, etc.)
- ❑ Dispose of liquid residues from paints, thinners, solvents, glues, and cleaning fluids as hazardous waste.

Construction Entrances and Perimeter

- ❑ Establish and maintain effective perimeter controls and stabilize all construction entrances and exits to sufficiently control erosion and sediment discharges from site and tracking off site.
- ❑ Sweep or vacuum any street tracking immediately and secure sediment source to prevent further tracking. Never hose down streets to clean up tracking.

Equipment Management & Spill Control

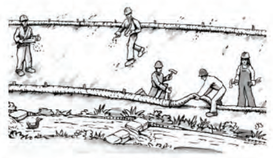
Maintenance and Parking

- ❑ Designate an area, fitted with appropriate BMPs, for vehicle and equipment parking and storage.
- ❑ Perform major maintenance, repair jobs, and vehicle and equipment washing off site.
- ❑ If refueling or vehicle maintenance must be done onsite, work in a bermed area away from storm drains and over a drip pan or drop cloths big enough to collect fluids. Recycle or dispose of fluids as hazardous waste.
- ❑ If vehicle or equipment cleaning must be done onsite, clean with water only in a bermed area that will not allow rinse water to run into gutters, streets, storm drains, or surface waters.
- ❑ Do not clean vehicle or equipment onsite using soaps, solvents, degreasers, or steam cleaning equipment.

Spill Prevention and Control

- ❑ Keep spill cleanup materials (e.g., rags, absorbents and cat litter) available at the construction site at all times.
- ❑ Inspect vehicles and equipment frequently for and repair leaks promptly. Use drip pans to catch leaks until repairs are made.
- ❑ Clean up spills or leaks immediately and dispose of cleanup materials properly.
- ❑ Do not hose down surfaces where fluids have spilled. Use dry cleanup methods (absorbent materials, cat litter, and/or rags).
- ❑ Sweep up spilled dry materials immediately. Do not try to wash them away with water, or bury them.
- ❑ Clean up spills on dirt areas by digging up and properly disposing of contaminated soil.
- ❑ Report significant spills immediately. You are required by law to report all significant releases of hazardous materials, including oil. To report a spill: 1) Dial 911 or your local emergency response number, 2) Call the Governor's Office of Emergency Services Warning Center, (800) 852-7550 (24 hours).

Earthmoving



- ❑ Schedule grading and excavation work during dry weather.
- ❑ Stabilize all denuded areas, install and maintain temporary erosion controls (such as erosion control fabric or bonded fiber matrix) until vegetation is established.
- ❑ Remove existing vegetation only when absolutely necessary, and seed or plant vegetation for erosion control on slopes or where construction is not immediately planned.
- ❑ Prevent sediment from migrating offsite and protect storm drain inlets, gutters, ditches, and drainage courses by installing and maintaining appropriate BMPs, such as fiber rolls, silt fences, sediment basins, gravel bags, berms, etc.
- ❑ Keep excavated soil on site and transfer it to dump trucks on site, not in the streets.

Contaminated Soils

- ❑ If any of the following conditions are observed, test for contamination and contact the Regional Water Quality Control Board:
  - Unusual soil conditions, discoloration, or odor.
  - Abandoned underground tanks.
  - Abandoned wells
  - Buried barrels, debris, or trash.

Paving/Asphalt Work

- ❑ Avoid paving and seal coating in wet weather or when rain is forecast, to prevent materials that have not cured from contacting stormwater runoff.
- ❑ Cover storm drain inlets and manholes when applying seal coat, tack coat, slurry seal, fog seal, etc.
- ❑ Collect and recycle or appropriately dispose of excess abrasive gravel or sand. Do NOT sweep or wash it into gutters.
- ❑ Do not use water to wash down fresh asphalt concrete pavement.

Sawcutting & Asphalt/Concrete Removal

- ❑ Protect nearby storm drain inlets when saw cutting. Use filter fabric, catch basin inlet filters, or gravel bags to keep slurry out of the storm drain system.
- ❑ Shovel, absorb, or vacuum saw-cut slurry and dispose of all waste as soon as you are finished in one location or at the end of each work day (whichever is sooner!).
- ❑ If sawcut slurry enters a catch basin, clean it up immediately.

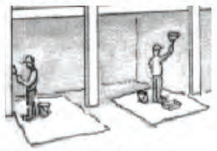
Concrete, Grout & Mortar Application

- ❑ Store concrete, grout, and mortar away from storm drains or waterways, and on pallets under cover to protect them from rain, runoff, and wind.
- ❑ Wash out concrete equipment/trucks offsite or in a designated washout area, where the water will flow into a temporary waste pit, and in a manner that will prevent leaching into the underlying soil or onto surrounding areas. Let concrete harden and dispose of as garbage.
- ❑ When washing exposed aggregate, prevent washwater from entering storm drains. Block any inlets and vacuum gutters, hose washwater onto dirt areas, or drain onto a bermed surface to be pumped and disposed of properly.

Landscaping

- ❑ Protect stockpiled landscaping materials from wind and rain by storing them under tarps all year-round.
- ❑ Stack bagged material on pallets and under cover.
- ❑ Discontinue application of any erodible landscape material within 2 days before a forecast rain event or during wet weather.

Painting & Paint Removal



Painting Cleanup and Removal

- ❑ Never clean brushes or rinse paint containers into a street, gutter, storm drain, or stream.
- ❑ For water-based paints, paint out brushes to the extent possible, and rinse into a drain that goes to the sanitary sewer. Never pour paint down a storm drain.
- ❑ For oil-based paints, paint out brushes to the extent possible and clean with thinner or solvent in a proper container. Filter and reuse thinners and solvents. Dispose of excess liquids as hazardous waste.
- ❑ Paint chips and dust from non-hazardous dry stripping and sand blasting may be swept up or collected in plastic drop cloths and disposed of as trash.
- ❑ Chemical paint stripping residue and chips and dust from marine paints or paints containing lead, mercury, or tributyltin must be disposed of as hazardous waste. Lead based paint removal requires a state-certified contractor.

Dewatering

- ❑ Discharges of groundwater or captured runoff from dewatering operations must be properly managed and disposed. When possible send dewatering discharge to landscaped area or sanitary sewer. If discharging to the sanitary sewer call your local wastewater treatment plant.
- ❑ Divert run-on water from offsite away from all disturbed areas.
- ❑ When dewatering, notify and obtain approval from the local municipality before discharging water to a street gutter or storm drain. Filtration or diversion through a basin, tank, or sediment trap may be required.
- ❑ In areas of known or suspected contamination, call your local agency to determine whether the ground water must be tested. Pumped groundwater may need to be collected and hauled off-site for treatment and proper disposal.

Storm drain polluters may be liable for fines of up to $10,000 per day!

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ekl environment & water
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REPLACEMENT OF 8-INCH PIPELINE UNDER CREEK AT PILARCITOS AVENUE (STRAWFLOWER)
COASTSIDE COUNTY WATER DISTRICT

CONSTRUCTION BEST MANAGMENT PRACTICES

	DATE	APPRVD	DESCRIPTION	REV
	MAR 2021	JPNS	100% DESIGN SUBMITTAL	

DATE: MAR 2021
SCALE: AS SHOWN
DRAWN: TCA
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REGISTERED PROFESSIONAL ENGINEER
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C 81606
EXP. 09/30/2021
CIVIL
STATE OF CALIFORNIA

100% DESIGN SUBMITTAL

SHEET NUMBER
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Path: \\ekiconsult.com\go\cad\EKI_CONSTRUCTION DWGS\B80108.01 (CIP PROJECTS)\B80108.11 Filename: B80108.11 - C-3 To C-5.dwg Plot Date: March 30, 2021 - 10:42 AM CADD User: Taylor Allen

APPENDIX F – PRELIMINARY DESIGN REPORT

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Preliminary Design Report

Coastside County Water District

Replacement of 8-Inch Pipeline Under Pilarcitos Creek at Pilarcitos Avenue (Strawflower) Project, Half Moon Bay, CA

FINAL
27 April 2020
EKI B80108.08

EKI ENVIRONMENT & WATER, INC.
www.ekiconsult.com
577 Airport Blvd, Suite 500 • Burlingame, CA 94010

Preliminary Design Report

Replacement of 8-Inch Pipeline Under Pilarcitos Creek at Pilarcitos Avenue (Strawflower) Project

Coastside County Water District

TABLE OF CONTENTS

LIST OF TABLES

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LIST OF ABBREVIATIONS

AACE	Association for the Advancement of Cost Engineering
APN	Assessor's Parcel Number
AWWA	American Water Works Association
bgs	below ground surface
CCWD or District	Coastside County Water District
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
City	City of Half Moon Bay
Creek	Pilarcitos Creek
DIP	ductile iron pipe
DR	Dimension Ratio
EA	each
EKI	EKI Environment & Water, Inc.
FPVC	fusible polyvinylchloride
ft	feet
GLA	Geo-Logic Associates
HDD	horizontal directional drilling
HDPE	high-density polyethylene
in	inch
IPS	Iron Pipe Size
IS/MND	Initial Study/Mitigated Negative Declaration
LF	linear feet
LSAA	1602 Lake and Streambed Alteration Agreement
NAVD88	North American Vertical Datum of 1988
OPC	opinion of probable construction cost
pcf	pounds per cubic feet
PDR	Preliminary Design Report
PE	Polyethylene
PG&E	Pacific Gas and Electric Company
P_{max}	maximum allowable drilling fluid pressure that the soil can withstand before hydrofracture occurs
P_{min}	minimum required pressure to return the soil cuttings back to the surface
psf	pounds per square foot
psi	pounds per square inch
R_{pmax}	radius of plastic zone
SF	square feet
SSMH	Sanitary Sewer Manhole
V_a	volume of the annulus
V_s	settlement trough volume

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1. INTRODUCTION

EKI Environment & Water, Inc. (EKI) is providing engineering design services to the Coastside County Water District (CCWD or District) for the Replacement of the 8-Inch Pipeline Under Pilarcitos Creek at Pilarcitos Avenue (Strawflower) Project (Project) located in Half Moon Bay, California (Figure 1). EKI has prepared this Preliminary Design Report (PDR) for CCWD to evaluate the feasibility of installing the new pipeline under Pilarcitos Creek via horizontal directional drilling (HDD) construction methods.

1.1. Project Background

The existing 8-inch pipeline crossing Pilarcitos Creek (creek) between the intersection of Pilarcitos Avenue and Oak Avenue south of the creek and the Strawflower Village Shopping Center north of the creek is one of only two pipelines supplying water to areas of the District south of Pilarcitos Creek, including downtown Half Moon Bay. The pipe's age, current condition, and exact location in the creek are unknown. A break occurring in the section of pipe underneath the creek bed would be difficult to detect and could cause significant water loss, serious water quality issues, and environmental damage with potential fines. The District completed an initial phase of work in June 2017 that consisted of installing approximately 400 feet of 8-inch pipe within the Strawflower access road from Highway 92 that ensures water supply to commercial customers in the event of a problem with the existing pipe under the creek.

In 2016, the District prepared a preliminary design to replace the section of pipe under the creek with a new pipeline running over the creek, attached to the existing pedestrian bridge, which is owned and maintained by the City of Half Moon Bay (City). Based on recent discussions between the District and the City, the District is concerned that it will be difficult for both parties to agree on terms for operations and maintenance of the bridge and pipeline that will be in the District's best interests. Consequently, the District decided to evaluate replacing the existing pipeline with a new pipe that crosses under the creek, installed via HDD. This trenchless construction method would also reduce impacts to the creek, which is known to be habitat for endangered steelhead. Figure 1 shows an aerial view of the project site and the preliminary crossing location.

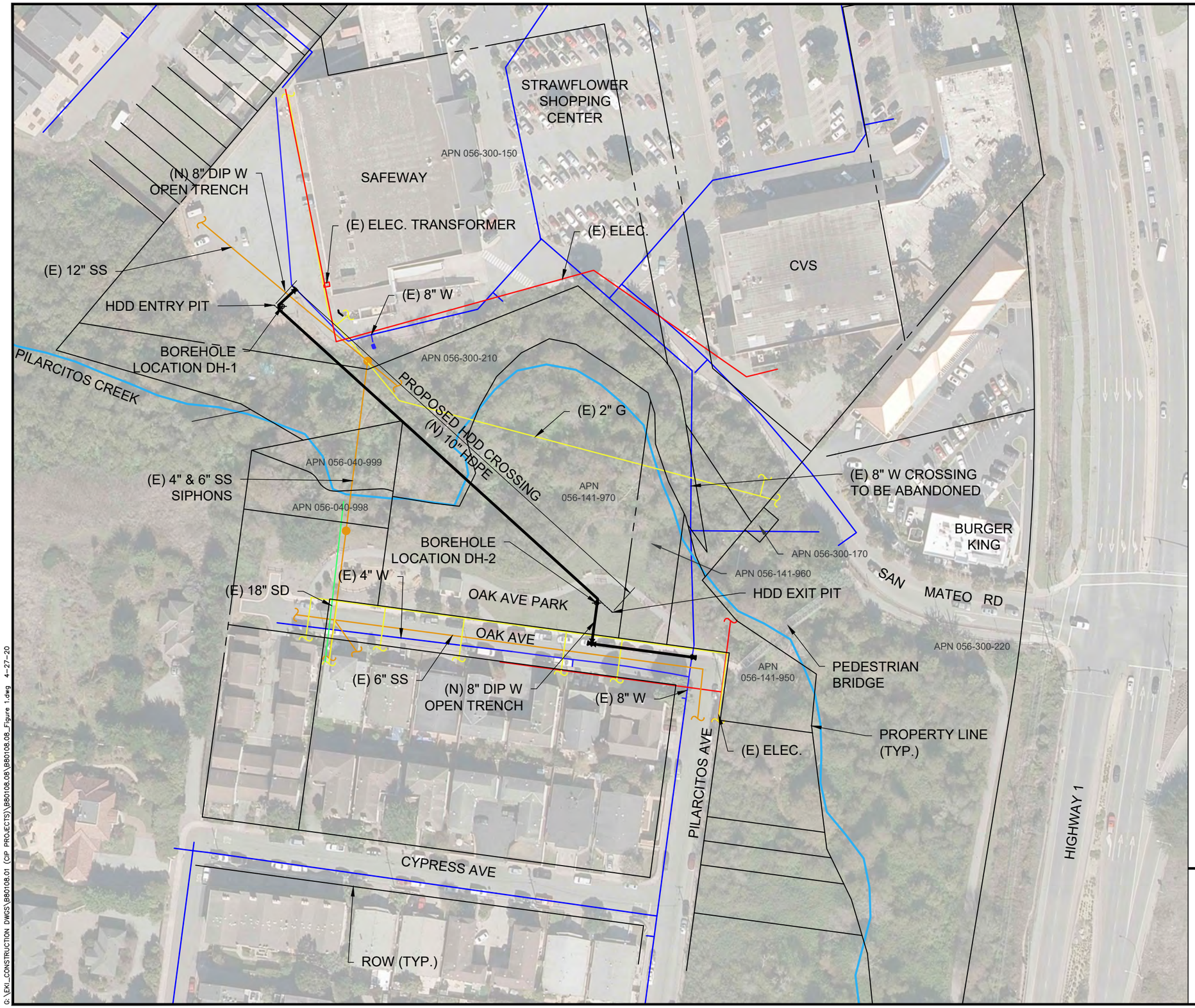
1.2. PDR Objectives and Scope

The main objectives of this PDR are to develop the preliminary design and construction approach for the new pipeline under Pilarcitos Creek. The scope of the preliminary design for the Project includes:

- Analysis of site conditions including potential utility conflicts;
- Identification of existing property boundaries and easements in the vicinity of the Project;
- Analysis of geotechnical conditions;
- Development of a preliminary pipeline alignment;

- Selection of pipe material and size;
- Calculations to confirm that the pipe can resist pullback forces during installation;
- Calculations to estimate the risk of hydrofracture;
- Calculations to estimate potential settlement at sensitive locations;
- Development of preliminary construction laydown and work areas;
- Review of permitting and easement requirements;
- Preparation of preliminary design drawings; and
- Preparation of a preliminary opinion of probable construction costs (OPC) and total project costs.

This PDR provides the basis for future detailed design and permitting efforts.



Legend:

- ROW/Property Line
- Existing Water Line
- Existing Storm Drain
- Existing Gas
- Existing Sanitary Sewer
- Existing Electrical
- Proposed Water Line
- Approximate Creek Flow Line

Abbreviations:

APN	Assessor's parcel number
(E)	Existing
ELEC.	Electrical
G	Gas
(N)	New
ROW	Right-of-Way
SD	Storm Drain
SS	Sanitary Sewer
TYP.	Typical
W	Water

Notes:

1. All locations are approximate.

N

0 100 200

(Scale in Feet)

Project Site Plan

Coastside County Water District
Half Moon Bay, CA
April 2020
EKI B80108.08

Figure 1

eki environment & water

G:\EKI_CONSTRUCTION DWGS\B80108.01 (CIP PROJECTS)\B80108.08\B80108.08_Figure 1.dwg 4-27-20

2. HORIZONTAL DIRECTIONAL DRILLING (HDD) CONSTRUCTION METHOD

HDD is a trenchless construction method whereby a pipe is installed along an arcing drill path, beginning and ending at the ground surface and typically passing under a conflicting feature. HDD can be used in most soil conditions including areas with high groundwater and is often used to cross rivers or other waterbodies. HDD installations may encounter difficulties in soils with cobbles and boulders.

HDD is typically a three-phase process. The first phase involves setting up a drill rig on one side of the crossing and drilling a pilot hole from a small entry pit in front of the rig. The entry pit contains drilling fluids. The bore begins with a vertically angled straight tangent section to quickly gain depth. Then the bore is steered in a vertical curved path into a horizontal section before following an upward curved path and straight tangent section to the exit point. Another small pit is typically excavated at the exit point to contain fluids and facilitate the reaming and pullback operations.

Figure 2 – HDD drill rig installing pilot bore [Left]; Pilot bore drill bit at exit pit [Right]

The second phase involves enlarging the pilot hole using reaming equipment to the diameter required for pullback of the pre-fabricated product pipe, typically 1.5 times the pipe diameter. The final borehole must be larger than the product pipe to reduce frictional pullback forces on the pipe by allowing for the flow of drilling fluids around the pipe. A reamer tool replaces the drill bit on the drill pipe and is rotated and pulled back by the HDD machine to expand the pilot hole. One or more reaming passes may be required depending on the product pipe size.

Figure 4 – Example reaming equipment

After reaming, the third phase involves pulling back the pre-fabricated product pipe through the enlarged hole from the exit point back to the drill rig at the entry pit. The product pipe is typically fully assembled before pullback while the bore is completed. Pullback is typically completed without interruption to reduce the risk of the bore collapsing.

Figure 3 – Example of pre-fabricated product pipe string [Left]; Pullback of product pipe [Right]

Drilling mud, typically a mixture of water and bentonite or polymer, is used to remove the soil cuttings, support the walls of the borehole, and cool the cutting tools. Mixing systems are used to mix the drilling fluid additives with water to achieve the fluid properties appropriate for the site-specific geology. Separation plants are used to remove soil cuttings and recycle drilling fluids.

Because no shafts or casing pipes are required, HDD installations often minimize impacts to nearby residents and businesses, have shorter construction durations, and are less expensive

than other types of trenchless construction. However, the surface-launched nature of HDD typically requires a longer overall crossing length and a long, narrow work area on one side of the crossing to fabricate the pipe string.

During HDD installations, there is the potential for hydrofracture – when drilling fluids inadvertently escape from the borehole and migrates to the ground surface. Hydrofracture or frac-out conditions occur when pressures in the drilling fluids build up within the borehole until they exceed the strength of the surrounding soils. Hydrofracture can lead to the discharge of drilling fluids and is a serious concern when crossing sensitive areas such as waterways.

3. SITE CONDITIONS

This section describes the site's surface conditions, existing utilities, and geotechnical conditions. These discussions are based on field visits, available utility maps, topographic and boundary surveying completed by O'Dell Engineering between September and November 2019, geotechnical investigations completed by Geo-Logic Associates (GLA) between September and November 2019, and ground-penetrating radar (GPR) services performed by Presidio Systems Inc. (PSI) in March 2020. The topographic and boundary survey base maps are included in Appendix A, and the geotechnical report is included in full in Appendix B. As-built records were not available for the existing 8-inch water main or other utilities.

3.1. Surface Conditions and Existing Utilities

The north end of the proposed creek crossing is on private property in the paved parking lot behind Safeway in the Strawflower Village shopping center. This parking lot is not heavily used due to its location behind the store. The parking lot is accessible from the east directly from San Mateo Road through the Strawflower Access Road, west of Highway 1. The asphalt concrete surface across the parking lot is essentially flat-lying. Thick overgrowth associated with Pilarcitos Creek riparian zone borders the parking lot to the south and west.

EKI researched existing utilities in the project area. Existing utilities are shown in Figure 1. The utilities north of the creek are summarized as follows:

- There are no overhead utilities in the Project area north of the creek.
- The District's existing 8-inch water main wraps around the Safeway in the parking lot to the Strawflower Access Road.
- According to maps provided by Pacific Gas and Electric Company (PG&E) and an existing easement, a 2-inch gas main and 3-inch electrical conduit run between the District's water line and the Safeway building. Per the PG&E maps, the 2-inch gas main extends parallel to the proposed crossing for approximately 150 feet, before it bends east towards Highway 1. The proposed crossing maintains a horizontal clearance from the gas main of at least 13 feet, but the exact location of the gas main must be verified by the contractor before construction.[1]
- A 12-inch sanitary sewer owned by the City runs southeast behind the Safeway in the parking lot to a manhole located in the vegetated area south of Safeway. From this manhole, parallel 6" and 4" sanitary sewer siphons run south under the creek to a manhole located along the southern bank of the creek. The project is anticipated to cross these siphons approximately 25 feet south of the manhole north of the creek. No as-built records are available for these siphons. The District contracted with PSI to

[1] Note that the location per the PG&E map is inconsistent with the location of the PG&E easement. There is additional clearance from the proposed crossing according based on the PG&E easement.

perform a GPR survey of the siphons. PSI marked the measured depths of both siphons at several locations between the upstream manhole and the creek bed. At the proposed crossing location, the upper 4" siphon is assumed to have approximately 6.25' of cover and the deeper 6" siphon is assumed to have 7.25' feet of cover based on the GPR measurements. The siphons are exposed above grade on the southern side of the creek bed, as shown on Figure 5.

Figure 5 – Exposed twin sanitary sewer siphons in Pilarcitos Creek, facing west.

The south end of the proposed crossing is in Oak Avenue Park along the north side of Oak Avenue, in the flat-lying, grassy area east of the bathroom and playground facilities. This park and the parcels in the creek riparian zone are owned by the City. There are no known underground or overhead utilities in the area of the park at the south end of the proposed crossing. A paved walking path with three small bridges runs north of the grassy area adjacent to the creek vegetation. A wire fence borders the creek vegetation to the south, north of the path. Due to the density of the brush, the creek bed has very limited accessibility from the south.

Based on the topographic survey data, the existing ground surface is approximately 42 feet on the north side of the proposed crossing and approximately elevation 44 feet on the south side of the proposed crossing.[2] The elevation of the bottom of the creek along its centerline near the proposed crossing is between approximately elevation 27 and 29 feet.

[2] All elevations are based on the North American Vertical Datum of 1988 (NAVD88).

The pipe on the south end that connects to the new crossing is proposed to be installed in an open trench south to Oak Avenue and east in the Oak Avenue right-of-way, where it will connect to the existing 8-inch water main at Pilarcitos Avenue. Oak Avenue consists of a two-lane street with parallel parking spaces along each side. The south side of the street (across from the park) is occupied by private residences. Oak Street utilities include the following:

- A 2-inch gas main runs along the northern back of walk;
- a 6-inch sanitary sewer runs along the centerline of the street;
- an existing 4-inch water main runs between the sanitary sewer and the southern edge of pavement; and
- An overhead electrical line runs behind the back of walk on the south side of the street and extends east across Pilarcitos Avenue.

Pilarcitos Avenue has been identified as a potential laydown area to pre-fabricate the new pipe before pullback. Pilarcitos Avenue is a two-lane residential street with private residences located only on the west side. The east side of the street is undeveloped and does not contain any driveways between Oak Avenue and Willow Avenue (approximately 485 feet), so it is well-suited for laying down and fabricating the pipe. An overhead electrical line runs along the east side of the street behind the back of walk.

3.2. Boundary Survey

O'Dell Engineering performed a boundary survey of the Project area to determine the property and easement ownership and location of property boundaries and easements as defined by an analysis of available record maps, title reports, supporting documents, and physical evidence. A boundary survey exhibit is included in Appendix A. A summary of the reviewed title reports is included in Table 1, below.

As listed in Table 1, an open-space conservation easement exists in Strawflower Shopping Center property (APN 056-300-150), which restricts development in the Pilarcitos Creek riparian zone and designates areas for permitted encroachments. The easement, however, explicitly exempts "the installation or repair of underground utility lines and septic systems" from the development restrictions. Therefore, this easement should not affect the Project implementation beyond what is typically required for the California Environmental Quality Act (CEQA) and California Coastal Act compliance (see Section 5).

Table 1 – Summary of Title Reports Included in Boundary Survey

Title Report No.	APN(s)	Owner	Easements
55914-1664743-19	056-141-950 056-141-960 056-141-970	City of Half Moon Bay	• Electrical transmission line, Great Western Power Company of California (location cannot be determined - not mapped) • Water main, Coastside County Water District (location cannot be determined - not mapped)
55914-1664750-19	056-300-150	HMB Musich, LLC	• Electrical and Gas Utilities, PG&E • Water main, Coastside County Water District • Sanitary sewer lines, City of Half Moon Bay • Electrical wires and pipeline, Augustino Tesi and others • Open-space conservation easement, Half Moon Bay Open Space Trust. •
55914-00007-19	056-300-210	City of Half Moon Bay	• Sanitary sewer lines, City of Half Moon Bay
55914-00010-19	115-040-998	Cypress-By-The-Sea HOA and Eight Condominium Owners (Common Area Portion) City of Half Moon Bay (Public Right-of-Way Portion)	• 15' Public Utilities Easement • Sanitary sewer lines, City of Half Moon Bay
55914-00009-19	115-040-999	Cypress-By-The-Sea HOA and Eight Condominium Owners	• 15' Public Utilities Easement • Sanitary sewer lines, City of Half Moon Bay

3.3. Geotechnical Conditions

GLA advanced two geotechnical borings, one on each side of the creek, on 27 September 2019 to evaluate the ground conditions to be expected along the replacement water pipeline alignment. The geotechnical report is included in full in Appendix A, and key surface and sub-surface conditions are summarized below.

GLA drilled and collected samples from the following exploratory borings, which are shown on the 30% Design Drawings (Appendix C):

- Boring DH-1 on the north side of the creek, in the asphalt section behind Safeway; and

- Boring DH-2 on the south side of the creek, in the grassy area of the Oak Avenue Park near the intersection of Pilarcitos Avenue and Oak Avenue.

According to available geologic maps, subsurface soils encountered on the site consist generally of alluvial fan and stream terrace deposits.

In drill hole DH-1, GLA observed very stiff to hard clay with sand to sandy clay to a depth of about 12 feet below ground surface (bgs), underlain by medium dense clayey sand to a depth of about 20 feet bgs. Below, GLA observed stiff lean clay to clayey silt to a depth of about 24½ feet bgs and medium dense to dense clayey sand to very stiff sandy lean clay to a depth of about 27½ feet bgs. Alternating layers of stiff clay and dense to very dense clayey sand and clayey sand with gravel were encountered below to the maximum explored depth of 50 feet bgs.

In drill hole DH-2, GLA observed very stiff to hard clay to a depth of about 9½ feet bgs, underlain by alternating layers of medium dense clayey sand and stiff to very stiff sandy clay and clay to a depth of about 22 feet bgs. These soils are underlain by medium dense to very dense clayey sand and clayey sand with gravel to the maximum explored depth of 50 feet bgs.

Groundwater was encountered in both DH-1 and DH-2 at a depth of approximately 18 and 18.5 ft bgs, respectively, which correspond to elevations of approximately 23.5 feet in DH-1 and 22 feet in DH-2. GLA notes that seasonal groundwater fluctuations may occur, and that groundwater is likely affected by the water level in Pilarcitos Creek.

The soil conditions are not anticipated to present significant challenges for HDD installations, as GLA did not encounter significant cobbles and boulders in either boring.

4. PRELIMINARY DESIGN

4.1. HDD Design Considerations

4.1.1. Design Standards and References

Design of pipeline crossing Pilarcitos Creek will be completed per the following standards and reference materials:

- ASTM-F1962 (2005), "Standard guide for use of maxi-horizontal directional drilling for placement of polyethylene pipe or conduit under obstacles, including river crossings", ASTM International.
- AWWA C906-15 Polyethylene (PE) Pressure Pipe and Fittings, 4 In. through 65 In. (100 mm Through 1,650 mm), For Waterworks.
- Handbook of PE Pipe, Second Edition, "Chapter 3 - Material Properties, Appendix B". Irving Tx: The Plastic Pipe Institute, 2008.
- Handbook of PE Pipe, Second Edition, "Chapter 12 - Horizontal Directional Drilling". Irving Tx: The Plastic Pipe Institute, 2008.
- Horizontal Directional Drilling (HDD) Good Practices Guidelines, Fourth Edition. North American Society for Trenchless Technology, 2017.
- Duyvestyn, Glenn (2009), "Comparison of Predicted and Observed HDD Installation Loads for Various Calculation Methods", Proceedings, NO-DIG 2009 International Conference, Toronto, ON, paper B-1-01.

