APPENDIX I
Civil Design

US Army Corps of Engineers
Corte Madera Creek Flood Risk Management Project
October 2018

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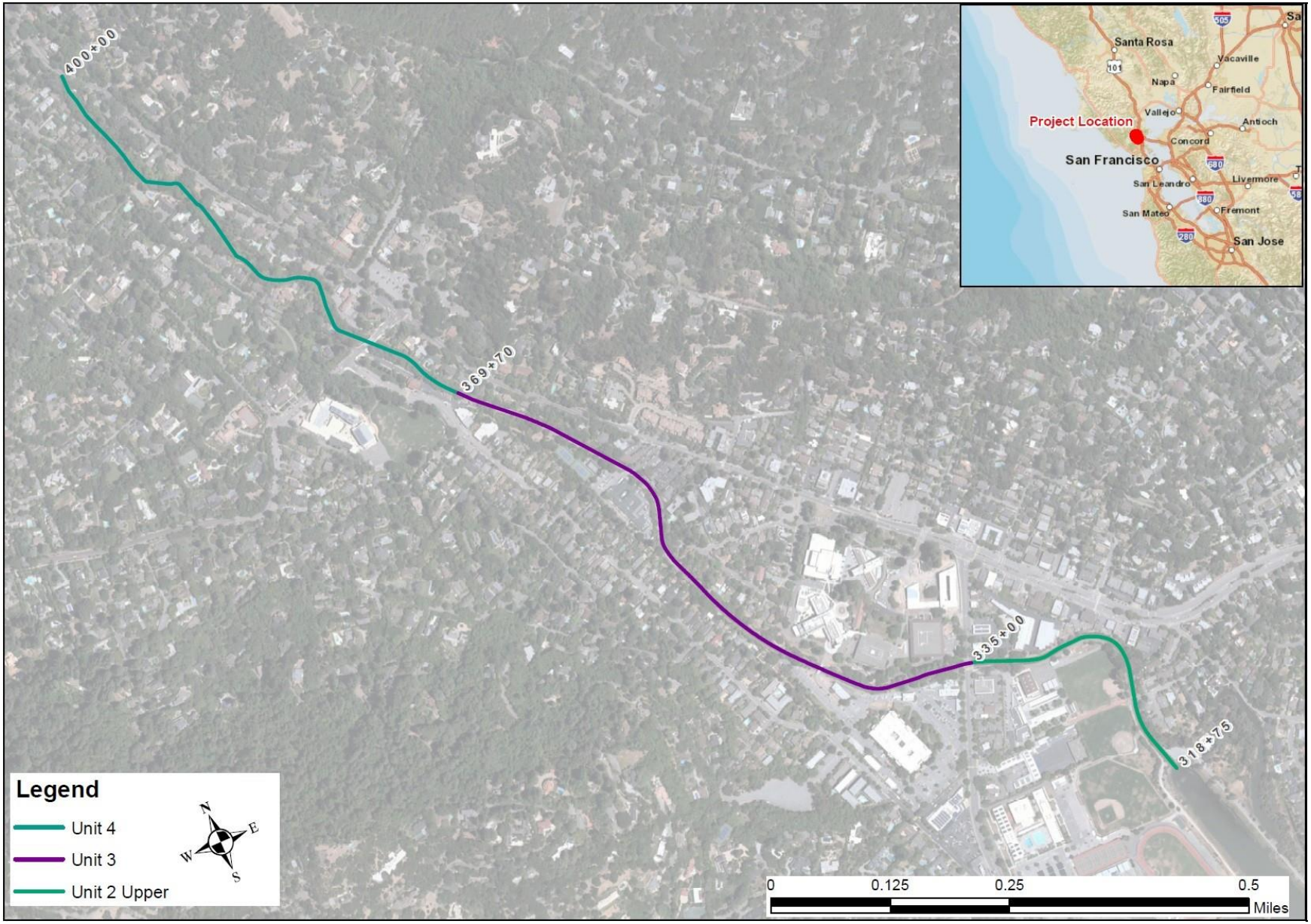


Figure 1: Project Location and Vicinity Map

PART 1 STUDY BACKGROUND

1.1 General

This appendix documents the Civil Design and Structural portion of the engineering analysis and follows the format of Engineer Regulation1110-2-1150. It covers the recommend alternative chosen to address the project objectives and solve the problems identified during the Alternative Milestone. Figure 1 shows the general location and vicinity of Units 4, 3 and the upper portion of Unit 2 that are included in the study.

1.2 Abbreviation and Names

TSP – Tentatively Selected Plan

USACE – US Army Corps of Engineers

NMFS – National Marine Fisheries Service

AMD – Adaptive Management Plan

CDFG – California Department of Fish and Games

CY – Cubic Yard

SF – Square Foot

QTY – Quantity

LS – Lump Sum

EA – Each

CE/ICA – Cost Effectiveness and Incremental Cost Analysis

1.3 Project-Specific References

USACE 2010. Final Corte Madera Creek Flood Control Study: Baseline Report. December.

USACE 1989. Corte Madera Creek Flood Control Project: Supplemental Information Paper II. September.

USACE 1990. USGS Sediment Survey. February.

USACE 1980. Corte Madera Creek Flood Control Project Unit 4: Revised Final Design Memorandum No. 2, Supplement No. 1. May.

1.4 Project Alternative Development and Selection

Including the no-action plan, ten alternatives were developed during the alternative formulation process. The alternatives were screened down to a final five arrays of alternatives by using the four main qualitative and quantitative screening criteria such as acceptability, completeness, effectiveness, and efficiency. The five final arrays of alternatives selected based on the above screening criteria include; Alternative A: Top-of-bank Floodwall, Alternative B: Top-of-bank Floodwall/Setback Floodwall/College of Marin Widening, Alternative F: Bypass/Allen Park Riparian Corridor/College of Marin Widening, Alternative G: Floodwall/ Allen Park Riparian

Corridor, and Alternative J: Bypass/Allen Park Riparian Corridor/Floodwall. The five alternatives were then compared based on mainly their complexity to address the project objectives, providing solution to the problems identified during pan formulation, acceptability for meeting local and USACE standards and policies, the efficiency to provide the highest benefit and opportunities, and on the availability of land and easement to provided access for construction. Each of these five alternatives were further evaluated to identify the most qualified alternative by comparing their economic benefit/cost ratio. The Tentatively Selected Plan (TSP) is the best fit alternative amongst the five final arrays of alternatives and is described below.

1.5 Tentatively Selected Plan (TSP) / Recommended Plan

Out of the five final arrays of alternatives that were evaluated, Alternative J is selected as the TSP based on the outcome from the benefit/cost ratio. The proposed features in Alternative J include:

- **An underground bypass that runs under San Francis Drake Blvd.** The bypass will be built from two 12 feet wide by 7 feet high reinforced concrete box culverts. The diversion of flow to the concrete box culvers is proposed to initiate on the left bank near the Corte Madera Creek and Ross Creek confluence in Unit 4. The bypass is proposed to discharge or merge with the Creek main channel Allen Park Riparian Corridor in Unit 3 (described below). The overall estimated length of the bypass is approximately 2,200 feet, which will be between approximate Stations 390+30 to 368+00. The bypass would begin on the left bank at Station 390+30 and the majority of the proposed alignment would run under Sir Francis Drake Boulevard (as shown in Figure 3-5b). The downstream termination point of the underground bypass would connect with the Allen Park Riparian Corridor near Station 368+00. Activities would include trenching portions of Sir Francis Drake Boulevard up to 20 feet deep by 30 feet wide for installation of the prefabricated box culverts. Although site preparation work would still be necessary, Alternative J would require minimal riparian vegetation removal because the majority of work would occur along an existing roadway.
- **Allen Park Riparian Corridor.** This feature will be constructed at Frederick P. Allen Park and it will have approximately 900 feet length and encompass approximately 2 acres. It is proposed to be built near the transition area of the Unit 3 concrete lined channel and the downstream portion of Unit 4. The transition area leading to Unit 3 is considered the main breakout zone during high flows due to the abrupt change in channel geometry and roughness. The downstream section of Unit 4 also has a Denil Fish ladder that exacerbated the constriction near this transition zone. As a result, the Denil Fish Ladder (located between Station 370+00 and 369+70) in Unit 4, will be removed. The Denil fish ladder would be replaced with a combination of natural bed material and biotechnical bank stabilization or stone protection treatments to create and restore natural flood plain. The modification near this location includes the removal of approximately 750 feet of the Unit 3 concrete lined portion. This channel modifications would be necessary to accommodate the change in flow dynamics and to modify and lower the channel floor elevations to allow a smooth transition and create a geomorphological sustainable channel bed. The channel bed modification would also extend upstream to approximately 110 feet upstream of Lagunitas Road Bridge. With this channel bed

modification, portion of the natural channel in Unit 4, extending a length of approximately 115 feet, within the reach between Lagunitas Road Bridge and the fish ladder, would be widened to increase hydraulic conveyance capacity. The demolished section of the Unit 3 channel would be re-graded with native material and be designed to meet fish passage criteria. Some additional proposed improvements that may be further refined during the future design of the project include lowering of the southwest side of the new creek channel in Allen Park to restore a historic floodplain and to increase flow capacity. The Allen Park riparian corridor would include a widened, native substrate channel that allows higher flows to spread over a larger area and include up to 4 feet high floodwalls around its perimeter.

Before the flow from this proposed riparian corridor and restored Unit 3 reach enters the downstream concrete lined section, additional bank armoring measures and new smooth transitional features will be included to protect outflanking and guide/funnel the flow towards the existing concrete channel. For the features included in the TSP plan, see Figure 2 below.

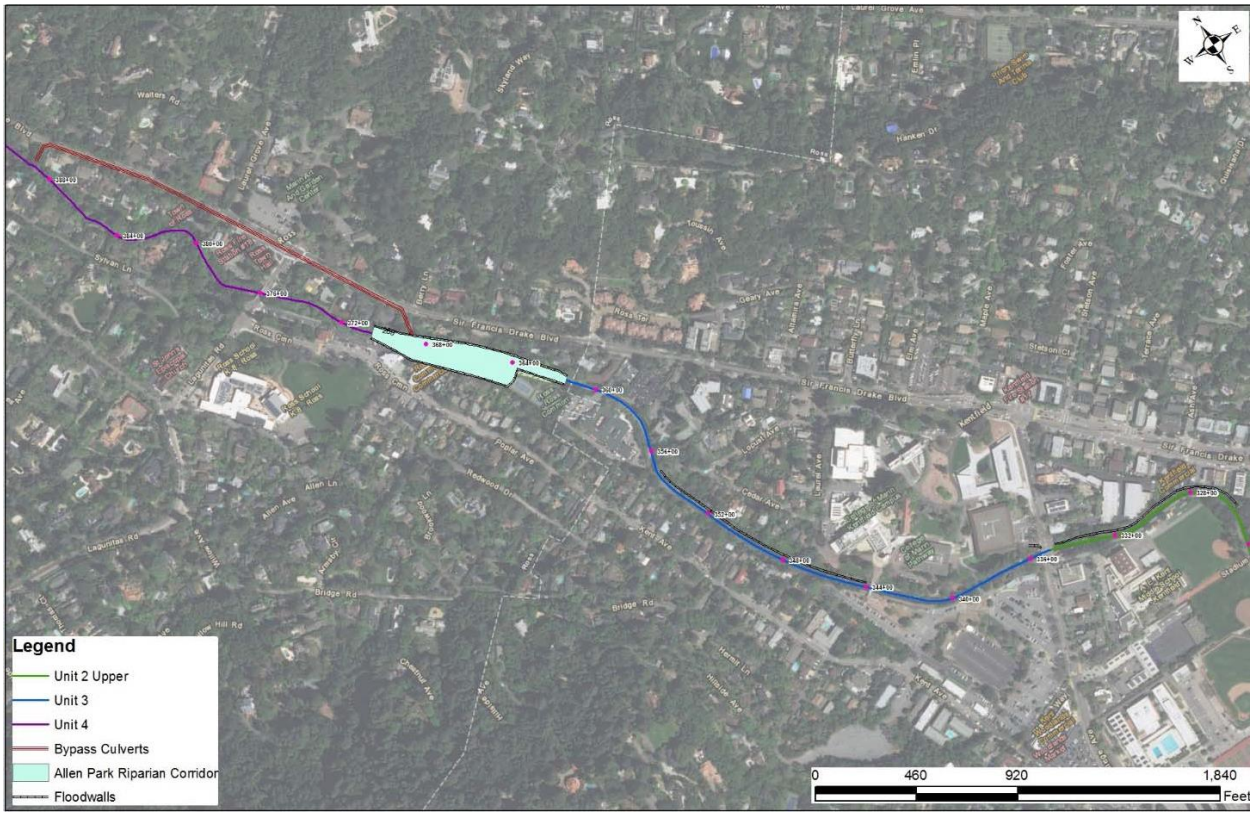


Figure 2: Features of the Selected Plan

- **<u>Floodwalls</u>**
  - **<u>Allen Park Perimeter Floodwall.</u>** Based on the result of the H&H model, a maximum of 4 feet high perimeter floodwall is proposed around the Allen Park riparian corridor. The floodwall would be constructed around the limits of the floodplain resulting from the 25 year occurrence and provides assurance that flanking

and bank erosion would not impact adjacent lands. It also serves the purpose of funneling the flow towards the concrete lined section at its downstream end.

- **Granton Park neighborhood**. Along the left bank of the Unit 3 and between approximate Stations 344+00 and 355+00, and top-of-bank floodwall is proposed to be near the Granton Park neighborhood terminating at the SMN Bridge on the western boundary of the College of Marin campus. Based on the outcome from the H&H model, the estimated height of the Granton Park floodwall would vary between 2 feet at its upstream end and 6 feet downstream section. Due to the height of the wall, extending the existing channel wall was not recommended. As a result, the new floodwall would be installed as a separate wall adjacent and attached to the landward face of the existing concrete channel wall.
- **College Avenue Floodwalls**. Beginning approximately 75 feet from the upstream face of the College Avenue bridge in Unit 3 and continuing all the way up until Station 325+70 in Unit 2, an overbank floodwall is proposed at the left bank of the creek. The section of the Floodwall at the upstream face of the College Avenue Bridge (known as a wingwall) would start or is tied to a high ground and be angled to smoothly funnel flow towards the underside of the bridge. The wing wall begin at high ground. The College Avenue floodwall would be constructed along the left bank and at its upstream limit have a maximum height of 4 feet and gradually taper down to a height of 2 feet downstream at its terminus.

