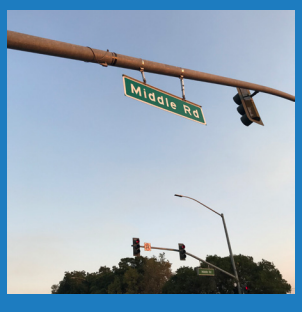
MID-PENINSULA WATER DISTRICT

DRAFT

Basis of Design Report

El Camino Real and Malcolm Avenue Improvements

Prepared by HydroScience Engineers



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SECTION 1

INTRODUCTION

The Mid-Peninsula Water District's (District) mission is to provide a safe and reliable source of water to approximately 28,000 people. As part of a larger strategic effort to accomplish their mission, the District began developing a Comprehensive System Analysis and Capital Improvement Program (CIP) in 2014. The CIP was approved in May 2016 and identifies 92 projects in nine pressure zones.

This basis of design report (Report) analyzes two of those CIP projects, which are identified in the CIP as follows:

Project No. 15-74 – Malcolm Avenue Improvements: This section of the Project will install approximately 550 linear feet (LF) of 8-inch ductile iron pipe (DIP). The customers along Malcolm Avenue currently experience high pressure and the configuration of the existing water main creates four dead ends. The new water pipeline will reconfigure the boundaries of Zones 1 and 2, thereby creating a looped system. **Figure 1D** shows the location of Malcolm Avenue.

Project No. 15-76 – El Camino Real Improvements: Approximately 4,100 LF of aging 8-inch cast iron (CI) pipe along the El Camino Real (ECR) will be replaced with a new 8-inch DIP. The new water pipeline will reduce maintenance and improve fire flows. The improvements on ECR include two water segments, which are referred to in this document as ECR North and ECR South. **Figures 1A-1C** show the location of both ECR North and ECR South.

The purpose of this Report is to discuss the considerations for pursuing alternate alignments for each pipeline segment. This Report presents our findings on the following key topics:

- Summary of Existing Data
- Considerations for Existing Utilities
- Alternatives and Recommendations for the Pipeline Alignments
- Discussion on Service Connections
- Proposed Design Criteria
- Project Implementation

SECTION 2

SUMMARY OF EXISTING DATA

2.1 Survey Data

O'Dell Engineering, Inc. (O'Dell) provided topographic mapping services for both Projects 15-74 and 15-76. Malcolm Avenue and the southbound lanes of ECR were field surveyed in August 2017. The northbound lanes of ECR were surveyed using aerial mapping methods. The aerial surveyor also provided a georeferenced aerial photograph for the entire right-of-way of ECR North and ECR South. An aerial photograph was not provided for the Malcolm Avenue location, but was obtained from publicly available aerial photography. Elements of the field survey included collecting invert and rim elevation data, curb and gutter locations, striping and signage locations, and other pertinent above grade features. Grade elevations are shown with contours at 0.5-foot intervals.

O'Dell's scope of work also included utility research. Where utility operators provided utility maps, the approximate location of those utilities were incorporated into the final survey maps and are shown on **Figures 1A-1D**. Existing utilities are described further in **Section 2.3**.

The right-of-way (ROW) line work shown on **Figures 1A-1D** was provided by O'Dell. The line work was created by stitching together available County record maps and fitting them to known monuments. Consequently, the source and accuracy of the ROW line work varies throughout.

2.2 Geology

A geotechnical study was not performed for this Project. During a site walk on June 14, 2017 (see **Section 2.3.2**) HydroScience staff observed a development at 572-600 El Camino Real and noted the presence of shallow rock formations. A conversation with the construction manager for the site revealed much of the site required heavy rock breaking equipment.

The City of Belmont (City) provided a copy of the geotechnical report for the project at 572-600 El Camino Real. A copy of the report is included as **Appendix C**. There were three bore holes completed for this report. Dense sandstone was found at 2, 5, and 7 foot depths. The bore holes were shallow, varying between 8 and 13 feet deep.

The geologic map included as **Figure 3a** of the geotechnical report implies a similar stratigraphy for the entire length of the Project.

2.3 Existing Infrastructure

This section includes further information on existing utilities and other existing infrastructure within the limits of this Project.