4.1.2. Pipe Size and Material

The new pipe must be sized to match the 8-inch inner diameter of the existing crossing and connecting piping. The product pipe material for HDD projects must be fully restrained and be flexible or have flexible joints. The most commonly used pipe materials for HDD projects are fused high-density polyethylene (HDPE) and fusible polyvinylchloride (FPVC). Restrained joint ductile iron pipe (DIP) is another option, but DIP requires cathodic protection and is limited to 5-degree flexibility at the joint, meaning it is not as flexible as HDPE or FPVC and may not work for short crossings. HDPE is more flexible than FPVC but has a thicker wall than FPVC for the same pressure class. The two products are usually cost competitive for the same project.

For purposes of this PDR, based on direction from the District, EKI assumed the product pipe will be butt-fused HDPE. The District has successfully installed HDPE pipes as part of the El Granada Pipeline Replacement Final Phase and Highway 1 South HDD projects. EKI could evaluate other pipe materials as part of the detailed design if directed to by the District.

The pipe's working pressure, or "the maximum anticipated, sustained operating pressure applied to the pipe exclusive of transient pressures" as defined by AWWA C906, is approximately 100 pounds per square inch (psi) at the bottom of the proposed bore path based on the current system operations. Future system operational changes could potentially increase the working

pressure to approximately 150 psi.[3] Based on this working pressure, a DR 13.5 PE4000 (Pressure Class 160 psi) pipe could be installed to accommodate anticipated internal pressures. As discussed in Section 4.1.4, however, a DR 11 PE4000 (Pressure Class 200 psi) pipe is required to resist pullback forces. Because of the HDPE pipe thickness, a nominal 10-inch DR 11 HDPE Iron Pipe Size (IPS) pipe is needed to meet the required 8-inch inner diameter and pressure class requirements.

For the open trench sections of the project that will connect the 10-inch HDPE crossing to the existing pipe on each side of the creek, 8-inch Class 52 DIP will be installed per the District's standards. HDPE adapters or mechanical joint fittings with the appropriate HDPE restraints will be used to connect the two pipe materials.

4.1.3. Bore Geometry Design

EKI developed an initial bore geometry design based on the site constraints, typical HDD entry and exit angles, the allowable minimum bending radii for HDPE pipe and HDD tooling, and assumed minimum depths of cover below the existing sanitary sewer and creek bed. EKI assumed a 20-foot minimum depth of cover below the creek bed, equivalent to the depth of cover of the pipe installed as part of the District's El Granada Final Phase HDD crossing, and typical minimum clearance below creeks to minimize the chance for fracking out of drilling fluid.[4] The bore geometry provides a depth of cover of approximately 15 feet below the lower sanitary sewer siphon based on the results of the GPR survey conducted over the siphons (see Section 3.1). The preliminary design assumes that the drill rig and entry point will be located north of the creek and pipe assembly and pullback will be staged south of the creek based on staging and work area considerations discussed in Section 4.1.7. Typical entry angles range from 5 to 18 degrees, and exit angles are typically shallower to ensure that the pipe can enter without excessive bending stresses and breakover height.

As discussed below, EKI confirmed the viability of this preliminary alignment by calculating pullback loads, pipe stresses, hydrofracture risk, and settlement risk associated with the alignment. The bore plan and profile are shown on Sheet C-1 of the 30% Design Drawings (Appendix C). A schematic of the typical bore geometry parameters is shown on Figure 5, and the design parameters for the preliminary HDD crossing alignment are listed in Table 2.

[3] The pipeline would see this pressure if the pressure reducing valves that reduce pressure to downtown Half Moon Bay were fully opened.

[4] The EL Granada Final Phase HDD crossing was designed and permitted with a depth of cover below the Creek bed of 15 feet, but the contractor chose to install the pipe with 20 feet of cover.

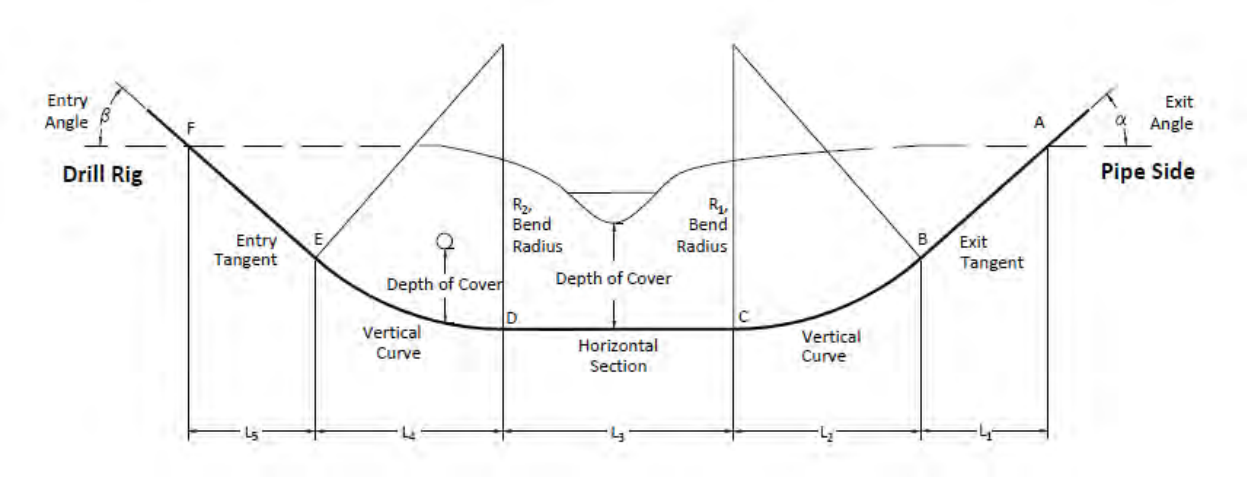


Figure 6 – Schematic of Typical Bore Geometry Design Parameters

Table 2 – Design Parameters for the Project's Preliminary HDD Crossing Alignment

Parameter[1]	Value
Entry Angle, β (degree)	15
Exit Angle, α (degree)	15
Horizontal Length of Bore Section 1 (straight tangent F to E), L_5 (feet)	59.1
Horizontal Length of Bore Section 2 (vertical curve E to D), L_4 (feet)	129.4
Horizontal Length of Bore Section 3 (horizontal section D to C), L_3 (feet)	85.9
Horizontal Length of Bore Section 4 (vertical curve C to B), L_2 (feet)	129.4
Horizontal Length of Bore Section 5 (straight tangent B to A), L_1 (feet)	65.3
Total Horizontal Length of Bore, L (feet)	469.2
Bend Radius of First Vertical Curve, R_2 (feet)	500
Bend Radius of Second Vertical Curve, R_1 (feet)	500
Depth of Cover Below Existing Sanitary Sewer Siphon (feet)	15
Depth of Cover Below Creek Bed (feet)	20
Notes: **(1) The numbering of the symbol subscripts is ordered based on the pipe pullback path (i.e., the reverse of the pilot bore path).**	

During preliminary design, EKI also evaluated an alternative alignment that ran from the Safeway parking lot to the turnout at the western end of Oak Avenue. This alignment would potentially be a shorter length and could eliminate the existing water main dead end at the end of Oak Avenue. However, based on preliminary analysis and discussions with several HDD contractors, EKI determined that the entry/exit angles and vertical curve bend radii would need to be far outside standard industry parameters to avoid staging area limitations and restricting access to residents along Oak Avenue during construction. This alternative alignment was not further evaluated.

4.1.4. Pipe Pullback Force and Stress Analysis

Pipes installed by HDD are subject to a variety of stresses during installation and long-term operation, including tensile pulling stresses, bending stresses, and external hoop or hydrostatic buckling stresses associated with earth loads and drilling fluid pressures. These loads and stresses must be evaluated to ensure that the proper pipe material and thickness are specified, and the design is adequate.

EKI calculated the anticipated stresses following the design guidelines of the Plastic Pipe Institute, ASTM F1962-05, and the HDD Good Practices Guidelines based on the preliminary bore geometry, pipe size and material (10-inch HDPE), and assumptions regarding drilling fluid properties and other contractor means and methods that include a level of conservatism relative to best practices. The following load conditions were evaluated:

1. Installation: Pullback forces on the pipe during installation using manufacturers' material properties to check tensile stress and buckling, assuming the pipe is installed empty (i.e., with no ballast) and is staged on rollers on the ground surface to reduce friction.
2. Operation: Post-installation loads from earth pressures to check pipe deflection and unconstrained buckling and hoop stresses, assuming the pipe is drained and empty for 1,000 hours (i.e., approximately 42 days).

The pullback load and stress calculations are provided in Appendix D. Based on the conditions and design guidelines described above, EKI determined that 10-inch DR 11 HDPE (PE 4000) will be able to resist the anticipated loads on the pipe according to the factors of safety prescribed in the design guidelines. Pullback stresses on the pipe could be further reduced by installing the pipe with ballast (i.e., filled with water); however, calculations indicate that ballast is not required.

If the District would like to evaluate a different pipe material such as FPVC, the analysis would need to be redone based on the other pipe's material properties.

4.1.5. Hydrofracture Analysis

As discussed in Section 2, hydrofracture is a serious concern for HDD installations that cross sensitive areas such as Pilarcitos Creek. Hydrofracture risks for the HDD alignment of this project have been evaluated, as detailed below, to ensure that the design is adequate to prevent hydrofracture.

The hydrofracture analyses were based on the procedures outlined in the HDD Good Practices Guidelines that evaluate and compare at each point along the alignment the maximum allowable drilling fluid pressure that the soil can withstand before hydrofracture occurs (P_{max}) and the minimum required pressure to return the soil cuttings to the surface (P_{min}). Locations where P_{min} exceeds the P_{max} have elevated risk of hydrofracture. The risk of hydrofracture was analyzed for drilling of the pilot bore only because this step of the HDD process is when the pressures on the borehole sidewalls are highest and the risk of hydrofracture is highest. The risk of hydrofracture

decreases dramatically for reaming passes due to the larger diameter bore resulting in lower downhole pressures and the drilling fluid being able to travel to either the exit or entry point.

The Delft Cavity Expansion Model is used to calculate P_{max} as outlined in the HDD Good Practices Guidelines and discussed in other sources (Bennett and Wallin, 2008, Staheli, et. al., 1998; Delft Geotechnics, 1997; Luger and Hergarden, 1988). The maximum allowable pressure is the safe upper bound value of allowable drilling fluid pressures for the HDD bore and is dependent on the depth of earth cover and the soil properties. The calculations assume homogeneous soil properties within each modeled soil layer and do not explicitly account for the possibility of preexisting preferential seepage paths to the ground surface. However, no potential preferential seepage paths have been identified for this project, based on the geotechnical investigation performed. The radius of plastic zone (R_{pmax}) is assumed to be 50% of the depth to the ground surface, providing a factor of safety.

The Bingham Plastic Model is used to calculate P_{min} based on the procedures outlined in the HDD Good Practices Guidelines and discussed in other sources (Ariaratnam, et al, 2003; Duyvestyn, 2009). The model assumes laminar flow conditions. The laminar flow approach generates a conservative result since the conditions will more likely be a combination of laminar and turbulent flow. The minimum required pressure is dependent on the length, depth, and diameter of the bore, as well as the drilling fluid properties. The assumptions regarding drilling fluid properties and other contractor means and methods include a level of conservatism relative to best practices. The assumed values approach the lower bounds of what could be considered good drilling practices. In this way, the resulting analysis includes an inherent qualitative factor of safety for competent HDD contractors who employ good practices.

4.1.5.1. Geotechnical Model

In addition to the bore geometry and drilling fluid properties the hydrofracture risk analysis described above is largely dependent on the geotechnical conditions (see Section 3.3). Representative average geotechnical parameter values were selected for each soil layer based on a review of the Project geotechnical report (GLA, 2019), the boring logs for DH-1 and DH-2, and an idealized soil profile provided by GLA (Figure 6).

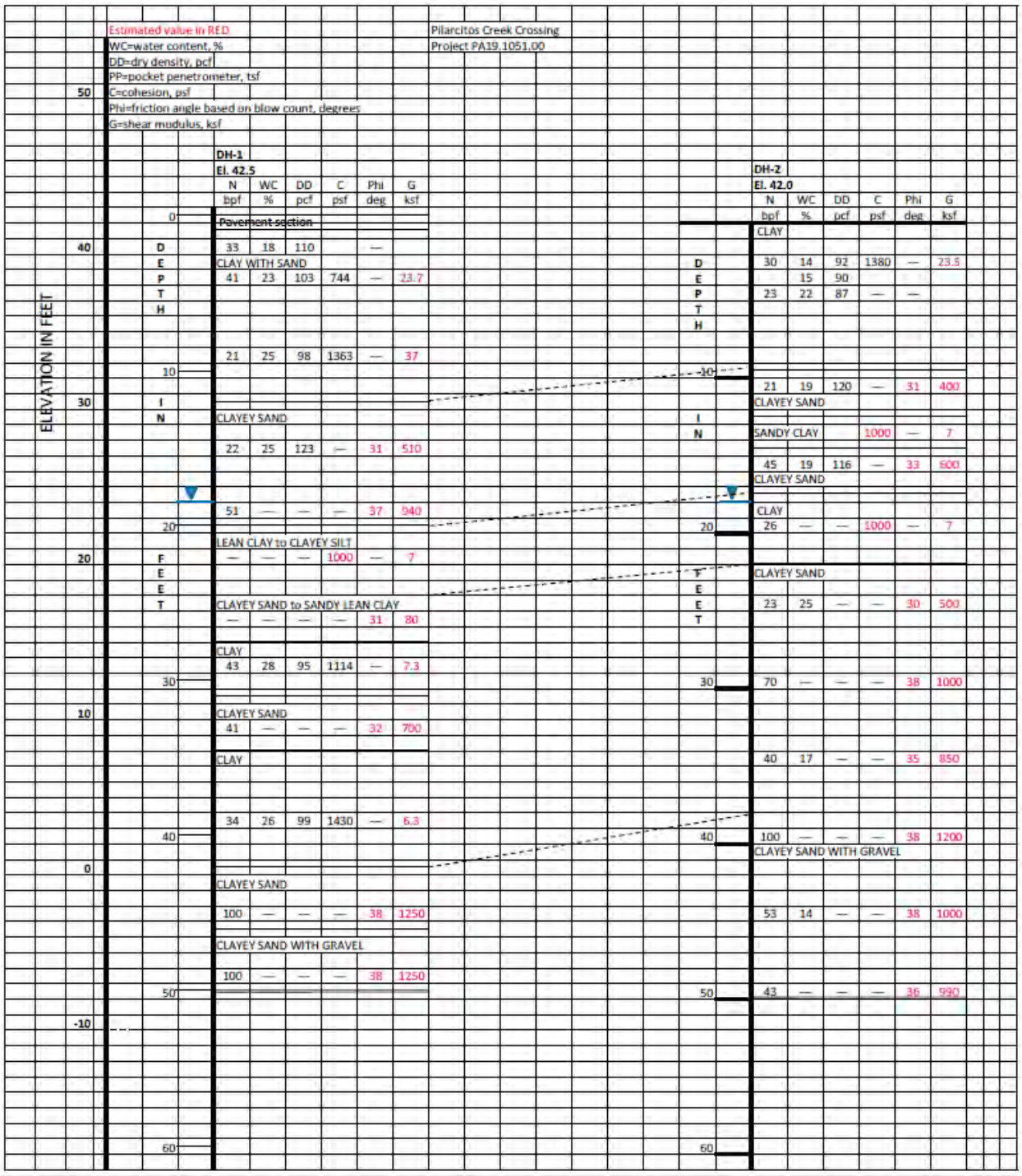


Figure 7 – Idealized Soil Profile (Courtesy of GLA)

The geotechnical model, including the parameters assumed for each soil layer, is summarized in Table 3, below. The geotechnical layer profile used in the hydrofracture analysis relative to the preliminary bore path is shown on Figure 7.

Table 3 – Assumed Geotechnical Parameters Used in the Hydrofracture Analysis

Soil Group No.	Soil Type	Elevation of Strata Top	Elevation of Stata Bottom	Unit Weight, γ (pcf)	Max Thickness (ft)	Friction Angle, φ (degree)	Shear Modulus, G (psf)	Cohesion Coeff., c (psf)
1	Clay to Clay with Sand	42	30.5	110	11	0	30,000	1,350
2	Clayey Sand	32.5	22.5	125	8	31	550,000	0
3	Clay to Clayey Silt	24.5	18	125	4.5	0	7,000	1,000
4	Clayey Sand to Clay	20	0.5	110	17.5	30	450,000	0
5	Clayey Sand with Gravel	4	-7.5	125	12	36	990,000	0

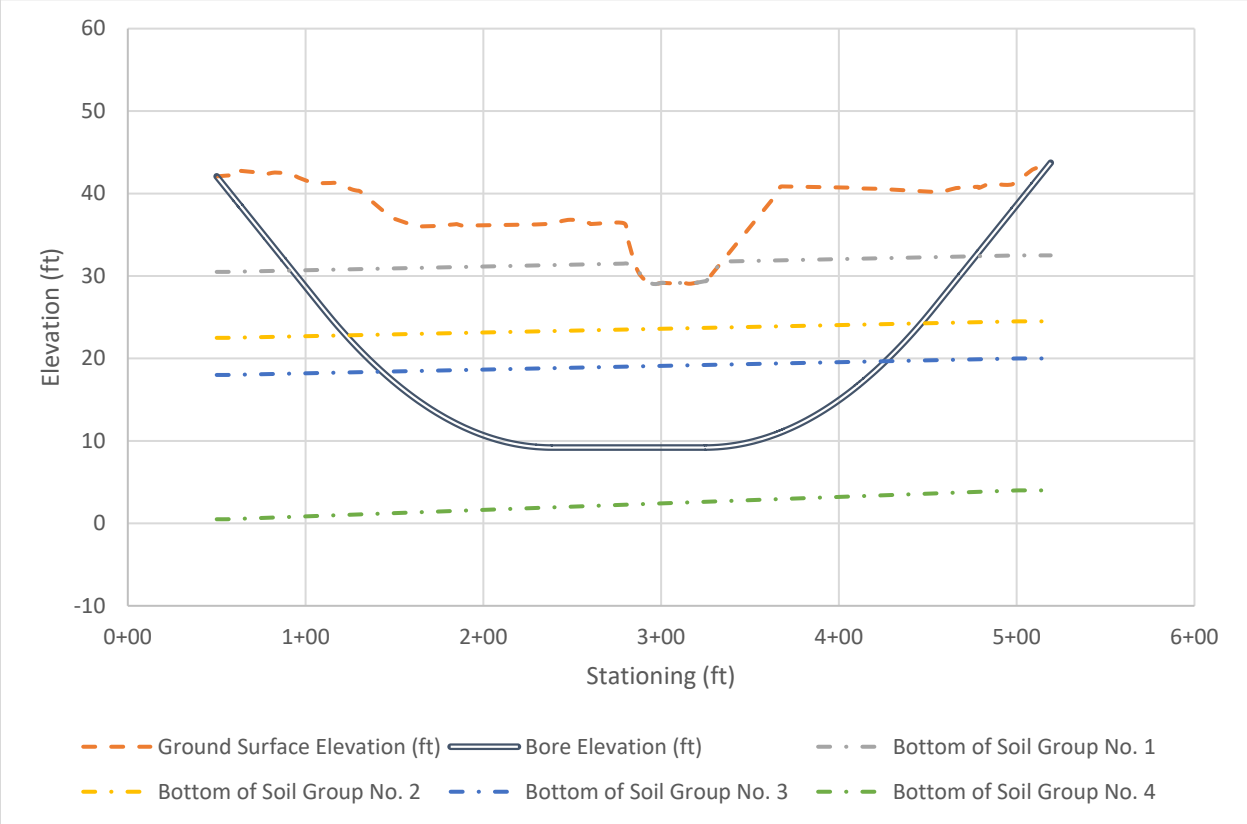


Figure 8 – Bore Geometry and Interpolated Soil Layers for HDD Crossing of Pilarcitos Creek

4.1.5.2. Results of Hydrofracture Analysis

The results of the hydrofracture evaluation for the pilot bore are calculated in Appendix E and shown on Figure 8. Figure 8 plots both the ground surface and bore profile in feet of elevation (top) on the secondary y-axis and P_{min} and P_{max} in psi (bottom) on the primary y-axis against horizontal stationing on the x-axis. The maximum allowable pressure that the soil can withstand before plastic yield (hydrofracture), P_{max}, increases with increasing depth of cover, with the lowest allowable pressures near the entry and exit points. The minimum required pressure to return the drilling fluid to the entry point, P_{min}, increases as the distance from the entry point increases and as the depth of the bore increases. As discussed above, critical locations (i.e., where the risk of hydrofracture is elevated) occur where P_{min} exceeds P_{max}.

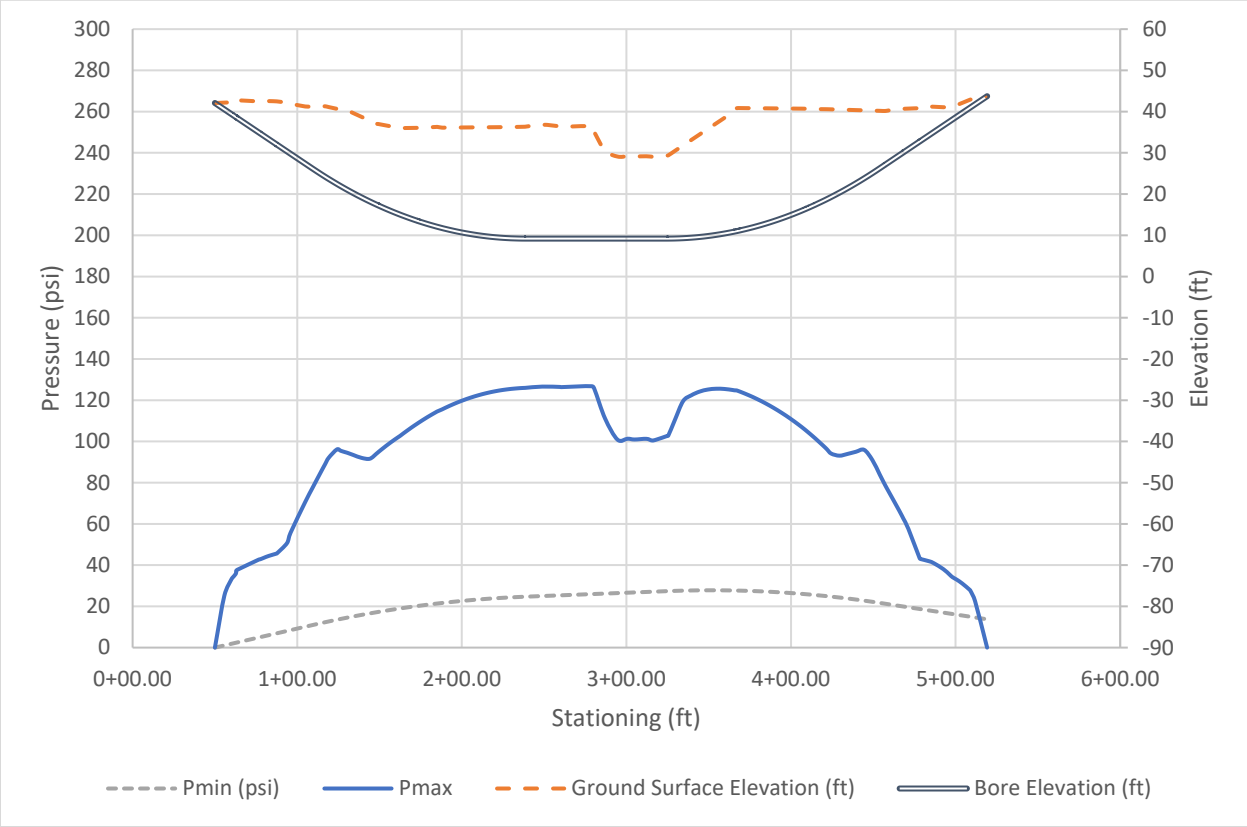


Figure 9 – Results of Hydrofracture Analysis Along HDD Alignment

The results show that the risk of hydrofracture during the pilot bore for this HDD crossing is low for most of the bore, with a slight risk of hydrofracture near the entry and exit points where the depth of cover is lowest. Hydrofracture at these locations can be controlled by entry and exit mud pits and by implementation of an emergency hydrofracture preparedness plan, which the contractor will be required to prepare before construction. More importantly, the risk of hydrofracture within the creek channel is estimated to be low due to the proposed bore geometry and the anticipated high strength nonpermeable soils.

It is important to note that the actual risk of hydrofracture during construction is dependent on contractor means and methods and actual ground conditions along and above the bore. For example, we assumed a pilot bore diameter of 8 inches and a drill pipe diameter of 4 inches. If the pilot bit used is smaller, with the same size drill pipe, the hydrofracture risk would increase. As such, the contractor will be required to submit their hydrofracture analysis that reflects their planned means and methods before installation to verify these results.

Similarly, if the soils beneath the creek channel are significantly different than those encountered in the geotechnical borings, the risk of hydrofracture could be affected. The results of these analyses apply to HDD work performed using industry good practices and within the parameters assumed in the analysis, which is based on the gathered topographical and geotechnical data.

4.1.6. Settlement Analysis

During HDD or after the pipe is installed, the collapse of the annular space between the pipe and the bore can result in settlement. Given that proposed crossing is predominately under an undeveloped area, settlement is not a major concern except where the bore crosses under the existing twin sanitary sewer siphons at approximately Station 1+74. Based on the depths of the siphons recorded as part of the GPR survey (see Section 3.1) and proposed depth of cover between the siphons and the new pipe (15 feet), EKI estimated the settlement risk associated with the HDD bore at the location of the twin sanitary sewer siphons.

The evaluation follows the approach outlined in the HDD Good Practices Guidelines. Settlement calculations are included in Appendix F. Based on the assumed depth of clearance from the sewer above the crown of the bore (not the pipe) and a settlement trough volume (V_s) of 0.5 x the volume of the annulus (V_a), the maximum settlement at the siphon is expected to be approximately 0.4 inches. This settlement trough volume assumption is likely conservative and could be as low as one third the volume of the annulus per the HDD Good Practices Guidelines (i.e., the calculation includes a factor of safety). Additionally, the design will require timely contact grouting of the annulus, which will also reduce the potential for settlement, and for the Contractor to perform pre- and post-installation CCTV inspections of the siphon. Based on these calculations and the proposed grouting and CCTV inspections, EKI finds that the risk of damaging the siphons as a result of the bore is low.

4.1.7. Work Area Considerations

As discussed in Section 2, an adequate work area for the HDD operations is a key component of an HDD design. An area of the parking lot behind Safeway was selected for the drill rig side of the installation based on the available space and to limit the disruption to residents. Enough space must be available on the rig side to accommodate the HDD rig, entry pit, mud mixing plant, and separation plant. The layout of the HDD equipment is generally flexible within a given space. As shown on Figure 10 and Sheet C-2 of the 30% Design Drawings (Appendix C), the preliminary design has delineated a work area of approximately 10,000 square feet (SF) in the parking lot, which should be enough space given the anticipated HDD rig size. This work area would all be located on private property owned by the Strawflower Village shopping center.

The exit side work area ideally has enough space to fabricate the entire pipe string prior to pull back and is wide enough to accommodate equipment for pipe support during pullback and fusion equipment. As shown on Figure 10 and Sheet C-2, the proposed exit side work area extends around the exit location in the Oak Avenue Park and south down the east side of Pilarcitos Avenue. The work area in Pilarcitos Avenue is long enough to fabricate the entire pipe length without crossing Willow Avenue. At least one lane of traffic will be maintained on the west side of Pilarcitos Avenue, and no driveways will be blocked. During pullback, the pipe string will curve around the corner of Oak Avenue and Pilarcitos Avenue to the exit point. Most of the exit side work area is in the public right-of-way. Approximately 4,000 SF is in the City-owned park.

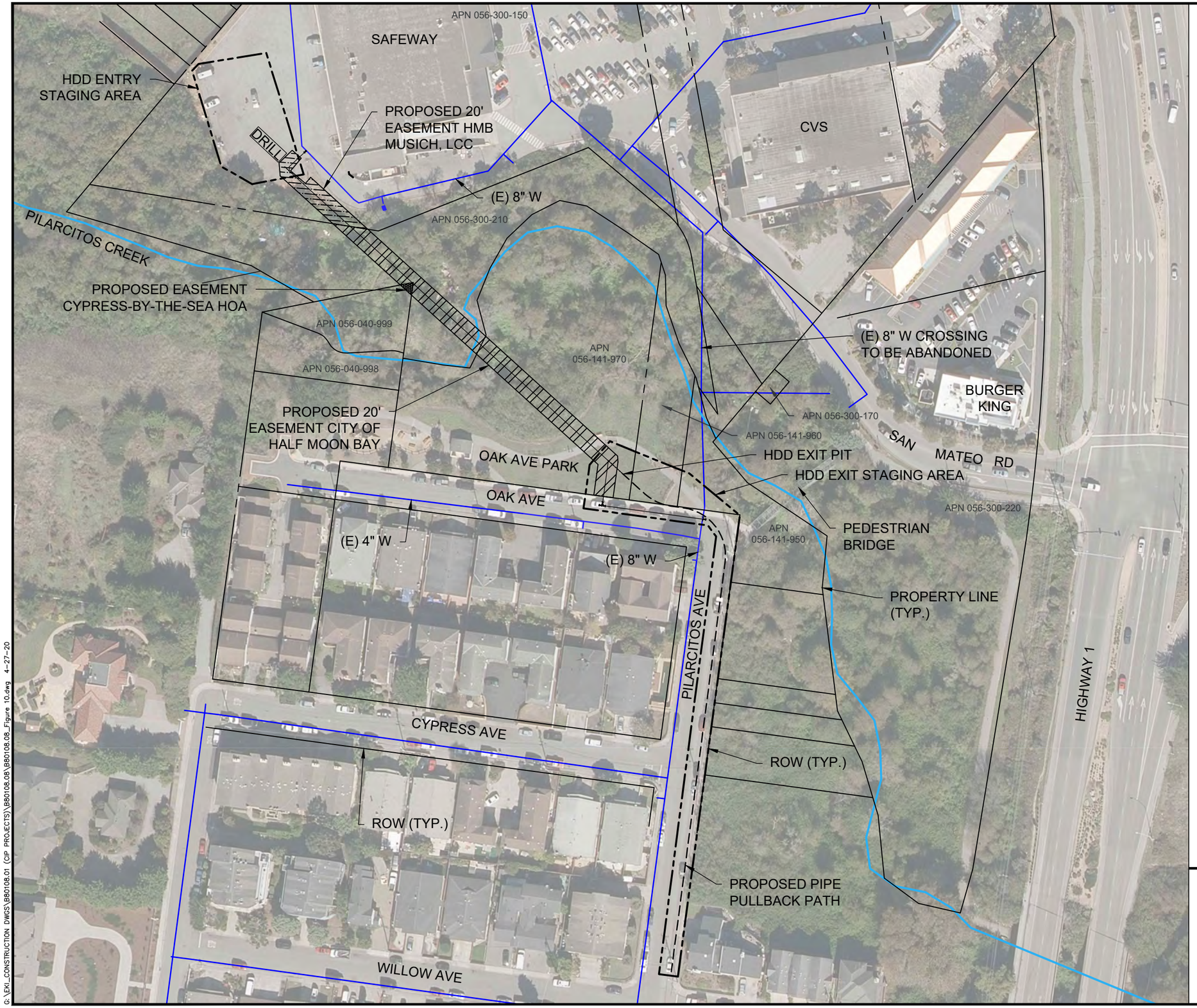
4.2. Open Trench Design Considerations

As discussed in Section 4.1.2 and shown on Sheet C-1 (Appendix C), there will be sections of DIP installed by open-trench construction on each side of the HDD crossing to connect to the existing water mains. The open trench sections will be Class 52 DIP, encased in polyethylene wrap, with a minimum 3-feet of cover per District standards. The connection north of the creek could be installed either by hot tap or cutting in a tee with a shutdown, depending on District preference. The connection south of the creek can be installed by cutting in a new tee and valve cluster without loss of service.