PART 2 CIVIL DESIGN

2.1 Quantity Computation

2.1.1 Earthwork

The quantity computations were developed based on the preliminary concept designs. The large amount of the excavations comes primarily from the features that include widened and deepened the channel and floodwall construction. Based on the preliminary site condition evaluation as well as existing geotechnical data, the recommended floodwall type for this project is inverted "T". As a result the amount of excavation is much larger compared to other floodwall types. Compared to the overbank floodwalls, the off-set floodwalls are anticipated to be shallow in depth and are anticipated to contribute lesser amount of excavation of materials.

The quantities have been reviewed for conformance with the plans and for the purpose of cost estimating for the selected or recommended Alternative. For the selected alternative (TSP), the table below summarizes the quantities of the different features to be utilized during the restoration effort. Detailed Plans showing placement of the different features listed in the tables below are provided in Attachments 4, 7 & 9. For construction cost associated with these quantities, refer to the Cost Engineering Appendix.

2.1.2 Concrete

The quantities for the concrete is estimated based on preliminary conceptual alignment developed during the alternative comparison. The wall heights were determined based on the preliminary water surface elevation estimated through the H&H model during the with-project

hydraulic analysis. Additional 2 feet assurance was included for all the floodwalls. The depth of the concrete structures was estimated based on the preliminary analysis of the underlying soil condition, the height of the proposed floodwalls, and availability real estate for the size of the footing. Most of the top-of-bank floodwall structures for the selected alternative are anticipated not to be as deep as the existing channel wall bed. Further future refinement and recommendation based on the Geotechnical and Structural factors is necessary to determine the sufficiency of the depths as well as the integrity of the existing concrete structures.

2.1.1 Shoring Material

Estimates were based on unit area of the shoring material. Usage of the shoring material is optional dependent on the depth and slope of the excavation. Shoring will be used to ensure safety of workers from unstable soil. Soil type and condition at the project site plays important factor in determining the amount of shoring needed when the depth of excavation is above the maximum limit provided by OSHA for stable soil.

2.1.2 Formwork

Estimates were based on unit area of the formwork. Steel formwork and accessories will be utilized for erecting of the floodwalls.

2.1.3 Rocks and Boulders

To be included during the next design refinement.

2.1.4 Biotechnical Bank Stabilization and Erosion Protection Fabrics

To be included during the next design refinement.

2.1.5 Tree Replanting

To be included during the next design refinement. Tree removal is included in the analysis.

2.1.6 Bank Stabilization Measures

To be included during the next design refinement.

Table 2-1. Material Quantity Estimates for the Selected Plan

Task	Quantity	Unit
Underground Reinforced Concrete Bypass		
Concrete Inlet Weir	10	CY
Concrete Inlet Headwall	18	CY
Traffic Re-route and Control	500,000	LS
Road Asphalt Demolition	7,333	SY
Shoring	99,000	SF
Excavation	36,667	CY
Double 12'X7' Underground Concrete Bypass	3,259	CY
Backfill	12,222	CY
Road Asphalt Pavement and Markings	66,000	SF

Concrete Outlet Headwall	18	CY
Reinforced Concrete Floodwalls		
Clearing & Grubbing	1.37	AC
Tree Removal	1.37	AC
Excavation	5,669	CY
Shoring	12,000	SF
Cast-in-place Concrete	2,493	CY
Form Work	44,445	SF
Backfill	3,067	CY
Hydro Seed	1.1	AC
Allen Park Riparian Corridor		
Clearing & Grubbing	1.7	AC
Tree Removal	1.7	AC
Demolish Pavement	3,319	SY
Demolish Concrete Channel	1,806	CY
Excavation(Area 1)	19,828	CY
Excavation (Area 2&3)	5,311	CY
Erosion Control Blanket	5,167	SY
Hydro Seed	1.7	AC
Fish Passage Transition Grading	270	CY
Fish Ladder		
Concrete/Gabion Demolition	49	CY
Excavation	114	CY
Erosion Mats (Jute Mesh)	110	SY
Hydro Seed	0.02	AC

AC = Acre, SY = Square Yard, CY = Cubic Yard, SF = Square Foot

2.2 Relocations

A sewer pipe that requires relocation was identified within the limits of the project. The sewer line crosses the creek at approximate Station of 370+00 with two 24 inch Techite pipes near the transition area of Unit 3 and 4. This location is where construction of the concrete channel was halted in 1971. For the recommended plan, this location would have a number of activities during construction including; removal of denil fish ladder, channel bed excavation, removal of portion of the Unit 3 concrete channel and construction of the Allen Park Riparian Corridor and floodwalls. Within the limits of the proposed Allen Park riparian corridor, approximately 1,000 ft segment of the sanitary sewer is proposed to be relocated to the right along and parallel with the right side perimeter floodwall. The crossing at Station 370+00 will either be completely removed or capped and abandoned in-place. The proposed relocation would require to new crossings that will connect to the sewer line running along the left bank of the creek. Further coordination with the Sponsor and Ross Valley Sanitary District (RVSD) regarding the relocation of this sewer line will be made during the feasibility phase preliminary design. It is the responsibility of the project Sponsor to coordinate with the RVSD in preparing the preliminary relocation designs. It is also the responsibility of the Sponsor to further investigate if

any additional relations are needed or identified during the future design phase of the project by communicating and coordinating with all the utility agencies impacted by the proposed project features. The pipe should be relocated to the proposed location before construction of the project near this site begins.

2.3 Utilities

All utilities in the vicinity of the study area have been shown on the preliminary drawings (Attachment 5). All the locations shown on the plans are approximate and will be confirmed during future detail design stages and before construction. The various types of utilities that may potentially be impacted include; overhead and underground electrical lines, gas lines, communication cables and wires, sanitary sewer lines, water lines and storm drains lines as shown in Table 2-2 below. It is anticipated that only few of the overhead power lines will impacted by the construction activity of the selected alternative. A number of storm drain utility pipes have been identified within the project footprints that may be impacted temporarily. If any additional utilities are discovered during the next phases of the project, they will be included on the next preliminary design stages. For list of the utilities within the vicinity of the project that may potentially be impacted, see Attachment 5 and Table 2-2 below.

Table 2-2. Potentially Impacted Utilities**.**

Channel (Unit #)	Utility Type	Pipe Size	Owner	Feature Type	Buried	Description	Material type
Communication (AT&T and Comcast)							
4	T/C		AT&T	Underground Cable		Crosses bypass.	
4	T/C		AT&T	Conduit		Crosses bypass.	
4	T/C		AT&T	Conduit		Adjacent to alignment for bypass	
4	T/C		AT&T	Conduit		Adjacent to Bypass. Runs parallel to Creek on left bank	
4	T/C		AT&T	Conduit		Adjacent to Bypass. Runs parallel to Creek on left bank	
4	T/C		AT&T	Aerial Cable		Adjacent to Bypass. Runs parallel to Creek on left bank	
4	T/C		AT&T	Aerial Cable		Adjacent to Bypass. Runs parallel to Creek on left bank	
3	T/C		AT&T	Cable	Yes	Adjacent to project. Located at upstream bridge of unit 2, downstream bridge unit 3	
3	T/C		AT&T	Underground Cable	Yes	Crosses project. Located at upstream bridge of unit 2, downstream bridge unit 3	
3	T/C		AT&T	Underground Cable	Yes	Adjacent to project. Located at upstream bridge of unit 2, downstream bridge unit 3	

3	T/C		AT&T	Underground Cable	Yes	Adjacent to project. Located at upstream bridge of unit 2, downstream bridge unit 3	
3	T/C		AT&T	Underground Cable	Yes	Crosses project. Located at upstream bridge of unit 2, downstream bridge unit 3	
3	T/C		AT&T	Underground Cable	Yes	Adjacent to project. Located at upstream bridge of unit 2, downstream bridge unit 3	
3	T/C		AT&T	Conduit		Adjacent to project.	
3	T/C		AT&T	Underground Cable	Yes	Adjacent to project.	
3	T/C		AT&T	Underground Cable	Yes	Adjacent to project.	
3	T/C		AT&T	Conduit		Adjacent to project.	
3	T/C		AT&T	Underground Cable	Yes	Adjacent to project.	
3	T/C		AT&T	Underground Cable	Yes	Crosses project.	
3	T/C		AT&T	Underground Cable	Yes	Crosses project.	
3	T/C		AT&T	Conduit		Crosses project.	
3	T/C		AT&T	Underground Cable	Yes	Crosses project and runs parallel on right bank	
3	T/C		AT&T	Underground Cable	Yes	Crosses project and runs parallel on right bank	
2	T/C		AT&T			Crosses project	
2	T/C		AT&T	Building Cable	Yes	Adjacent to project	
2	T/C		AT&T	Underground Cable	Yes	Adjacent to project. Runs parallel to project alignment ending at upstream end of unit 2.	
4	C		Comcast	Overhead Strand / Pole		Cable is within alignment for bypass	
4	C		Comcast	Overhead Strand / Pole		Cable line at upstream end of unit 4. It is adjacent to and crosses the alignment for bypass	
4	C		Comcast	Overhead Strand / Pole		Cable line runs adjacent to bypass alignment	

3	C		Comcast	Underground Trench/Vault	Yes	Cable line is at the bridge in units 2 and 3.	
3	C		Comcast	Overhead Strand / Pole		Located adjacent to project on left bank	
3	C		Comcast	Overhead Strand / Pole		Located adjacent to project on left bank	
3	C		Comcast	Underground Trench/Vault	Yes	Cable line goes through project in unit 3	
2	C		Comcast	Underground Trench/Vault		Cable line is at the bridge in units 2 and 3.	
Water Lines (Marine Municipal Water District)							
4	WL	12	MMWD	Pipe	Yes	Crosses bypass. Pipe is underground	Welded Steel (WS)
4	WL	24	MMWD	Pipe	Yes	Adjacent to bypass. Pipe is underground	Welded Steel (WS)
4	WL	24	MMWD	Pipe	Yes	Adjacent to bypass. Pipe is underground	Welded Steel (WS)
4	WL	12	MMWD	Pipe	Yes	Crosses in and out of bypass alignment. Pipe is underground	Welded Steel (WS)
4	WL	8	MMWD	Pipe	Yes	Adjacent to bypass. Pipe is underground	Cast Iron
4	WL	8	MMWD	Pipe	Yes	Adjacent to bypass. Pipe is underground	Welded Steel (WS)
4	WL		MMWD	Lateral		Adjacent to alignment for bypass	Service Lateral
4	WL		MMWD	Lateral		Adjacent to alignment for bypass	Service Lateral
4	WL	12	MMWD	Pipe	Yes	Adjacent to alignment for bypass	Plastic (PVC)
4	WL	12	MMWD	Pipe	Yes	Adjacent to alignment for bypass	Cast Iron
4	WL		MMWD	Lateral		Adjacent to alignment for bypass	Service Lateral
4	WL	24	MMWD	Pipe	Yes	Adjacent to Project. Pipe is underground	Welded Steel (WS)
4	WL	6	MMWD	Pipe	Yes	Adjacent to alignment for bypass	Cast Iron
4	WL	12	MMWD	Pipe	Yes	Adjacent to alignment for bypass	Cast Iron

4	WL	6	MMWD	Pipe	Yes	Adjacent to alignment for bypass	Cast Iron
4	WL	12	MMWD	Pipe	Yes	Adjacent to alignment for bypass	Cast Iron
4	WL	12	MMWD	Pipe	Yes	Adjacent to alignment for bypass	Cast Iron
4	WL	12	MMWD	Pipe	Yes	Adjacent to alignment for bypass	Cast Iron
3	WL	10	MMWD	Pipe		Crosses at College Ave. Pipe is above ground	Welded Steel (WS)
3	WL	10	MMWD	Pipe		Crosses at College Ave. Pipe is underground	Welded Steel (WS)
3	WL	12	MMWD	Pipe		Parallels on bike path and adjacent to project. Pipe is underground	Welded Steel (WS)
3	WL	24	MMWD	Pipe		Parallels on bike path and adjacent to project. Pipe is underground	Welded Steel (WS)
3	WL	24	MMWD	Pipe		Parallels on bike path and adjacent to project. Pipe is underground	Welded Steel (WS)
3	WL		MMWD	Lateral		Adjacent to Project and parallel to bike path	Service Lateral
3	WL	1	MMWD	Pipe		Adjacent to Project and parallel to bike path	Copper
3	WL	24	MMWD	Pipe	Yes	Adjacent to Project and parallel to bike path.	Welded Steel (WS)
3	WL	24	MMWD	Pipe	Yes	Adjacent to Project and parallel to bike path.	Welded Steel (WS)
3	WL	24	MMWD	Pipe	Yes	Adjacent to Project and parallel to bike path.	Welded Steel (WS)
3	WL	12	MMWD	Pipe	Yes	Adjacent to Project and parallel to bike path.	Welded Steel (WS)
3	WL	12	MMWD	Pipe	Yes	Adjacent to Project and parallel to bike path.	Welded Steel (WS)
3	WL	24	MMWD	Pipe	Yes	Adjacent to Project and parallel to bike path.	Welded Steel (WS)
3	WL	26	MMWD	Pipe	Yes	Adjacent to Project and parallel to bike path.	Welded Steel (WS)
3	WL	26	MMWD	Pipe	Yes	Adjacent to Project and parallel to bike path.	Welded Steel (WS)
3	WL	8	MMWD	Pipe	Yes	Adjacent to Project and parallel to bike path.	Welded Steel (WS)
3	WL		MMWD	Lateral		Adjacent to Project and parallel to bike path.	Service Lateral