2.3.1 Existing Utilities

The survey (discussed in **Section 2.1**) provides the base map for the 30% design drawings.. This section summarizes the utility information collected by O'Dell.

At the time the survey was being completed, HydroScience Engineers, Inc. (HydroScience) was planning to

perform a geotechnical investigation for this project. In preparation for this work, HydroScience obtained a ticket through Underground Service Alert North 811 (811). The utility information obtained through the 811 process was used to inform the design. The utility markings were captured by the field survey, and the organizations listed on the 811 web portal were contacted and record drawings were obtained as shown in **Table 2-1**.

TABLE 2-1: Utility Coordination Summary

UTILITY	CLEAR [1]	REQUESTED	RECEIVED
AT&T	No	✓	✓
COMCAST	No	✓	No
County of San Mateo	NR	No	-
City of Belmont	No	✓	✓
City of Redwood City	Yes	-	-
City of San Mateo	Yes	-	-
California Water Services	NR	No	-
Level 3 Communications	No	✓	✓
MCI Worldcom	NR	No	-
Mid-Peninsula Water District [2]	No	✓	✓
Pacific Bell	NR	No	-
PG&E Gas	No	✓	✓
PG&E Electric	No	✓	□
San Francisco Public Utilities Commission	Yes	-	-
Sprint	Yes	-	-
Qwest Communications	NR	No	-
Teleport Communications	NR	No	-
Wave Broadband	NR	No	-
XO Communications	NR	No	-
Zayo	NR	No	-
NOT LISTED [3]			
Caltrain	Yes	-	-
Caltrans (District 4)	No	✓	✓
CenturyLink National Network	Yes [4]	No	-
SamTrans	Unk [5]	No	-
United States Postal Service	Unk	No	-

Table Notes

1. "Clear" indicates whether utilities are within the Project limits. A "Yes" indicates the utility does not operate any infrastructure within the Project limits. A "No" indicates the utility does operate infrastructure within the Project limits. An "NR" indicates No Response.
2. District provided geographic information system (GIS) data files.
3. These utilities or organizations did not appear in the 811 search but may require coordination.
4. CenturyLink National Network did not appear in the 811 search but issued a notification by email confirming no utilities are owned or operated within the Project limits.
5. If SamTrans or USPS facilities will be disturbed during construction, replacement of such facilities will be replaced in accordance with the respective agency requirements.

2.3.2 Site Walk Observations

HydroScience staff walked the Project limits on June 14, 2017. A second site walk occurred on July 27, 2017. Observations from those site walks are listed below. Specific utility crossings are discussed in **Section 4.1.1** and **Section 5.1.1**, for ECR North, ECR South, and Malcolm Avenue respectively.

- Most of the existing utilities along ECR lie in the No. 1 and No. 2 southbound lanes.
- The sidewalk along the southbound lanes (western edge of ECR) contains much of the existing 8-inch CI water pipelines, buried electrical lines for street lights, and a 2-inch high-pressure gas pipeline.
- The electrical lines are mostly overhead along ECR, but there are three vaults near Middle Road marked "HVE".
- Most of the storm drain and sanitary sewer pipelines are located along the western edge of ECR, in the No. 2 southbound lane and parking zones.
- Near the northwest corner of ECR and Waltermire Street there are several large communication vaults.
- At North Road (see **Figure 1A** – Plan 1), the City of Belmont operates the North Road Sanitary Sewer Pump Station.
- There are development projects currently under construction at both 490 and 600 El Camino Real, immediately south of Davey Glen Road.
- It is likely that coordination will be required with SamTrans and the United States Postal Service (USPS). Coordination will occur during the design phase to ensure that any facilities impacted during construction will be protected in-place or replaced in accordance with agency specific requirements. Project coordination is further discussed in **Section 6.4**.

2.4 Corrosive Soils

A corrosion analysis report will be developed by Cal Engineering & Geology (CEG). CEG will perform a survey of site conditions to observe such issues as: corrosion on existing infrastructure and the presence of existing utilities that may impose stray electrical current (e.g. electrified rail tracks, existing cathodic protection systems). They will obtain soil and water (if present) samples and analyze them for chloride and sulfate concentrations, as well as pH levels.