The PDR assumes that this Project will be completed prior to the District's Pine Willow Oak Project, which will replace the existing 4-inch water main on Oak Avenue with a new 8-inch main. Therefore, the preliminary design assumes that the exit side open trench section will extend east on Oak Avenue to the existing 8-inch crossing near Pilarcitos Avenue. The new pipe will include valves and caps on each end along Oak Avenue to facilitate extending this line as part of the Pine Willow Oak Project. All water service laterals will remain connected to the existing 4-inch water main along Oak Avenue until the Pine Willow Oak Project is completed, at which point service laterals will be reconnected to the new 8-inch water main.

4.3. Abandonment of Existing Crossing

The existing crossing will be cut and capped at each end and abandoned in place.



Legend:

- ROW /Property Line
- Existing Water Line
- Proposed Water Line
- Approximate Creek Flow Line
- Proposed Permanent Easement - HMB Musich, LCC
- Proposed Permanent Easement - City of Half Moon Bay
- Proposed Permanent Easement - Cypress-By-The-Sea HOA
- Staging Area
- DRILL — HDD Drill Rig Location

Abbreviations:

APN	Assessor's parcel number
(E)	Existing
(N)	New
ROW	Right-of-Way
TYP.	Typical
W	Water

Notes:

1. All locations are approximate.

N

0 100 200

(Scale in Feet)

Proposed Staging Areas and Easements

Coastside County Water District
Half Moon Bay, CA
April 2020
EKI B80108.08

Figure 10

G:\EKI_CONSTRUCTION_DWGS\B80108.01 (CIP PROJECTS)\B80108.08\B80108.08_Figure 10.dwg 4-27-20

5. PERMITTING, CEQA, AND EASEMENTS

The project will need to comply with the California Environmental Quality Act (CEQA) and the California Coastal Act. No additional environmental permits will be required.

Because there will technically be no impact to the creek, except in the event of hydrofracture, the California Department of Fish and Wildlife (CDFW) recommends but does not require a 1602 Lake and Streambed Alteration Agreement (LSAA) for HDD projects that cross under waterways. The District can decide based on its risk tolerance to apply or not. For the El Granada Final Phase Project completed in 2016, the District decided not to apply for an LSAA because the risk of hydrofracture was anticipated to be low and measures were put in place to mitigate the risk of hydrofracture, including specialty HDD inspection services, development of a frac-out plan, and an independent hydrofracture analysis by the contractor. Based on the results of the hydrofracture analysis discussed in Section 4.1.5, we assume that the District will follow a similar approach for this Project and not apply for an LSAA. If the District decides to apply for an LSAA, the permitting process would significantly delay the project schedule.

The District will serve as the lead agency for the CEQA compliance effort. Based on our understanding of the Project, we believe that the project will not qualify for a categorical exemption because the construction has the potential to result in environmental impacts (e.g., cultural resources and noise) that could require mitigation measures. Therefore, we assume that an Initial Study/Mitigated Negative Declaration (IS/MND) will be required and a cultural resources evaluation will be needed to support the IS/MND. After the CEQA process, the District will also need to apply for a Coastal Development Permit through the City's Planning Department. This is the same process that was required for the El Granada Final Phase Project.

The District will need to purchase permanent and temporary construction easements for this Project. Table 4 summarizes the required temporary and permanent easements by parcel. The proposed permanent easements are also shown on Figure 10.

Table 4 – Summary of Easement Requirement

APN	Property Owner	Approximate Permanent Easement Area[1] (SF)	Approximately Temporary Construction Easement Area[2] (SF)
056-300-150	HMB Musich, LLC	1,840	10,000
056-040-999	Cypress-By-The-Sea HOA and Eight Condominium Owners	85	N/A
056-300-210	City of Half Moon Bay	3,550	N/A
056-141-970, -60, -50	City of Half Moon Bay	4,270	5,700

Notes:
1. Assumes 20-foot permanent easement centered on proposed alignment.
2. Areas are inclusive of permanent easement areas.

An encroachment permit with the City will also be required for the open trench section along Oak Avenue and the work area needed to fabricate the pipe string along Pilarcitos Avenue.

6. PRELIMINARY DESIGN PLANS

The 30% plan and profile sheet and construction staging area plan for the Project are included in Appendix C.

7. OPINION OF PROBABLE CONSTRUCTION COST

A preliminary Opinion of Probable Construction Costs (OPC) was prepared for the Project as described in this PDR and is presented in Table 5, below. The OPC assumes an overall 25% contingency and a 3% escalation to the midpoint of construction in Fall 2020. The OPC has an expected accuracy range of -20% to +30%, in conformance with AACE International Class 3 estimates (AACE International, 2019).

Table 5 – Total Project Opinion of Probable Construction Cost[5]

Item	Description	Unit	Qty.	Unit Price	Item Cost
1	Horizontal Directional Drilling, Including Furnish and Install 10" DR 11 HDPE Pipe	LF	470	$ 430	$ 202,100
2	Furnish, Install and Backfill 8-inch DIP	LF	181	$ 230	$ 41,630
3	Fitting: Furnish and Install 8" Tee	EA	2	$ 1,400	$ 2,800
4	Fitting: Furnish and Install 8" 45 Degree Bend	EA	3	$ 1,100	$ 3,300
5	Fitting: Furnish and Install 8" 11.25 Degree Bend	EA	1	$ 1,000	$ 1,000
5	Fitting: Furnish and Install 8" x 6" HDPE Reducer with HDPE Adaptor	EA	2	$ 1,500	$ 3,000
6	Fitting: Furnish and Install 8" Cap	EA	2	$ 800	$ 1,600
7	Furnish and Install 8" Gate Valve	EA	4	$ 2,600	$ 10,400
8	Plug to Abandon Existing Water Main	EA	2	$ 1,500	$ 3,000
9	Connection to Existing 8" Water Main behind Safeway (Includes tapping sleeve and valve)	EA	1	$ 10,000	$ 10,000
10	Connection to Existing 8" Water Main at Oak Ave and Pilarcitos Ave (Includes Couplings)	EA	1	$ 8,000	$ 8,000
11	Final Paving of Water Main Trench	SF	800	$ 10	$ 8,000
12	Final Site Restoration	SF	300	$ 5	$ 1,500
13	Pre- and Post-Installation CCTV Inspection of Sanitary Sewer Siphons	LS	1	$ 7,500	$ 7,500
				Subtotal	**$ 303,830**
				Contingency (25%)	$ 75,958
				Total	**$ 379,788**
				Escalation (3%)	$ 11,394
				Grand Total[6]	**$ 391,182**

[5] The OPC has an expected accuracy range of -20% to +30%, in conformance with AACE International Class 3 estimates for projects at the 10%-40% design level.

[6] Grand Total is rounded to the nearest thousand dollars.

An estimated Opinion of Total Project Costs, including construction, design, construction management, permitting, and administration costs is included in Table 6, below. The Opinion of Total Project Costs does not include the cost to acquire easements.

Table 6 – Opinion of Probable Total Project Cost

Item No.	Description	Total Cost[7]	Notes
1. Engineering Design Costs			
1.1	Preliminary Design (Including Surveying and Geotechnical Investigations)	$ 105,000	Existing Preliminary Design Fee
1.2	Detailed Design	$ 35,000	Estimated Future Detailed Design Fee
	Engineering Design Subtotal	**$ 140,000**	
2. Construction Costs			
2.1	Construction Costs	$ 304,000	See Table 5
2.2	25% Construction Contingency	$ 76,000	See Table 5
2.3	3% Escalation	$ 11,000	See Table 5
	Construction Subtotal	**$ 391,000**	
3. Administration Costs			
3.1	Construction Management and Engineering Services During Construction	$ 49,000	Assumed 12.5% of Total Construction Costs
3.2	Permitting Fees	$ 5,000	Estimated
3.3	Easement Costs	Not Included	
3.4	CEQA Compliance	$ 41,000	Based on WRA Proposal dated 22 January 2020
3.5	15% Administrative Contingency	$ 15,000	15% of Total Administrative Costs
	Administration Subtotal	**$ 109,000**	
	GRAND TOTAL	**$ 639,000**	

[7] All costs rounded to the nearest thousand dollars.

8. REFERENCES

AACE International Recommended Practice No. 18R-97, Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries, Rev. March 6, 2019

Ariaratnam, Samuel T., Stauber, Richard M., Bell, Jason, Harbin, Bruce C., Canon, Frank, (2003). "Predicting and Controlling Hydraulic Fracturing During Horizontal Directional Drilling" American Society of Civil Engineers Conference Proceeding Paper, New Pipeline Technologies, Security, and Safety.

ASTM F1962-05, "Standard guide for use of maxi-horizontal directional drilling for placement of polyethylene pipe or conduit under obstacles, including river crossings", ASTM International.

AWWA C906-15, "Polyethylene (PE) Pressure Pipe and Fittings, 4 In. through 65 In. (100 mm Through 1,650 mm), For Waterworks." American Water Works Association.

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Geo-Logic Associates (2019), "Geotechnical Investigation, Proposed Pilarcitos Creek Crossing, San Mateo Road & Oak Avenue, Half Moon Bay, California", November 20, 2019.

Luger, H.J., and Hergarden H.J.A.M., (1988). "Directional Drilling in Soft Soil: Influence of Mud Pressures", International Society of Trenchless Technology, NoDig Conference.

PPI, (2008). Handbook of PE Pipe, Second Edition, "Chapter 3 - Material Properties, Appendix B" and "Chapter 12 - Horizontal Directional Drilling". Irving Tx: The Plastic Pipe Institute (PPI), 2008.

Staheli, K., Bennett, R.D., O'Donnell, H., Hurley, T., (1998). "Installation of Pipelines Beneath Levees Using Horizontal Directional Drilling", U.S. Army Corps of Engineers Technical Report, CPAR-GL-98-1.

Appendix A

Topographic and Boundary Survey Base Maps

January 2020

O'Dell Engineering

ABBREVIATIONS

AC	ASPHALT CONCRETE
BOW	BACK OF WALK
CONC	CONCRETE
CR	CROWN
EP	EDGE OF PAVEMENT
FD	FOUND
FL	FLOWLINE
FM	METAL/WIRE FENCE
FW	WOOD FENCE
HP	HINGE POINT
LIP	LIP OF GUTTER
SMH	SEWER MANHOLE
SWL	STRIPING-SOLID WHITE LINE
TC	TOP OF CURB
TOE	TOE OF SLOPE
TRANS	TRANSFORMER
USA	UNDERGROUND SERVICE ALERT
WMA	MASONRY WALL
WV	WATER VALVE

LEGEND

BACKFLOW PREVENTER
BENCHMARK
BOLLARD
CLEAN OUT
CONTOUR (45)
CURB
DOOR
DRAIN INLET
ELECTRIC METER/BOX
ELECTROLIER
ELEVATION W/ DESCRIPTION (40.77 EP)
NATURAL GROUND SHOT (42.9)
FIRE HYDRANT
FOUND MONUMENT
FOUND MONUMENT IN WELL
GUY WIRE
IRRIGATION VALVE (IRR)
SANITARY SEWER MANHOLE (S)
SIGN
STREET/SITE LIGHT PULL BOX (S)
TREES
UNDERGROUND UTILITY LINE LABEL AND DIRECTION (6" SS)
UTILITY POLE
WALL
WATER METER/BOX (W)
WATER VALVE (WV)

BOUNDARY LINES
- ADJACENT PROPERTY LINE
- CENTER LINE
- EASEMENT LINE
- PROPERTY LINE
- RIGHT OF WAY LINE

HARDSCAPE LINES
- BACK OF CURB
- FACE OF CURB
- FLOWLINE
- LIP OF GUTTER
- SIDEWALK/CONCRETE

MISCELLANEOUS LINES
- BUILDING OUTLINE
- FENCE, CHAIN-LINK
- FENCE, METAL (HEIGHT NOTED)
- FENCE, WOOD (HEIGHT NOTED)

UTILITY LINES
- GAS LINE
- OVERHEAD
- SANITARY SEWER
- WATER

SURVEY CONTROL:

HORIZONTAL DATUM
NORTH AMERICAN DATUM OF 1983 (NAD83).

COORDINATE SYSTEM
COORDINATES SHOWN HEREON ARE GROUND AND BASED ON THE CALIFORNIA COORDINATE SYSTEM OF 1983 (CCS83), ZONE III.

VERTICAL DATUM
NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

PROJECT BENCHMARK (NGS BM DESINATION F 1239)
BENCH MARK DISK SET IN A RETAINING WALL OR CONCRETE LEDGE OF CULVERT HEADWALL AT THE SOUTHEAST CORNER OF THE JUNCTION OF STATE HIGHWAY 1 AND KELLY AVENUE, IN THE TOP AND 0.9 FOOT NORTH OF THE SOUTH END OF THE EAST CONCRETE HEADWALL OF 24 INCH PIPE CULVERT ⌀, 31 FEET EAST FO THE CENTER LINE OF THE AVENUE, 7 FEET NORTH OF STEEL LIGHT POLE "D 3036" AND ABOUT 1/2 FOOT LOWER THEN THE HIGHWAY.
ELEVATION = 62.78' (NAVD 88)

LOCAL BM
PT 15951 BEING MAG NAIL SET IN AC APPROXIMATELY 237' NORTHWEST ALONG OAK AVENUE FROM THE INTERSECTION WITH PILARCITOS AVENUE, 18' NORTH OF A POWER POLE.
ELEVATION = 40.53' (NAVD 88)

BASIS OF BEARINGS
THE BEARING BETWEEN POINTS 15951 TO 15953 BEING N 21° 49'10" W.

CONTROL POINT TABLE			
POINT NUMBER	NORTHING	EASTING	DESCRIPTION
15951	1998663.97	5999899.24	SET GCP
15952	1998971.41	5999787.74	SET GCP
15953	1999195.00	5999686.63	SET GCP
15954	1999107.95	5999613.01	SET GCP

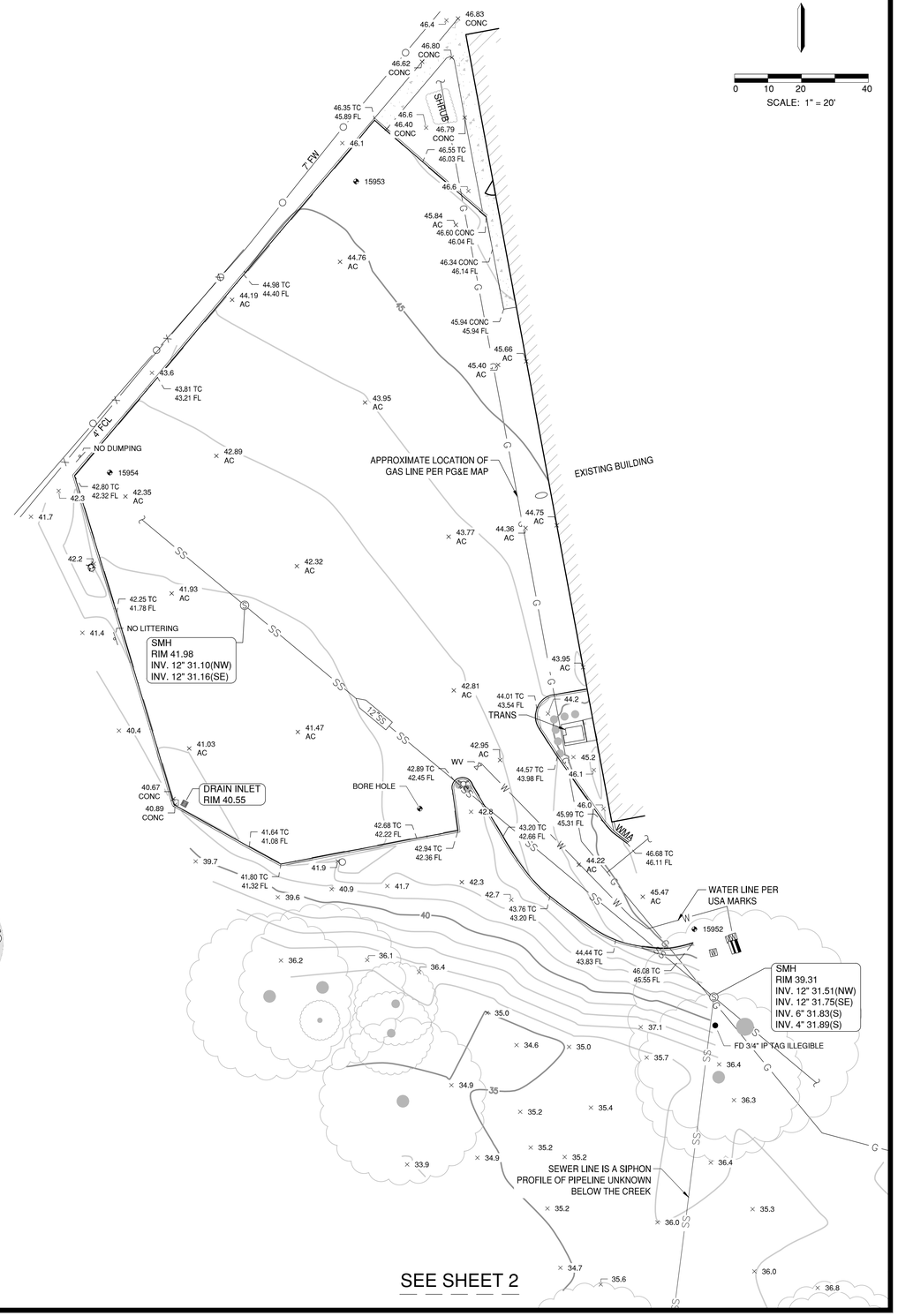
UTILITY NOTES:

PHYSICAL ITEMS SHOWN ON THIS SURVEY ARE LIMITED TO THOSE SURFACE ITEMS VISIBLE AS OF THE DATE OF THIS SURVEY. SUBSURFACE OBJECTS, IF ANY, ARE NOT SHOWN, WITH THE EXCEPTION OF UNDERGROUND UTILITY LINES. NO WARRANTY IS IMPLIED AS TO THE EXACT LOCATION OF THESE LINES OR AS TO THE COMPLETENESS OF THE UTILITY INFORMATION SHOWN HEREON. SAID SUBSURFACE OBJECTS MAY INCLUDE, BUT ARE NOT LIMITED TO, CONCRETE FOOTINGS, SLABS, SHORING, STRUCTURAL PILES, UTILITY VAULTS, PIPING, UNDERGROUND TANKS, ADDITIONAL UNDERGROUND UTILITY LINES, TELECOMMUNICATION LINES, FIBER OPTIC LINES AND ANY OTHER SUBSURFACE STRUCTURES OR FACILITIES NOT REVEALED BY A SURFACE INSPECTION ON THE DATE THAT THE FIELD WORK FOR THIS SURVEY WAS PERFORMED. FIELD WORK WAS PERFORMED ON SEPTEMBER 26 AND OCTOBER 10, 2019.

CALL BEFORE YOU DIG U S A 800-227-2600

MONUMENTATION NOTE:

PRIOR TO COMMENCEMENT OF ANY CONSTRUCTION ON THIS SITE, IT IS ADVISED THAT ALL INVOLVED PARTIES REVIEW SECTION 8771 AND SECTION 8725 OF THE BUSINESS AND PROFESSIONS CODE AND SECTION 605 OF THE CALIFORNIA PENAL CODE TO ENSURE THAT MONUMENT CONSERVATION HAS BEEN PROPERLY ADDRESSED.



PLAN REVISIONS

NO.	DATE	REVISION

O'DELL ENGINEERING
1165 Scenic Drive, Suite A
Modesto, CA 95350
odellengineering.com

TOPOGRAPHIC SURVEY
PILARCITOS CREEK
PHASE OF PROJECT
HALF MOON BAY, CALIFORNIA

TOPO

APPROVED:

DESIGNED:	
DRAWN:	BG
CHECKED:	SP
SCALE:	1"=20'
DATE:	10/31/2019
JOB NO.:	37011
FILE NO.:	37011-TP.DWG

SHEET NO.
1
OF
2

Y:\Jobs\37011 CCWD Pilarcitos Creek Survey\Survey\MapDwg\37011-TP.dwg style 12:59:15 11/15/2019

SEE SHEET 1

WATER LINE PER USA MARKS

SMH
RIM 39.31
INV. 12" 31.51(NW)
INV. 12" 31.75(SE)
INV. 6" 31.83(S)
INV. 4" 31.89(S)

FD 3/4" IP TAG ILLEGIBLE

SEWER LINE IS A SIPHON
PROFILE OF PIPELINE UNKNOWN
BELOW THE CREEK

APPROXIMATE LOCATION OF
GAS LINE PER PG&E MAP

SMH
RIM 38.20
INV. 8" 32.98(S)
INV. 8" 32.49(N)
INV. 6" 32.99(N)

DENSE BRUSH
AREA NOT ACCESSIBLE FOR
SURVEY PURPOSES
ELEVATION DERIVED FROM
COUNTY DIGITAL ELEVATION MODEL

CATCH BASIN
TC 39.23 @CL
INV. 18" 31.32(N)
INV. 18" 31.36(S)

SMH
RIM 39.87
INV. 8" 34.65(N)
INV. 6" 34.71(E)
INV. 6" 34.67(SE)
INV. 8" 34.48(S)
INV. 8" 34.65(W)

SMH
RIM 40.14

FD 3/4" IP NOT TAG

FD 3/4IP RCE 20707

SMH
RIM 41.12
INV. 6" 36.00(E)
INV. 6" 35.98(W)

BORE LOCATION

NOT THROUGH STREET

SIGN

WATER LINE PER
USA MARKS

OAK AVENUE

BRIDGE

BENCH
CONC

SMH
RIM 46.94
INV. 6" 39.74(S)
INV. 6" 39.60(W)

FD 3/4" IP IN MON WELL RE 8724

PILARCITOS AVENUE

N

0 10 20 40
SCALE: 1" = 20'

PLAN REVISIONS

NO.	DATE	REVISION

O'DELL ENGINEERING
1165 Scenic Drive, Suite A
Modesto, CA 95350
odellengineering.com

TOPOGRAPHIC SURVEY
PILARCITOS CREEK
HALF MOON BAY, CALIFORNIA

TOPO

APPROVED:

DESIGNED:	
DRAWN:	BG
CHECKED:	SP
SCALE:	1"=20'
DATE:	10/31/2019
JOB NO.:	37011
FILE NO.:	37011-TP.DWG

SHEET NO.
2
OF
2

Y:\Jobs\37011 CCWD Pilarcitos Creek Survey\Survey\Map\Dwg\37011-TP.dwg style 13:00:15 11/15/2019

EXHIBIT 1
BOUNDARY SURVEY WITH UTILITY EASEMENTS
BY O'DELL ENGINEERING
SENT ON 1/27/2020

SCALE: 1"=30'

EASEMENT NOTES:

1. EASEMENT FOR ELECTRIC TRANSMISSION LINE RECORDED 2/6/1936 BK 677 PG 177 - NOT LOCATABLE FROM RECORD.
2. EASEMENT FOR WATER MAIN RECORDED 8/1/1963 BK 4515 PG 643 - NOT LOCATABLE FROM RECORD.
3. EASEMENT FOR CREEK SIDE TRAIL RECORDED 3/18/1992 INST NO. 92038184 - NOT LOCATABLE FROM RECORD.

SFN
PER 9LL56

1052
SFN /1.5FT TO NORTH

SFN
PER 9LL56

9059
SFN

FD 3/4" IP TAG ILLEG
ACCEPTED AS 0.58' OFFSET MONUMENT
TO CORNER PER 9LL56

1053
49.161
FD 3/4" IP TAG NOT LEGIBLE

LOT 3

LOT A

LOT 4

10' GAS AND ELECT. EASEMENT
PER INST NO 84124834
REC NOV. 20, 1984

PARCEL3 PER TITLE REPORT
ORDER NO. 55914-1664750-19
NON-EXCLUSIVE EASEMENT FOR
ACCESS AND UTILITY PURPOSES
OVER LOT 2

LOT 1

LOT 2

LLA RECORDED 5/11/1984
DOC NO 84051211
AS SHOWN ON ROS BK 9 LLS PG 56

FD 6x6 CONC MON WITH SCRIBED X
DOES NOT FIT RECORD MEASUREMENTS
PER 59PM12

FD 3/4" IP TAG ILLEG
HELD FOR LINE
DISTANCE BETWEEN MONUMENTS
IS 1.60' LESS THEN RECORD
PER 59PM12

1050
52.894
FD 3/4" IP TAG NOT LEGIBLE

1054
53.399
FD CONC MON W/ SCRIBED X

10' GAS AND ELECT. EASEMENT
PER INST NO 85016036
REC FEB. 20, 1985

LOT 5
PARCEL 1 PER TITLE REPORT
ORDER NO. 55914-1664750-19

MATCH LINE SEE PAGE 2

MATCH LINE SEE PAGE 1

EXHIBIT 1
BOUNDARY SURVEY WITH UTILITY EASEMENTS
BY O'DELL ENGINEERING
SENT ON 1/27/2020

0 15 30 60 90
SCALE: 1"=30'

EASEMENT NOTES:

1. EASEMENT FOR ELECTRIC TRANSMISSION LINE RECORDED 2/6/1936 BK 677 PG 177 - NOT LOCATABLE FROM RECORD.
2. EASEMENT FOR WATER MAIN RECORDED 8/1/1963 BK 4515 PG 643 - NOT LOCATABLE FROM RECORD.
3. EASEMENT FOR CREEK SIDE TRAIL RECORDED 3/18/1992 INST NO. 92038184 - NOT LOCATABLE FROM RECORD.