3	WL	24	MMWD	Pipe		Adjacent to Project. Pipe is underground	Welded Steel (WS)
3	WL	12	MMWD	Pipe		Adjacent to Project. Pipe is underground	Welded Steel (WS)
3	WL		MMWD	Lateral		Adjacent to Project.	Service Lateral
3	WL	24	MMWD	Pipe		Adjacent to Project. Pipe is underground	Welded Steel (WS)
2	WL	20	MMWD	Pipe		Crosses at Stadium Way, above ground	Welded Steel (WS)
2	WL	20	MMWD	Pipe		Crosses at Stadium Way, underground	Welded Steel (WS)
2	WL		MMWD	Lateral		Adjacent to Stadium Way	Service Lateral
2	WL		MMWD	Lateral		Adjacent to Stadium Way	Service Lateral
2	WL	8	MMWD	Pipe		Crosses at Stadium Way, underground	Welded Steel (WS)
2	WL	9	MMWD	Pipe		Crosses at Stadium Way, underground	Welded Steel (WS)
2	WL	10	MMWD	Pipe		Crosses at College Ave. Pipe is above ground	Welded Steel (WS)
2	W	10	MMWD	Pipe		Crosses at College Ave. Pipe is underground	Welded Steel (WS)
Electrical Lines (PG&E)							
4	E		PG&E	Single Phase Secondary Conductor		Utility is within alignment for bypass	
4	E		PG&E	Three Phase Secondary Conductor		Utility is within the project limits.	
4	E		PG&E	Three Phase Secondary Conductor		Utility is within alignment for bypass	
4	E		PG&E	Single Phase Secondary Conductor		Utility is within alignment for bypass	
4	E		PG&E	Three Phase Secondary Conductor		Utility is within alignment for bypass	

4	E		PG&E	Underground Wire or Conductor		Underground wire within alignment for bypass	
4	E		PG&E	Jointly Owned Utility Pole		Located adjacent to bypass	
4	E		PG&E	Jointly Owned Utility Pole		Located adjacent to bypass	
4	E		PG&E	Street Light		Located adjacent to bypass	
4	E		PG&E	Transformer Bank Open Delta		Located within alignment for bypass	
4	E		PG&E	Street Light		Located near bypass alignment	
4	E		PG&E	Line Fuse		Located adjacent to bypass	
4	E		PG&E	Line Switch		Located within alignment for bypass	
4	E		PG&E	Jointly Owned Utility Pole		Located within alignment for bypass	
4	G		PG&E	Service Line		Adjacent to bypass	Plastic
4	G		PG&E	Service Line		Adjacent to bypass	Plastic
4	G		PG&E	Service Line		Adjacent to bypass	Plastic
4	G		PG&E	Service Line		Adjacent to bypass	Plastic
4	G		PG&E	Service Line		Located within alignment for bypass	Plastic
4	G		PG&E	DC PAR Flag		Adjacent to bypass alignment	
4	G		PG&E	DC PAR Flag		Located within alignment for bypass	
4	G		PG&E	Service Line		Adjacent to alignment for bypass	Plastic
4	G		PG&E	Service Line		Located within alignment for bypass	Steel
4	G		PG&E	Service Line		Adjacent to alignment for bypass	Steel
4	G		PG&E	DC PAR Flag		Adjacent to alignment for bypass	
4	G		PG&E	DC PAR Flag		Located within alignment for bypass	

4	G		PG&E	DC PAR Flag		Located within alignment for bypass	
4	G		PG&E	DC PAR Flag		Located within alignment for bypass	
4	G		PG&E	Service Line		Located within alignment for bypass	Steel
4	G		PG&E	Service Line		Located within alignment for bypass	Steel
4	G		PG&E	Service Line		Adjacent to alignment for bypass	Plastic
4	G		PG&E	Service Line		Adjacent to alignment for bypass	Plastic
4	G		PG&E	Service Line		Adjacent to alignment for bypass	Plastic
4	G		PG&E	DC PAR Flag		Located within alignment for bypass	
4	G		PG&E	DC PAR Flag		Located within alignment for bypass	
4	G		PG&E	DC PAR Flag		Located within alignment for bypass	
4	G		PG&E	Service Line		Located within alignment for bypass	Plastic
4	G		PG&E	Distribution Main		Adjacent to alignment for bypass	Plastic
4	G		PG&E	Distribution Main		Located within alignment for bypass	Plastic
4	G		PG&E	Deactivated Pipe		Located within alignment for bypass	
4	G		PG&E	Cathodic Protection Line		Located within alignment for bypass	
4	G		PG&E	Cathodic Protection Line		Located within alignment for bypass	
4	G		PG&E	Service Line		Adjacent to alignment for bypass	Plastic
4	G		PG&E	Service Line		Located adjacent to bypass alignment	Plastic
4	G		PG&E	ETS Below Ground		Adjacent to alignment for bypass	
4	G		PG&E	ETS Below Ground		Located within alignment for bypass	
4	G		PG&E	DC PAR Flag		Located within alignment for bypass	

4	G		PG&E	DC PAR Flag		Adjacent to alignment for bypass	
4	G		PG&E	DC PAR Flag		Adjacent to alignment for bypass	
4	G		PG&E	Service Line		Adjacent to alignment for bypass	Plastic
4	G		PG&E	Service Line		Adjacent to alignment for bypass	
4	G		PG&E	Service Line		Adjacent to alignment for bypass	
4	G		PG&E	Service Line		Adjacent to alignment for bypass	
4	G		PG&E	Service Line		Adjacent to alignment for bypass	
3	E		PG&E	Underground Wire or Conductor	Yes	Underground wire on right bank. Wire is adjacent to project and should not be affected.	
3	E		PG&E	Three Phase Primary Conductor		Wire runs through project. Utility could be affected.	
3	E		PG&E	Three Phase Primary Conductor		Wire runs through project. Utility could be affected.	
3	E		PG&E	Three Phase Primary Conductor		Wire is adjacent to project.	
3	E		PG&E	Three Phase Primary Conductor		Wire is above ground. Adjacent to project.	
3	E		PG&E	Underground Wire or Conductor	Yes	Wire is adjacent to project.	
3	E		PG&E	Single Phase Primary Conductor		Electrical utility pole adjacent to project	
3	E		PG&E	Splice Box for 4, 12, 21 KV Conductor (Primary)		Box is underground and adjacent to project	
3	E		PG&E	Pad mounted Transformer	Yes	transformer is adjacent to project	
3	E		PG&E	Transformer		Located adjacent to project	

3	E		PG&E	Jointly Owned Anchor		Located adjacent to project	
3	E		PG&E	Three Phase Primary Conductor		Wire runs through project. Located at unit 3 and unit 2	
3	E		PG&E	Three Phase Primary Conductor		Wire runs through project. Located at unit 3 and unit 2	
3	E		PG&E	Three Phase Primary Conductor		Wire runs through project. Located at unit 3 and unit 2	
3	E		PG&E	Underground Wire or Conductor	Yes	Wire runs through project. Located at unit 3 and unit 2	
3	E		PG&E	Underground Wire or Conductor	Yes	Wire runs through project. Located at unit 3 and unit 2	
3	E		PG&E	Underground Wire or Conductor	Yes	Wire runs through project. Located at unit 3 and unit 2	
3	E		PG&E	Single Phase Secondary Conductor		Wire runs through project. Located at unit 3 and unit 2	
3	E		PG&E	Three Phase Primary Conductor		Wire runs through project. Located at unit 3 and unit 2	
3	E		PG&E	Street Light		Located at unit 3 and unit 2. Crosses project.	
3	E		PG&E	Street Light		Located at unit 3 and unit 2. Crosses project.	
3	E		PG&E	Splice Box for 4, 12, 21 KV Conductor (Primary)	Yes	Located at unit 3 and unit 2. Crosses project.	
3	E		PG&E	Splice box for 120/240 V Conductor	Yes	Located at unit 3 and unit 2. Crosses project.	
3	E		PG&E	Splice box for 120/240 V Conductor	Yes	Located at unit 3 and unit 2. Crosses project.	

3	E		PG&E	Street Light		Located at unit 3 and unit 2. Crosses project.	
3	E		PG&E	Street Light		Located at unit 3 and unit 2. Crosses project.	
3	E		PG&E	Splice box for 120/240 V Conductor (underground)	Yes	Located at unit 3 and unit 2. Crosses project.	
3	G		PG&E	Service Line		Located adjacent to project	Plastic
3	G		PG&E	Service Line		Located adjacent to project	Plastic
3	G		PG&E	Service Line		Located adjacent to project	Plastic
3	G		PG&E	Service Line		Located adjacent to project	steel
3	G		PG&E	Service Line		Located adjacent to project	Plastic
3	G		PG&E	Service Line		Located adjacent to project	Plastic
3	G		PG&E	DC PAR Flag		Located adjacent to project	
3	G		PG&E	DC PAR Flag		Located adjacent to project	
3	G		PG&E	DC PAR Flag		Located adjacent to project	
3	G		PG&E	Service Line		Located adjacent to project	steel
3	G		PG&E	Distribution Main		Located adjacent to project	
3	G		PG&E	End Cap		Located adjacent to project	
3	G		PG&E	Distribution Main		Crosses in to project. Located in unit 3 and unit 2	
3	G		PG&E	Distribution Main		Crosses in to project. Located in unit 3 and unit 2	
3	G		PG&E	Cathodic Protection Line		Crosses in to project. Located in unit 3 and unit 2	
3	G		PG&E	Service Line		Adjacent to project. Located in unit 3 and unit 2	Plastic
3	G		PG&E	Service Line		Adjacent to project. Located in unit 3 and unit 3	Plastic
3	G		PG&E	End Cap		Adjacent to project. Located in unit 3 and unit 2	

3	G		PG&E	ETS Below Ground		Crosses in to project. Located in unit 3 and unit 2	
3	G		PG&E	End Cap		Located where unit 3 and unit 2 meet	
3	G		PG&E	End Cap		Located where unit 3 and unit 2 meet	
2	Electrical		PG&E	Unknown Wire or Conductor		Wire is adjacent to project.	
2	Electrical		PG&E	Wire or Conductor	Yes	Adjacent to project. Runs parallel to project.	
2	Electrical		PG&E	Jointly Owned Anchor		Anchor is adjacent to project.	
2	Electrical		PG&E	Street Light		Light is adjacent to project.	
2	Electrical		PG&E	Jointly Owned Utility Pole		Pole is adjacent to project.	
2	G		PG&E	DC PAR Flag		Adjacent to project	
2	G		PG&E	DC PAR Flag		Adjacent to project	
2	G		PG&E	Service Line		Adjacent to project.	Plastic
2	G		PG&E	Service Line		Adjacent to project.	Plastic
2	G		PG&E	Service Line		Adjacent to project.	Plastic
2	G		PG&E	Service Line		Adjacent to project.	Plastic
2	G		PG&E	Service Line		Adjacent to project.	Steel
2	G		PG&E	Service Line		Adjacent to project.	Steel
2	G		PG&E	DC PAR Flag		Adjacent to project	
Sanitary Sewer (Ross Valley Sanitary District)							
4	SS	6	RVSD	Gravity Main (G)	Yes	Adjacent to bypass. Runs parallel.	Vitrified Clay Pipe (VCP)
4	SS	36	RVSD	Gravity Main (G)	Yes	Adjacent and runs parallel to bypass	Reinforced Concrete Pipe (RCP)

4	SS	6	RVSD	Gravity Main (G)	Yes	Adjacent to bypass. Runs parallel.	Asbestos Cement (AC)
4	SS	36	RVSD	Gravity Main (G)	Yes	Adjacent to bypass. Connects to two lines that cross the bypass, SSL-01 and SSL-15	Reinforced Concrete Pipe (RCP)
4	SS	39	RVSD	Gravity Main (G)	Yes	Located at unit 4 downstream and unit 3 upstream. Connects to two lines that cross the bypass, SSL-01 and SSL-15. Runs parallel in unit 3	Reinforced Concrete Pipe (RCP)
4	SS	24	RVSD	Siphon (SI)	Yes	Located at unit 4 downstream and unit 3 upstream. Crosses bypass	Techite (TEC)
4	SS	25	RVSD	Siphon (SI)	Yes	Located at unit 4 downstream and unit 3 upstream. Crosses bypass	Techite (TEC)
3	SS	12	RVSD	Gravity Main (G)	Yes	Located adjacent to project. Connected to SSL-09.	Reinforced Concrete Pipe (RCP)
3	SS	39	RVSD	Gravity Main (G)	Yes	Adjacent and runs parallel to project in unit 3 right bank. Ross Valley Trunk Sewer - Corte Madera Creek	Reinforced Concrete Pipe (RCP)
3	SS	39	RVSD	Gravity Main (G)	Yes	Adjacent and runs parallel to project in unit 3 right bank. Ross Valley Trunk Sewer - Corte Madera Creek	Reinforced Concrete Pipe (RCP)
3	SS	39	RVSD	Gravity Main (G)	Yes	Adjacent and runs parallel to project in unit 3 right bank. Ross Valley Trunk Sewer - Corte Madera Creek	Reinforced Concrete Pipe (RCP)
3	SS	39	RVSD	Gravity Main (G)	Yes	Adjacent and runs parallel to project in unit 3 right bank. Ross Valley Trunk Sewer - Corte Madera Creek	Reinforced Concrete Pipe (RCP)
3	SS	39	RVSD	Gravity Main (G)	Yes	Adjacent and runs parallel to project in unit 3 right bank. Ross Valley Trunk Sewer - Corte Madera Creek	Reinforced Concrete Pipe (RCP)
3	SS	39	RVSD	Gravity Main (G)	Yes	Adjacent and runs parallel to project in unit 3 right bank. Ross Valley Trunk Sewer - Corte Madera Creek	Reinforced Concrete Pipe (RCP)
3	SS	39	RVSD	Gravity Main (G)	Yes	Adjacent and runs parallel to project in unit 3 right bank. Ross Valley Trunk Sewer - Corte Madera Creek	Reinforced Concrete Pipe (RCP)