CEG will summarize the corrosion test results and will present the findings in a report. Based on the results of the analysis, HydroScience will work with the District to determine if a cathodic protection system is warranted. Per **Section 3.3**, the pipe will be encased in an 8-mil polyethylene sleeve as a minimum protection against corrosion.

2.5 Hazardous Materials

The presence of hazardous materials can impact the cost and schedule of a construction project if the planning and design phases do not adequately address the potential for contaminated soil and groundwater. The construction activities of potential concern include trench spoils and dewatering. Contaminated soil and groundwater require special handling and disposal.

A search of the Department of Toxic Substances Control's (DTSC) data management system, EnviroStor, indicated that there were no active cleanup sites or operating permitted sites within the Project limits.

A search of the State Water Resources Control Board's (SWRCB) data management system, Geotracker, showed multiple leaking underground storage tank (LUST) sites, but each one had been cleaned up and the sites closed.

SECTION 3

PROJECT DESIGN CRITERIA

3.1 Safety and Operations

The final alignment of the new 8-inch water pipeline will be designed to maximize safety and access for District staff, and preferably be located on the western side of ECR, which is where the existing services are located. We understand the District prefers to have the new water pipeline installed as close as possible to the edge of roadway, and to have as few elbows (jogs) as possible. For ECR, this means that the new pipeline should be installed as close as possible to the western edge of the Caltrans ROW as possible. Locating the pipeline near the western edge would allow for the best opportunity to provide safer traffic control, should pipeline maintenance be required.

3.2 Design Flows and Velocities

As part of the District's CIP, a hydraulic model was built to identify deficiencies within the distribution system. The results of the system analysis set the pipe sizes based on the following constraints:

Minimum Fire Flow	1,500 gpm
Maximum Fire Flow	2,500 gpm
Maximum Velocity	15 ft/s

3.3 Pipe

Design criteria for pipe material, coating, lining, joints, and fittings are set by District standards and project specific requirements. The pipe size was set by the District's CIP and based on the hydraulic model and constraints discussed in **Section 3.2**.

Size	8-inch (Nominal Pipe Size)
Material	Ductile Iron (Pressure Class 350)
Coating	Asphalt Coated
Lining	Cement Mortar
Joints	Restrained
Fittings	Ductile Iron (350 psi working pressure)
Operating Pressure	135 psi
Corrosion Protection	Polyethylene Encasement (8-mil)
Standards	AWWA C104, C105, C111, C150, C151, C153

3.4 Valves and Appurtenances

Valves and appurtenances will conform to the District's Standard Specifications. The following subsections further describe these requirements.

3.4.1 Isolation Valves

All isolation valves are to be gate valves meeting the District's Standard Specifications, as outlined below.

Type	Gate Valve (Mueller A-2362)
Body	Ductile Iron
Coating	Epoxy
Options	EPDM Disc and O-rings

3.4.2 Air Valves

Air valves and appurtenances will conform to the District's Standard Specifications.

Type	Combination
Manufacturer	Val-Matic (Model 201C-X045)
Size	1-inch (for 8-inch pipe)
Pressure Rating	300 psi
Materials	Body and Cover: Cast iron Parts: Stainless Steel
Standards	AWWA C512, AWWA C550, NSF 61, ASTM A126

3.4.3 Blow Offs

Blow offs will conform to the District's Standard Specifications.

Size	4-inch
Manufacturer	Kupferle
Standards	NSF 372

3.5 Pipeline Separation Requirements

Minimum pipeline separation requirements are governed by California Code of Regulations (CCR) § 64572. The District's separation requirements are shown in Standard No. MP-20 and meet or exceed the separation requirements in CCR § 64572. The following pipeline separation requirements reflect the District's requirements.

Horizontal Separation from Crossing Utility	
Storm drain, gas, telephone, electric, and communication lines	5 feet
Sanitary Sewer	10 feet

Vertical Separation from Crossing Utility	
Storm drain, sanitary sewer	2 feet (above)
Gas, telephone, electric, and cable	2-feet above or below

3.6 Trench Design

Trench design criteria depends on the trench location. The Project limits include both Caltrans and City ROW. It is expected that Caltrans will likely require slurry backfill, a 12-inch asphalt concrete section, and a slightly deeper pipeline than the City requires. This will be confirmed by the Caltrans' Encroachment Permit.