20' WATER EASEMENT
PER INST NO 84051212
REC MAY 11, 1984

APN 056-300-150

20' WATER EASEMENT
PER INST NO 84051212
REC MAY 11, 1984

10' SEWER EASEMENT
PER BK 4902 PG 57
REC FEB 25, 1965

FD X
NOT ACCEPTED AS CORNER PER 9LL56

1023
12.038
FD 3/4 IP

SFN
PER 9LL56

10' SEWER EASEMENT
PER BK 4902 PG 57
REC FEB 25, 1965

10' GAS AND ELECT. EASEMENT
PER INST NO 85004530
REC JAN. 15, 1985

10' GAS AND ELECT. EASEMENT
PER INST NO 84124834
REC NOV. 20, 1984

2' EASEMENT ELECT. WIRES
AND PIPELINES
PER INST NO 92574
BK 41 PG 200
REC JUNE 1, 1922

10' GAS AND ELECT. EASEMENT
PER INST NO 84124834
REC NOV. 20, 1984

10' GAS AND ELECT. EASEMENT
PER INST NO 85016036
REC FEB. 20, 1985

1022
37.286
FD 3/4" IP TAG ILLEGIBLE

FD 3/4" IP TAG ILLEG
"RC? ???8"
ACCEPTED AS CORNER PER 9LL56

APN 056-300-210

NORTH LINE PARCEL 1
PER TITLE REPORT
DESCRIBED AS CL OF
PILARCITOS CREEK
1989 CL OF PILARCITOS CREEK

SFN
PER 9LL56

9034
SFN /4FT TO WEST

SFN
PER 9LL56

1025
SFN

EASEMENT FOR PARKING
PER INST NO 84051215
REC MAY 11, 1984

PARCEL 1

10' SEWER EASEMENT
PER BK 4902 PG 57
REC FEB 25, 1965

APN 056-040-999

15' PUE
PER 90RSM09

EAST LINE LOT 28
ASSESSOR LINE

PARCEL APPEARS TO BE
EXCLUDED FROM ALL TITLE REPORT
DESCRIPTIONS. THIS PARCEL IS NOT
ACCOUNTED FOR WITH AN APN NUMBER

1055
49.705
FD 3/4 IP IN WALK NO TAG

FD 3/4" IP TAG ILLEG
"LS 357?"
ACCEPTED AS CORNER PER 59PM12

1054
37.697
FD 3/4" IP TAG NOT LEGIBLE

FD 3/4" IP NO TAG FLUSH IN CONC
PER 59PM12

PARCEL 2

COMMON AREA LOT 2
BK 90 RSM PG 09

1000
×29.947
FD 3/4 BD

APN 056-040-998

APN 056-141-970

EAST LINE LOT 26
ASSESSOR LINE

NOT ACCESSIBLE
PER 9LL56

APN 056-300-170

PARCEL 1 PER TITLE REPORT
ORDER NO. 55914-1664743-19

PARCEL2 PER TITLE REPORT
ORDER NO. 55914-1664750-19
50' NON-EXCLUSIVE EASEMENT FOR
INGRESS AND EGRESS

BK 90 RSM PG 09
PUBLIC RIGHT OF WAY

FD 3/4" IP TAG "RCE 20707"
PER CR#1497A
ACCEPTED AS CORNER PER 90-MAPS-09

9029
SFN

SFN
PER 90-MAPS-09

1028
39.917
FD 3/4IP RCE 20707

APN 056-141-960

APN 056-300-220

BK 59 PM PG 12

3030
39.694
8FT TO PL FD 3/4" IP NO TAG

5FT TO PL FD 3/4" IP NO TAG

2030
× 39.767
5FT TO PL FD 3/4" IP NO TAG

FD 3/4" IP NO TAG
ACCEPTED AS CORNER PER 90-MAPS-09

OAK AVE

APN 056-141-950

SNF
PER 59PM12

9056
SFN

1031
× 45.978
FD 3/4" IP IN MON WELL CASE

PARCEL 2 PER TITLE REPORT
ORDER NO. 55914-1664743-19

APPROXIMATE LOCATION
16' SANITARY SEWER EASEMENT
DOC NO 4275-AT
PER 59-PM-012
EXACT LOCATION COULD NOT BE
DETERMINED FROM RECORD

FD 3/4" IP "RE 8724"
IN WELL
PER 90-MAPS-09

SNF
PER 59PM12

9057
SFN

BK 3 RSM PG 94
PILARCITOS PARK

PILARCITOS AVE

EXHIBIT 2
BOUNDARY SURVEY WITH CONSERVATION EASEMENT

BY O'DELL ENGINEERING
SENT ON 1/27/2020

0 15 30 60 90
SCALE: 1"=30'

N

EASEMENT NOTES:

1. EASEMENT FOR ELECTRIC TRANSMISSION LINE RECORDED 2/6/1936 BK 677 PG 177 - NOT LOCATABLE FROM RECORD.
2. EASEMENT FOR WATER MAIN RECORDED 8/1/1963 BK 4515 PG 643 - NOT LOCATABLE FROM RECORD.
3. EASEMENT FOR CREEK SIDE TRAIL RECORDED 3/18/1992 INST NO. 92038184 - NOT LOCATABLE FROM RECORD.

11
12
13

LOT 5
PARCEL 1 PER TITLE REPORT
ORDER NO. 55914-1664750-19

APN 056-300-150

FD X
NOT ACCEPTED AS CORNER PER 9LL56

AREA OF PERMITTED ENCROACHMENTS PER INST 84051210 ESTABLISHED BY RUBBER SHEET FROM EXHIBIT

RIPARIAN CORRIDOR BUILDING SETBACK PER INST 84051210 ESTABLISHED BY RUBBER SHEET FROM EXHIBIT

RIPARIAN LINE PER INST 84051210 ESTABLISHED BY RUBBER SHEET FROM EXHIBIT

NOT ACCESSIBLE DUE TO VEGETATION PER 9LL56

1023
× 27.266
FD 3/4" IP TAG ILLEGIBLE

FD 3/4" IP TAG ILLEG
"RC? ???8"
ACCEPTED AS CORNER PER 9LL56

APN 056-300-210

1023
× 28.238
SFN

SFN
PER 9LL56

9024
SFN

SFN
PER 9LL56

NORTH LINE PARCEL 1
PER TITLE REPORT
DESCRIBED AS CL OF
PILARCITOS CREEK
1989 CL OF PILARCITOS CREEK

SFN
PER 9LL56

9024
SFN
1.70 WEST

PARCEL 1

EASEMENT FOR PARKING
PER INST NO 84051215
REC MAY 11, 1984

SFN
PER 9LL56

9025
SFN

FD 3/4" IP TAG ILLEG
"LS 35??"
ACCEPTED AS CORNER PER 59PM12

1035
43.697
FD 3/4" IP TAG NOT LEGIBLE

APN 056-040-999

EAST LINE LOT 28
ASSESSOR LINE

AREA OF PERMITTED ENCROACHMENTS PER INST 84051210 ESTABLISHED BY RUBBER SHEET FROM EXHIBIT

PARCEL 2

COMMON AREA LOT 2
BK 90 RSM PG 09

1001
× 29.347
FD 3" BD

PARCEL APPEARS TO BE EXCLUDED FROM ALL TITLE REPORT DESCRIPTIONS. THIS PARCEL IS NOT ACCOUNTED FOR WITH AN APN NUMBER

RIPARIAN CORRIDOR BUILDING SETBACK PER INST 84051210 ESTABLISHED BY RUBBER SHEET FROM EXHIBIT

APN 056-040-998

APN 056-141-970

EAST LINE LOT 26
ASSESSOR LINE

NOT ACCESSIBLE
PER 9LL56

RIPARIAN LINE PER INST 84051210 ESTABLISHED BY RUBBER SHEET FROM EXHIBIT

APN 056-300-170

PARCEL 1 PER TITLE REPORT
ORDER NO. 55914-1664743-19

BK 90 RSM PG 09
PUBLIC RIGHT OF WAY

FD 3/4" IP TAG "RCE 20707"
PER CR#1497A
ACCEPTED AS CORNER PER 90-MAPS-09

APN 056-141-960

9029
SFN

SFN
PER 90-MAPS-09

1028
39.917
FD 3/4IP RCE 20707

APN 056-300-220

BK 59 PM PG 12

PARCEL2 PER TITLE REPORT
ORDER NO. 55914-1664750-19
50' NON-EXCLUSIVE EASEMENT FOR INGRESS AND EGRESS

3030
39.694
8FT TO PL FD 3/4" IP NO TAG

2030
× 39.767
5FT TO PL FD 3/4" IP NO TAG

5FT TO PL FD 3/4" IP NO TAG

FD 3/4" IP NO TAG
ACCEPTED AS CORNER PER 90-MAPS-09

OAK AVE

APN 056-141-950

Appendix B

Geotechnical Investigation Proposed Pilarcitos Creek Crossing

November 20, 2019

Geo-Logic Associates

GEOTECHNICAL INVESTIGATION
PROPOSED PILARCITOS CREEK CROSSING

SAN MATEO ROAD & OAK AVENUE
HALF MOON BAY, CALIFORNIA

NOVEMBER 20, 2019
PROJECT PA18.1051.00

SUBMITTED TO:

EKI Environmental & Water
577 Airport Boulevard, Suite 500
Burlingame, CA 94010

PREPARED BY:

Geo-Logic Associates
16055 Caputo Drive, Suite D
Morgan Hill, California 95037
(408) 778-2818

GEOTECHNICAL INVESTIGATION
PROPOSED PILARCITOS CREEK CROSSING
SAN MATEO ROAD & OAK AVENUE
HALF MOON BAY, CALIFORNIA

Table of Contents

1 INTRODUCTION

This report presents the results of our geotechnical investigation for the proposed pipeline crossing at Pilarcitos Creek, west of Highway 1 in Half Moon Bay, California. The proposed pipeline crossing alignment is referenced as the "property" in this report. The approximate location of the project site is shown on the Vicinity Map included on Figure 1. A layout of the existing site conditions, the proposed pipeline crossing alignment, and locations of our drill holes are shown on Figure 1.

This report presents our findings, conclusions, and geotechnical recommendations for design and construction of the project. These findings, conclusions, and recommendations are based on information collected and reviewed during this investigation. The conclusions and recommendations in this report should not be extrapolated to other areas or used for other projects without our review.

1.1 Project Description

The project will involve construction of a new 8-inch inside diameter (I.D.) high-density polyethylene (HDPE) pipe section across Pilarcitos Creek, between the Strawflower Shopping Center in the north and the Oak Avenue Park in the south, a distance of approximately 450 feet, using horizontal directional drilling (HDD) construction method. The HDD pit at the north end of the crossing will be located in the parking lot behind the Safeway store in the Strawflower Shopping Center. The HDD pit at the south end of the crossing will be located in the Oak Avenue Park on the north side of Oak Avenue. The pits will be about 4 to 5 feet in depth. The proposed invert of the HDPE pipe will be at least 15 feet below the creek bed.

The above project descriptions are based on information provided to us. If the actual project differs from those described above, Geo-Logic Associates (GLA) should be contacted to review our findings, conclusions, and recommendations and present any necessary modifications to address the different project development schemes.

1.2 Information Provided

For this investigation, we were provided with the following.

- A drawing titled 'Conceptual Horizontal Directional Drilling (HDD) Alignment, Construction Staging Areas, and Easements," dated September 2019, prepared by EKI Environment and Water.

- Topographic Survey, Pilarcitos Creek, Sheets 1 and 2, dated October 31, 2019, prepared by O'Dell Engineering.

- Project information.

1.3 Purpose and Scope of Services

The purpose of this geotechnical investigation was to explore subsurface conditions in the area of the proposed HDD pits and to provide geotechnical recommendations for design and construction of the proposed improvements. The following work was performed.

1. Performed a site reconnaissance to observe site surface conditions and to mark locations of our exploration.

2. Reviewed available geologic and geotechnical information pertinent to the site.

3. Obtained a drilling permit from San Mateo County Environmental Health Services (SMCEHS).

4. Notified Underground Service Alert (USA) for underground utility clearance.

5. Coordinated our drilling with our client.

6. Subcontracted with a private underground locator to check the proposed exploration locations for presence of underground utilities.

7. Explored subsurface conditions by means of two exploratory drill holes to a depth of approximately 50 feet below ground surface.

8. Performed laboratory tests on selected soil samples from the drill holes to measure pertinent engineering properties of the samples.

9. Performed engineering analysis on the field and laboratory data.

10. Prepared this geotechnical investigation report.

2 SITE INVESTIGATION

This investigation consists of a site reconnaissance and a subsurface exploration program. The site reconnaissance was to observe existing site surface conditions. The subsurface exploration program was to explore earth conditions at the project site. The observed surface and subsurface site conditions are discussed in Section 3 of this report.

2.1 Subsurface Exploration

Our subsurface exploration program involved drilling of two exploratory drill holes (DH-1 and DH-2) on September 27, 2019. The exploratory drill holes were located in the field by referencing to existing site features and pacing; therefore, their locations are approximate. The approximate locations of the drill holes are shown on Figure 1.

The two exploratory drill holes were advanced using a truck-mounted Mobile B-53R drilling rig equipped with 8-inch diameter hollow-stem augers. The depth of exploration was approximately 50 feet below ground surface (bgs). In the field, our personnel visually classified the materials encountered and maintained a log of each drill hole.

Soil samples were obtained using a 2-inch outside diameter (O.D.; 1.4-inch inside diameter, I.D.) split-barrel sampler (also called a Standard Penetration Test sampler) and a 3-inch O.D. (2½-inch I.D.) split-barrel sampler. Soil samples were obtained by driving the sampler up to 18 inches into the earth material using a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler was recorded for each 6-inch penetration interval. The number of blows required to drive the sampler the last 12 inches, or the penetration interval indicated on the log when harder material was encountered, is shown as blows per foot (blow count) on the drill hole logs.

In the field, our personnel visually classified the materials encountered and maintained a log of each drill hole. Visual classification of soils encountered in our drill holes was made in general accordance with the Unified Soil Classification System (ASTM D 2487 and D 2488). The results of our laboratory tests were used to refine our field classifications. Two Keys to Soil Classification, one for fine grained soils and one for coarse grained soils, are included in Appendix A, together with the logs of the drill holes.

2.2 Laboratory Testing

Geotechnical laboratory testing was conducted on selected soil samples collected from our drill holes. These tests included moisture content, dry density, grain size analysis, and percentage passing a No. 200 sieve. The laboratory test results are presented on the drill hole logs at the corresponding sample depths. The results of the grain size analysis tests are presented in Appendix B.

3 FINDINGS

3.1 Surface Conditions

The proposed pipeline crossing is approximately 450 feet in length and extends between the parking lot behind the Safeway store in the Strawflower Shopping Center on the north side of Pilarcitos Creek and the Oak Avenue Park on the south side of Pilarcitos Creek.

The parking lot behind Safeway is off of San Mateo Road and west of Highway 1. The asphalt concrete surface across the parking lot is essentially flat-lying.

Oak Avenue Park is in a residential neighborhood with generally flat-lying topography. The park has grass fields, a restroom building, asphalt concrete trails, picnic and play areas, and several pedestrian wood bridges.

Based on the topographic survey maps provided to us, the existing ground surface is at approximately elevation 42½ feet in the area of our DH-1 and approximately elevation 40 feet in the area of our DH-2. The flowline in the creek is between roughly elevation 27 and 29 feet. Both creek banks are covered with heavy vegetation.

3.2 Subsurface Conditions

Subsurface soils encountered in our two drill holes consist generally of alluvial fan and stream terrace deposits according to the geologic map "Offshore and Onshore Geology and Geomorphology, Offshore of Half Moon Bay Map Area, California," prepared by United States Geological Survey, 2014.

In drill hole DH-1, the subsurface soils consist of very stiff to hard clay with sand to sandy clay to a depth of about 12 feet below ground surface (bgs), underlain by medium dense clayey sand to a depth of about 20 feet bgs. This sand is underlain by stiff lean clay to clayey silt to a depth of about 24½ feet bgs, and medium dense to dense clayey sand to very stiff sandy lean clay to a depth of about 27½ feet bgs. Below, alternating layers of stiff clay and dense to very dense clayey sand and clayey sand with gravel were encountered to the maximum explored depth of 50 feet bgs.

In drill hole DH-2, the subsurface soils consist of very stiff to hard clay to a depth of about 9½ feet bgs, underlain by alternating layers of medium dense clayey sand and stiff to very stiff sandy clay and clay to a depth of about 22 feet bgs. These soils are underlain by medium dense to very dense clayey sand and clayey sand with gravel to the maximum explored depth of 50 feet bgs.

3.3 Groundwater

Groundwater was encountered at a depth of approximately 18½ and 18 feet bgs in our drill

holes DH-1 and DH-2, respectively. These depths correspond to an elevation of roughly 24 feet in DH-1 and roughly 22 feet in DH-2.

It should be noted that fluctuations in the groundwater level may occur due to seasonal variations in rainfall and temperature, pumping from wells, regional groundwater recharge program, irrigation, or other factors that were not evident at the time of our investigation. We expect groundwater and water level in Pilarcitos Creek is closely related.

3.4 Variations in Subsurface Conditions

Our interpretations of soil and groundwater conditions, as described in this report, are based on information obtained from drill holes and laboratory testing for this study. Our conclusions and recommendations are based on these interpretations. Please realize the site has undergone different phases of development and grading. Therefore, it is likely that undisclosed variations in subsurface conditions exist at the site, such as old foundations, abandoned utilities, and localized areas of deep and loose fill.

Careful observations should be made during construction to verify our interpretations. Should variations from our interpretations be found, we should be notified to evaluate whether any revisions should be made to our recommendations.

4 SEISMIC CONSIDERATIONS

4.1 Earthquake Faulting

The Greater San Francisco Bay Area is seismically dominated by the active San Andreas Fault system, the tectonic boundary between the northward moving Pacific Plate (west of the fault) and the North American Plate (east of the fault). This movement is distributed across a complex system of generally strike-slip, right-lateral, and subparallel faults.

Potential sources of significant earthquake ground shaking at the site include several active and potentially active faults in the San Francisco Bay area, as well as faults farther afield. The faults were first compiled on the State's Fault Activity Map (Jennings, 1974; Jennings and Bryant, 2010). This map has now been integrated into the US Geological Survey's Quaternary Fault and Fold Database and made available as a .kmz "drape" over Google Earth terrain files.

The distance to a seismic source (fault) is defined by the NGA relationships as the closest distance to the seismogenic zone, be it in the subsurface or at the surface; distances may therefore differ from distances measured on the ground surface. The distances shown on the table below are for reference only, as they are horizontal distances from the site to the surface trace of the seismic source, and not necessarily the closest distance to a (dipping) seismogenic zone. These distances were measured using the US Geological Survey's Quaternary Fault and Fold Database, with major faults listed in approximate order of distance from the site; not all sources are listed in the summary table below.

Fault Name	Approximate Distance	Orientation from Site
San Gregorio	3 km	Southwest
Pilarcitos	6¼ km	Northeast
San Andreas	8¾ km	Northeast
Sierra	12½ km	Northeast
Pulgas	17½ km	Southeast
Stanford	17 km	Southeast

4.2 Ground Accelerations

According to the California Building Code (CBC) and American Society of Civil Engineers (ASCE) Standard 7, the spectral response acceleration at any period can be taken as the lesser of the spectral response accelerations from the probabilistic and deterministic ground motion approaches. The U.S. Seismic Design Maps tool available at the Structural Engineers Association of California (SEAOC) website was used for this purpose to retrieve seismic design parameter values for design of buildings at the subject site. Two levels of ground motions are considered in the Application: Risk-targeted Maximum Considered Earthquake (MCER) and Design Earthquake (DE), with both probabilistic and deterministic values defined in terms of maximum-direction rather than geometric-mean, horizontal spectral acceleration. The

probabilistic MCER spectral response accelerations are represented by a 5 percent damped acceleration response spectrum having a 1 percent probability of collapse within a 50-year period and in the direction of the maximum horizontal response. The probabilistic Design Earthquake (DE) Sa value at any period can be taken as two-thirds of the MCER Sa value at the same period.

Using the Seismic Design Maps application at the SEAOC website, a site Class D, and the latitude and longitude of the site (latitude 37.46886º N, longitude -121.43653º W), the calculated geometric mean peak ground accelerations adjusted for site class effects (PGAM) for the MCEG (Geometric Mean Maximum Considered Earthquake) are presented below.

2016 California Building Code, ASCE 7-10	2019 California Building Code, ASCE 7-16
0.792g	0.859g

4.3 Seismicity

The Working Group on California Earthquake Probabilities' (WGCEP) estimates of the probabilities of major earthquakes are now in their sixth iteration, with the greatest changes in approach being the inclusion of multifold rupture scenarios, in the progressive consideration of more potential seismic sources, the possibility of earthquakes on unrecognized faults, and the inclusion of the notion of fault "readiness". Current estimates (WGCEP, 2014) for the San Francisco region indicate a 72% probability of a large (magnitude 6.7 or greater) earthquake in the San Francisco Bay area as a whole over the 30-year period beginning in 2014; this overall probability is greater than the previous (WGCEP, 2007) probability of 63%, due mainly to the inclusion of multi-fault rupture scenarios. The estimate for the Calaveras fault alone is 14.4% (revised up from the 7% presented by WGCEP, 2007); for the (northern) San Andreas fault alone, 27.4% (revised upward from the WGCEP (2007) value of 21%); and for the Hayward fault, 45.3% (revised upward from the WGCEP (2007) value of 31%).

4.4 Liquefaction

Soil liquefaction is a phenomenon in which saturated granular soils, and certain fine-grained soils, lose their strength due to the build-up of excess pore water pressure during cyclic loading, such as that induced by earthquakes. Soils most susceptible to liquefaction are saturated, clean, loose, fine-grained sands and non-plastic silts. Certain gravels, plastic silts, and clays are also susceptible to liquefaction. The primary factors affecting soil liquefaction include: 1) intensity and duration of seismic shaking; 2) soil type; 3) relative density of granular soils; 4) moisture content and plasticity of fine-grained soils; 5) overburden pressure; and 6) depth to ground water.

Our review of the Association of Bay Area Governments Resilience Program Liquefaction Hazard Zone map for the project site (Association of Bay Area Governments Resilience Program, August 7, 2018) indicates the site is in a liquefaction hazard zone.

A liquefaction analysis was performed based on subsurface information from our drill holes DH-1 and DH-2, a peak ground acceleration of 0.79g, earthquake magnitude of 8.1, and groundwater level of 18 feet bgs. The results of our analysis suggest the sand layer in DH-1 between depths of roughly 31 and 34½ feet and the sand layer in DH-2 between depths of roughly 22 and 27 feet are susceptible to liquefaction. The estimated liquefaction-induced settlement is 1 inch or less.

5 CONCLUSIONS AND DISCUSSION

Based on our geotechnical evaluation, it is our opinion the project site may be considered for construction of the proposed pipeline crossing provided our geotechnical opinions, conclusions, and recommendations are incorporated in the design and construction of the project. Our opinions, conclusions, and recommendations are based on our understanding of the proposed development, data review, properties of soils encountered in our subsurface exploration, laboratory test results, and engineering analyses. Geotechnical considerations for this project are discussed below.

5.1 Ground Rupture

The project site is not located in an Alquist-Priolo Earthquake Fault Zone. Because no active or potentially active faults are known to cross the site, the risk of fault rupture through the project site is low.

5.2 Seismic Shaking

The project site is located in an area of high seismicity. Based on general knowledge of the site seismicity, it should be anticipated that, during their useful life, the proposed improvements will be subject to at least one severe earthquake (magnitude 7 to 8+) that could cause considerable ground shaking at the site. It is also anticipated that the site will periodically experience small to moderate magnitude earthquakes.

5.3 Groundwater and Granular Soils

Groundwater was encountered at a depth of about 18 feet bgs at the time of our subsurface exploration. Groundwater is expected to be affected by water level in the adjacent Pilarcitos Creek and will fluctuate between the wet winter months and the dry summer months. As currently planned, the proposed HDD pits will be about 4 to 5 feet in depth; therefore, they should be above the groundwater level. However, the pipeline will be installed below groundwater level and through sandy soils. The HDD designer and contractor should consider the presence of groundwater and granular soils in their design and construction.

6 GEOTECHNICAL RECOMMENDATIONS

6.1 Site Preparation, Clearing and Stripping

Prior to grading, construction areas should be cleared of obstructions and deleterious materials which may include designated structures, utility lines, trees and roots, and other below grade obstacles encountered during the clearing operation. Depressions, excavations, and holes that extend below the planned finish grades should be cleaned and backfilled with engineered fill compacted to the requirements given under the section of "Engineered Fill Placement and Compaction."

6.2 Excavation, Temporary Construction Slopes, and Shoring

Temporary excavations will be required for the HDD pits (about 4 to 5 feet in depth). The upper soils at both HDD pit locations are generally clays. The walls of excavations in clayey soils and less than 5 feet in height should be able to stand near vertical with proper bracing, provided proper moisture content in the soils is maintained. Excavations and temporary construction slopes should be constructed in accordance with the current OSHA safety standards and local jurisdiction. The stability and safety of excavations, braced or unbraced, is the responsibility of the contractor. Care should be exercised when excavating in the proximity of existing structures and improvements.

Contractors are responsible for the design, installation, maintenance, and removal of all required temporary shoring and bracing systems. The presence of existing structures, pavements, and underground utilities must be incorporated in the design of the shoring and bracing systems.

Trench excavations adjacent to existing or proposed foundations should be above an imaginary plane having an inclination of 1½:1 (horizontal to vertical) extending down from the bottom edge of the foundations.

6.3 Horizontal Directional Drilling (HDD)

HDD is typically a three-phase process. The first phase involves drilling a pilot hole from the entry pit to the receiving pit along the proposed pipeline alignment. The second phase involves enlarging the pilot hole with reaming equipment to the desired diameter, typically 1.5 times the pipe diameter. A reamer tool replaces the drill bit and is pulled back by the HDD machine to expand the pilot hole. The third phase involves pulling back the product pipe attached to the reamer through the enlarged hole from the receiving pit to the entry pit. Drilling mud, typically a mixture of water and bentonite or polymer, is used to remove the soil cuttings and support the walls of the hole. HDD is applicable to most soil conditions but will experience difficulty where cobbles and boulders are encountered.

Subsurface soils encountered in our drill holes consist of stiff to hard clays and medium dense

to very dense sands. Groundwater was encountered at about 18 feet bgs.

In general, clay soils have a low potential for caving but sand and gravel soils have a higher potential for caving. The sandy soils may vary from a few feet to over 8 feet thick, and contain gravel. In DH-1, the upper approximately 12 feet consist of clay, underlain by layers of clays and clayey sands. In DH-2, the upper approximately 10 feet consist of clay, underlain by layers of clays and clayey sands to about 22 feet and clayey sands from 22 to 50 feet. Significant cobbles and boulders were not encountered in our borings. The contractor should, however, be aware that high blow counts were measured in the deeper sandy soils.

Drilling fluid should be used during the drilling and back-reaming operations. The viscosity and density of the drilling fluid should be appropriate for the different soil conditions anticipated at the project site, including clayey sands and clays as encountered in our drill holes.

6.4 Backfilling of the Entry and Receiving Pits

The entry and receiving pits may be backfilled with the excavated on-site soil or approved import soil. After removal of equipment, the bottom of the pits should be compacted to at least 90 percent relative compaction at a soil water content of 2 to 4 percent above the laboratory optimum value. After the subgrade has been compacted, the pits may be raised to finish grade with placement of engineered fill. In the parking lot area, the pavement section should be replaced in kind.

Moisture conditioning of subgrade soils for compaction should consist of adding water if the soils are too dry and allowing the soils to dry if the soils are too wet. Where encountered, unstable, wet or soft soil will require processing before compaction can be achieved. If construction schedule does not allow for air-drying, other means such as lime or cement treatment of the soil or excavation and replacement with suitable material may be considered. Geotextile fabrics may also be used to help stabilize the subgrade. The method to be used should be determined at the time of construction based on the actual site conditions. We recommend obtaining unit prices for subgrade stabilization during the construction bid process.

If import fill is necessary to backfill the pits, the fill material should not contain rocks or lumps larger than 3 inches in greatest dimension, should not contain more than 15 percent of the material larger than 1½ inches, and should contain at least 20 percent passing the No. 200 sieve. In addition to these requirements, import fill should have a low expansion potential as indicated by Plasticity Index of 15 or less (per ASTM D4318), or Expansion Index of less than 20 (per ASTM D4829).

All fills should be approved by the project Geotechnical Engineer prior to delivery to the site. At least 5 working days prior to importing to the site, a representative sample of the proposed import fill should be delivered to our laboratory for evaluation. Import fills should be tested and approved for residential use per the California Department of Toxic Substances Control (DTSC) guidelines.

Engineered fill should be placed in horizontal lifts each not exceeding 8 inches in thickness, moisture conditioned to the required moisture content, and mechanically compacted to the recommendations below. Relative compaction or compaction is defined as the in-place dry density of the compacted soil divided by the laboratory maximum dry density as determined by ASTM Test Method D1557, latest edition, expressed as a percentage. Moisture conditioning of soils should consist of adding water to the soils if they are too dry and allowing the soils to dry if they are too wet.

Engineered fills consisting of on-site or imported soils should be compacted to at least 90 percent relative compaction with moisture content between about 1 and 3 percent above the laboratory optimum value. In pavement areas, the upper 8 inches of soil below the pavement section should be compacted to a minimum of 95 percent relative compaction. Aggregate base in vehicle pavement areas should be compacted at slightly above the optimum moisture content to a minimum of 95 percent relative compaction.

6.5 Wet Weather Construction

If construction is to be performed during the winter rainy months, the owner and contractors should be fully aware of the potential impact of wet weather. Rainstorms can cause delay to construction and damage to previously completed work by saturating compacted pads or subgrades, or flooding excavations.

Earthwork during rainy months will require extra effort and caution by the contractors. The contractors are responsible for protecting their work to avoid damage by rainwater. Standing pools of water should be pumped out immediately. Construction during wet weather conditions should be addressed in the project construction bid documents and/or specifications. We recommend the contractors submit a wet weather construction plan outlining procedures they will employ to protect their work and to minimize damage to their work by rainstorms.

7 PLAN REVIEW, EARTHWORK AND FOUNDATION OBSERVATION

Post-report geotechnical services by Geo-Logic Associates (GLA), typically consisting of pre-construction design consultations and reviews and construction observation and testing services, are necessary for GLA to confirm the recommendations contained in this report. This report is based on limited sampling and investigation, and by those constraints may not have discovered local anomalies or other varying conditions that may exist on the project site. Therefore, this report is only preliminary until GLA can confirm that actual conditions in the ground conform to those anticipated in the report. Accordingly, as an integral part of this report, GLA recommends post-report, construction related geotechnical services to assist the project team during design and construction of the project. GLA requires that it perform these services if it is to remain as the project Geotechnical Engineer-of-record.

During design, GLA can provide consultation and supplemental recommendations to assist the project team in design and value engineering, especially if the project design has been modified after completion of our report. It is impossible for us to anticipate every design scenario and use of construction materials during preparation of our report. Therefore, retaining GLA to provide post-report consultation will help address design changes, answer questions and evaluate alternatives proposed by the project designers and contractors.

Prior to issuing project plans and specifications for construction bidding purposes, GLA should review the grading, drainage and foundation plans and the project specifications to determine if the intent of our recommendations has been incorporated in these documents. We have found that such a review process will help reduce the likelihood of misinterpretation of our recommendations which may cause construction delay and additional cost.

Construction phase services can include, among other things, the observation and testing during site clearing, stripping, excavation, mass grading, subgrade preparation, fill placement and compaction, backfill compaction, foundation construction and pavement construction activities.

Geo-Logic Associates would be pleased to provide cost proposals for follow-up geotechnical services. Post-report geotechnical services may include additional field and laboratory services.

8 LIMITATIONS

In preparing the findings and professional opinions presented in this report, Geo-Logic Associates (GLA) has endeavored to follow generally accepted principles and practices of the engineering geologic and geotechnical engineering professions in the area and at the time our services were performed. No warranty, express or implied, is provided.