3	SS	12	RVSD	Gravity Main (G)	Yes	Located adjacent to project. Connects to SSL-60 and SSL-37	Reinforced Concrete Pipe (RCP)
3	SS	39	RVSD	Gravity Main (G)	Yes	Adjacent and runs parallel to project in unit 3 right bank. Ross Valley Trunk Sewer - Corte Madera Creek	Reinforced Concrete Pipe (RCP)
3	SS	39	RVSD	Gravity Main (G)	Yes	Adjacent and runs parallel to project in unit 3 right bank ends in unit 2. Ross Valley Trunk Sewer - Corte Madera Creek	Reinforced Concrete Pipe (RCP)
2	SS	39	RVSD	Gravity Main (G)	Yes	Adjacent and runs parallel to project in unit 3 right bank ends in unit 2. Ross Valley Trunk Sewer - Corte Madera Creek	Reinforced Concrete Pipe (RCP)
2	SS	39	RVSD	Gravity Main (G)	Yes	Adjacent and runs parallel in unit 2. Ross Valley Trunk Sewer - Corte Madera Creek	Reinforced Concrete Pipe (RCP)
2	SS	39	RVSD	Gravity Main (G)	Yes	Adjacent and runs parallel in unit 2. Ross Valley Trunk Sewer - Corte Madera Creek	Reinforced Concrete Pipe (RCP)
2	SS	39	RVSD	Gravity Main (G)	Yes	Adjacent and runs parallel in unit 2. Ross Valley Trunk Sewer - Corte Madera Creek	Reinforced Concrete Pipe (RCP)
2	SS	8	RVSD	Gravity Main (G)	Yes	Adjacent to project in unit 2. Located at 890 College Ave Easement. Runs perpendicular to creek connecting SSL-02 and SSL-63	Asbestos Cement (AC)
2	SS	8	RVSD	Gravity Main (G)	Yes	Adjacent to project in unit 2. Located at 890 College Ave Easement. Runs parallel to creek	
2	SS	8	RVSD	Gravity Main (G)	Yes	Adjacent to project in unit 2. Located at 890 College Ave Easement. Runs parallel to creek	
2	SS	42	RVSD	Gravity Main (G)	Yes	Adjacent and runs parallel in unit 2. Ross Valley Trunk Sewer - Corte Madera Creek	Reinforced Concrete Pipe (RCP)
2	SS	30	RVSD	Gravity Main (G)	Yes	Adjacent to project in unit 2. Stadium Way Siphon connected to SSL-45	Steel Pipe (SP)
2	SS	18	RVSD	Siphon (SI)	Yes	Crosses creek. Large Diameter Trunk - 18 to 30	Steel Pipe (SP)

2	SS	18	RVSD	Siphon (SI)	Yes	Crosses creek. Large Diameter Trunk - 18 to 30	Steel Pipe (SP)
2	SS	21	RVSD	Siphon (SI)	Yes	Crosses creek. Large Diameter Trunk - 18 to 30	Steel Pipe (SP)
2	SS	21	RVSD	Siphon (SI)	Yes	Crosses creek. Large Diameter Trunk - 18 to 30	Steel Pipe (SP)
2	SS	21	RVSD	Siphon (SI)	Yes	Adjacent to creek. Large Diameter Trunk - 18 to 30	Steel Pipe (SP)
2	SS	18	RVSD	Siphon (SI)	Yes	Crosses creek. Large Diameter Trunk - 18 to 30	Steel Pipe (SP)
2	SS	30	RVSD	Gravity Main (G)	Yes	Adjacent to creek. Large Diameter Trunk - 18 to 30. VERY LOW FLOW (Bypass line, can activate). Jurisdiction: Cnty.	Concrete Pipe (CP)
2	SS	30	RVSD	Gravity Main (G)	Yes	Adjacent to creek. Large Diameter Trunk - 18 to 30. VERY LOW FLOW (Bypass line, can activate). Jurisdiction: Cnty.	Concrete Pipe (CP)
2	SS	30	RVSD	Gravity Main (G)	Yes	Adjacent to creek. Near Kent Middle School	Concrete Pipe (CP)
2	SS	30	RVSD	Gravity Main (G)	Yes	Adjacent to creek. Near Kent Middle School	Polyvinyl Chloride (PVC)
2	SS	42	RVSD	Gravity Main (G)	Yes	Adjacent to creek. Near downstream end of unit 2.	Reinforced Concrete Pipe (RCP)
Storm Drain Pipes (Marine County, MC)							
4	SD	12	MC	Outlet		Within alignment for bypass.	
4	SD	12	MC	Outlet		Within alignment for bypass.	
4	SD		MC	Headwall Structure		Within alignment for bypass.	
4	SD		MC	Outlet		Within alignment for bypass.	
4	SD	18	MC	Outlet		Within alignment for bypass.	CMP
4	SD		MC	Outlet		Within alignment for bypass.	
4	SD		MC	Pump		Pump for interior drainage control. Within alignment for bypass.	

4	SD		MC	Pump		Pump for interior drainage control. Within alignment for bypass.	
4	SD		MC	Outlet		Within alignment for bypass.	
4	SD		MC	Outlet		Within alignment for bypass.	
4	SD		MC	Outlet		Within alignment for bypass.	
4	SD		MC	Outlet		Within alignment for bypass.	
4	SD		MC	Pump		Pump for interior drainage control. Within alignment for bypass.	
4	SD		MC	Outlet		Within alignment for bypass.	
4	SD		MC	Outlet		Within alignment for bypass.	
4	SD		MC	Outlet		Within alignment for bypass.	
4	SD		MC	Outlet		Within alignment for bypass.	
4	SD		MC	?		Within alignment for bypass.	
4	SD		MC	Headwall Structure		Within alignment for bypass.	
4	SD		MC	Headwall Structure		Within alignment for bypass.	
4	SD		MC	Outlet		Within alignment for bypass.	
4	SD		MC	Outlet		Within alignment for bypass.	
4	SD		MC	Inlet		Within alignment for bypass.	
4	SD		MC	Outlet			
3	SD		MC	outlet		Drains into Creek	
3	SD		MC	outlet		Drains into Creek	
3	SD		MC	outlet		Drains into Creek	
3	SD		MC	outlet		Drains into Creek	
3	SD	72	MC	outlet		Drains into Creek	RCP

3	SD	36	MC	outlet		Drains into Creek	RCP
3	SD	18	MC	outlet		Drains into Creek	RCP
3	SD		MC	Catch Basin			
3	SD	12	MC	outlet		Drains into Creek	CMP
3	SD	8	MC	outlet		Drains into Creek	
3	SD	12	MC	outlet		Drains into Creek	
3	SD	60	MC	outlet		Drains into Creek	
3	SD	18	MC	outlet		Drains into Creek	RCP
3	SD	18	MC	Catch Basin		Near Creek could be effected.	
3	SD	18	MC	outlet		Drains into Creek	RCP
3	SD	30	MC	outlet		Drains into Creek	RCP
3	SD	24	MC	outlet		Drains into Creek	RCP
3	SD	30	MC	outlet		Drains into Creek	RCP
3	SD	24	MC	outlet		Drains into Creek	RCP
3	SD	18	MC	outlet		Drains into Creek	RCP
3	SD	24	MC	outlet		Drains into Creek	RCP
3	SD	18	MC	outlet		Drains into Creek	CMP
3	SD	24	MC	outlet		flap gate drains into Creek	RCP
3	SD	24	MC	outlet		Drains into Creek	RCP
3	SD	8	MC	outlet		Drains into Creek	
3	SD	24	MC	outlet		Drains into Creek	RCP
3	SD	18	MC	outlet		Drains into Creek	RCP
3	SD	24	MC	outlet		Drains into Creek	RCP
2	SD		MC	Outlet		Drains into Creek. not sure if two pipes	
2	SD		MC	Outlet		Drains into Creek. not sure if two pipes	
2	SD	15	MC	Outlet		Drains into Creek	CMP

2	SD	24	MC	Outlet		Drains into Creek	CMP
2	SD	15	MC	Outlet		Drains into Creek	CMP
2	SD	15	MC	Outlet		Drains into Creek	CMP
2	SD		MC	Outlet		Drains into Creek	
2	SD		MC	Outlet		Drains into Creek	
2	SD		MC	Outlet		Drains into Creek	
2	SD		MC	Outlet		Drains into Creek	
2	SD	24	MC	Outlet		Drains into Creek	CMP
2	SD		MC	Outlet		Drains into Creek	RCP
2	SD		MC	Outlet		Drains into Creek	RCP

T/C = Telephone/Cable, SD = Storm Drain, G = Gas, SS = Sanitary Sewer, WL = Water Line, C = Cable, E = Electrical

2.4 Construction Phasing

Due to short construction window each year (June15 to October 15) and the amount of work anticipated in each Unit, the project broken in to three groups for construction in three consecutive construction widows. Outside of the environmental window limits, off-channel work can be performed on all portion of the project features. The phasing of the construction also helps minimize the temporary combined impact on the habitats in the creek due to the construction activity. The result of this decision has been applied to the calculation of the project construction cost estimate. Table 2-3 below shows the breakdown, estimated schedule and sequence of construction. Further refinements are anticipated as the project goes through the next design phase.

Table 2-3. Construction Schedule

Construction Phase	Sub-Segment	Start Date	Estimated Duration (calendar Days)
1	Allen Park Riparian Corridor Station 377+32 to 361+40	Jun-2020	95
2	Unit 2 – From downstream end of the concrete lined Section to College Ave. Bridge or Station 321+25 to 335+00	Jan-2021	70
3	Units 3 From college Ave. Bridge to upstream end of concrete lined section (the fish ladder) or Station 335+00 to 370+00	Mar-2021	70

4	Upstream end of project to Station 3670+00	Jun-2021	300

2.5 Salvage and Re-use

Portion of the excavated earthen material from the project site will be stored near the project site to be used as a bank stabilization and treatment fill as needed. The need for salvaging and re-use of the material acquired from the project site will be further explored as the selected plan goes through further design phases.

2.6 Applicable Design Criteria Standards

The project utilizes the technical design approach and guidance found in the USACE Engineers Manual (EM) and the policies and procedures laid out in the Engineers Regulation (ER's). The table below summarizes the design criteria used for the project.

Table 2-4. Civil Engineering Design Requirements

Publication Number	Title	Publication Date
Engineer Manual (EM)		
EM 1110-2-2000	Standard Practice for Concrete for Civil Works Structures Proponent: CECW-EG	3/31/2001
EM 1110-2-2902	Conduits, Culverts, and Pipes	3/31/1998
Engineer Regulations (ER)		
ER 1110-2-1150	Engineering and Design for Civil Works Projects	8/31/1999
ER 1110-2-8160	Engineering and Design: Policies for Referencing Project Evaluation Grades To Nationwide Vertical Datums	3/1/2009
ER 1110-345-700	Design Analysis, Drawings and Specifications	5/30/1997
Engineer Technical Manual (ETL)		
ETL 1110-2-583	Guidelines for Landscape Planting and Vegetation Management at levees, Floodwalls, Embankment Dams, and Appurtenant Structures.	30 April 2014

2.7 Borrow Site and Disposal Area

It is anticipated that the excavation activity during the grading for the Allen Park, construction of the flood walls, and installation of the underground bypass can generate a large amount earthen material. Portion of the excavated earthen material needed for re-use as either a bank stabilization or treatment fill will be stored near the project site in one of the staging areas identified for the project. The excess clean material will be hauled off to receiving agencies within the proximity of the project to minimize cost. No hazardous material requiring special

handling or disposal is anticipated on the project sites. It is anticipated that miscellaneous debris including concrete rubble or other unwanted material may be encountered during construction. These materials will become the property of the contractor. It will be the responsibility of the contractor to identify appropriate landfill or other waste receiving agencies for excessive waste that can't be reused or recycled. There is no need for borrow source as the project mainly involves installation of underground bypasses and floodwalls.

2.8 Flow Diversion and Dewatering

It is anticipated that some form of partial or full flow diversion and dewatering may be required during construction of the project. Particular areas or features of work that may require diversion or deterring could be the construction of the Allen Park Riparian corridor, inlet areas of the underground bypass and during demolition of the upstream section of Unit 3 channel wall. This tasks can be accomplished using coffer dams to isolate the work area from the main channel. The methods used for diversion and water isolation are highly dependent on the contractor and the site condition. Some of the methods may include: sheet pile installation, gravel bags and plastic liner dams, installation of water filled berms/bladders and or k-rail placement with plastic overlay and gravel bag anchors acting as a coffer dam. Details regarding the location, type and some of the methods will be included during the future design of the project.

2.9 Construction Access, Haul Routes and Staging Area

Majority of the lands along the creek banks near the projects site are privately owned developments and residential buildings. Getting access to the project sites may require travelling though roads that are within privately owned lands and businesses. Prospective strategic staging locations and routs have been identified but their availability is unknown (Attachment 2). As a result, the proposed construction access routes and staging areas should be reviewed by the Sponsor or Marine County Flood Control and Water Conservation District (MCFCWCD) and vetted for use before construction. Their availability should provide enough time to cover the entire construction time period. The construction activity is anticipated to have minimal impacts to other resources and infrastructures. All existing paved roads used during construction of the project will be protected from damage. All ramps connecting to main streets are to be improved to accommodate heavy construction vehicular traffic. Any damage resulting from the use of the roads will be repaired and restored to their original condition at the completion of the projects.

2.9.1 Unit 2 Upper Reach

Proposed haul routes and the construction staging areas for the upper concrete lined reach of the channel of Unit 2 are shown on Attachment 2. An approximately 7000 SF area near the left downstream end of the reach has been identified as staging and storage area. Access to this location available via the Marine County Bicycle Route from Bon Air Road. Usage of this route may require expansion and capacity augmentation of the road if it is determined that it going to be utilized by heavier vehicles. Additional proposed short term staging area, approximately

20,000 SF, has been identified adjacent to the right bank at the downstream end of the project. The availability of the land and access route to this location have to be investigated during the project Pre-construction Engineering Design (PED) phase. During this phase of the project the sponsor (MCFCWCD) have to approach that is owned by College of Marine to communicate and confirm the availability as this location may not greatly interfere with the rest of the sport fields and at the same time could be strategic during construction. Discussion with the College should also include possibility of getting access to this location via Stadium Way from College Avenue. The Proposed ingress/egress to the different project sites within the Creek and access to the project staging area can be facilitated through the County Bike lanes along the creek bank. Two additional staging areas on the left and the right banks of the Unit 2 upstream end of the reach are proposed at the corners of the College Avenue Bridge. Even though they are smaller in area, both location can provide optional temporary storage and/or staging accommodations. Both of this locations indicate that they have no record of ownership and their availability should be confirmed and vetted by the County during the PED phase.