Both agency's trench design considerations are presented below.

Caltrans ROW	
Depth of Cover	42 inches
Backfill	Per Caltrans Standard Specifications and encroachment permit requirements

City of Belmont ROW	
Depth of Cover	36 inches
Backfill	Per District Standard Specifications and City encroachment permit

3.7 Design Loads

Design	AASHTO Standard Specifications for Highway Bridges (16th Edition) and per geotechnical report (see **Appendix C**)
Dead Loads	Concrete: 150 PCF Soil: 125.5 PCF (per geotechnical report, see **Appendix C**)
Live Loads	AASHTO HS20-44: 32,000 lbs (rear axle loading)

3.8 Acceptance Testing

Pressure and Leakage Test	285 psi (measured at lowest elevation)
Disinfections	Per District Standard Specification Section 15060
Standards	AWWA C600, AWWA C651

SECTION 4

EL CAMINO REAL IMPROVEMENTS

4.1 Existing Utility Considerations

A general overview of the existing utilities and field conditions are discussed in **Section 2.3**. This section presents features and locations of existing utilities identified by HydroScience along ECR. Specific locations identified herein may be referenced on **Figures 1A-1C**.

4.1.1 Existing Utility Information and Locations

Water: The District provided GIS data for the horizontal locations of the existing water pipelines. Vertical locations can be inferred from survey data, which include elevations of the operating nuts for accessible valves. The existing 8-inch CI pipe that will be replaced during this Project is generally located between 5 and 8 feet from the western ROW boundary and lies under either the concrete curb and gutter or the sidewalk. There is a short section of the existing water pipeline that veers east across the No. 2 lane to approximately 19 feet east of the western ROW boundary between Belmont Avenue and Davey Glen Road.

Sanitary Sewer: The City owns, operates, and maintains the sanitary sewer (SS) collection system within the Project limits. Generally, there are either one or two SS pipelines running north to south along the length of ECR North. From 530 El Camino Real and to the north, sanitary sewage flows north. From 564 El Camino Real and to the South, sanitary sewage flows to the south.

All of the SS pipelines are in the southbound lanes between 5 and 25 feet east of the western ROW boundary. The average cover for the SS within ECR North is 4.7 feet. The average cover for the SS within ECR South is 7.2 feet.

There is also a sanitary sewer force main (SSFM) traveling from the North Road PS, which is located at the northwest corner of North Road and ECR, across ECR, and then south within the shoulder of the northbound lane of ECR south to approximately 600 El Camino Real. From that point south, a separate gravity SS flows south along the shoulder of the northbound lane of ECR to the southern extend of ECR North. This SSFM is an 8-inch asbestos cement pipe. **Figure 1A (Plan 1)** shows the location of the North Zone Pump Station and the SSFM crossing ECR.

Storm Drain: The City also maintains storm drain (SD) facilities at three distinct areas along the ECR. The SD inlets and SD pipelines are adjacent to the SS on the western edge of ECR. The average cover over the SD pipelines along ECR is 2.9 feet. The average distance between the western ROW boundary and the centerline of the SD pipelines is about 7 feet. There are at least four locations where the SD crosses ECR. The SD pipe diameters vary between 18 and 36 inches. The cover over the pipelines across ECR is unknown. Storm flows are collected on the western side of ECR and then flow under ECR to the eastern boundary of the ROW.

Gas: Pacific Gas & Electric (PG&E) owns the gas pipelines along El Camino Real. There are two gas pipelines along the ECR; one 2-inch and one 8-inch. Both are high-pressure steel pipelines.

The existing 8-inch steel high pressure gas pipeline extends along ECR between just south of Ruth Avenue and the southern extent of ECR South. Primarily, this 8-inch high pressure gas pipeline is located between

approximately 24-30 feet east of the western ROW boundary of ECR. Between Emmett Avenue and Waltermire Street, the 8-inch gas pipeline exists under the sidewalk on the western side of ECR. Record drawings received from PG&E indicate that gas pipelines are typically between 24 and 36 inches deep.

This 8-inch gas pipeline was potholed at three locations for the development at 600 El Camino Real. HydroScience observed the USA and utility locating markings, and obtained a copy of the potholing report. The potholing report indicated that this 8-inch high pressure gas pipeline is located at a cover of approximately 40-inches.