The conclusions and recommendations contained in this report are based, in part, on information that has been provided to us. In the event that the general development concept or general location and type of structures are modified, our conclusions and recommendations shall not be considered valid unless we are retained to review such changes and to make any necessary additions or changes to our recommendations. To remain as the project Geotechnical Engineer-of-record, GLA must be retained to provide geotechnical services as discussed under the Post-report Geotechnical Services section of this report.

Subsurface exploration is necessarily confined to selected locations and conditions may, and often do, vary between these locations. Should conditions different from those described in this report be encountered during project development, GLA should be consulted to review the conditions and determine whether our recommendations are still valid. Additional exploration, testing, and analysis may be required for such evaluation.

Should persons concerned with this project observe geotechnical features or conditions at the site or surrounding areas which are different from those described in this report, those observations should be reported immediately to GLA for evaluation.

It is important that the information in this report be made known to the design professionals involved with the project, that our recommendations be incorporated into project drawings and documents, and that the recommendations be carried out during construction by the contractor and subcontractors. It is not the responsibility of GLA to notify the design professionals and the project contractors and subcontractors.

The findings, conclusions, and recommendations in this report are applicable only to the specific project development on this specific site. These data should not be used for other projects, sites, or purposes unless they are reviewed by GLA or a qualified geotechnical professional.

Report prepared by,

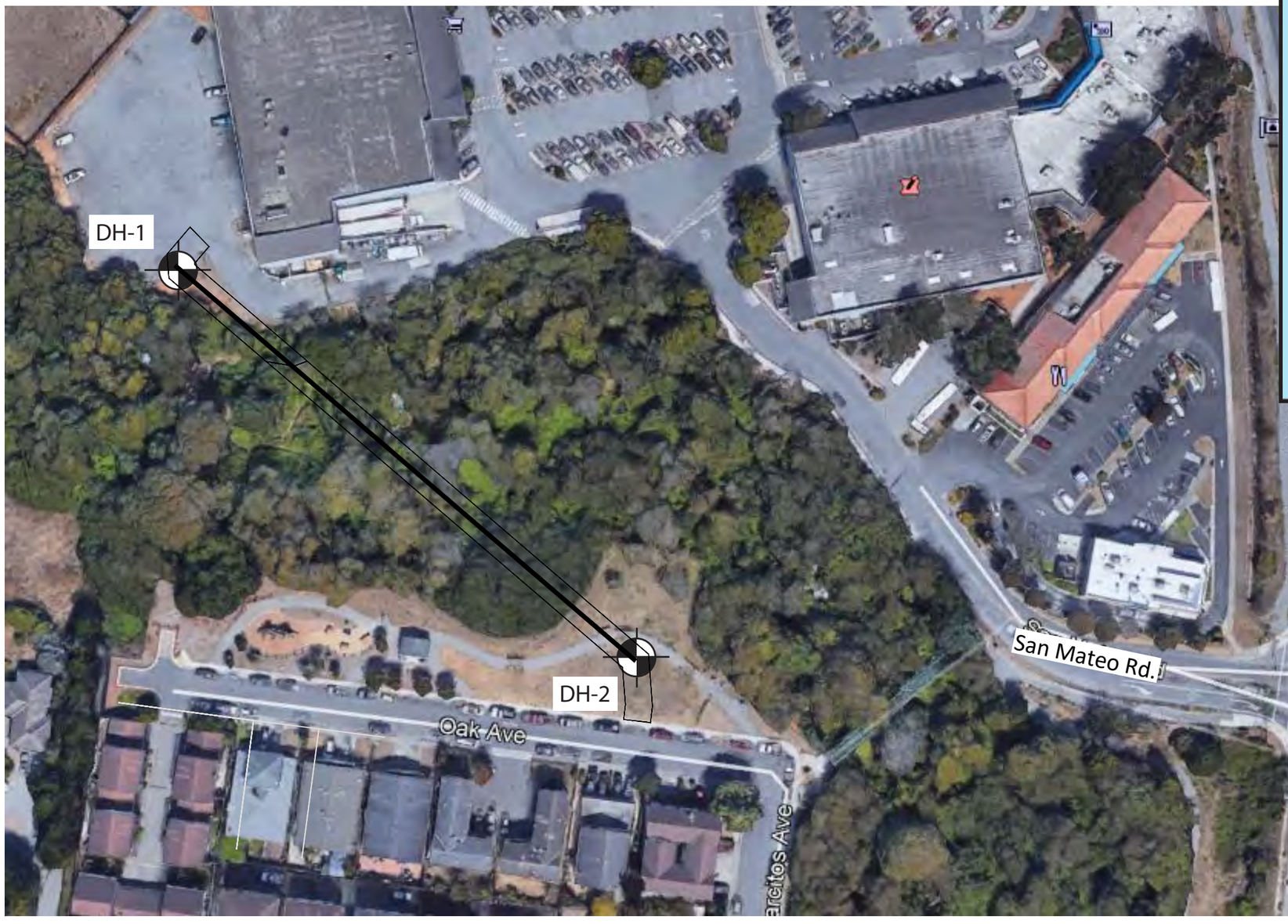
Geo-Logic Associates

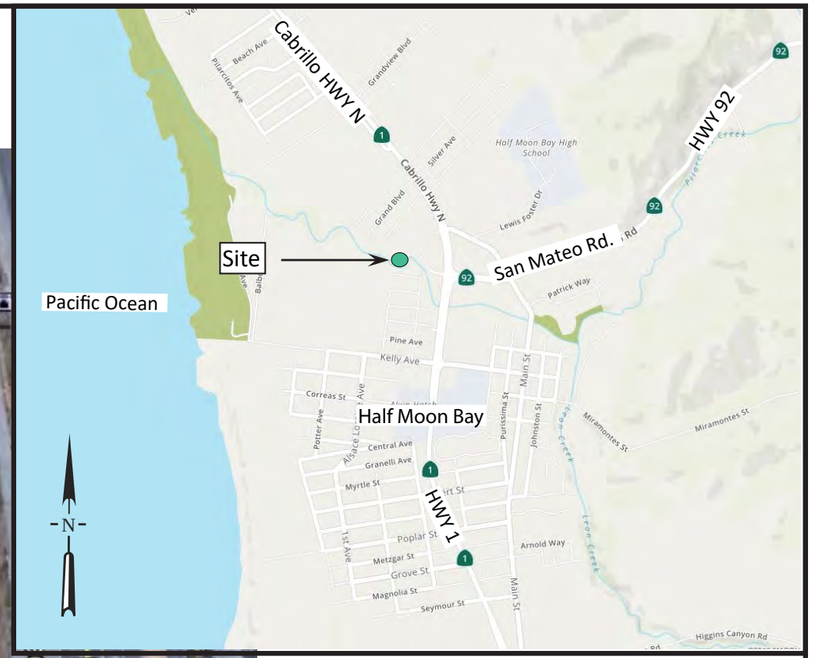
DRAFT FOR CLIENT REVIEW

Chalerm (Beeson) Liang
GE 2031

Fs/csl

Copies: Jonathan Sutter, EKI Environment and Water (3 hard copies & 1 electronic copy)





Vicinity Map (no scale)

EXPLANATION

DH-2 — Exploratory drill hole

Proposed HDD bore path

N

0 80 ft

Geo-Logic ASSOCIATES	16055 Caputo Drive, Suite D Morgan Hill, California 95037 Phone (408) 778-2818 Fax (408) 779-6879	Drafted By: Francesca Senes Date: September 2019 Checked By: Beeson Liang Revision: September 2019	**SITE PLAN (Proposed Development)** **Pilarcitos Creek Crossing** **San Mateo, California**	FIGURE 1 PROJECT PA19.1032

APPENDIX A

KEYS TO SOIL CLASSIFICATION

and

DRILL HOLE LOGS

KEY TO SOIL CLASSIFICATION - FINE GRAINED SOILS

(50% OR MORE IS SMALLER THAN NO. 200 SIEVE SIZE)

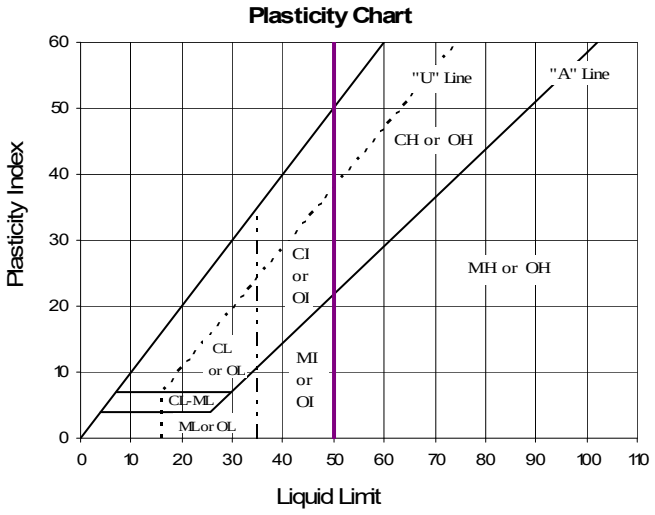
(modified from ASTM D2487 to include fine grained soils with intermediate plasticity)

MAJOR DIVISIONS			GROUP SYMBOLS	GROUP NAMES
SILTS AND CLAYS (Liquid Limit less than 35) Low Plasticity	Inorganic	PI < 4 or plots below "A" line	ML	Silt, Silt with Sand or Gravel, Sandy or Gravelly Silt, Sandy or Gravelly Silt with Sand or Gravel
	Inorganic	PI > 7 or plots on or above "A" line	CL	Lean Clay, Lean Clay with Sand or Gravel, Sandy or Gravelly Lean Clay, Sandy or Gravelly Lean Clay with Sand or Gravel
	Inorganic	PI between 4 and 7	CL-ML	Silty Clay, Silty Clay with Sand or Gravel, Sandy or Gravelly Silty Clay, Sandy or Gravelly Silty Clay with Sand or Gravel
	Organic	See footnote 3	OL	Organic Silt (below "A" Line) or Organic Clay (on or above "A" Line) (1,2)
SILTS AND CLAYS (35 ≤ Liquid Limit < 50) Intermediate Plasticity	Inorganic	PI < 4 or plots below "A" line	MI	Silt, Silt with Sand or Gravel, Sandy or Gravelly Silt, Sandy or Gravelly Silt with Sand or Gravel
	Inorganic	PI > 7 or plots on or above "A" line	CI	Clay, Clay with Sand or Gravel, Sandy or Gravelly Clay, Sandy or Gravelly Clay with Sand or Gravel
	Organic	See footnote 3	OI	Organic Silt (below "A" Line) or Organic Clay (on or above "A" Line) (1,2)
SILTS AND CLAYS (Liquid Limit 50 or greater) High Plasticity	Inorganic	PI plots below "A" line	MH	Elastic Silt, Elastic Silt with Sand or Gravel, Sandy or Gravelly Elastic Silt, Sandy or Gravelly Elastic Silt with Sand or Gravel
	Inorganic	PI plots on or above "A" line	CH	Fat Clay, Fat Clay with Sand or Gravel, Sandy or Gravelly Fat Clay, Sandy or Gravelly Fat Clay with Sand or Gravel
	Organic	See note 3 below	OH	Organic Silt (below "A" Line) or Organic Clay (on or above "A" Line) (1,2)

1. If soil contains 15% to 29% plus No. 200 material, include "with sand" or "with gravel" to group name, whichever is predominant.
2. If soil contains ≥30% plus No. 200 material, include "sandy" or "gravelly" to group name, whichever is predominant. If soil contains ≥15% of sand or gravel sized material, add "with sand" or "with gravel" to group name.
3. Ratio of liquid limit of oven dried sample to liquid limit of not dried sample is less than 0.75.

CONSISTENCY	UNCONFINED SHEAR STRENGTH (KSF)	STANDARD PENETRATION (BLOWS/FOOT)
VERY SOFT	< 0.25	< 2
SOFT	0.25 – 0.5	2 – 4
FIRM	0.5 – 1.0	5 – 8
STIFF	1.0 – 2.0	9 – 15
VERY STIFF	2.0 – 4.0	16 – 30
HARD	> 4.0	> 30

MOISTURE	CRITERIA
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp, but no visible water
Wet	Visible free water, usually soil is below the water table



GEO-LOGIC ASSOCIATES

KEY TO SOIL CLASSIFICATION – COARSE GRAINED SOILS

(MORE THAN 50% IS LARGER THAN NO. 200 SIEVE SIZE)

(modified from ASTM D2487 to include fines with intermediate plasticity)

MAJOR DIVISIONS			GROUP SYMBOLS	GROUP NAMES[1]
GRAVELS (more than 50% of coarse fraction is larger than No. 4 sieve size)	Gravels with less than 5% fines	Cu ≥ 4 and 1 ≤ Cc ≤ 3	GW	Well Graded Gravel, Well Graded Gravel with Sand
		Cu < 4 and/or 1 > Cc > 3	GP	Poorly Graded Gravel, Poorly Graded Gravel with Sand
	Gravels with 5% to 12% fines	ML, MI or MH fines	GW-GM	Well Graded Gravel with Silt, Well Graded Gravel with Silt and Sand
			GP-GM	Poorly Graded Gravel with Silt, Poorly Graded Gravel with Silt and Sand
		CL, CI or CH fines	GW-GC	Well Graded Gravel with Clay, Well Graded Gravel with Clay and Sand
			GP-GC	Poorly Graded Gravel with Clay, Poorly Graded Gravel with Clay and Sand
	Gravels with more than 12% fines	ML, MI or MH fines	GM	Silty Gravel, Silty Gravel with Sand
		CL, CI or CH fines	GC	Clayey Gravel, Clayey Gravel with Sand
		CL-ML fines	GC-GM	Silty Clayey Gravel; Silty, Clayey Gravel with Sand
SANDS (50% or more of coarse fraction is smaller than No. 4 sieve size)	Sands with less than 5% fines	Cu ≥ 6 and 1 ≤ Cc ≤ 3	SW	Well Graded Sand, Well Graded Sand with Gravel
		Cu < 6 and/or 1 > Cc > 3	SP	Poorly Graded Sand, Poorly Graded Sand with Gravel
	Sands with 5% to 12% fines	ML, MI or MH fines	SW-SM	Well Graded Sand with Silt, Well Graded Sand with Silt and Gravel
			SP-SM	Poorly Graded Sand with Silt, Poorly Graded Sand with Silt and Gravel
		CL, CI or CH fines	SW-SC	Well Graded Sand with Clay, Well Graded Sand with Clay and Gravel
			SP-SC	Poorly Graded Sand with Clay, Poorly Graded Sand with Clay and Gravel
	Sands with more than 12% fines	ML, MI or MH fines	SM	Silty Sand, Silty Sand with Gravel
		CL, CI or CH fines	SC	Clayey Sand, Clayey Sand with Gravel
		CL-ML fines	SC-SM	Silty, Clayey Sand; Silty, Clayey Sand with Gravel

US STANDARD SIEVES	3 Inch	¾ Inch	No. 4	No. 10	No. 40	No. 200	
	COARSE	FINE	COARSE	MEDIUM	FINE		
COBBLES & BOULDERS	GRAVELS		SANDS				SILTS AND CLAYS

RELATIVE DENSITY (SANDS AND GRAVELS)	STANDARD PENETRATION (BLOWS/FOOT)
Very Loose	0 - 4
Loose	5 – 10
Medium Dense	11 – 30
Dense	31 - 50
Very Dense	50+

1. Add “with sand” to group name if material contains 15% or greater of sand-sized particle. Add “with gravel” to group name if material contains 15% or greater of gravel-sized particle.

MOISTURE	CRITERIA
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp, but no visible water
Wet	Visible free water, usually soi is below the water table

GEO-LOGIC ASSOCIATES

DATE: 9/27/2019	LOG OF EXPLORATORY DRILL HOLE	DH- 1
PROJECT NAME: Pilarcitos Creek Crossing	PROJECT NUMBER:	PA19.1051
DRILL RIG: Mobile B-53R	LOGGED BY:	BL
HOLE DIAMETER: 8-inch hollow stem auger	HOLE ELEVATION:	±42½ ft

SAMPLER: D = 3" OD, 2½" ID Split-spoon; X = 2½" OD, 2" ID Split-spoon; I = Standard Penetrometer (2" OD SPT); S = Slough in sample

GROUND WATER DEPTH: Initial: ±18.5 ft; Final: ---

DESCRIPTION OF EARTH MATERIALS	SOIL TYPE	DEPTH (ft)	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	% PASSING #200 SIEVE	LIQUID LIMIT	WATER CONTENT	PLASTICITY INDEX	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
PAVEMENT (±2.5" AC over ±5" baserock)												
CLAY with SAND: Brown, moist, very stiff to hard; with mostly fine sand	Cl	1	S									
		2	D	33	4.5+			18		110		
black below approximately 2¼ feet		3	D									
		4	S									
Sandy Clay, dark brown, mostly fine sand		5	D	41	2			18				
		6	D		1.5							
		7										
		8										
		9	S									
Clay with Sand, brown, with trace organics		10	D	21	1.5			22		101		
		11	D		2.5							
		12										
CLAYEY SAND: Grey brown, moist, medium dense; mostly fine sand	SC	13										
		14	S									
		15	D	22		23		25		123		
		16	D									
		17										
		18										
		19	S									
light brown, dense, mostly fine to medium sand, some coarse sand, trace fine gravel		20	I	51								
			I									

DATE: 12/13/2018	LOG OF EXPLORATORY DRILL HOLE	DH- 1
PROJECT NAME: Pilarcitos Creek Crossing	PROJECT NUMBER:	PA19.1051
DRILL RIG: Mobile B-53R	LOGGED BY:	BL
HOLE DIAMETER: 8-inch hollow stem auger	HOLE ELEVATION:	±42½ ft

SAMPLER: D = 3" OD, 2½" ID Split-spoon; X = 2½" OD, 2" ID Split-spoon; I = Standard Penetrometer (2" OD SPT); S = Slough in sample

GROUND WATER DEPTH: Initial: ±18.5 ft; Final: ---

DESCRIPTION OF EARTH MATERIALS	SOIL TYPE	DEPTH (ft)	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	% PASSING #200 SIEVE	LIQUID LIMIT	WATER CONTENT	PLASTICITY INDEX	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
LEAN CLAY to CLAYEY SILT: Grey, moist, stiff	CL/ ML	21										
		22										
		23										
		24	S I	33		49		27				
CLAYEY SAND to SANDY LEAN CLAY: Grey, moist to wet, medium dense to dense sand/very stiff clay; mostly fine sand	SC/ CL	25										
		26										
		27										
CLAY: Grey, moist, stiff	CI	28										
		29	S D	43	2.5			26		101		
		30	D		1.25							
CLAYEY SAND: Grey, moist to wet, dense; mostly fine to medium sand	SC	31										
		32										
		33										
		34	S D	41	1.5			31		93		
CLAY: Grey, moist, stiff	CI	35	D									
		36										
		37										
		38										
		39	S D	34	2			30		94		
		40	D		1.75							

DATE: 12/13/2018	LOG OF EXPLORATORY DRILL HOLE	DH- 1
PROJECT NAME: Pilarcitos Creek Crossing	PROJECT NUMBER:	PA19.1051
DRILL RIG: Mobile B-53R	LOGGED BY:	BL
HOLE DIAMETER: 8-inch hollow stem auger	HOLE ELEVATION:	±42½ ft

SAMPLER: D = 3" OD, 2½" ID Split-spoon; X = 2½" OD, 2" ID Split-spoon; I = Standard Penetrometer (2" OD SPT); S = Slough in sample

GROUND WATER DEPTH: Initial: ±18.5 ft; Final: ---

DESCRIPTION OF EARTH MATERIALS	SOIL TYPE	DEPTH (ft)	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	% PASSING #200 SIEVE	LIQUID LIMIT	WATER CONTENT	PLASTICITY INDEX	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
CLAY (continued)	CL	41										
		42										
CLAYEY SAND: Grey, moist, very dense; mostly fine sand	SC	43										
		44	S I I	38 50/5"								
mostly fine to medium sand		45										
		46										
CLAYEY SAND with GRAVEL: Grey, moist, very dense, fine to coarse sand; wih fine gravel	SC	47										
		48										
		49	S I I	40 50/5"		15		12				
BOTTOM OF HOLE = 50 FEET		50										
		51										
		52										
		53										
		54										
		55										
		56										
		57										
		58										
		59										
		60										

DATE: 9/27/2019	LOG OF EXPLORATORY DRILL HOLE	DH- 2
PROJECT NAME: Pilarcitos Creek Crossing	PROJECT NUMBER:	PA19.1051
DRILL RIG: Mobile B-53R	LOGGED BY:	BL
HOLE DIAMETER: 8-inch hollow stem auger	HOLE ELEVATION:	±40 ft

SAMPLER: D = 3" OD, 2½" ID Split-spoon; X = 2½" OD, 2" ID Split-spoon; I = Standard Penetrometer (2" OD SPT); S = Slough in sample

GROUND WATER DEPTH: Initial: ±18 ft; Final: ---

DESCRIPTION OF EARTH MATERIALS	SOIL TYPE	DEPTH (ft)	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	% PASSING #200 SIEVE	LIQUID LIMIT	WATER CONTENT	PLASTICITY INDEX	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
CLAY: Brown, moist, very stiff to hard	CL	1										
		2	S									
		3	D	30	4.5+			15		90		
		4	S									
dark brown		5	D	23	3.8			22		87		
		6	D		3							
		7										
		8										
		9	S									
sandy clay, brown, stiff to very stiff		10	D	21		46		19		120		
CLAYEY SAND: Brown, moist, medium dense; mostly fine to medium sand	SC	11	D									
		12										
SANDY CLAY: Brown, moist, very stiff, with mostly fine sand	CL	13										
		14	S									
		15	D	45	2.7	23		26 19		101 116		
CLAYEY SAND: Grey, moist, medium dense; fine to coarse sand	SC	16	D									
		17										
CLAY: Brown, moist, stiff	CL	18										
		19	S									
		20	I	26								
CLAY: Grey, moist, stiff; with thin sand lenses	CL		I									

DATE: 9/27/2019	LOG OF EXPLORATORY DRILL HOLE	DH- 2
PROJECT NAME: Pilarcitos Creek Crossing	PROJECT NUMBER:	PA19.1051
DRILL RIG: Mobile B-53R	LOGGED BY:	BL
HOLE DIAMETER: 8-inch hollow stem auger	HOLE ELEVATION:	±40 ft

SAMPLER: D = 3" OD, 2½" ID Split-spoon; X = 2½" OD, 2" ID Split-spoon; I = Standard Penetrometer (2" OD SPT); S = Slough in sample

GROUND WATER DEPTH: Initial: ±18 ft; Final: ---

DESCRIPTION OF EARTH MATERIALS	SOIL TYPE	DEPTH (ft)	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	% PASSING #200 SIEVE	LIQUID LIMIT	WATER CONTENT	PLASTICITY INDEX	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
CLAY (continued)	CI	21										
		22										
CLAYEY SAND: Grey, moist to wet, medium dense; mostly fine sand	SC	22										
		23										
		24	S D	23		43		25				
	SC/ CL	25										
		26										
		27										
		28										
very dense		29	S I	70								
		30										
		31										
		32										
		33										
dense, fine to coarse sand, fine gravel		34	S I	40		17		17				
		35										
		36										
		37										
		38										
very dense		39	S I	15 50/6"								
		40										

DATE: 9/27/2019	LOG OF EXPLORATORY DRILL HOLE	DH- 2
PROJECT NAME: Pilarcitos Creek Crossing	PROJECT NUMBER:	PA19.1051
DRILL RIG: Mobile B-53R	LOGGED BY:	BL
HOLE DIAMETER: 8-inch hollow stem auger	HOLE ELEVATION:	±40 ft

SAMPLER: D = 3" OD, 2½" ID Split-spoon; X = 2½" OD, 2" ID Split-spoon; I = Standard Penetrometer (2" OD SPT); S = Slough in sample

GROUND WATER DEPTH: Initial: ±18 ft; Final: ---

DESCRIPTION OF EARTH MATERIALS	SOIL TYPE	DEPTH (ft)	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	% PASSING #200 SIEVE	LIQUID LIMIT	WATER CONTENT	PLASTICITY INDEX	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
CLAYEY SAND with GRAVEL: Grey, moist to wet, dense to very dense; fine to coarse sand, with fine gravel	SC	41										
		42										
		43										
		44	S	53		18		14				
		45	I									
		46										
		47										
		48										
		49	S	43		15						
		50	I									
BOTTOM OF HOLE = 50 FEET		51										
		52										
		53										
		54										
		55										
		56										
		57										
		58										
		59										
		60										

APPENDIX B

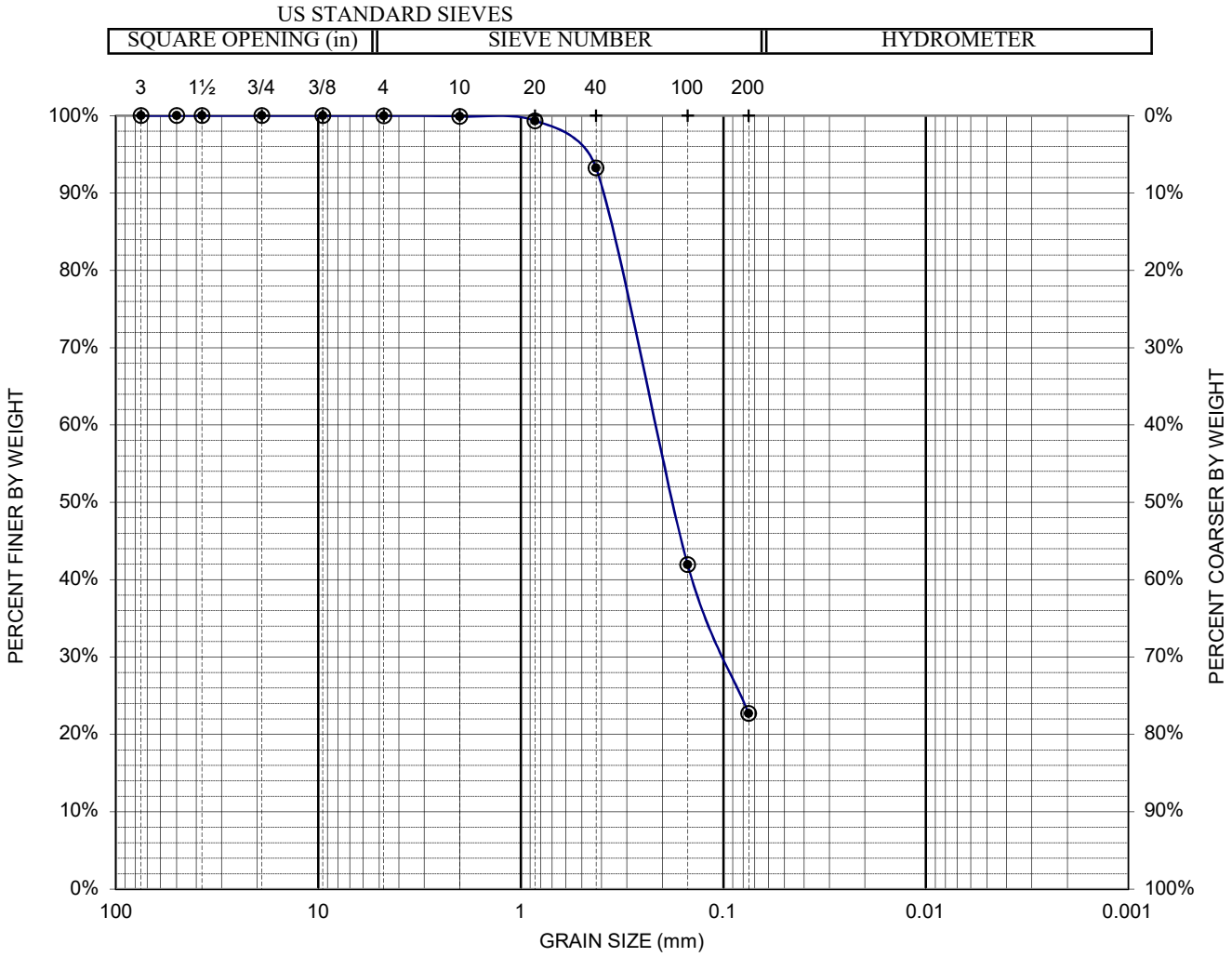
LABORATORY TEST RESULTS

GRAIN SIZE TEST RESULTS

PROJECT NAME	Pilarcitos Creek Crossing			**PROJECT No.**	PA19.1051.00
DRILL HOLE No.	1	**DEPTH (ft)** 14.5-15	**SAMPLE** 0	**DATE OF TEST**	11/13/2019

SOURCE/QUARRY: ---

DESCRIPTION OF SOIL: Grey brown clayey sand, mostly fine sand



	COARSE	FINE	COARSE	MEDIUM	FINE	
COBBLES	GRAVEL		SAND			SILT & CLAY
	0.0%		77.3%			22.7%

REMARKS:

RevOct20070

GEO-LOGIC ASSOCIATES

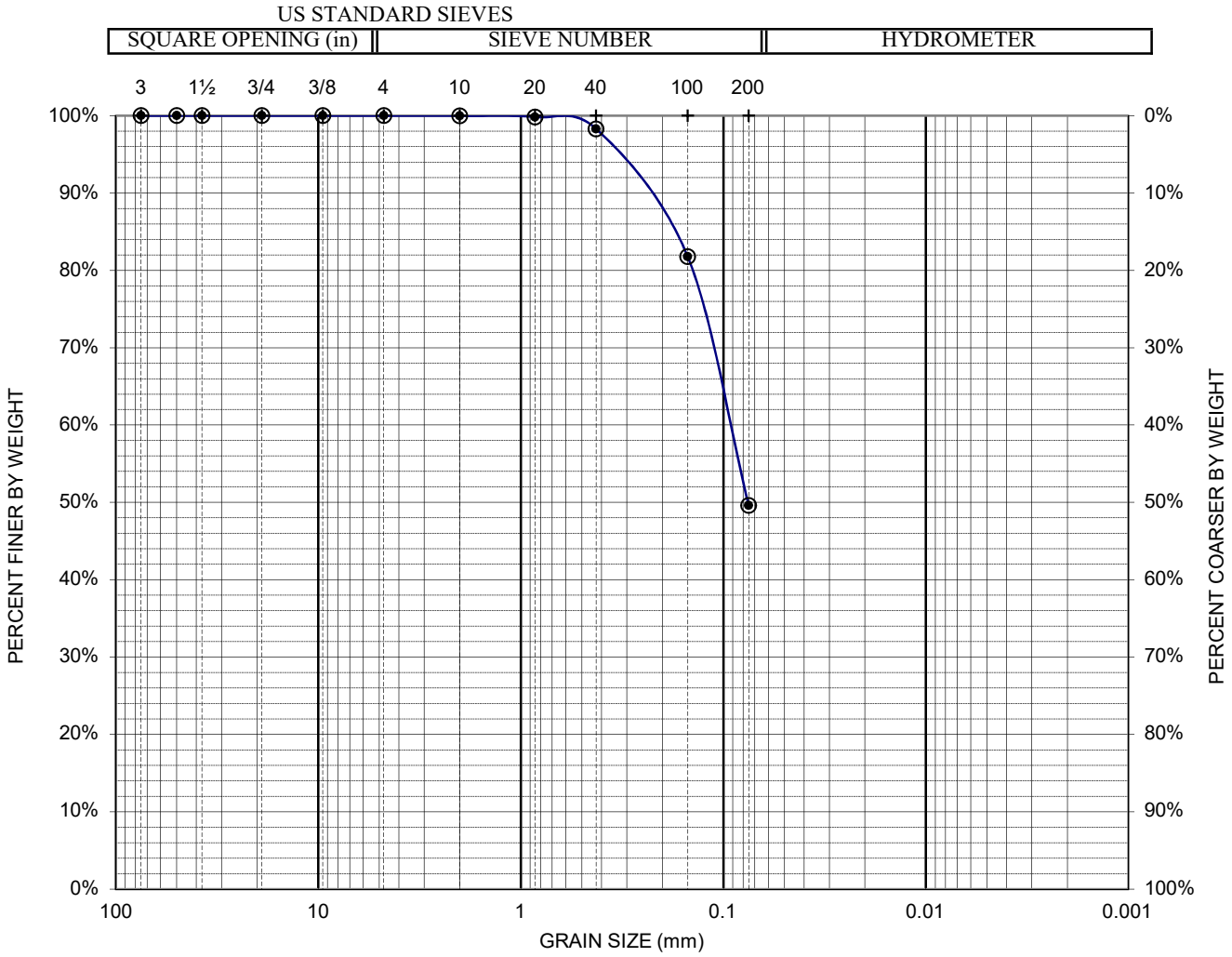
Figure B-1

GRAIN SIZE TEST RESULTS

PROJECT NAME	Pilarcitos Creek Crossing			**PROJECT No.**	PA19.1051.00
DRILL HOLE No.	1	**DEPTH (ft)** 24.5-25	**SAMPLE** 0	**DATE OF TEST**	11/13/2019

SOURCE/QUARRY: ---

DESCRIPTION OF SOIL: Grey clayey sand to sandy lean clay, fine sand



	COARSE	FINE	COARSE	MEDIUM	FINE	
COBBLES	GRAVEL		SAND			SILT & CLAY
	0.0%		50.4%			49.6%

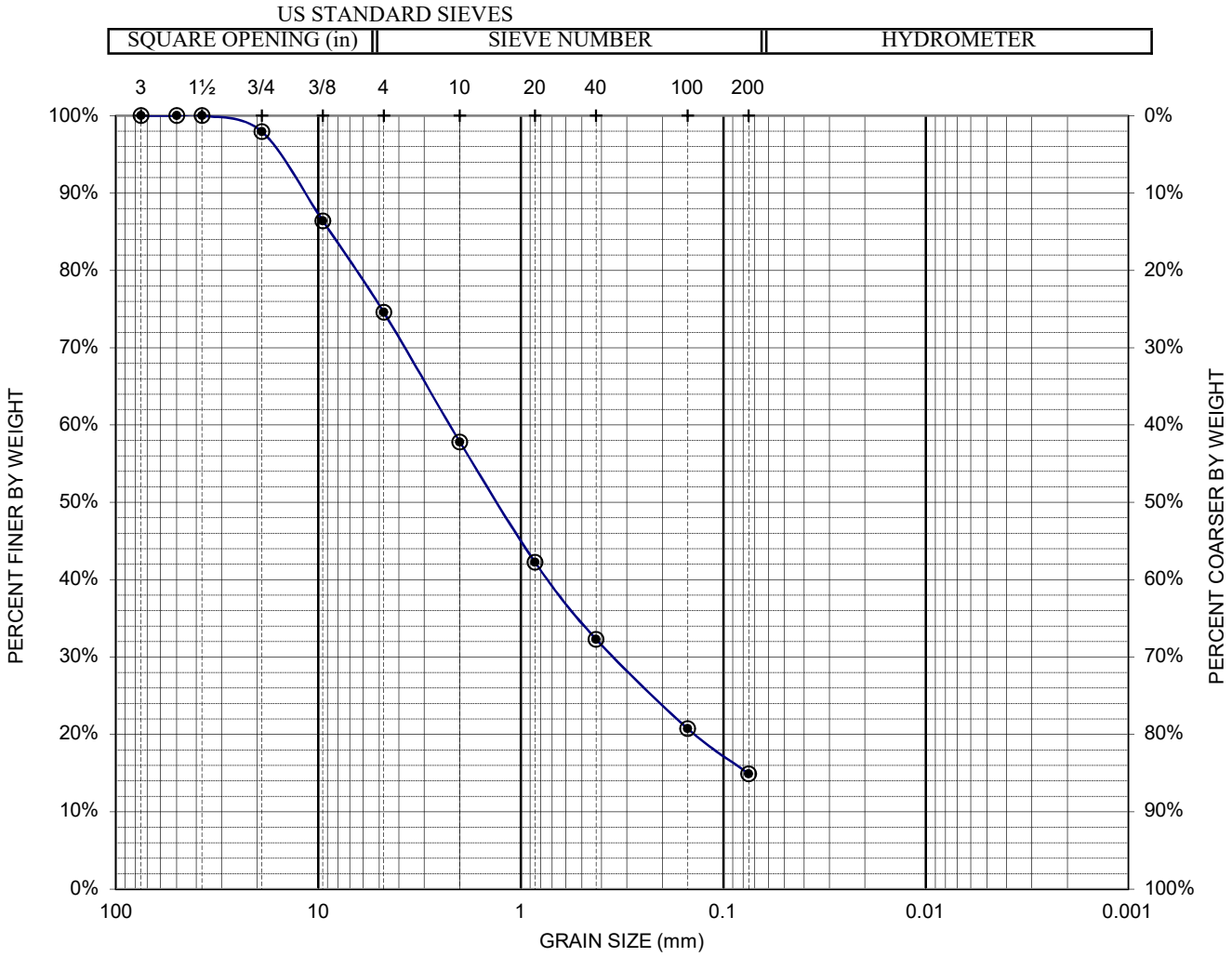
REMARKS:

GRAIN SIZE TEST RESULTS

PROJECT NAME	Pilarcitos Creek Crossing			**PROJECT No.**	PA19.1051.00
DRILL HOLE No.	1	**DEPTH (ft)** 49-50	**SAMPLE** 0	**DATE OF TEST**	11/13/2019

SOURCE/QUARRY: ---

DESCRIPTION OF SOIL: Grey clayey sand, fine to coarse sand, fine gravel



	COARSE	FINE	COARSE	MEDIUM	FINE	
COBBLES	GRAVEL		SAND			SILT & CLAY
	25.4%		59.6%			14.9%

REMARKS:

GEO-LOGIC ASSOCIATES

Figure B-3

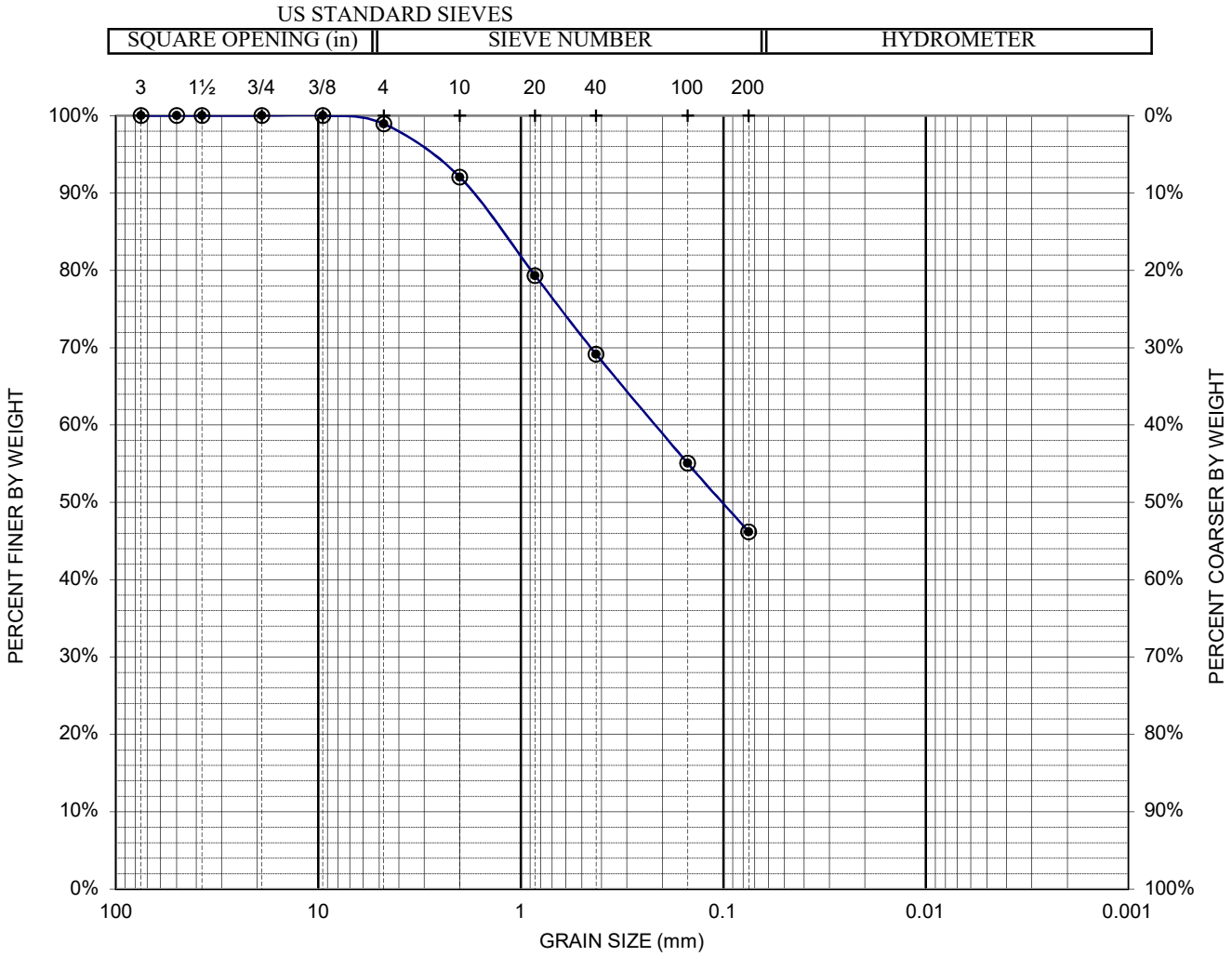
RevOct20070

GRAIN SIZE TEST RESULTS

PROJECT NAME	Pilarcitos Creek Crossing			**PROJECT No.**	PA19.1051.00
DRILL HOLE No.	2	**DEPTH (ft)** 9.5-10	**SAMPLE** 0	**DATE OF TEST**	11/14/2019

SOURCE/QUARRY: ---

DESCRIPTION OF SOIL: Brown clayey sand, fine sand



	COARSE	FINE	COARSE	MEDIUM	FINE	
COBBLES	GRAVEL		SAND			SILT & CLAY
	1.1%		52.7%			46.2%

REMARKS:

GEO-LOGIC ASSOCIATES

Figure B-4

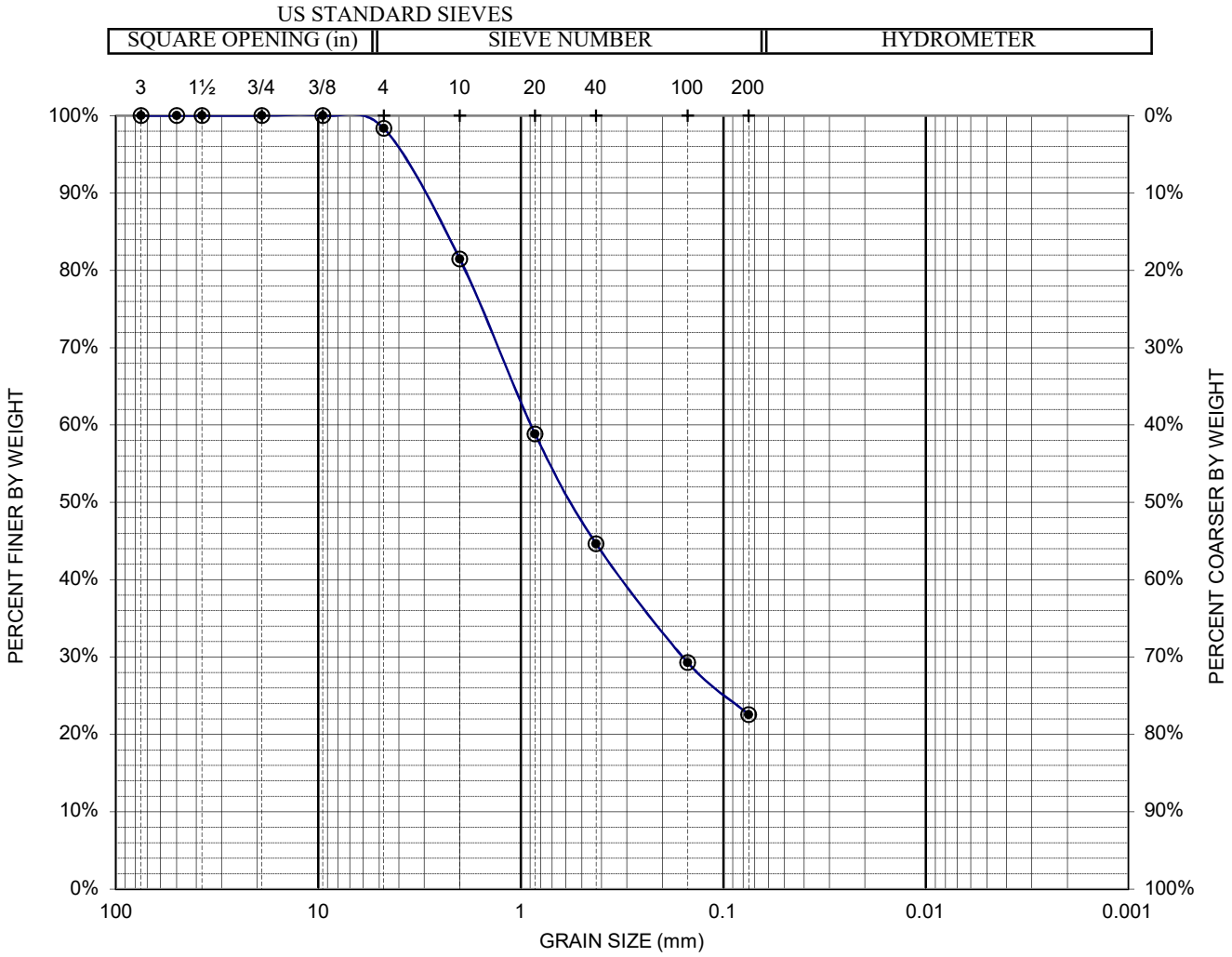
RevOct20070

GRAIN SIZE TEST RESULTS

PROJECT NAME	Pilarcitos Creek Crossing			**PROJECT No.**	PA19.1051.00
DRILL HOLE No.	2	**DEPTH (ft)** 14.5-15	**SAMPLE** 0	**DATE OF TEST**	11/14/2019

SOURCE/QUARRY: ---

DESCRIPTION OF SOIL: Grey clayey sand, fine to coarse sand



	COARSE	FINE	COARSE	MEDIUM	FINE	
COBBLES	GRAVEL		SAND			SILT & CLAY
	1.7%		75.8%			22.6%

REMARKS:

GEO-LOGIC ASSOCIATES

Figure B-5

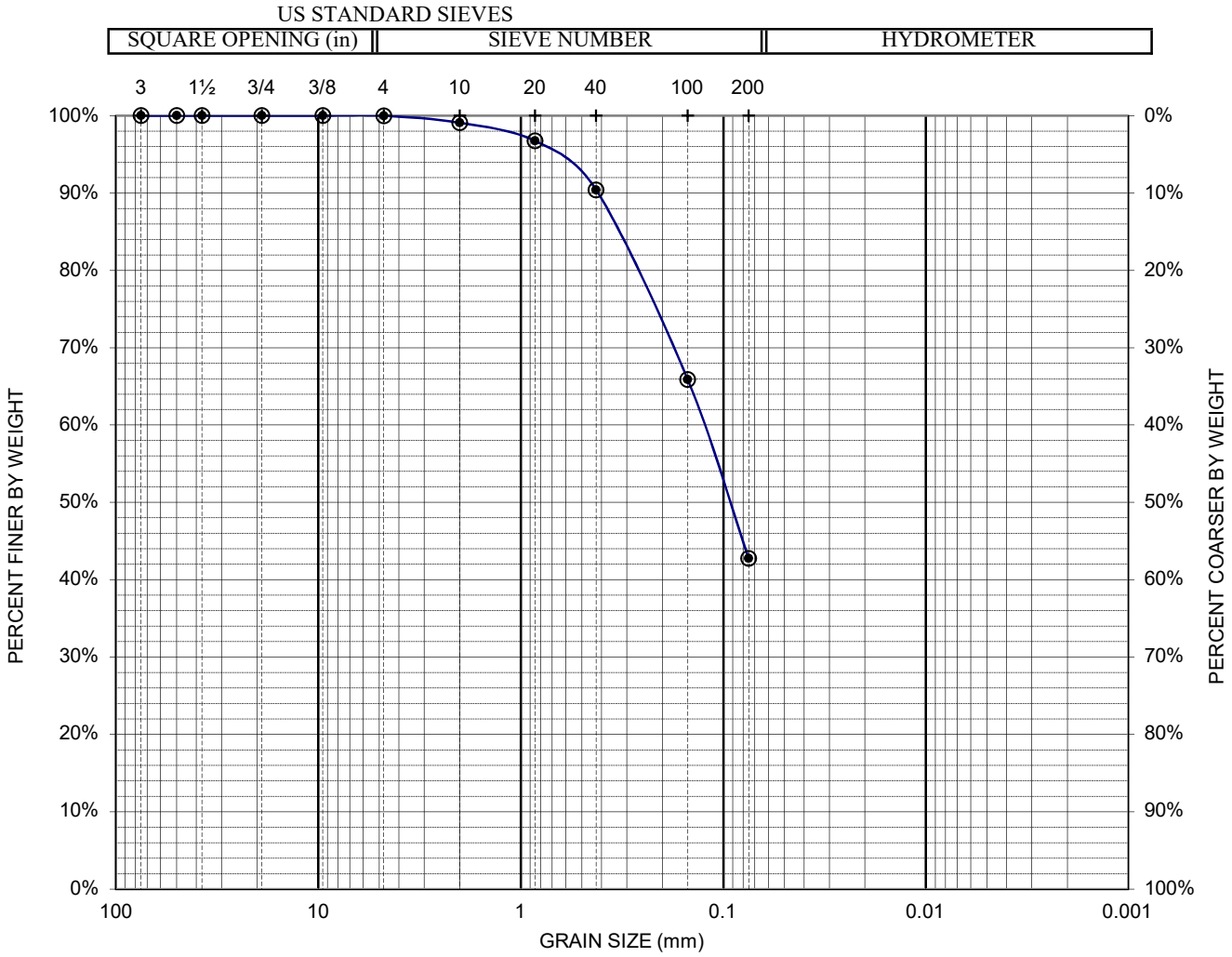
RevOct20070

GRAIN SIZE TEST RESULTS

PROJECT NAME	Pilarcitos Creek Crossing			**PROJECT No.**	PA19.1051.00
DRILL HOLE No.	2	**DEPTH (ft)** 24-25	**SAMPLE** 0	**DATE OF TEST**	11/14/2019

SOURCE/QUARRY: ---

DESCRIPTION OF SOIL: Grey clayey sand, mostly fine sand



	COARSE	FINE	COARSE	MEDIUM	FINE	
COBBLES	GRAVEL		SAND			SILT & CLAY
	0.0%		57.2%			42.8%

REMARKS:

GEO-LOGIC ASSOCIATES

Figure B-6

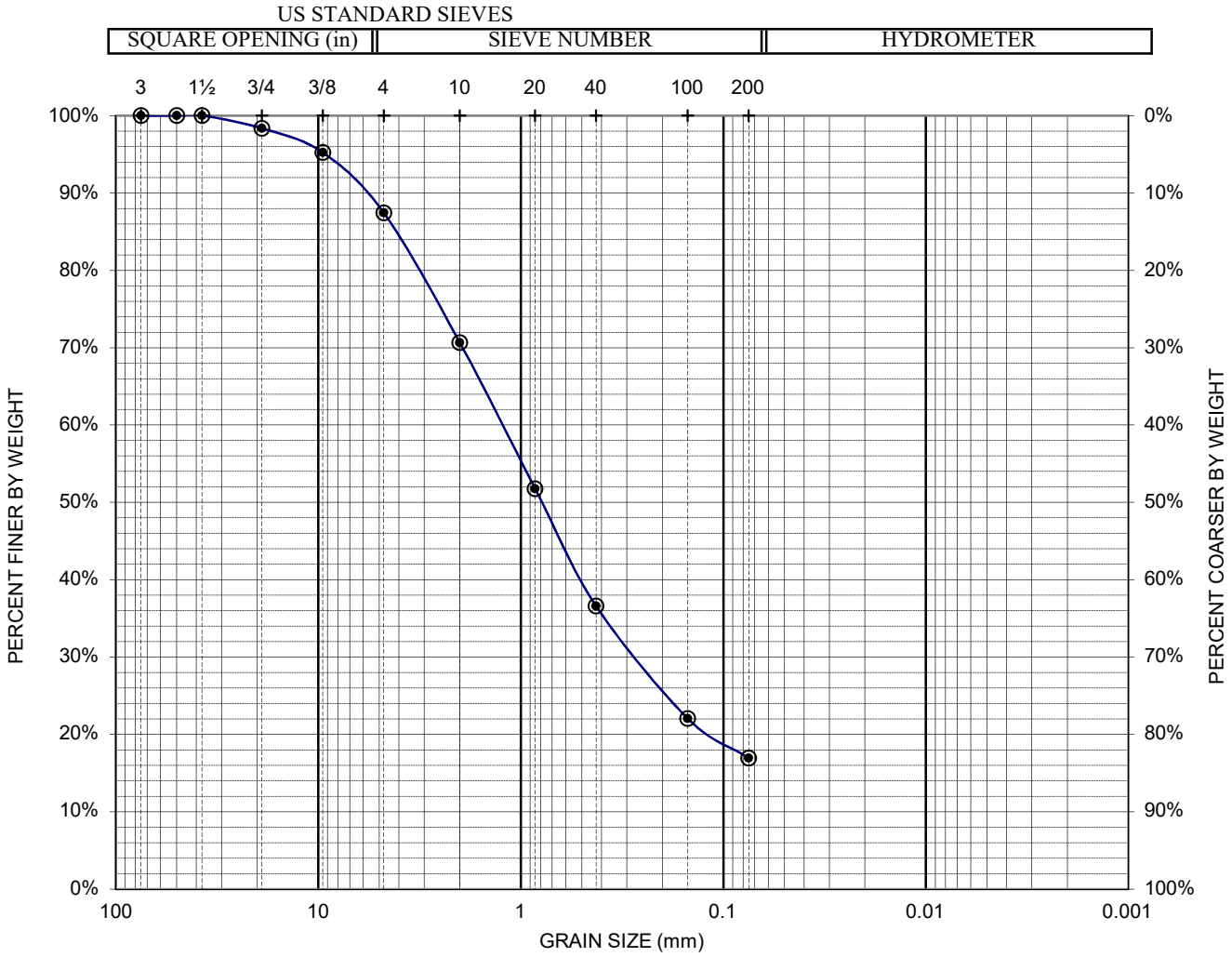
RevOct20070

GRAIN SIZE TEST RESULTS

PROJECT NAME	Pilarcitos Creek Crossing			**PROJECT No.**	PA19.1051.00
DRILL HOLE No.	2	**DEPTH (ft)**	34-35	**SAMPLE** 0	**DATE OF TEST** 11/14/2019

SOURCE/QUARRY: ---

DESCRIPTION OF SOIL: Grey clayey sand, fine to coarse sand, fine gravel



	COARSE	FINE	COARSE	MEDIUM	FINE	
COBBLES	GRAVEL		SAND			SILT & CLAY
	12.6%		70.5%			17.0%

REMARKS:

GEO-LOGIC ASSOCIATES

Figure B-7

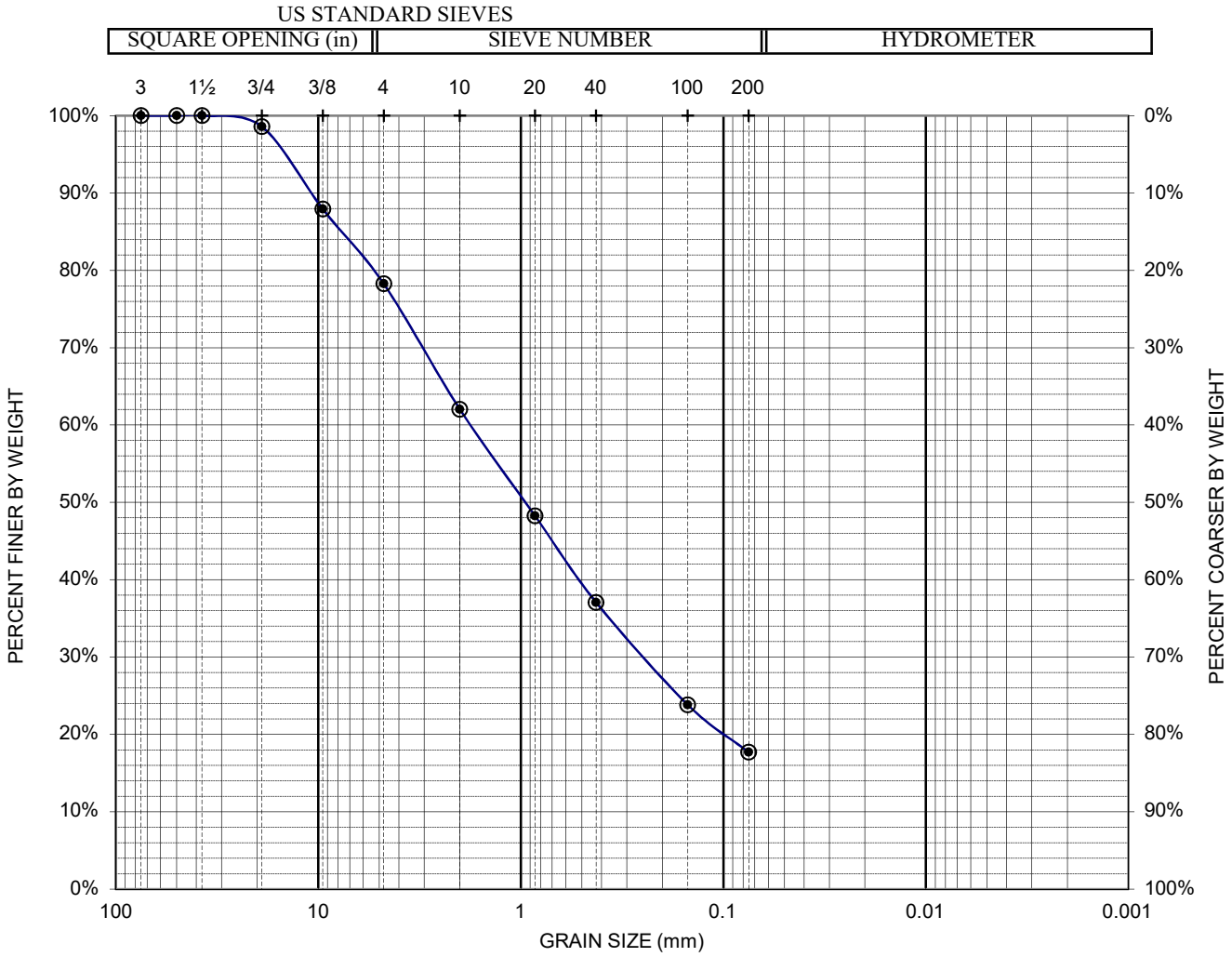
RevOct20070

GRAIN SIZE TEST RESULTS

PROJECT NAME	Pilarcitos Creek Crossing			**PROJECT No.**	PA19.1051.00
DRILL HOLE No.	2	**DEPTH (ft)** 44-45	**SAMPLE** 0	**DATE OF TEST**	11/14/2019

SOURCE/QUARRY: ---

DESCRIPTION OF SOIL: Grey clayey sand with gravel, fine to coarse sand, fine gravel



	COARSE	FINE	COARSE	MEDIUM	FINE	
COBBLES	GRAVEL		SAND			SILT & CLAY
	21.7%		60.5%			17.7%

REMARKS:

GEO-LOGIC ASSOCIATES

Figure B-8

RevOct20070

Appendix C

30% Design Drawings

(See Appendix E of the Biological Resources Evaluation for 100% Design Drawings)

Appendix D

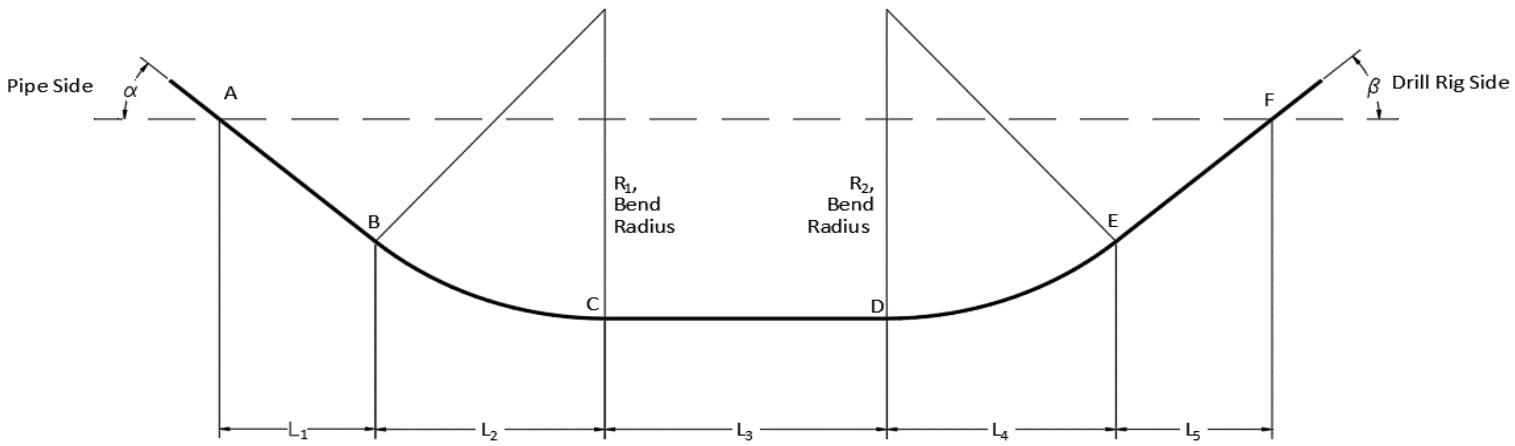
Calculations of Pullback Loads and Stresses

Table 1 - Assumed Parameters

Variable	Definition	Unit	Assumed Value
D_{pipe}	Outer diameter of the pipe	Inches (in)	10.75
DR	Pipe Dimiension Ratio	-	11
ρ_w	Unit weight of water	pounds per cubic feet (lb/ft^3)	62.4
Υ_p	Specific gravity of pipe material	-	0.96
w_p	Weight of the pipe on the ground surface	pounds per gallon (lbs/ft)	*
D_{bore}	bore diameter	Inches (in)	16.125
T_i	Tensile load in section	pounds (lbs)	*
T_{hki}	Tensile load due to hydrokinetic drag in each bore section	pounds (lbs)	*
μ_g	Coefficient of friction between the pipe and rollers/ground surface	-	0.15
μ_b	Coefficient of friction between the pipe and bore	-	0.3
α	Angle of descent (exit angle)	radians	0.262
β	Angle of ascent (entry angle)	radians	0.262
γ	Angle of flat central tangent section	radians	0.000
w_b	Bouyant weight of the pipe in the bore (negative = bouyant)	pounds per gallon (lbs/gal)	*
w_{df}	Weight of drilling fluid	pounds per gallon (lbs/gal)	11
L_1	Horizontal length of bore section 1 (straight tangent; A to B)	feet (ft)	65.27
L_2	Horizontal length of bore section 2 (vertical curve; B to C)	feet (ft)	129.43
L_3	Horizontal length of bore section 3 (straight section; C to D)	feet (ft)	85.88
L_4	Horizontal length of bore section 4 (vertical curve; D to E)	feet (ft)	129.43
L_5	Horizontal length of bore section 5 (straight tangent; E to F)	feet (ft)	59.14
R_1	Bend radius of a first vertical curve	feet (ft)	500.00
R_2	Bend radius of a second vertical curve	feet (ft)	500.00
H_B	Depth of borehole from ground surface (taken from entry)	feet (ft)	17.49
H_C	Depth of borehole from ground surface (taken from entry)	feet (ft)	34.53
H_D	Depth of borehole from ground surface (taken from entry)	feet (ft)	34.53
H_E	Depth of borehole from ground surface (taken from entry)	feet (ft)	17.49
PV	Plastic viscosity of the drilling fluid	Centipoise (cp)	60.00
YP	Yield point of the drilling fluid	pounds per 100 sqaure feet [$lb/(100ft^2)$]	25.00
V_a	Annular flow velocity in the bore	feet per second (ft/sec)	*
R_{df}	Drilling fluid pumping rate	gallons per minute (gal/min)	150
Δp_i	Pressure drop due to hydrokinetic drag	pounds per square inch (lb/in^2)	*
t	pipe wall thickness	Inches (in)	0.977
I	Moment of inertia ($t^3/12$)	in^4	0.078
E (Installation)	Time-dependent modulus of elasticity of pipe material (12 hour assumed from PE4710)	pounds per square inch (lb/in^2)	63,000
E (Operation)	Time-dependent modulus of elasticity of pipe material (1000 hour assumed from PE4710)	pounds per square inch (lb/in^2)	46,000
F_s	Maximum allowable pull load or safe pull force	pounds (lbs)	*
T_{allow}	Safe pull stress	pounds per square inch (lb/in^2)	1,150
γ_b	Specific gravity of drilling fluid	-	1.32
γ_c	Specific gravity of ballast water	-	1.00
P_{net}	Net external pressure on pipe during installation	pounds per square inch (lb/in^2)	*
P_{mud}	Hydrostatic head due to drilling fluid, pounds per square inch	pounds per square inch (lb/in^2)	*
$P_{hydrokinetic}$	Hydrostatic head due to hydrokinetic drag (recommended 10 psi)	pounds per square inch (lb/in^2)	10
$P_{internal}$ (Install.)	Pressure due to internal contents during installation	pounds per square inch (lb/in^2)	0
$P_{internal}$ (Oper.)	Pressure due to internal contents during operation with pipe drained	pounds per square inch (lb/in^2)	0
P_{UC}	Unconstrained bucking pressure	pounds per square inch (lb/in^2)	*
f_0	ovality compansation factor	-	*
F_R	Unconstrained bucking pressure reduction factor	-	*
F_{CR}	Critical buckling pressure	pounds per square inch (lb/in^2)	*
P_E	External earth pressure from deformed borehole with arching mobilized	pounds per square inch (lb/in^2)	*
k	Arching factor	-	*
g_{se}	Soil unit weight	pounds per cubic feet (lb/ft^3)	125
H_w	Depth to groundwater (taken from entry)	feet (ft)	18.50
B	Silo width (assumed to equal backreamed bore diameter)	feet (ft)	1.344
δ	Angle of wall friction (for HDD, equals soil friction angle)	degree	23.5
K	Rankine active earth pressure coefficient	-	0.430
P_{SUR}	Surcharge and live loads	pounds per square inch (lb/in^2)	0
v	Poisson's ratio HDPE	-	0.46
Ballasted	"Yes"/"No"	-	No

* Calculated Value

Figure 1 - Bore Geometry Schematic



(1) Estimate Pipe Weights

(1.1) Weight of empty pipe (lb/ft) [1]

$$w_p = \pi \left(D_{pipe} \frac{ft}{12\ in} \right)^2 \frac{DR - 1}{DR^2} \rho_w \gamma_p$$

w_p (lb/ft)	12.5

(1.2) Net Buoyant Force on Empty Pipe (lb/ft) (Buoyant = Negative) [1]

$$w_b = \pi \frac{\left(D_{pipe} \frac{ft}{12\ in} \right)^2}{4} \rho_w \gamma_b - w_p$$

w_b (lb/ft)	-39.4

(1.3) Net Buoyant Force on ballasted Pipe (lb/ft) (Buoyant = Negative) [1]

$$w_b = \pi \frac{\left(D_{pipe} \frac{ft}{12\ in} \right)^2}{4} \rho_w \left(\gamma_b - \gamma_c \left(1 - \frac{2}{DR} \right) \right)^2 - w_p$$

w_b (lb/ft)	2.6

(1.4) Ballasted? No

w_b (lb/ft)	-39.4

(2) Calculate Pipe Pull Forces Along HDD Profile

(2.1) Hydrokinetic drag [5]:

$$T_{hki} = \Delta p_i \frac{\pi\left(D_{bore}^2 - D_{pipe}^2\right)D_{pipe}}{4\left(D_{bore} - D_{pipe}\right)}$$

Where:

$$\Delta p_i = \left(\frac{PV \cdot V_a}{1000\left(D_{bore} - D_{pipe}\right)^2} + \frac{YP}{200\left(D_{bore} - D_{pipe}\right)}\right) L_i$$

And where:

$$V_a = \frac{0.408 \cdot R_{df}}{\left(D_{bore}^2 - D_{pipe}^2\right)}$$

V_a (ft/s)	0.42

	1	**2**	**3**	**4**	**5**
Δp_i (lb/in^2)	1.58	3.12	2.07	3.12	1.43
T_{hki} (lb)	357	709	470	709	324

(2.2) Tensile load at points A, B, C, D, E, and F [4]:

$$T_A = e^{\mu_g \alpha}\left(\mu_a w_p (L_1 + L_2 + L_3 + L_4)\right)$$

$$T_B = T_A + T_{hk1} + \mu_b |w_b| L_1 \cos\alpha - w_b L_1 \sin\alpha - e^{\mu_g \alpha}\left(\mu_g w_p L_1\right)$$

$$T_C = e^{\mu_b(\alpha-\gamma)}\left(T_B + T_{hk2} + \mu_b |w_b| L_2 - w_b L_2 \sin\frac{\alpha}{2} - e^{\mu_g \alpha}\left(\mu_g w_p L_2\right)\right)$$

$$T_D = T_C + T_{hk3} + \mu_b |w_b| L_3 \cos\gamma - w_b L_3 \sin\gamma - e^{\mu_b(\alpha-\gamma)}\left(e^{\mu_g \alpha}\left(\mu_g w_p L_3\right)\right)$$

$$T_E = e^{\mu_b(\beta+\gamma)}\left(T_D + T_{hk4} + \mu_b |w_b| L_4 - w_b L_4 \sin\frac{\beta}{2} - e^{\mu_b(\alpha-\gamma)}\left(e^{\mu_g \alpha}\left(\mu_g w_p L_4\right)\right)\right)$$

$$T_F = T_E + T_{hk5} + \mu_b |w_b| L_5 \cos\beta - w_b L_5 \sin\beta - e^{\mu_b(\beta+\gamma)}\left(e^{\mu_b(\alpha-\gamma)}\left(e^{\mu_g \alpha}\left(\mu_g w_p L_5\right)\right)\right)$$

Where Maximum allowable pull load of safe pull force (ASTM F1962):

$$F_s = (T_{allow})\pi D_{pipe}^2\left(\frac{1}{DR} - \frac{1}{DR^2}\right)$$

F_s (lb)	34,505

Location	**Calculated Loads, T_i (lb)**	**Startup Loads, T_i* (lb)**	**Factor of Safety (F_s/T_i)**
Entry point (A)	914	1,370	25.2
End of straight tangent/beginning of vertical curve (B)	2,554	3,831	9.0
End of vertical curve/beginning of straight section (C)	5,630	8,446	4.1
End of straight section/beginning of vertical curve (D)	6,934	10,402	3.3
End of vertical curve/beginning of straight tangent (D)	10,346	15,520	2.2
Exit point (F)	11,813	17,720	1.9

*Startup loads estimated at 1.5x steady state loads

(3) Combined pipe stress at points A, B, C, D, E, and F [4]:

$$s_{ti} = \frac{T_i}{\pi t\left(D_{pipe} - t\right)} + \frac{E_T D_{pipe}}{2R_i}$$

Location	Combined Stress, s_{ti}* (lb/in^2)	Combined Stress Ratio (s_{ti}/T_{allow}) (Must be ≤1)	
Entry point (A)	46	0.04	Good
End of straight tangent/beginning of vertical curve (B)	184	0.16	Good
End of vertical curve/beginning of straight section (C)	338	0.29	Good
End of straight section/beginning of vertical curve (D)	403	0.35	Good
End of vertical curve/beginning of straight tangent (D)	574	0.50	Good
Exit point (F)	591	0.51	Good

*Startup loads estimated at 1.5x steady state loads

(4) Pipe Collapse During Installation:

(4.1) Net external pressure on the pipe during installation [4]:

$$P_{net} = P_{mud} + P_{hydrokinetic} - P_{internal}$$

where:

$$P_{mud} = \frac{7.48}{144} w_{df} H_i$$

Location	Net external pressure, P_{net} (lb/in^2)
Entry point (A)	--
End of straight tangent/beginning of vertical curve (B)	20
End of vertical curve/beginning of straight section (C)	30
End of straight section/beginning of vertical curve (D)	30
End of vertical curve/beginning of straight tangent (D)	20
Exit point (F)	--

(4.2) Pipe Vertical Ring Deflection During Installation (Buoyant Deflection) [1]:

$$\%Deflection = \frac{0.1169 * \left(\frac{7.48}{1728} w_{df}\right)\left(\frac{D_{pipe}}{2}\right)}{EI} \times 100$$

1728

%Deflection	0.09

(4.3) Critical buckling pressure:

From reference [2], Figure 3:

f_0	1

$$P_{UC} = \left(\frac{2E}{1-v^2}\right)\left(\frac{1}{DR-1}\right)^3 f_0$$

P_{UC} (lb/in^2)	159.8

$$F_R = \sqrt{5.57 - \left(\frac{s_{ti}}{2T_{allow}} - 1.09\right)^2} - 1.09$$

$$F_{CR} = P_{UC} F_R$$

Location	Reduction Factor, F_R	Critical Buckling Pressure, F_{CR} (lb/in^2)	Installation Buckling Stress Ratio (FCR/Pnet) (must be ≥2)	
Entry point (A)	--	--	--	
End of straight tangent/beginning of vertical curve (B)	1.04	167	8.3	Good
End of vertical curve/beginning of straight section (C)	1.07	172	5.8	Good
End of straight section/beginning of vertical curve (D)	1.09	174	5.8	Good
End of vertical curve/beginning of straight tangent (D)	1.12	178	8.9	Good
Exit point (F)	--	--	--	

(5) Pipe Collapse During Operations:

(5.1) Earth pressure for deformed borehole with arching mobilized (i.e., not collapsed borehole)

$$P_E = \frac{k g_{se} H_C}{144}$$

where:

$$k = \frac{1 - e^{-2\frac{KH_C}{B}\tan\left(\frac{\delta}{2}\right)}}{2\frac{KH_C}{B}\tan\left(\frac{\delta}{2}\right)}$$

k	0.22
P_E (lb/in^2)	6.5

(5.2) Groundwater Pressure

$$P_{GW} = \frac{\rho_w(H_C - H_W)}{144}$$

P_{GW} (lb/in^2)	6.9

(5.3) Net external pressure on the pipe during operation (drained):

Max of:

$$P_{net} = P_E + P_{GW} + P_{SUR} - P_{internal}$$

or:

$$P_{net} = P_{MUD} - P_{internal}$$

P_{net} (lb/in^2)	19.7

(5.4) Pipe Vertical Ring Deflection During Operation:

(5.4.1) Ring Deflection from earth pressure:

$$\%deflection = \frac{0.0125P_E}{\left(\frac{E}{12(DR-1)^3}\right)} \times 100$$

%Deflection	2.11

(5.4.2) Buoyant Deflection:

$$\%Deflection = \frac{0.1169 * \left(\frac{7.48}{1728} w_{df}\right)\left(\frac{D_{pipe}}{2}\right)}{EI} \times 100$$

%Deflection	0.13

(5.4.2) Reissner Effect:

$$\%Deflection = \left(\frac{2}{3}\right)Z + \left(\frac{71}{135}\right)Z^2$$

$$Z = \frac{\frac{3}{2}(1-v^2)\left(D_{pipe} - t\right)^4}{16t^2(12 \times R_1)^4}$$

Z	5.4505E-13
%Deflection	3.6337E-11

(5.4.2) Total Deflection:

%Deflection	2.24

(5.4.3) Allowable Deflection:

%Deflection	5.00	Check > Total Deflection

(5.5) Critical buckling pressure during operation:

$$F_{CR} = P_{UC}$$

$$P_{UC} = \left(\frac{2E}{1-v^2}\right)\left(\frac{1}{DR-1}\right)^3 f_0$$

f_0	0.82
F_{CR} (lb/in^2)	95.7
Installation Buckling Stress Ratio (FCR/Pnet) (must be ≥2)	4.8

Good

REFERENCES

[1] ASTM-F1962 (2005), "Standard guide for use of maxi-horizontal directional drilling for placement of polyethylene pipe or condituit under obstacles, including river crossings", ASTM International.
[2] Handbook of PE Pipe, Second Edition, "Chapter 3 - Material Properties, Appendix B". Irving Tx: The Plastic Pipe Institute, 2008.
[3] Handbook of PE Pipe, Second Edition, "Chapter 12 - Horizontal Directional Drilling". Irving Tx: The Plastic Pipe Institute, 2008.
[4] Horizontal Directional Drilling (HDD) Good Practices Guidelines, Fourth Edition. North American Society for Trenchless Technology,
[5] Duyvestyn, Glenn (2009), "Comparison of Predicted and Observed HDD Installation Loads for Various Calculation Methods", Proceedings, NO-DIG 2009 International Conference, Toronto, On, paper B-1-01.

TABLE B.1.1
Apparent Elastic Modulus for 73°F (23°C)

Duration of Sustained Loading	Design Values For 73°F (23°C) [1,2,3]					
	PE 2XXX		PE3XXX		PE4XXX	
	psi	MPa	psi	MPa	psi	MPa
0.5hr	62,000	428	78,000	538	82,000	565
1hr	59,000	407	74,000	510	78,000	538
2hr	57,000	393	71,000	490	74,000	510
10hr	50,000	345	62,000	428	65,000	448
12hr	48,000	331	60,000	414	63,000	434
24hr	46,000	317	57,000	393	60,000	414
100hr	42,000	290	52,000	359	55,000	379
1,000hr	35,000	241	44,000	303	46,000	317
1 year	30,000	207	38,000	262	40,000	276
10 years	26,000	179	32,000	221	34,000	234
50 years	22,000	152	28,000	193	29,000	200
100 years	21,000	145	27,000	186	28,000	193

From Reference [2]

TABLE 2
Design Deflection Limits of Buried Polyehtylene Pipe, Long Term, %*

DR or SDR	21	17	15.5	13.5	11	9	7.3
Deflection Limit (% Δy/D) Non-Pressure Applications	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Deflection Limit (%Δy/D) Pressure Applications	7.5	6.0	6.0	6.0	5.0	4.0	3.0

* Design deflection limits per ASTM F1962, Guide for Use of Maxi-Horizontal Directional Drilling for Placement of PE Pipe or Conduit Under Obstacles, Including River Crossings.

From Reference [3]

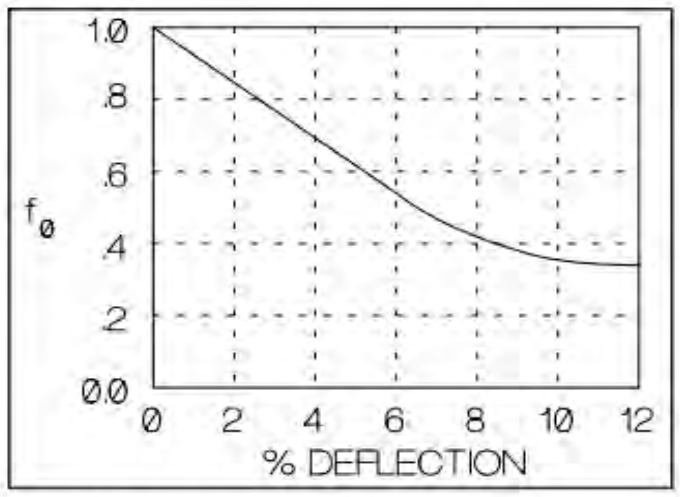


Figure 3 Ovality Compensation Factor f_O

From Reference [3]

Appendix E

Calculations of Hydrofracture Risk

(1) Summary of Input Values

(1.1) Summary of Input Values

Table 1 - Geotechnical Model

Soil Group No.	Soil Type	Elevation of Strata Top	Elevation of Stata Bottom	Unit Weight	Max Thickness (ft)	Friction Angle,	Shear Modulus, G (psf)	Cohesion Coeff., c (psf)
1	Clay to Clay with Sand	42	30.5	110	11	0	30000	1350
2	Clayey Sand	32.5	22.5	125	8	31	550000	0
3	Clay to Clayey Silt	24.5	18	125	4.5	0	7000	1000
4	Clayey Sand to Clay	20	0.5	110	17.5	30	450000	0
5	Clayey Sand with Gravel	4	-7.5	125	12	36	990000	0

(1.2) Groundwater Parameters

El_w (ft)	23.5	groundwater elevation taken from entry

(1.3) Assumed Drilling Fluid Properties

γ_{mud} (lb/gal)	11	unit weight of drilling fluid	
μ_p (cp)	60	viscosity of the drilling fluid	
Q (gal/min)	150	flow rate at the drill bit	
τ_y (lb/100 $ft^{2)}$	25	yield point of drilling fluid	might be a little high - more like 15 in real world
v (ft/sec)	1.18	velocity of the drilling fluid = Q/A, i.e., flow rate/area of bore annulus	

(1.3) Assumed Bore Dimensions

d_{bore} (in)	8.00	Min. diameter of bore hole to avoid hydrofracture below creek
R_0 (ft)	0.33	Bore hole radius d/2
d_{pipe} (in)	3.500	diameter of drill pipe
A (ft^2)	0.28	area of bore annulus
R_{pmax} (ft)	50% x h_{tot}	Radius of plastic zone

(2) Maximum Allowable Pressure (P_{max}) Calculation

$$P_{max} = u + [\sigma'_0 \cdot (1 + \sin\varphi) + c \cdot \cos\varphi + c \cdot \cot\varphi]\left(\left(\frac{R_0}{R_{pmax}}\right)^2 + \frac{\sigma'_0 . \sin\varphi + c \cdot \cos\varphi}{G}\right)^{\frac{-\sin\varphi}{1+\sin\varphi}} - c \cdot \cot\varphi$$

Where:

P_{max} = Maximum allowable pressure that a given soil at a given depth can withstand without hydrofracturing, lb/ft^3

φ = Friction angle of soil

R_0 = Bore radius, ft

G = Shear modulus, lb/ft^3

c = Cohesion coefficient, lb/ft^2

u = Initial groundwater pressure, defined as γwater * hw, lb/FT2

R_{pmax} = Radius of the plastic zone (ft). (May include safety factor to prevent the plastic zone from reaching the ground surface).

σ_0' = Effective stress as defined as γ * (h_{tot} - h_w) + γ' * h_w, where

γ = Total unit weight of soil above groundwater, lb/FT3

γ' = Effective unit weight of soil below groundwater, equal to γ - γ_{water}, lb/ft^3

γ_{water} = 62.4 lb/ft^3 for fresh water and 64.08 lb/ft^3 for salt water

h_{tot} = Depth of the bore below ground surface, ft

h_w = Depth of the bore below groundwater elevation, ft

(3) Minimum Required Downhole Pressure (Pmin) Calculation

$$P_{min} = \frac{7.48 \cdot \gamma_{mud} . h_{bore}}{144} + L_{bore} . \left[\left(\frac{\mu_p \cdot v}{1000 \cdot (d_{bore} - d_{pipe})^2}\right) + \left(\frac{\tau_y}{200 \cdot (d_{bore} - d_{pipe})}\right)\right]$$

Where:

γ_{mud} = unit weight of drilling fluid, lb/gal

h_{bore} = Height of mud column or the difference in depth from a specific location in the bore to the surface of the entry pit, ft

L_{bore} = Horizontal distance from a specific location in the bore to entry pit, ft

μ_p = Viscosity of drilling fluid, cp

v = Velocity of the drilling fluid = Q/A, i.e., flow rate/area of bore annulus, ft/sec