2.9.2 Unit 3

The proposed haul routes and the construction staging areas for Unit 2 reach are shown on Attachment 2. Near the upstream end of the reach, two locations have been identified on the left bank that can potentially be used as a staging and storage locations based on the Marine County's Land and Easement Ownership map. These two locations are Flood Control Fee Title lands as identified on the map. Access to these locations can be made directly from Sir Francis Drake Blvd. Additional Flood Control Fee Title area along the left bank of this reach is proposed for staging and storage near Station 350+00. Access to this location is available via Laurel Avenue from Sir Francis Drake Blvd.

2.9.1 Unit 4

As in the other reaches of the project, the majority of the land on both the left and right bank are privately owned. MCFCWCD owns a parcel, approximately 15,000 SF on the right bank of the channel near Station 390+00. This location is the primary creek access, staging and storage location for most of the Unit 4 reach. Access to this location is available directly from Sir Francis Drake Blvd into the gated County property. Approximately 1,200 feet downstream from this lactation, temporary channel access and small area for staging can be facilitated with Ross Valley Fire Department. Access to this location is through the Fire Department entrance directly from San Francis Drake Blvd or additional arraignment have to be facilitated to get access directly from Lagunitas Rd if traffic impact to the Fire Department is anticipated to be high. On the right bank of the Creek, the possibility acquiring additional staging area and access appears to be very slim as most of the residential structures are built at a close proximity to the channel bank. The only opportunity available near the downstream end of Unit 4 reach is to facilitate with the Town of Ross to utilize portion of the Post Office parking along the channel bank. The proposed 1150 SF area staging area is shown on Attachment 1. Further communication is required with Town of Ross during the PED phase to make this location, and if possible additional land farther downstream, available for the contractor for used during construction. Access to this location in available directly from Lagunitas Rd.

PART 3 STRUCTURAL REQUIREMENTS

3.1 Design Requirements *(EM, ER, …)*

Table 3-1. Structural Engineering Design Requirements

Publication Number	Title	Publication Date
Engineer Manual (EM)		
EM 1110-2-2000	Standard Practice for Concrete for Civil Works Structures Proponent: CECW-EG	3/31/2001
EM 1110-2-2902	Conduits, Culverts, and Pipes	3/31/1998
ACI and ASTM		
ACI 318/318R	Building Code Requirements for Structural Concrete and Commentary	(2005)
AASHTO M 198	Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants	
ASTM C 39	Test Method for Compressive Strength of Cylindrical Concrete Specimens	
ASTM A 184	Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement	
ASTM A 185	Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete	
ASTM A 615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement	
ASTM A 706	Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement	
ASTM A 497	Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete	
ASTM C 33	Standard Specification for Concrete Aggregates	
ASTM C143	Standard Test Method for Slump of Hydraulic-Cement	
ASTM C 150	Standard Specification for Portland Cement	
ASTM C173	Standard Test Method for Air Content of Freshly Mixed Concrete by	

	Volumetric Method	
ASTM C 231	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method	
ASTM C 260	Standard Specification for Air-Entraining Admixtures for Concrete	
ASTM C 443	Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets	
ASTM C 494	Standard Specification for Chemical Admixtures for Concrete	
ASTM C 618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete	
ASTM C 990	Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants	
Engineer Technical Manual (ETL)		
ETL 1110-2-583	Guidelines for Landscape Planting and Vegetation Management at levees, Floodwalls, Embankment Dams, and Appurtenant Structures.	30 April 2014

3.2 Design Data

The data utilized for the design of the project including but not limited to; survey, hydrologic, hydraulic, and geotechnical will be summarized during the future refinement of the selected alternative.

3.3 Concrete Structures

Future design will include some detail regarding all the concrete and steel material properties and structures design analysis including Stability, Stress, Seismic, and Thermal Stress Analysis for the different concrete features described below. See attachment 6 for the conceptual structural details used for the quantity estimates.

3.3.1 Underground Bypass

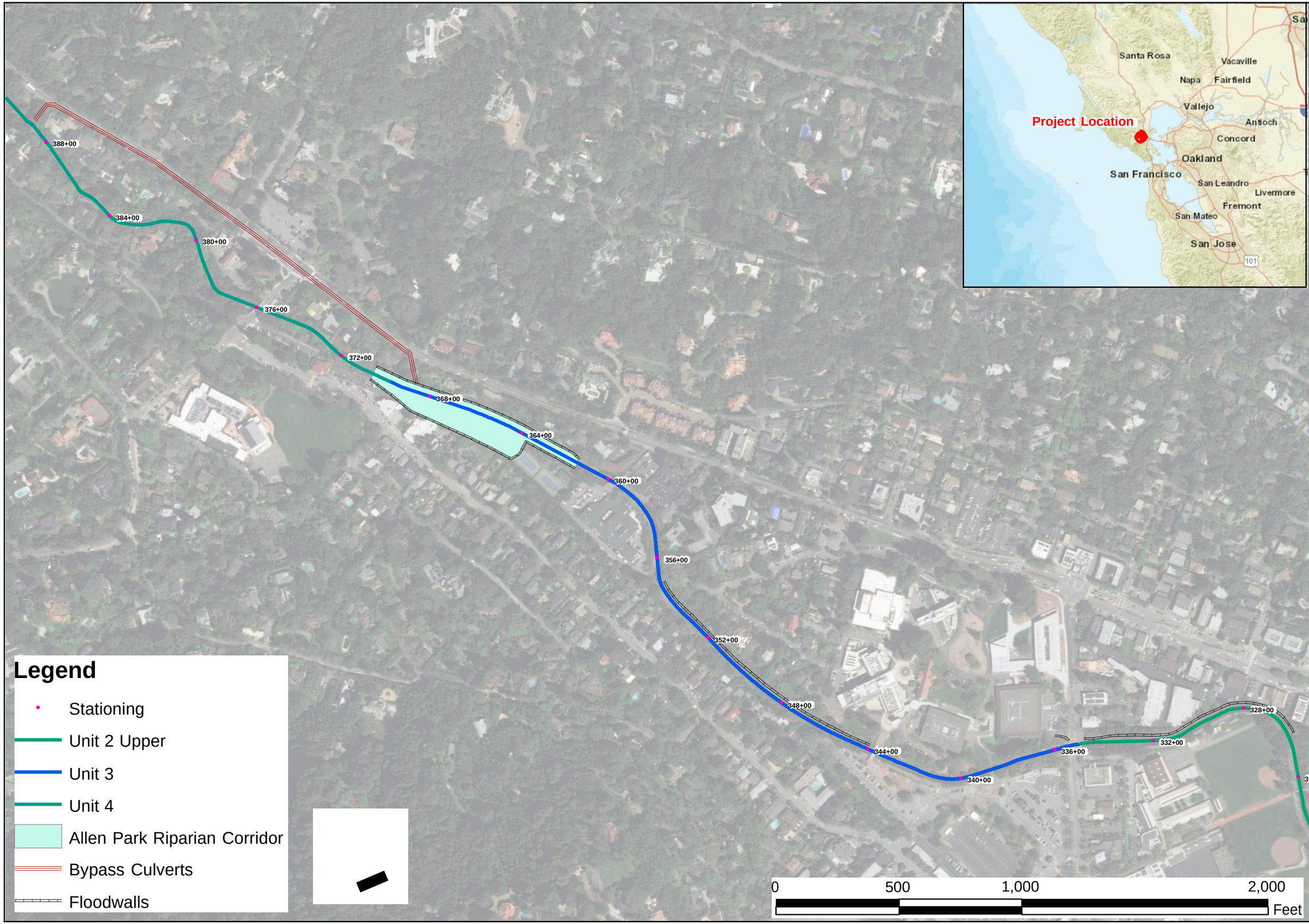
Two underground bypasses running under the San Francis Drake Blvd are proposed (see Figure 2). Each of the proposed underground bypass will have a 12 feet width by 7 feet high internal dimensions. The engineering PDT used prefabricated reinforced concrete bypass structure that will come as split box culvert (top and bottom sections) to be installed on site. The length of each piece will be designed to fit in and be transported on a large truck. The minimum thickness of the vertical stem will be 12 inches while the minimum bottom and top sides have a minimum of 14 inches thickness. All the walls will be double reinforced.

3.3.2 Floodwalls

All the floodwalls in the recommended alternatives are proposed to be construct with an inverted "T" type wall with different dimensions depending on the height of the wall. The concrete walls that are proposed to be constructed adjacent to the outside face of the existing concrete channel wall will be provided with intervals of a support column that is buried deeper than the floodwalls. For the short floodwall types, the idea of extending the existing channel wall was dropped out due to the understanding that the condition of the existing channel wall is close to serving the full designed life cycle. Routine annual inspection have also indicated that there are some scours damages and other nonstructural related deficiencies in the underwater portion of the walls. The condition of the existing channel wall is proposed to be evaluated during the pre-construction engineering and design phase (PED). The information obtained from the investigation will be utilized to inform the design of the proposed project features.

Corte Madera Creek Flood Risk Management Study

Tentatively Selected Plan Features and Location Map



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CALIFORNIA

CORTE MADERA CREEK FLOOD RISK MANAGEMENT STUDY MARIN COUNTY

General Investigation

Tentatively Selected Plan Features and Location Map

Preliminary Proposed Access Route, and Staging Area Locations

Plate 1

Plate 2

Plate 3

Plate 4

Plate 5

Plate

Legend

- Unit 2 Upper
- Unit 3
- Unit 4
- Bypass Culverts
- Floodwalls
- Allen Park Riparian Corridor
- Access Routes
- Staging Area (see EIS/EIR)

0 500 1,000 2,000 Feet

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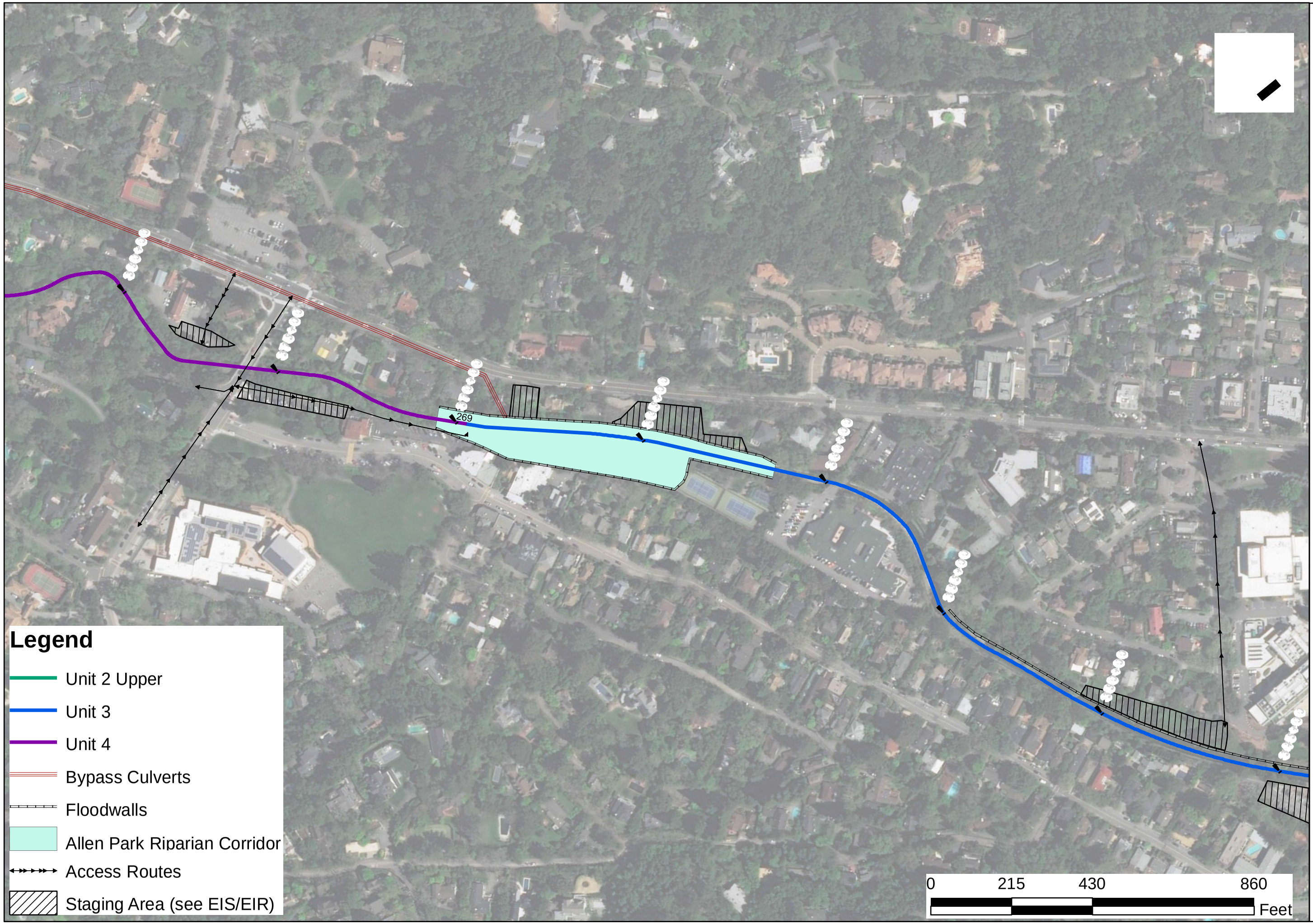
CALIFORNIA

CORTE MADERA CREEK FLOOD RISK MANAGEMENT PROJECT MARINE COUNTY

General Investigation

TSP Access Route, and Staging Area



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CORTE MADERA CREEK FLOOD RISK MANAGEMENT PROJECT

MARIN COUNTY

General Investigation

TSP Access Route, and Staging Area

Plate 2

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General Investigation
TSP Access Route, and Staging Area

CALIFORNIA

Plate 1

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General Investigation

TSP Access Route, and Staging Area

Plate 3

Legend

- Unit 2 Upper
- Unit 3
- Unit 4
- Bypass Culverts
- Floodwalls
- Allen Park Riparian Corridor
- Access Routes
- Staging Area (see EIS/EIR)

0 175 350 700

Feet

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General Investigation
TSP Access Route, and Staging Area