The existing 2-inch steel high-pressure pipeline is located under the sidewalk along the western edge of ECR. This pipeline extends from Davey Glen Road to Middle Road.

Electric: HydroScience staff met with PG&E in the field on July 27, 2017. There are several overhead power lines along ECR. There are also three large electrical vaults in the No. 2 southbound lane of ECR, just north of Middle Road. These vault locations can be seen on **Figure 1B (Plan 6)** and **Figure 1C (Plan 7)**. Several conduits run between these vaults and crowd the western side of ECR, north of Middle Road.

Communication: Communication lines exist along the entire length of ECR. Communication duct banks are generally within the No. 1 southbound lane. Near Waltermire Street, there are two large communication vaults. The utility locator was unsure of the actual horizontal extents of the vaults but did paint the buried limits. These limits can be seen in the photograph below. If the markings are correct, the vaults occupy most of the western half of the ECR ROW. The orange paint markings show one vault extending across southbound lane No. 1; the other vault occupies most lane No. 2, the parking zone, and some of the sidewalk. **Figure 4, Section E-E** shows the approximate location of these vaults.

Communication Vaults and Markings near Waltermire Street

4.1.2 Existing Utility Considerations

The vertical and horizontal alignment of the new 8-inch water pipeline will be optimized during the design phase to minimize utility crossings and meet separation requirements where possible. Based on survey data and record drawing information, it will be difficult to meet the District's separation requirements while locating the pipeline in the southbound lanes. **Table 3-1** provides a summary of the utility crossings, showing approximate cover and indicating whether vertical separation requirements are expected to be met.

Table 4-1: ECR North and ECR South Utility Crossing Summary

Station	Crossing Utility [1]	Existing Cover (FT)
ECR North		
0+07	8" SS	5.4
3+05	Communication	Unknown
4+14	8" Gas	3.3 [2]
4+73	Communication	Unknown
5+80	8" SS	3.6
9+04	Communication	Unknown
11+66	36" SD	Unknown
12+00	Communication	Unknown
12+12	8" Gas	3.3
12+13	8" SS	6.4
12+18	1" Gas	Unknown
14+84	2" Gas	Unknown
14+86	Electric	Unknown
15+13	8" SS	6.6
15+70	Communication	Unknown
15+98	Electric	Unknown
16+03	Communication	Unknown
16+27	Communication	Unknown
17+01	8" SS	5.1
17+18	8" Gas	3.3
17+22	Communication	Unknown
17+87	24" SD	Unknown
21+89	Communication	Unknown
24+49	8" Gas	3.3
25+39	18" SD	4.6
26+27	8" Gas	3.3
36+07	8" SS	5.4
36+56	12" SD	2.7
38+56	8" Gas	3.3
38+60	12" SD	2.3

Table 4-1: ECR North and ECR South Utility Crossing Summary (continued)

Station	Crossing Utility [1]	Existing Cover (FT)
ECR South		
0+06	8" Gas	3.3
0+14	12" SD	3.2
0+37	Communication	Unknown
0+45	8" SS	5.4
0+68	Communication	Unknown
2+52	Communication	Unknown
3+51	8" SS	8.7
3+58	Communication	Unknown
4+27	Communication	Unknown
4+40	18" SD	5.7
4+50	12" SS	8.1

Table Notes

1. Overhead electrical lines exist in the Project area but are not shown in the table.
2. The cover on the 8-inch gas pipeline is only known at 600 El Camino Real. The cover shown in the table is based on historic pothole information and direction from PG&E on presumed cover.
3. The crossing summary does not include the existing 8-inch water pipeline.

Caltrans requires 42-inches of cover over any new water pipeline. The District's separation requirements (see **Section 3.5**) require new water mains to be installed at least 24-inches above any SD or SS; and 24-inches over or under any gas, telephone, electric, and communication line. Therefore, any existing SS or SD that has a cover of less than 6.25 feet will require an exception to either:

1. Install the new 8-inch water main with less than 42-inches of cover; or
2. Have the water pipeline go under the existing SS or SD.