Q = flow rate of drilling fluid at drill bit, gal/min

d_{bore} = Diameter of bore hole, in

d_{pipe} = Diameter of drill or product pipe, in

Table 2 - Hydrofracture Evaluation Results

HDD Profile								Soil Group Bottom Elevation (ft)					Soil Group Thickness Above Bore (ft)					Soil Properties (Weighted Average)					Groundwater and Soil Pressure		Maximum Allowable Pressure		Minimum Required Downhole Pressure
Horizontal Distance from Entry Point (ft)	Station	Description	Ground Surface Elevation (ft)	Bore Elevation (ft)	h_{tot}, Depth of bore BGS (ft)	h_w, Depth of the bore below GW (ft)	h_{bore}, height of mud column (ft)	Soil Group No. 1	Soil Group No. 2	Soil Group No. 3	Soil Group No. 4	Soil Group No. 5	Soil Group No. 1	Soil Group No. 2	Soil Group No. 3	Soil Group No. 4	Soil Group No. 5	φ (deg)	G (lb/ft^2)	c (lb/ft^2)	γ (lb/ft^3)	γ' (lb/ft^3)	u (lb/ft^2)	σ_0' (lb/ft^2)	P_{max} (psf)	P_{max} (psi)	P_{min} (psi)
0.00	0+50.00	Entry (F)	42.08	42.08	0.00	0.00	0.00	30.5	22.5	18	0.5	-7.5	0.00	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	0	0	0	0.0
5.74	0+55.74	DH-1	42.18	40.54	1.64	0.00	1.54	30.5	22.5	18	0.5	-7.5	1.64	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	180.142161	3632.40643	25	1.1
10.12	0+60.12		42.24	39.37	2.87	0.00	2.71	30.5	22.5	18.0	0.5	-7.5	2.87	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	315.808828	4788.95837	33	1.9
10.50	0+60.50		42.25	39.27	2.98	0.00	2.81	30.5	22.5	18.0	0.5	-7.5	2.98	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	328.106393	4856.49901	34	1.9
10.61	0+60.61		42.25	39.24	3.01	0.00	2.84	30.5	22.5	18.0	0.5	-7.5	3.01	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	331.347793	4873.63921	34	2.0
12.67	0+62.67		42.25	38.69	3.56	0.00	3.39	30.5	22.5	18.0	0.6	-7.5	3.56	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	392.050381	5151.99614	36	2.3
12.88	0+62.88		42.59	38.63	3.96	0.00	3.45	30.5	22.5	18.0	0.6	-7.5	3.96	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	435.638508	5312.78462	37	2.4
12.96	0+62.96		42.74	38.61	4.13	0.00	3.47	30.5	22.5	18.0	0.6	-7.5	4.13	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	454.49589	5374.70967	37	2.4
13.41	0+63.41		42.75	38.49	4.26	0.00	3.59	30.5	22.5	18.0	0.6	-7.5	4.26	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	468.856164	5419.24923	38	2.5
13.59	0+63.59		42.75	38.44	4.31	0.00	3.64	30.5	22.5	18.0	0.6	-7.5	4.31	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	474.160274	5435.17251	38	2.5
26.63	0+76.63		42.47	34.95	7.52	0.00	7.13	30.6	22.6	18.1	0.7	-7.5	7.52	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	827.613546	6146.99388	43	4.9
27.54	0+77.54		42.37	34.70	7.67	0.00	7.38	30.6	22.6	18.1	0.7	-7.5	7.67	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	843.428767	6170.28046	43	5.1
29.75	0+79.75		42.44	34.11	8.33	0.00	7.97	30.6	22.6	18.1	0.7	-7.5	8.33	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	916.251446	6273.07249	44	5.5
32.67	0+82.67		42.55	33.33	9.22	0.00	8.75	30.6	22.6	18.1	0.7	-7.5	9.22	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	1014.39589	6402.55625	44	6.0
37.59	0+87.59		42.48	32.01	10.47	0.00	10.07	30.6	22.6	18.1	0.8	-7.5	10.47	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	1151.67489	6571.70187	46	6.9
37.61	0+87.61		42.48	32.00	10.48	0.00	10.08	30.6	22.6	18.1	0.8	-7.5	10.48	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	1152.26423	6572.40534	46	6.9
43.85	0+93.85		42.16	30.33	11.83	0.00	11.75	30.7	22.7	18.2	0.8	-7.5	11.49	0.34	0.00	0.00	0.00	0.89	44861.12	1311.42	110.43	48.03	0.00	1306.00998	7305.52741	51	8.1
45.94	0+95.94		41.94	29.77	12.17	0.00	12.31	30.7	22.7	18.2	0.8	-7.5	11.26	0.91	0.00	0.00	0.00	2.31	68776.57	1249.33	111.12	48.72	0.00	1351.93565	8017.88811	56	8.5
54.88	1+04.88		41.24	27.38	13.86	0.00	14.70	30.7	22.7	18.2	0.9	-7.5	10.52	3.34	0.00	0.00	0.00	7.47	155384.19	1024.48	113.62	51.22	0.00	1574.89904	10174.4725	71	10.1
59.13	1+09.13	E	41.26	26.24	15.02	0.00	15.84	30.7	22.7	18.2	0.9	-7.5	10.52	4.50	0.00	0.00	0.00	9.29	185790.16	945.54	114.49	52.09	0.00	1719.69908	11121.0697	77	10.9
64.13	1+14.13		41.28	24.93	16.35	0.00	17.15	30.8	22.8	18.3	1.0	-7.5	10.52	5.84	0.00	0.00	0.00	11.06	215580.88	868.20	115.35	52.95	0.00	1886.37383	12212.286	85	11.8
66.92	1+16.92		41.29	24.22	17.07	0.00	17.86	30.8	22.8	18.3	1.0	-7.5	10.52	6.56	0.00	0.00	0.00	11.91	229721.02	831.49	115.76	53.36	0.00	1976.28374	12806.6554	89	12.3
69.13	1+19.13		41.10	23.67	17.43	0.00	18.41	30.8	22.8	18.3	1.0	-7.5	10.32	7.12	0.00	0.00	0.00	12.66	242280.36	798.89	116.12	53.72	0.00	2024.15703	13259.1267	92	12.7
74.13	1+24.13		40.67	22.47	18.20	1.03	19.61	30.8	22.8	18.3	1.0	-7.5	9.86	8.00	0.34	0.00	0.00	13.62	258090.60	750.17	116.87	54.47	64.50	2063.05004	13844.9302	96	13.5
76.46	1+26.46		40.47	21.92	18.55	1.58	20.16	30.8	22.8	18.3	1.1	-7.5	9.65	8.00	0.89	0.00	0.00	13.37	253203.85	750.79	117.19	54.79	98.32	2075.10039	13747.5605	95	13.9
79.13	1+29.13		40.35	21.32	19.03	2.18	20.76	30.8	22.8	18.3	1.1	-7.5	9.52	8.00	1.51	0.00	0.00	13.03	246802.99	754.59	117.50	55.10	136.17	2099.54023	13651.1251	95	14.3
80.53	1+30.53		40.28	21.01	19.27	2.49	21.07	30.8	22.8	18.3	1.1	-7.5	9.44	8.00	1.83	0.00	0.00	12.87	243649.95	756.43	117.65	55.25	155.63	2111.97094	13603.7832	94	14.6
84.13	1+34.13		39.62	20.22	19.40	3.28	21.86	30.9	22.9	18.4	1.1	-7.5	8.77	8.00	2.63	0.00	0.00	12.78	241309.55	745.89	118.22	55.82	204.47	2089.02877	13452.4009	93	15.1
89.13	1+39.13		38.71	19.18	19.53	4.32	22.90	30.9	22.9	18.4	1.2	-7.5	7.84	8.00	3.69	0.00	0.00	12.70	238652.91	730.84	118.98	56.58	269.44	2054.28826	13251.1684	92	15.9
94.13	1+44.13		37.80	18.19	19.61	5.31	23.89	30.9	22.9	18.4	1.2	-7.5	6.90	8.00	4.50	0.20	0.00	12.96	241244.87	704.85	119.56	57.16	331.10	2013.17309	13193.3625	92	16.6
98.14	1+48.14		37.07	17.44	19.63	6.06	24.64	30.9	22.9	18.4	1.2	-7.5	6.15	8.00	4.50	0.98	0.00	14.12	257517.36	652.51	119.55	57.15	378.16	1968.67072	13546.0022	94	17.1
99.13	1+49.13		37.00	17.26	19.74	6.24	24.82	30.9	22.9	18.4	1.2	-7.5	6.08	8.00	4.50	1.16	0.00	14.33	260179.04	643.76	119.50	57.10	389.46	1969.62946	13642.5352	95	17.3
99.42	1+49.42		36.98	17.21	19.77	6.29	24.87	30.9	22.9	18.4	1.2	-7.5	6.06	8.00	4.50	1.21	0.00	14.39	260949.31	641.23	119.48	57.08	392.74	1969.89175	13670.5146	95	17.3
104.13	1+54.13		36.63	16.38	20.25	7.12	25.70	30.9	22.9	18.4	1.3	-7.5	5.69	8.00	4.50	2.07	0.00	15.31	273152.53	601.21	119.26	56.86	444.54	1970.67675	14103.337	98	17.9
109.13	1+59.13		36.25	15.55	20.71	7.95	26.53	31.0	23.0	18.5	1.3	-7.5	5.29	8.00	4.50	2.92	0.00	16.20	285089.37	562.12	119.05	56.65	496.37	1969.09679	14525.2082	101	18.6
112.53	1+62.53		36	15.01	20.99	8.49	27.07	31.0	23.0	18.5	1.3	-7.5	5.02	8.00	4.50	3.47	0.00	16.77	292687.86	537.27	118.93	56.53	529.76	1966.60906	14790.6492	103	19.0
114.13	1+64.13		36.01	14.77	21.24	8.73	27.31	31.0	23.0	18.5	1.4	-7.5	5.02	8.00	4.50	3.72	0.00	16.93	294518.31	531.01	118.83	56.43	544.95	1979.22336	14931.1584	104	19.2
119.13	1+69.13		36.04	14.04	22.00	9.46	28.04	31.0	23.0	18.5	1.4	-7.5	5.03	8.00	4.50	4.47	0.00	17.37	299735.21	513.17	118.52	56.12	590.31	2017.02021	15348.628	107	19.7
122.85	1+72.85		36.06	13.53	22.53	9.97	28.55	31.0	23.0	18.5	1.4	-7.5	5.03	8.00	4.50	4.99	0.00	17.66	303172.31	501.41	118.32	55.92	621.97	2043.55062	15638.462	109	20.2
124.13	1+74.13		36.08	13.36	22.72	10.14	28.72	31.0	23.0	18.5	1.4	-7.5	5.05	8.00	4.50	5.17	0.00	17.74	304076.18	498.26	118.25	55.85	632.45	2054.18498	15736.7637	109	20.3
129.13	1+79.13		36.18	12.74	23.44	10.76	29.34	31.1	23.1	18.6	1.5	-7.5	5.12	8.00	4.50	5.81	0.00	18.02	307269.58	487.10	118.00	55.60	671.40	2094.19424	16101.1045	112	20.8
134.13	1+84.13		36.27	12.17	24.10	11.33	29.91	31.1	23.1	18.6	1.5	-7.5	5.19	8.00	4.50	6.41	0.00	18.27	309977.09	477.61	117.78	55.38	707.16	2131.7721	16434.8362	114	21.3
135.13	1+85.13		36.29	12.06	24.23	11.44	30.02	31.1	23.1	18.6	1.5	-7.5	5.21	8.00	4.50	6.52	0.00	18.31	310465.53	475.90	117.74	55.34	713.93	2138.99666	16497.9837	115	21.4
137.94	1+87.94		36.11	11.76	24.35	11.74	30.32	31.1	23.1	18.6	1.5	-7.5	5.02	8.00	4.50	6.83	0.00	18.60	314442.01	462.99	117.70	55.30	732.27	2133.19006	16635.2931	116	21.6
140.13	1+90.13		36.12	11.55	24.57	11.95	30.53	31.1	23.1	18.6	1.6	-7.5	5.01	8.00	4.50	7.06	0.00	18.71	315727.68	458.60	117.63	55.23	745.87	2144.37668	16757.7669	116	21.8
145.13	1+95.13		36.13	11.09	25.05	12.41	30.99	31.1	23.1	18.6	1.6	-7.5	5.01	8.00	4.50	7.54	0.00	18.93	318385.22	449.55	117.49	55.09	774.65	2168.18225	17016.9938	118	22.3
150.13	2+00.13		36.15	10.67	25.48	12.83	31.41	31.1	23.1	18.6	1.6	-7.5	5.00	8.00	4.50	7.97	0.00	19.12	320687.03	441.70	117.36	54.96	800.28	2189.58055	17248.3035	120	22.6
155.13	2+05.13		36.17	10.31	25.85	13.19	31.77	31.2	23.2	18.7	1.7	-7.5	5.00	8.00	4.50	8.36	0.00	19.29	322664.87	434.97	117.25	54.85	822.76	2208.57755	17452.1828	121	23.0
160.13	2+10.13		36.18	10.00	26.18	13.50	32.08	31.2	23.2	18.7	1.7	-7.5	4.99	8.00	4.50	8.69	0.00	19.43	324344.71	429.25	117.16	54.76	842.10	2225.17844	17629.0493	122	23.3
165.13	2+15.13		36.20	9.75	26.46	13.75	32.33	31.2	23.2	18.7	1.8	-7.5	4.99	8.00	4.50	8.97	0.00	19.55	325747.60	424.47	117.09	54.69	858.30	2239.38768	17779.2554	123	23.6
170.13	2+20.13		36.22	9.54	26.68	13.96	32.54	31.2	23.2	18.7	1.8	-7.5	4.98	8.00	4.50	9.20	0.00	19.64	326890.45	420.59	117.03	54.63	871.37	2251.20899	17903.0919	124	23.9
175.13	2+25.13		36.24	9.38	26.86	14.12	32.70	31.3	23.3	18.8	1.8	-7.5	4.97	8.00	4.50	9.38	0.00	19.72	327786.52	417.54	116.98	54.58	881.32	2260.64539	18000.7903	125	24.2
179.57	2+29.57		36.25	9.28	26.97	14.22	32.80	31.3	23.3	18.8	1.9	-7.5	4.97	8.00	4.50	9.50	0.00	19.77	328383.53	415.52	116.95	54.55	887.53	2267.02756	18065.7781	125	24.4
180.13	2+30.13		36.26	9.27	26.99	14.23	32.81	31.3	23.3	18.8	1.9	-7.5	4.97	8.00	4.50	9.52	0.00	19.77	328409.86	415.42	116.95	54.55	888.14	2268.05713	18072.9704	126	24.4
185.13	2+35.13		36.30	9.21	27.09	14.29	32.87	31.3	23.3	18.8	1.9	-7.5	4.99	8.00	4.50	9.60	0.00	19.78	328519.13	414.97	116.92	54.52	891.84	2275.92606	18122.8043	126	24.6
188.29	2+38.29		36.33	9.20	27.13	14.30	32.88	31.3	23.3	18.8	1.9	-7.5	5.01	8.00	4.50	9.62	0.00	19.78	328472.35	415.09	116.91	54.51	892.57	2279.67168	18140.9804	126	24.7
188.56	2+38.56	D	36.34	9.20	27.14	14.30	32.88	31.3	23.3	18.8	1.9	-7.5	5.02	8.00	4.50	9.63	0.00	19.77	328381.50	415.37	116.91	54.51	892.58	2280.77516	18143.0669	126	24.7
198.90	2+48.90		36.82	9.20	27.62	14.30	32.88	31.4	23.4	18.9	2.0	-7.5	5.45	8.00	4.50	9.67	0.00	19.48	323903.30	429.34	116.79	54.39	892.58	2333.57516	18231.5764	127	25.0
209.84	2+59.84		36.4	9.20	27.20	14.30	32.88	31.4	23.4	18.9	2.1	-7.5	4.98	8.00	4.50	9.72	0.00	19.84	329199.88	412.68	116.89	54.49	892.58	2287.37516	18206.6968	126	25.4
210.32	2+60.32		36.3	9.20	27.10	14.30	32.88	31.4	23.4	18.9	2.1	-7.5	4.88	8.00	4.50	9.72	0.00	19.91	330337.20	409.12	116.92	54.52	892.58	2276.37516	18194.452	126	25.4
228.88	2+78.88		36.41	9.20	27.21	14.30	32.88	31.5	23.5	19.0	2.3	-7.5	4.91	8.00	4.50	9.81	0.00	19.92	330410.51	408.78	116.89	54.49	892.58	2288.47516	18257.898	127	26.0
230.67	2+80.67		34.9	9.20	25.70	14.30	32.88	31.5	23.5	19.0	2.3	-7.5	3.39	8.00	4.50	9.81	0.00	21.10	348189.72	353.07	117.29	54.89	892.58	2122.37516	18022.2228	125	26.0
237.07	2+87.07		30.51	9.20	21.31	14.30	32.88	30.5	23.5	19.0	2.3	-7.5	0.00	6.97	4.50	9.84	0.00	23.99	389173.53	211.13	118.07	55.67	892.58	1624.03093	15993.134	111	26.2
244.62	2+94.62		29.1	9.20	19.90	14.30	32.88	29.1	23.6	19.1	2.4	-7.5	0.00	5.53	4.50	9.88	0.00	23.50	377610.16	226.08	117.56	55.16	892.58	1447.27198	14522.624	101	26.4
250.76	3+00.76		29.17	9.20	19.97	14.30	32.88	29.2	23.6	19.1	2.4	-7.5	0.00	5.57	4.50	9.91	0.00	23.52	378076.16	225.29	117.56	55.16	892.58	1455.60807	14590.8344	101	26.6

HDD Profile								Soil Group Bottom Elevation (ft)					Soil Group Thickness Above Bore (ft)					Soil Properties (Weighted Average)					Groundwater and Soil Pressure		Maximum Allowable Pressure		Minimum Required Downhole Pressure
Horizontal Distance from Entry Point (ft)	Station	Description	Ground Surface Elevation (ft)	Bore Elevation (ft)	h_{tot}, Depth of bore BGS (ft)	h_w, Depth of the bore below GW (ft)	h_{bore}, height of mud column (ft)	Soil Group No. 1	Soil Group No. 2	Soil Group No. 3	Soil Group No. 4	Soil Group No. 5	Soil Group No. 1	Soil Group No. 2	Soil Group No. 3	Soil Group No. 4	Soil Group No. 5	φ (deg)	G (lb/ft^2)	c (lb/ft^2)	γ (lb/ft^3)	γ' (lb/ft^3)	u (lb/ft^2)	σ_0' (lb/ft^2)	P_{max} (psf)	P_{max} (psi)	P_{min} (psi)
254.90	3+04.90		29.12	9.20	19.92	14.30	32.88	29.1	23.6	19.1	2.5	-7.5	0.00	5.50	4.50	9.92	0.00	23.50	377551.33	225.86	117.53	55.13	892.58	1449.07899	14536.2464	101	26.8
262.11	3+12.11		29.17	9.20	19.97	14.30	32.88	29.2	23.7	19.2	2.5	-7.5	0.00	5.52	4.50	9.96	0.00	23.52	377820.79	225.29	117.52	55.12	892.58	1454.84295	14583.0196	101	27.0
265.56	3+15.56		29.06	9.20	19.86	14.30	32.88	29.1	23.7	19.2	2.5	-7.5	0.00	5.39	4.50	9.97	0.00	23.48	376789.28	226.54	117.47	55.07	892.58	1440.86039	14466.8717	100	27.1
268.22	3+18.22		29.12	9.20	19.92	14.30	32.88	29.1	23.7	19.2	2.6	-7.5	0.00	5.44	4.50	9.98	0.00	23.50	377250.89	225.86	117.48	55.08	892.58	1448.18107	14527.0876	101	27.2
274.44	3+24.44	C	29.36	9.20	20.16	14.30	32.88	29.4	23.7	19.2	2.6	-7.5	0.00	5.65	4.50	10.01	0.00	23.59	379168.38	223.17	117.55	55.15	892.58	1477.76177	14771.2591	103	27.4
275.45	3+25.45		29.4	9.20	20.20	14.30	32.88	29.4	23.7	19.2	2.6	-7.5	0.00	5.69	4.50	10.02	0.00	23.60	379480.56	222.74	117.56	55.16	892.51	1482.64513	14811.4225	103	27.4
279.44	3+29.44		30.46	9.22	21.24	14.28	32.86	30.5	23.7	19.2	2.7	-7.5	0.00	6.73	4.50	10.01	0.00	23.96	387841.14	211.85	117.93	55.53	891.02	1613.96955	15898.5499	110	27.5
284.44	3+34.44		31.79	9.30	22.50	14.20	32.78	31.8	23.8	19.3	2.7	-7.5	0.04	8.00	4.50	9.96	0.00	24.30	396199.85	202.43	118.33	55.93	886.34	1775.79565	17213.9196	120	27.6
289.44	3+39.44		33.12	9.42	23.70	14.08	32.66	31.8	23.8	19.3	2.7	-7.5	1.35	8.00	4.50	9.85	0.00	22.94	375755.29	266.65	117.91	55.51	878.53	1916.21799	17623.044	122	27.7
294.44	3+44.44		34.45	9.60	24.86	13.90	32.48	31.8	23.8	19.3	2.8	-7.5	2.66	8.00	4.50	9.70	0.00	21.68	357103.17	325.30	117.54	55.14	867.61	2054.25707	17881.1292	124	27.8
299.44	3+49.44		35.78	9.82	25.96	13.68	32.26	31.8	23.8	19.3	2.8	-7.5	3.96	8.00	4.50	9.50	0.00	20.53	339896.04	379.47	117.22	54.82	853.55	2189.91036	18025.3129	125	27.8
304.44	3+54.44		37.12	10.10	27.02	13.40	31.98	31.8	23.8	19.3	2.8	-7.5	5.27	8.00	4.50	9.25	0.00	19.44	323860.45	430.02	116.94	54.54	836.37	2323.17463	18081.3175	126	27.8
309.44	3+59.44		38.45	10.42	28.02	13.08	31.66	31.9	23.9	19.4	2.9	-7.5	6.58	8.00	4.50	8.94	0.00	18.42	308777.48	477.61	116.69	54.29	816.04	2454.04593	18067.1161	125	27.8
314.44	3+64.44		39.78	10.80	28.98	12.70	31.28	31.9	23.9	19.4	2.9	-7.5	7.89	8.00	4.50	8.59	0.00	17.45	294468.98	522.83	116.47	54.07	792.58	2582.51958	17995.3973	125	27.7
315.58	3+65.58		40.08	10.89	29.19	12.61	31.19	31.9	23.9	19.4	2.9	-7.5	8.19	8.00	4.50	8.50	0.00	17.23	291299.24	532.85	116.42	54.02	786.78	2611.47536	17971.9917	125	27.7
316.79	3+66.79		40.73	10.99	29.74	12.51	31.09	31.9	23.9	19.4	2.9	-7.5	8.83	8.00	4.50	8.41	0.00	16.82	285123.53	552.28	116.31	53.91	780.46	2678.14982	17965.5394	125	27.7
317.41	3+67.41		40.85	11.05	29.80	12.45	31.03	31.9	23.9	19.4	3.0	-7.5	8.95	8.00	4.50	8.35	0.00	16.73	283841.90	556.35	116.29	53.89	777.15	2688.82264	17947.1526	125	27.7
318.65	3+68.65		40.86	11.15	29.71	12.35	30.93	31.9	23.9	19.4	3.0	-7.5	8.95	8.00	4.50	8.25	0.00	16.68	283228.25	558.40	116.31	53.91	770.37	2684.75726	17894.8684	124	27.6
319.44	3+69.44		40.86	11.23	29.63	12.27	30.85	31.9	23.9	19.4	3.0	-7.5	8.95	8.00	4.50	8.18	0.00	16.66	282906.23	559.49	116.33	53.93	765.96	2681.05597	17860.0999	124	27.6
324.44	3+74.44		40.84	11.70	29.14	11.80	30.38	31.9	23.9	19.4	3.0	-7.5	8.91	8.00	4.50	7.73	0.00	16.47	280660.01	567.09	116.44	54.04	736.18	2656.23406	17623.9798	122	27.5
329.44	3+79.44		40.82	12.23	28.59	11.27	29.85	32.0	24.0	19.5	3.0	-7.5	8.86	8.00	4.50	7.22	0.00	16.26	278031.14	575.97	116.56	54.16	703.24	2628.99594	17359.6784	121	27.4
334.44	3+84.44		40.80	12.81	27.99	10.69	29.27	32.0	24.0	19.5	3.1	-7.5	8.82	8.00	4.50	6.67	0.00	16.01	274981.85	586.27	116.70	54.30	667.12	2599.33389	17066.5218	119	27.2
339.44	3+89.44		40.78	13.44	27.34	10.06	28.64	32.0	24.0	19.5	3.1	-7.5	8.78	8.00	4.50	6.06	0.00	15.72	271466.37	598.13	116.86	54.46	627.81	2567.23943	16743.7354	116	27.0
344.44	3+94.44		40.76	14.12	26.64	9.38	27.96	32.0	24.0	19.5	3.2	-7.5	8.74	8.00	4.50	5.40	0.00	15.39	267429.04	611.75	117.04	54.64	585.30	2532.70326	16390.4297	114	26.8
349.44	3+99.44		40.74	14.85	25.89	8.65	27.23	32.0	24.0	19.5	3.2	-7.5	8.70	8.00	4.50	4.69	0.00	15.02	262801.99	627.35	117.24	54.84	539.58	2495.7153	16005.5826	111	26.5
354.44	4+04.44		40.72	15.64	25.09	7.86	26.44	32.1	24.1	19.6	3.2	-7.5	8.66	8.00	4.50	3.93	0.00	14.59	257501.91	645.20	117.47	55.07	490.63	2456.26463	15588.0158	108	26.2
357.77	4+07.77		40.71	16.19	24.52	7.31	25.89	32.1	24.1	19.6	3.3	-7.5	8.63	8.00	4.50	3.39	0.00	14.27	253548.90	658.52	117.65	55.25	456.23	2428.61845	15291.0997	106	26.0
359.44	4+09.44		40.67	16.47	24.20	7.03	25.61	32.1	24.1	19.6	3.3	-7.5	8.58	8.00	4.50	3.12	0.00	14.11	251710.12	664.79	117.75	55.35	438.43	2410.92237	15134.1531	105	25.9
360.89	4+10.89		40.64	16.73	23.91	6.77	25.35	32.1	24.1	19.6	3.3	-7.5	8.54	8.00	4.50	2.87	0.00	13.97	250033.82	670.50	117.84	55.44	422.68	2395.3325	14994.616	104	25.8
362.35	4+12.35		40.62	16.98	23.64	6.52	25.10	32.1	24.1	19.6	3.3	-7.5	8.52	8.00	4.50	2.62	0.00	13.82	248149.34	676.89	117.93	55.53	406.55	2380.82666	14851.9335	103	25.7
364.44	4+14.44		40.61	17.36	23.25	6.14	24.72	32.1	24.1	19.6	3.3	-7.5	8.50	8.00	4.50	2.25	0.00	13.57	245127.79	687.07	118.07	55.67	382.97	2361.79071	14643.5972	102	25.5
364.54	4+14.54		40.61	17.38	23.23	6.12	24.70	32.1	24.1	19.6	3.3	-7.5	8.50	8.00	4.50	2.23	0.00	13.56	244978.66	687.57	118.07	55.67	381.83	2360.86896	14633.4655	102	25.5
369.44	4+19.44		40.59	18.30	22.29	5.20	23.78	32.1	24.1	19.6	3.4	-7.5	8.46	8.00	4.50	1.33	0.00	12.92	237098.99	714.11	118.41	56.01	324.24	2314.7	14118.3985	98	25.1
371.77	4+21.77		40.58	18.76	21.82	4.74	23.32	32.1	24.1	19.6	3.4	-7.5	8.44	8.00	4.50	0.88	0.00	12.58	232936.55	728.12	118.59	56.19	295.74	2291.89969	13860.1924	96	25.0
374.44	4+24.44		40.55	19.30	21.25	4.20	22.78	32.2	24.2	19.7	3.4	-7.5	8.39	8.00	4.50	0.36	0.00	12.18	227993.50	744.83	118.82	56.42	262.21	2262.7503	13551.6383	94	24.7
379.44	4+29.44		40.49	20.35	20.14	3.15	21.73	32.2	24.2	19.7	3.4	-7.5	8.31	8.00	3.83	0.00	0.00	12.31	232159.00	747.17	118.81	56.41	196.86	2196.23423	13406.3967	93	24.3
384.44	4+34.44		40.43	21.45	18.98	2.05	20.63	32.2	24.2	19.7	3.5	-7.5	8.22	8.00	2.76	0.00	0.00	13.07	245836.73	730.16	118.50	56.10	128.17	2120.98373	13530.2493	94	23.8
389.44	4+39.44		40.37	22.60	17.76	0.90	19.48	32.2	24.2	19.7	3.5	-7.5	8.14	8.00	1.62	0.00	0.00	13.96	262068.64	710.06	118.13	55.73	56.12	2042.36132	13679.2054	95	23.3
394.44	4+44.44		40.30	23.81	16.50	0.00	18.27	32.2	24.2	19.7	3.6	-7.5	8.06	8.00	0.44	0.00	0.00	15.03	281584.70	685.98	117.67	55.27	0.00	1941.03287	13812.8636	96	22.8
399.44	4+49.44		40.24	25.07	15.17	0.00	17.01	32.3	24.3	19.8	3.6	-7.5	7.97	7.20	0.00	0.00	0.00	14.70	276661.97	709.63	117.12	54.72	0.00	1776.74905	13100.8802	91	22.2
403.88	4+53.88	B	40.19	26.24	13.95	0.00	15.84	32.3	24.3	19.8	3.6	-7.5	7.90	6.05	0.00	0.00	0.00	13.44	255468.23	764.65	116.50	54.10	0.00	1625.0948	12096.0057	84	21.7
407.13	4+57.13		40.15	27.11	13.04	0.00	14.97	32.3	24.3	19.8	3.7	-7.5	7.85	5.19	0.00	0.00	0.00	12.34	237070.35	812.41	115.97	53.57	0.00	1512.06076	11362.2622	79	21.3
409.34	4+59.34		40.28	27.70	12.58	0.00	14.38	32.3	24.3	19.8	3.7	-7.5	7.97	4.61	0.00	0.00	0.00	11.36	220605.53	855.16	115.50	53.10	0.00	1452.48962	10899.1618	76	21.0
415.80	4+65.80		40.66	29.44	11.22	0.00	12.64	32.3	24.3	19.8	3.7	-7.5	8.32	2.91	0.00	0.00	0.00	8.03	164703.78	1000.29	113.89	51.49	0.00	1278.35857	9557.73632	66	20.2
418.29	4+68.29		40.67	30.10	10.57	0.00	11.98	32.4	24.4	19.9	3.7	-7.5	8.32	2.25	0.00	0.00	0.00	6.61	140801.58	1062.34	113.20	50.80	0.00	1196.22818	9005.36686	63	19.9
418.39	4+68.39		40.68	30.13	10.55	0.00	11.95	32.4	24.4	19.9	3.7	-7.5	8.33	2.23	0.00	0.00	0.00	6.54	139679.53	1065.26	113.16	50.76	0.00	1193.9856	8984.11343	62	19.9
421.29	4+71.29		40.73	30.91	9.82	0.00	11.17	32.4	24.4	19.9	3.8	-7.5	8.36	1.46	0.00	0.00	0.00	4.61	107355.93	1149.17	112.23	49.83	0.00	1102.55061	8301.69504	58	19.6
428.20	4+78.20		40.82	32.76	8.06	0.00	9.32	32.4	24.4	19.9	3.8	-7.5	8.06	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	886.863467	6232.39782	43	18.7
428.80	4+78.80		40.68	32.92	7.76	0.00	9.16	32.4	24.4	19.9	3.8	-7.5	7.76	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	853.77902	6185.31823	43	18.7
433.94	4+83.94		41.14	34.30	6.84	0.00	7.78	32.4	24.4	19.9	3.9	-7.5	6.84	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	752.882263	6031.1063	42	18.0
436.79	4+86.79		41.18	35.06	6.12	0.00	7.02	32.4	24.4	19.9	3.9	-7.5	6.12	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	673.281143	5893.8835	41	17.7
442.58	4+92.58		41.06	36.61	4.45	0.00	5.47	32.5	24.5	20.0	3.9	-7.5	4.45	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	489.426235	5479.52269	38	17.0
446.29	4+96.29		41.07	37.60	3.47	0.00	4.48	32.5	24.5	20.0	4.0	-7.5	3.47	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	381.177408	5107.37943	35	16.5
448.05	4+98.05		41.18	38.08	3.10	0.00	4.00	32.5	24.5	20.0	4.0	-7.5	3.10	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	341.403032	4925.16041	34	16.3
450.77	5+00.77	DH-2	41.6	38.81	2.79	0.00	3.27	32.5	24.5	20	4	-7.5	2.79	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	307.433541	4740.54239	33	16.0
454.08	5+04.08		42.12	39.69	2.43	0.00	2.39	32.5	24.5	20	4	-7.5	2.43	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	267.074345	4475.00809	31	15.6
458.41	5+08.41		42.83	40.85	1.98	0.00	1.23	32.5	24.5	20	4	-7.5	1.98	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	217.551591	4053.18337	28	15.0
459.16	5+09.16		42.93	41.05	1.88	0.00	1.03	32.5	24.5	20	4	-7.5	1.88	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	206.446033	3939.25585	27	15.0
461.83	5+11.83		43.16	41.77	1.39	0.00	0.31	32.5	24.5	20	4	-7.5	1.39	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	153.050246	3247.94291	23	14.6
469.15	5+19.15	Exit (A)	43.73	43.73	0.00	0.00	-1.65	32.5	24.5	20	4	-7.5	0.00	0.00	0.00	0.00	0.00	0.00	30000.00	1350.00	110.00	47.60	0.00	0	0	0	13.7

Appendix F

Calculations of Settlement Risk below Sanitary Sewer Siphon

Settlement Risk below Sanitary Sewer Siphon

Maximum Settlement Above the Bore Centerline:

$$\Delta h_{CL} = V_s / w$$

where:

$$w = \frac{d_b}{2} + \left(h_c + \frac{d_b}{2}\right) \cdot \tan\left(45 - \frac{\varphi}{2}\right)$$

and

$$V_a = \frac{\pi}{4} \cdot \left({d_b}^2 - {d_o}^2\right)$$

and

h_c (ft)	14.75	Depth of clearance from sewer above crown of the bore (not the pipe) (Assumed)
d_b (in)	16.125	Diameter of the bore
d_p (in)	10.75	Diameter of the product pipe
φ (deg)	18	At station 1+74

V_a (in^3/in)	113.5	Volume of the annulus per unit of the bore length
V_s (in^3/in)	56.7	Settlement trough volume per unit of bore length (assumed to equal 0.5*V_a)
w (in)	142.5	Settlement trough half width
Δh_{CL} (in)	0.40	Settlement trough depth at centerline (maximum settlement)

APPENDIX B – ARCHAEOLOGICAL SURVEY REPORT

Due to sensitive information contained within the Archaeological Survey Report, this report is not available for public release but is on file with the Coastside County Water District.