Plate 4

Legend

- Unit 2 Upper
- Unit 3
- Unit 4
- Bypass Culverts
- Floodwalls
- Allen Park Riparian Corridor
- Access Routes
- Staging Area (see EIS/EIR)

0 205 410 820 Feet

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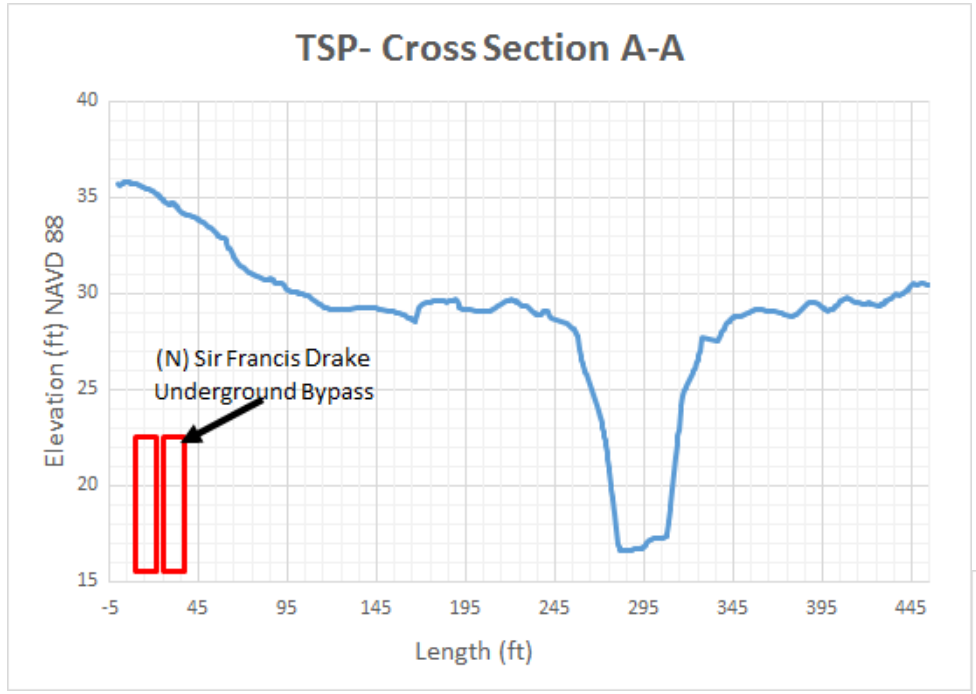
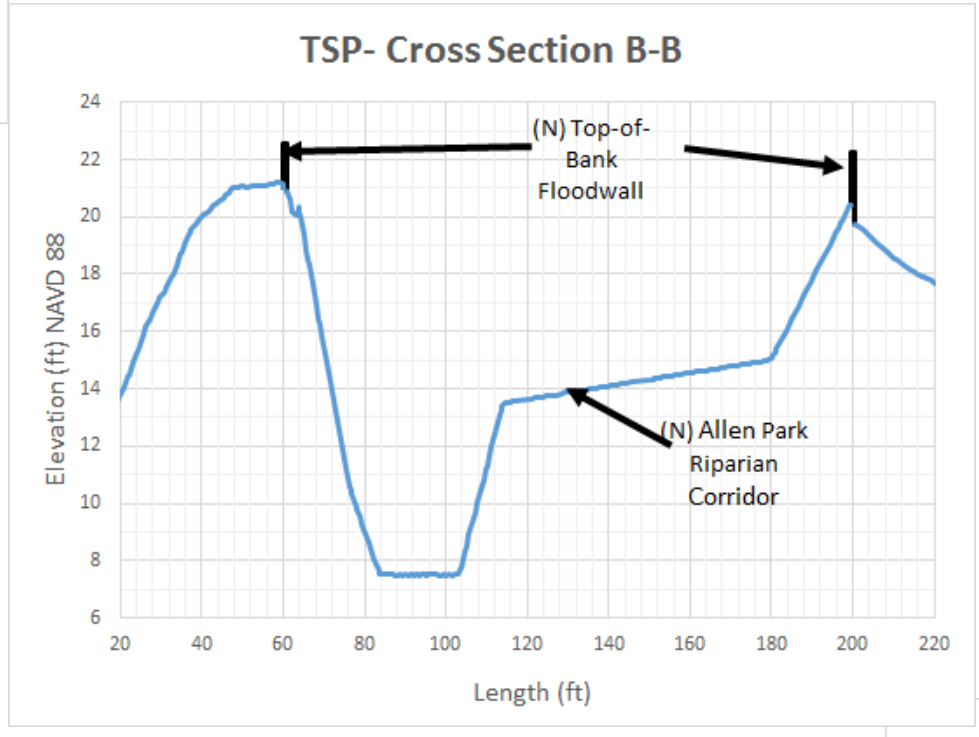
General Investigation
TSP Access Route, and Staging Area

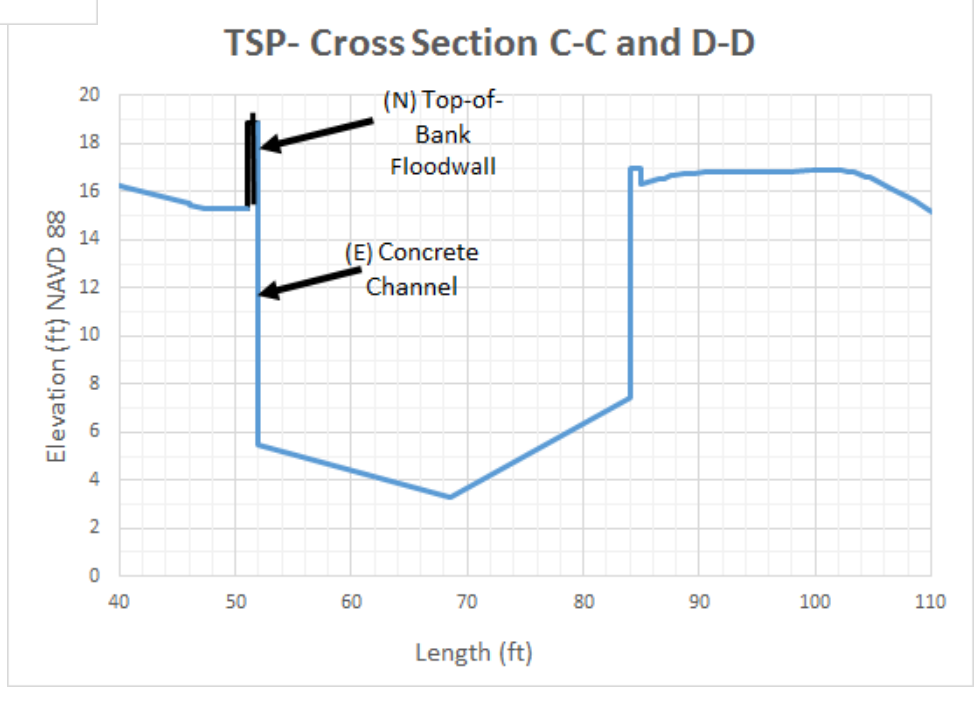
Plate 5

Preliminary Detailed Layout Plan
(Pending)

Preliminary Cross Sections







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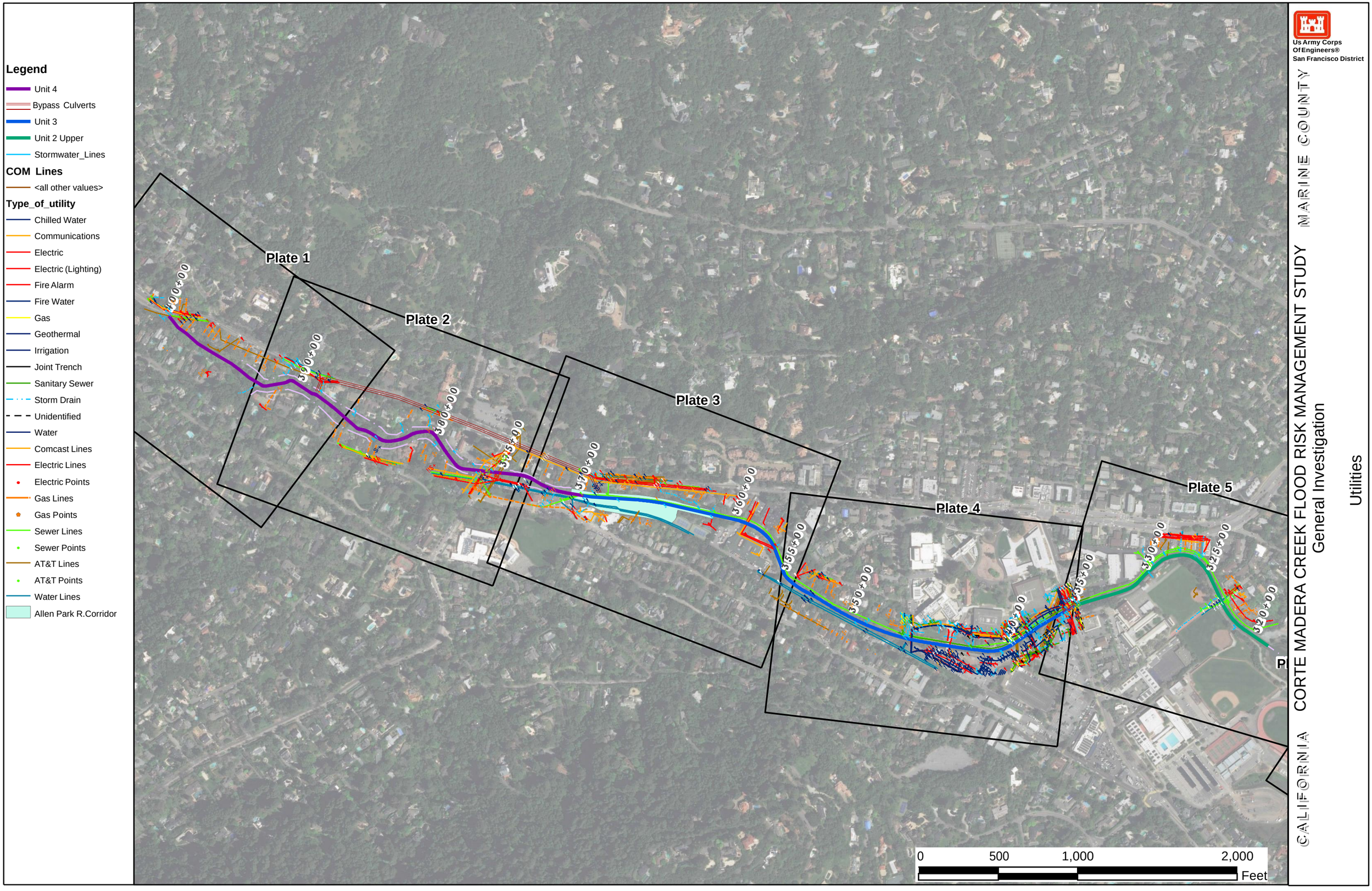
General Investigation

Prelemenary Cross Sections

Utility Within Vicinity of the Selected Plan


Legend
Unit 4
Bypass Culverts
Unit 3
Unit 2 Upper
Stormwater_Lines
COM Lines
<all other values>
Type_of_utility
Chilled Water
Communications
Electric
Electric (Lighting)
Fire Alarm
Fire Water
Gas
Geothermal
Irrigation
Joint Trench
Sanitary Sewer
Storm Drain
Unidentified
Water
Comcast Lines
Electric Lines
Electric Points
Gas Lines
Gas Points
Sewer Lines
Sewer Points
AT&T Lines
AT&T Points
Water Lines
Allen Park R.Corridor
Plate 1
Plate 2
Plate 3
Plate 4
Plate 5
300+00
305+00
310+00
315+00
320+00
325+00
330+00
335+00
340+00
345+00
350+00
355+00
360+00
0
500
1,000
2,000
Feet
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General Investigation
Utilities
CALIFORNIA
MARINE COUNTY

Legend

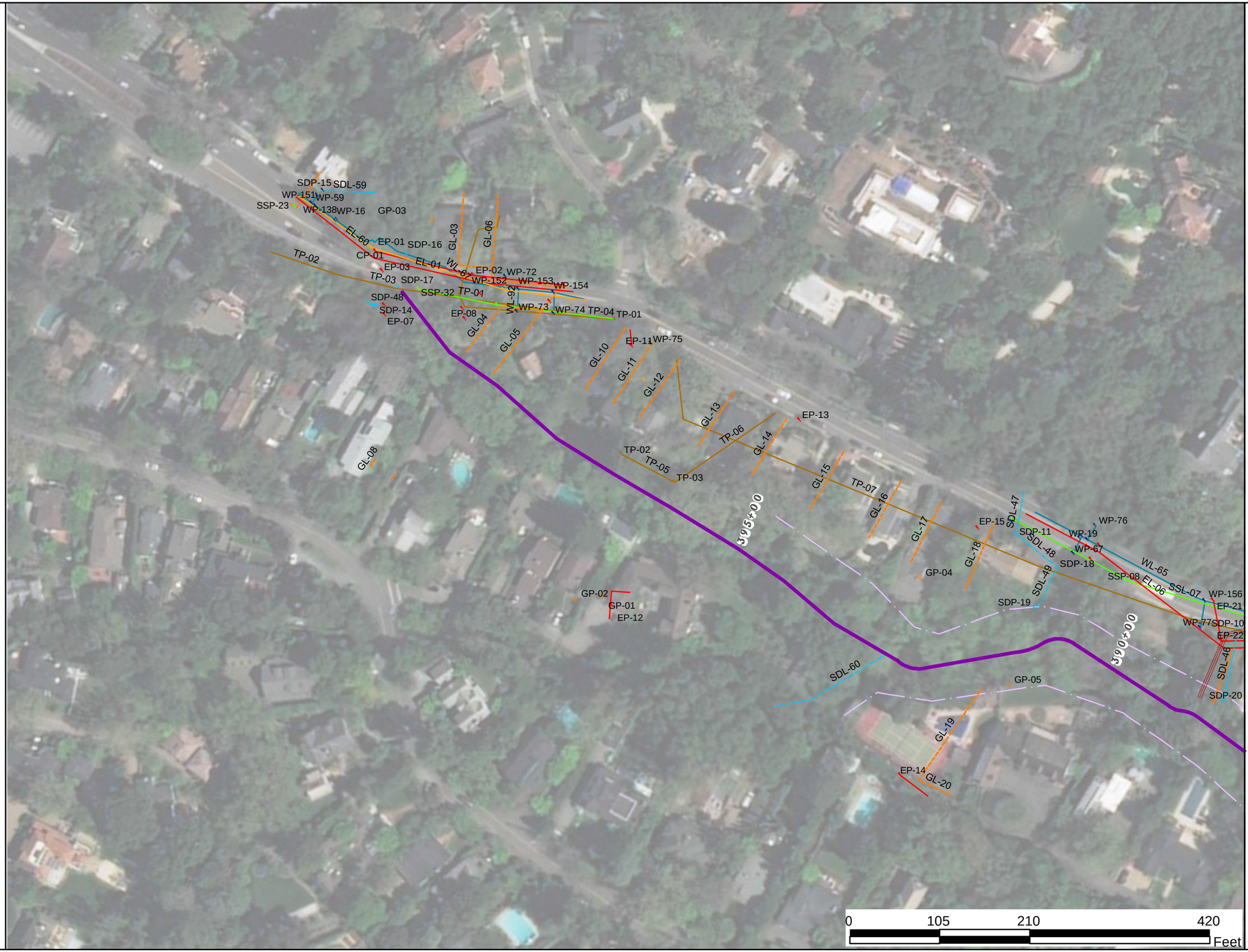
- Bypass Culverts
- Allen Park R.Corridor
- Floodwalls
- Unit 4
- Unit 3
- Unit 2 Upper
- Stormwater_Lines

COM Lines

- <all other values>

Type_of_utility

- Chilled Water
- Communications
- Electric
- Electric (Lighting)
- Fire Alarm
- Fire Water
- Gas
- Geothermal
- Irrigation
- Joint Trench
- Sanitary Sewer
- Storm Drain
- Unidentified
- Water
- Comcast Lines
- Electric Lines
- Electric Points
- Gas Lines
- Gas Points
- Sewer Lines
- Sewer Points
- AT&T Lines
- AT&T Points
- Water Lines



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General Investigation
Utilities

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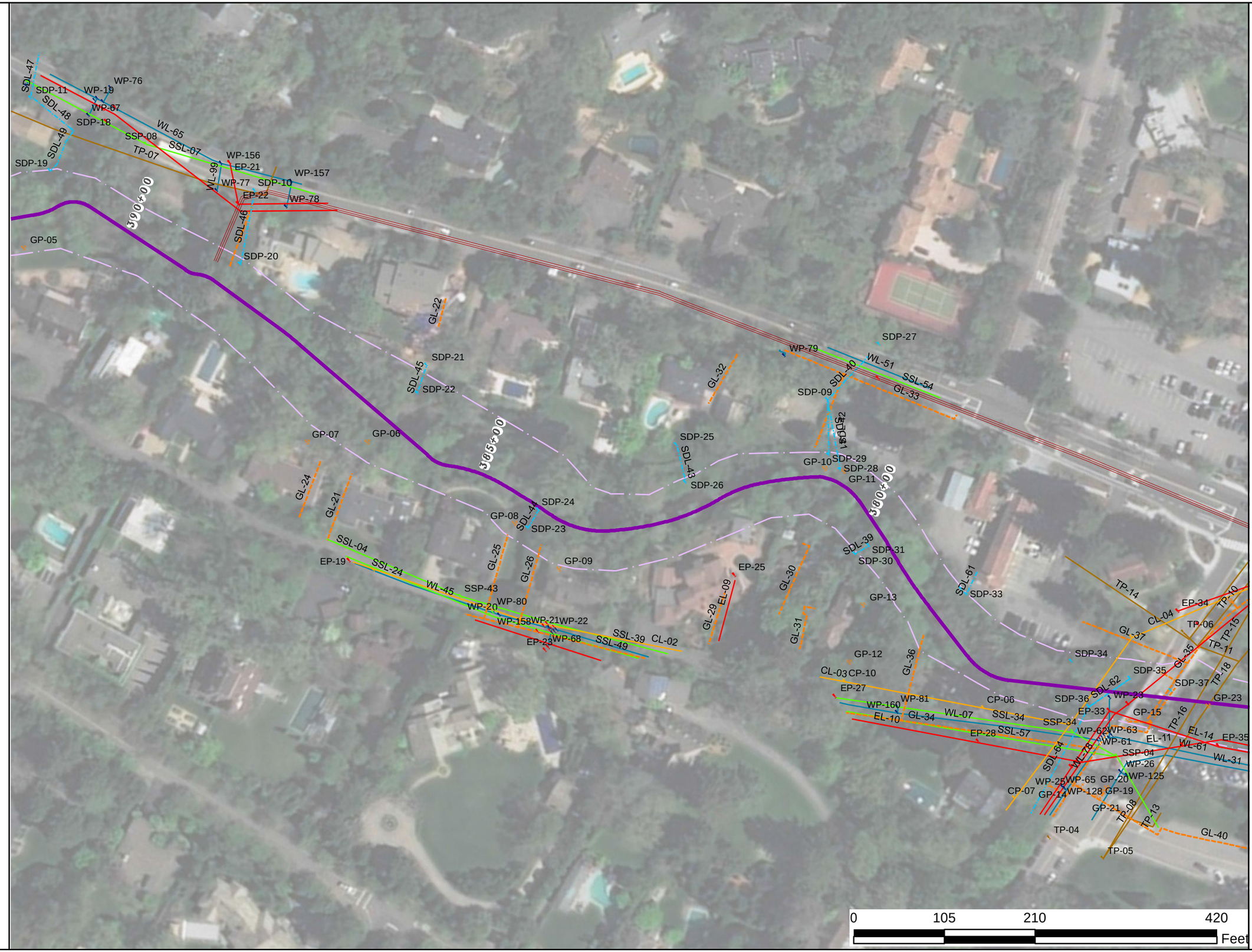
Plate 1



Legend

- Bypass Culverts
- Allen Park R.Corridor
- Floodwalls
- Unit 4
- Unit 3
- Unit 2 Upper
- Stormwater_Lines

COM Lines

- <all other values>

Type_of_utility

- Chilled Water
- Communications
- Electric
- Electric (Lighting)
- Fire Alarm
- Fire Water
- Gas
- Geothermal
- Irrigation
- Joint Trench
- Sanitary Sewer
- Storm Drain
- Unidentified
- Water
- Comcast Lines
- Electric Lines
- Electric Points
- Gas Lines
- Gas Points
- Sewer Lines
- Sewer Points
- AT&T Lines
- AT&T Points
- Water Lines

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General Investigation

MARIN COUNTY
CALIFORNIA

Utilities

Plate 2

Legend

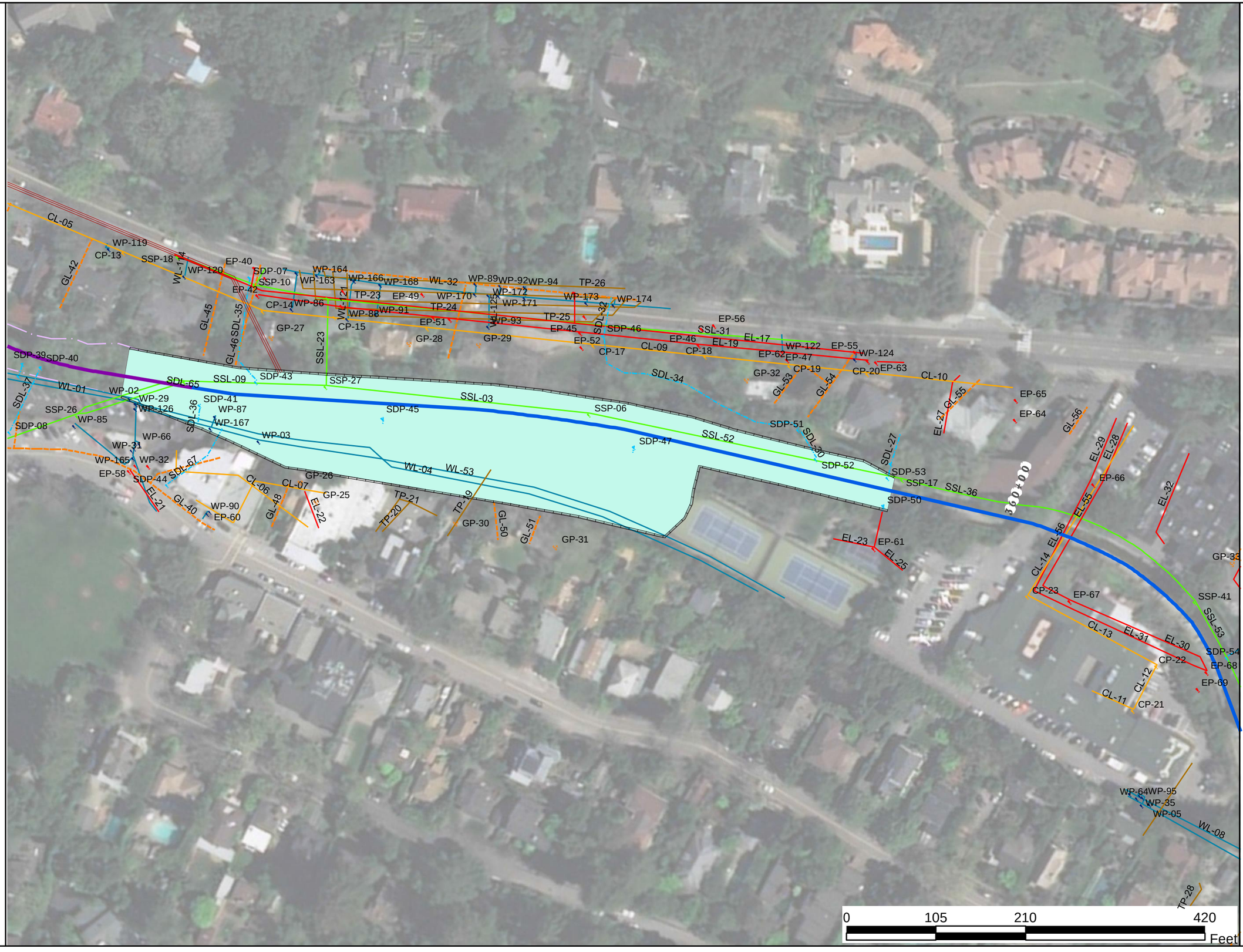
- Bypass Culverts
- Allen Park R.Corridor
- Floodwalls
- Unit 4
- Unit 3
- Unit 2 Upper
- Stormwater_Lines

COM Lines

- <all other values>

Type_of_utility

- Chilled Water
- Communications
- Electric
- Electric (Lighting)
- Fire Alarm
- Fire Water
- Gas
- Geothermal
- Irrigation
- Joint Trench
- Sanitary Sewer
- Storm Drain
- Unidentified
- Water
- Comcast Lines
- Electric Lines
- Electric Points
- Gas Lines
- Gas Points
- Sewer Lines
- Sewer Points
- AT&T Lines
- AT&T Points
- Water Lines



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General Investigation
Utilities

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MARINE COUNTY

Plate 3

Legend

- Bypass Culverts
- Allen Park R.Corridor
- Floodwalls
- Unit 4
- Unit 3
- Unit 2 Upper
- Stormwater_Lines

COM Lines

- <all other values>

Type_of_utility

- Chilled Water
- Communications
- Electric
- Electric (Lighting)
- Fire Alarm
- Fire Water
- Gas
- Geothermal
- Irrigation
- Joint Trench
- Sanitary Sewer
- Storm Drain
- Unidentified
- Water
- Comcast Lines
- Electric Lines
- Electric Points
- Gas Lines
- Gas Points
- Sewer Lines
- Sewer Points
- AT&T Lines
- AT&T Points
- Water Lines

0 95 190 380 Feet

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General Investigation
MARIN COUNTY
CALIFORNIA

Utilities

Plate 4

Legend

- Bypass Culverts
- Allen Park R.Corridor
- Floodwalls
- Unit 4
- Unit 3
- Unit 2 Upper
- Stormwater_Lines

COM Lines

- <all other values>

Type_of_utility

- Chilled Water
- Communications
- Electric
- Electric (Lighting)
- Fire Alarm
- Fire Water
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- Geothermal
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- Joint Trench
- Sanitary Sewer
- Storm Drain
- Unidentified
- Water
- Comcast Lines
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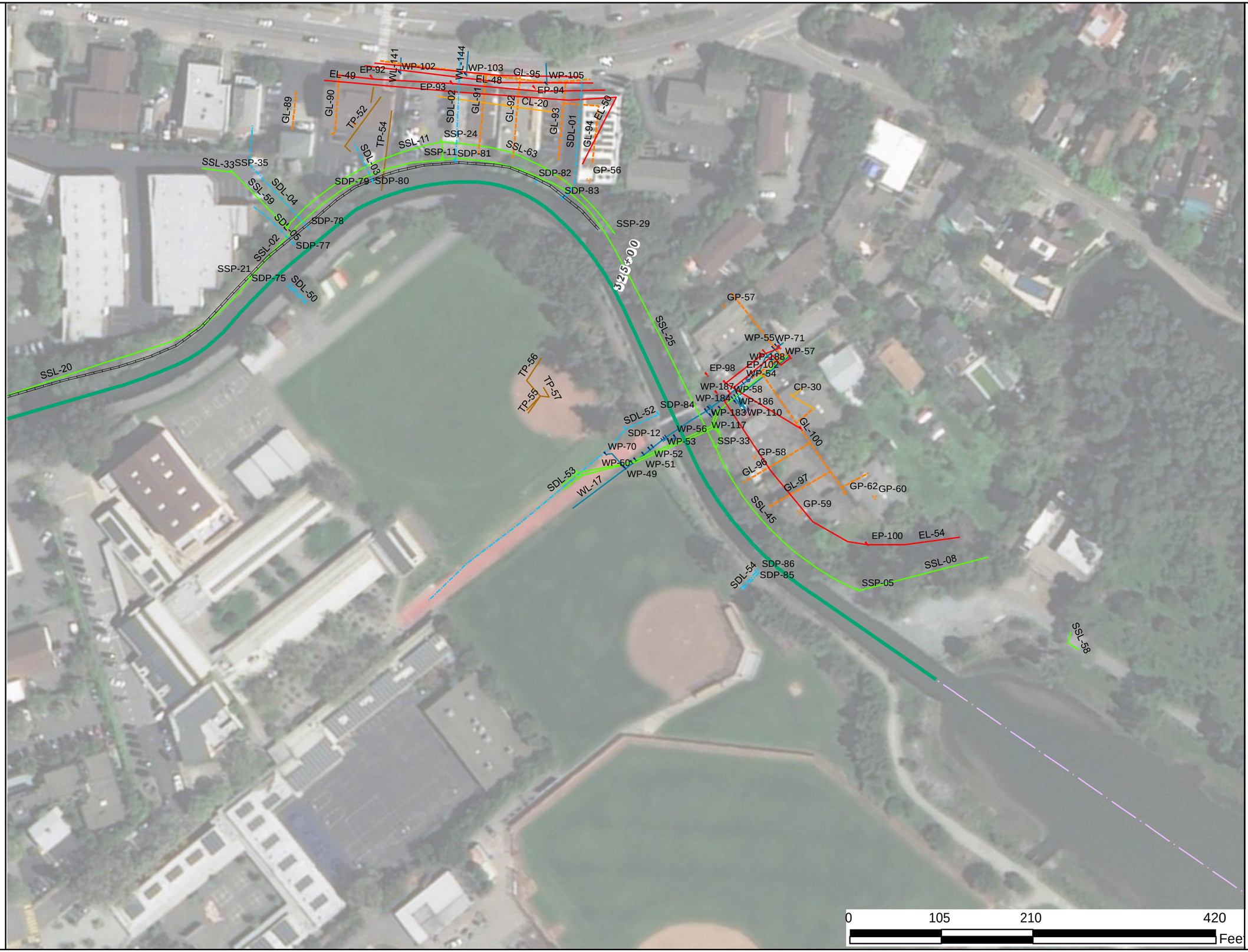
- Gas Lines
- Gas Points
- Sewer Lines
- Sewer Points
- AT&T Lines
- AT&T Points
- Water Lines



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General Investigation
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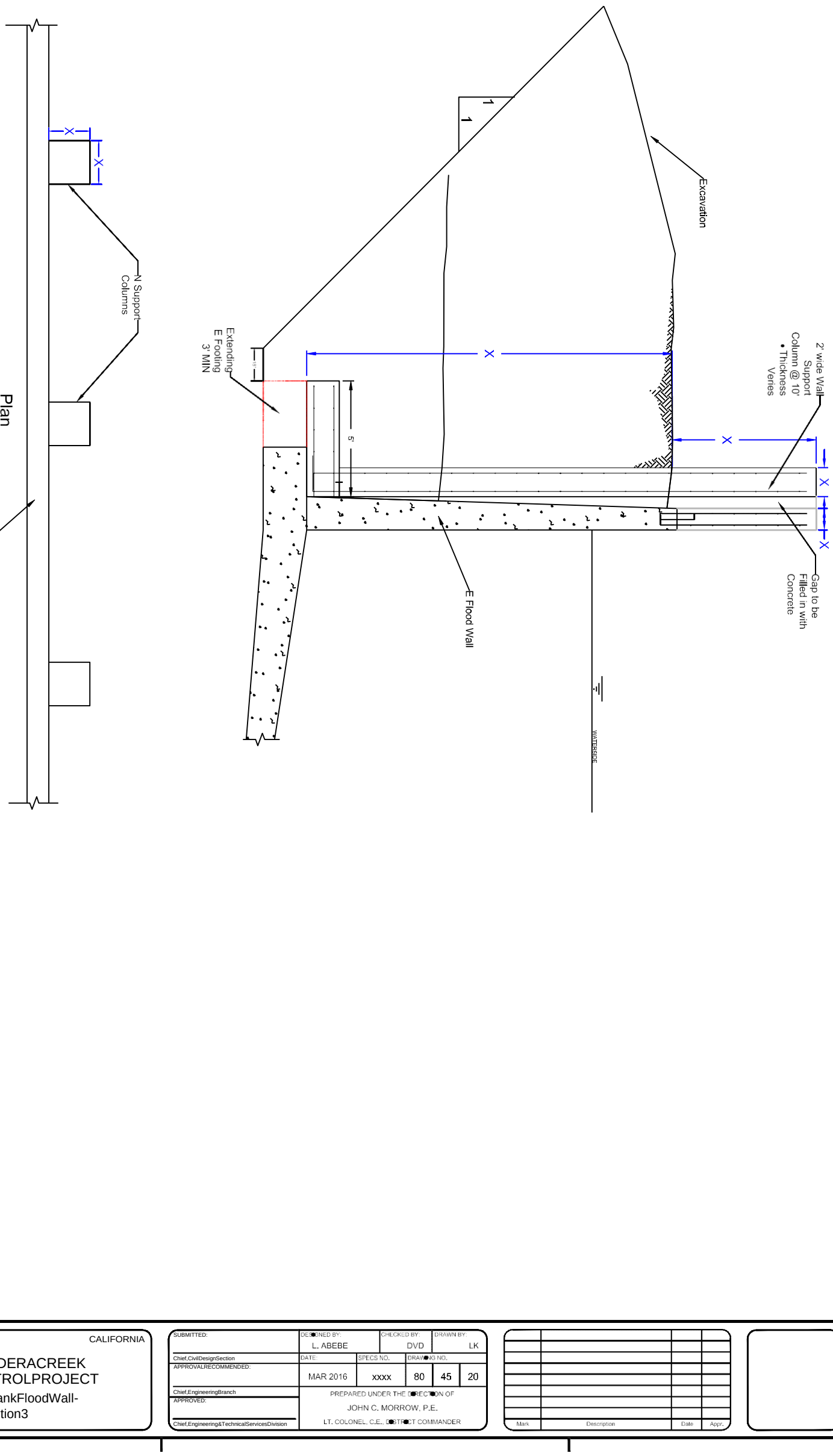
CALIFORNIA

Utilities

Plate 5

Concept Structural Details



Sheet Reference Number
---- OF 10

MARINCOUNTY CALIFORNIA

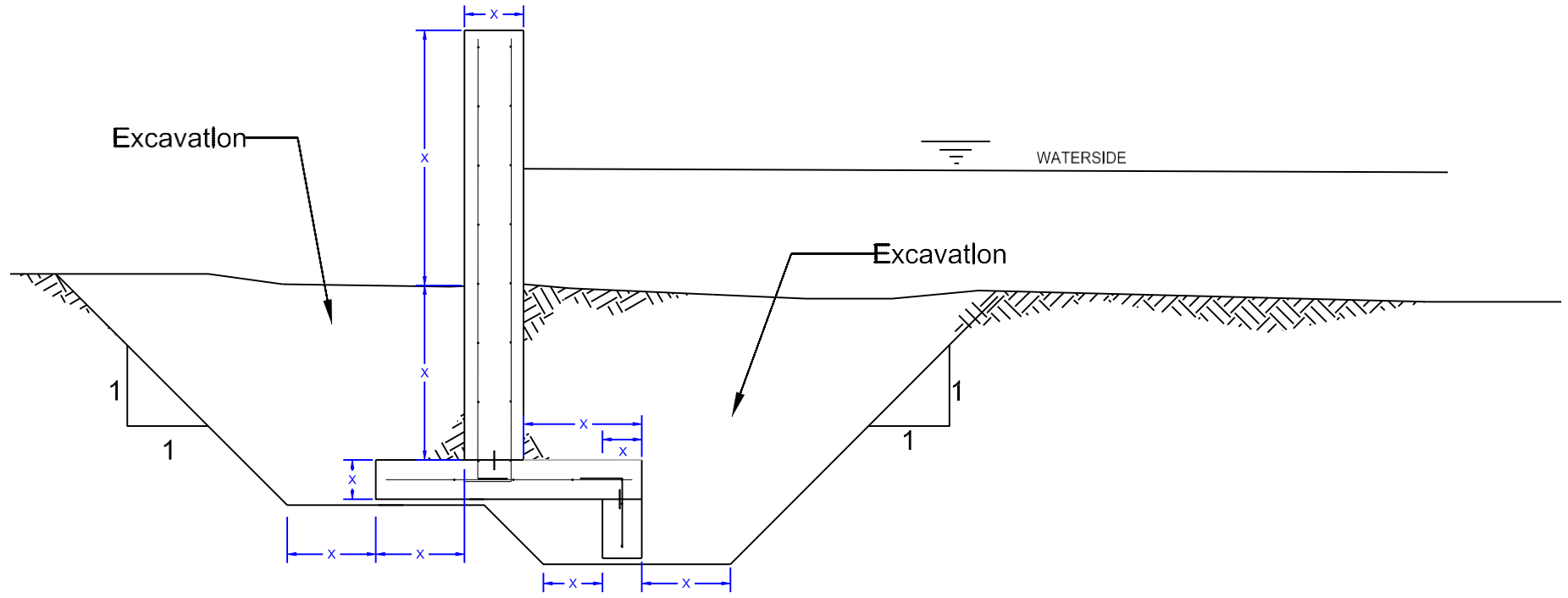
CORTEMADERACREEK FLOODCONTROLPROJECT

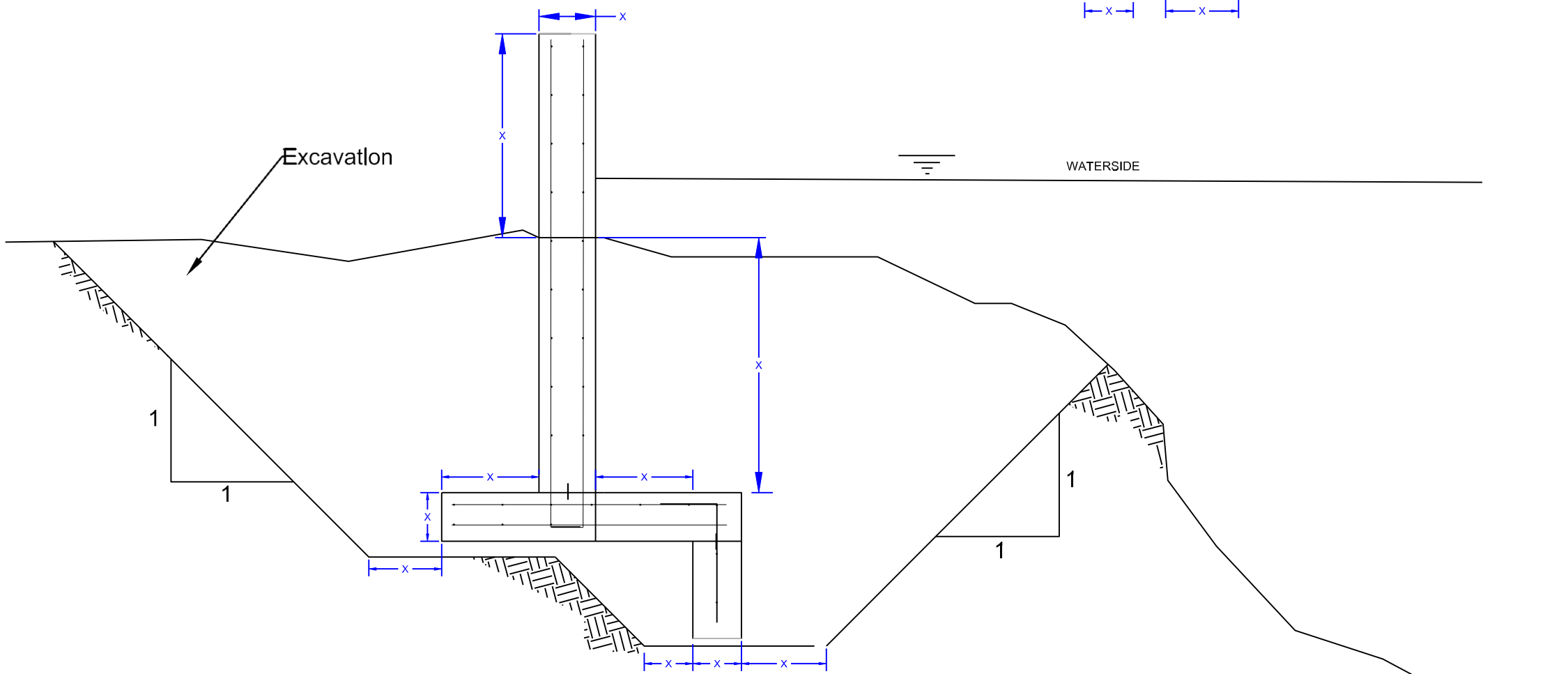
Unit2&3OverBankFloodWall-Option3

SUBMITTED:	DESIGNED BY: L. ABEBE	CHECKED BY: DVD	DRAWN BY: LK
Chief,CivilDesignSection	DATE:	SPECS NO.	DRAWING NO.
APPROVALRECOMMENDED:	MAR 2016	xxxx	80 45 20
Chief,EngineeringBranch	PREPARED UNDER THE DIRECTION OF		
APPROVED:	JOHN C. MORROW, P.E.		
Chief,Engineering&TechnicalServicesDivision	LT. COLONEL, C.E., DISTRICT COMMANDER		

Mark	Description	Date	Appr.

USArmyCorps ofEngineers
San Francisco District
1455 Market Street
San Francisco CA 94103





USArmyCorps ofEngineers
San Francisco District
1455 Market Street
San Francisco, CA 94103

DESIGNED BY: L. ABEBE	DRAWN BY: DVD	CHECKED BY: LK	
DATE: MAR 2016	SPECS NO: xxxx	DRAWING NO: 80	SHEET NO: 45
			20

PREPARED UNDER THE SUPERVISION OF
JOHN C. MORROW, P.E.
LT. COLONEL, C.E., DISTRICT COMMANDER

SUBMITTED:
Chief, Civil Design Section

APPROVED AND RECOMMENDED:
Chief, Engineering Branch

APPROVED:
Chief, Engineering & Technical Services Division

CALIFORNIA
MARIN COUNTY

CORTE MADERA CREEK FLOOD CONTROL PROJECT

OverBank Flood Wall and Set Back Flood Wall

Sheet Reference Number

---- OF 10

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