The California Waterworks Standards (California Code of Regulations (CCR), Title 22, Division 4, Chapter 16, § 64572) establish criteria for the separation of new water mains from non-potable pipelines. Public water systems should ensure that these distances are met, whenever feasible, for all new construction. The Division of Drinking Water (DDW) recognizes that certain conditions may call for the installation of pipelines with less separation distance than what is required by the regulations. In these situations, the District may propose an alternative pursuant to CCR, Title 22, § 64551.100.

4.2 Pipeline Alignment

This section will discuss alignment options for the new water pipeline to be constructed at ECR North and ECR South, as shown on **Figures 1A-1C**. Two alternatives are discussed in **Section 4.2.1** for ECR North, and in **Section 4.2.2** for ECR South.

4.2.1 ECR North

The new water pipeline for ECR North will tie into the existing 8-inch water pipeline located at the intersection of North Road and El Camino Real. The new water pipeline will replace an existing parallel 8-inch CI pipeline. The southern end of ECR North will tie back into the existing system at Middle Road and ECR.

Alternative 1: The Alternative 1 alignment shown on **Figure 1A-1C** (Plans 1-7) was laid out as close to the District's requirements as possible, while still trying to meet the District's intent of locating the pipeline further to the west. To meet the District requirements without exception relative to separation requirements, some sections of the alignment would need to be pushed further east, resulting in additional elbows (undesirable per District preferences, albeit unavoidable). These sections include:

- Station 16+00 to 17+25 (see **Figure 1A** – Plan 3)
- Station 24+35 to 26+50 (see **Figure 1B** – Plans 4 and 5)
- Station 34+40 to 37+50 (see **Figure 1B** – Plans 6 and 7)

Alternative 2: If the minimum separation criteria were to be changed to 5-feet horizontal, certain sections of the alignment could be shifted further west within El Camino Real. Some sections of the new water main would remain further east than preferred as there are too many utilities along the western side of ECR to accommodate the new water main without requiring relocation of one or more utilities owned by others. Alternative 2 is shown on the figures as a bold dashed line. Note this alternative includes additional elbows than Alternative 1.

4.2.2 ECR South

Figure 1C presents the pipeline alignment alternatives for ECR South. ECR South will connect to the existing District distribution system at the intersections of ECR at both Emmett Avenue and Waltermire Street.

Locating the new water pipeline on the western side of ECR on ECR South is going to be difficult. Meeting all of the separation requirements is difficult, but a bigger issue is how to avoid two large telecommunication vaults that occupy virtually the entire width of the ECR southbound lane Nos. 1 and 2. There are no alternatives for installing the new water main under the sidewalk because even a minimum recommendation on separation (4 feet) does not provide enough space for the new water main.

Alternative 1: This option provides 10 feet of separation, per District requirements, from the existing utilities. This alternative would locate the pipeline in the northbound lanes of ECR, and will also require several elbows to best route the pipeline. Further, the service for Safeway would need to extend across the southbound lanes and median for connection with the new 8" water main.

Alternative 2: This option provides at least 4 feet of separation from existing utilities but it doesn't gain much in the way of getting the alignment closer to the western side of ECR. Even with the minimum separation reduced to 4 feet, there isn't enough space to get around the two communication vaults shown in the above photograph.

Alternative 2A: Figure 1C shows a sub-alternative, Alternative 2A. This alternative keeps the new pipeline on the western edge of ECR adjacent to the existing 8-inch water pipeline and the 8-inch gas pipeline. There are two issues related to this alternative: 1) there would be little separation between the new 8-inch water pipeline and the existing 8-inch gas pipeline; and 2) there are several large trees that would present an issue during construction and could impede future maintenance work. Another minor consideration is the concrete bus pad in

the southbound No. 2 lane that would need to be crossed, requiring review and coordination with SamTrans. A variation of this alternative could be to obtain an easement through the southeast corner of the Safeway parking lot. This variation is not shown on **Figure 1C**.

4.3 Service Connections

There are a total of thirty-five (35) service connections on ECR North and ECR South, including twenty-three (23) water service connections, four (4) fire service connections, and eight (8) fire hydrant connections.

During the design phase, a water service schedule and service connection map will be developed. A site walk will be scheduled with the District after the 60% design submittal to confirm the physical locations of each connection.

SECTION 5

MALCOLM AVE AREA IMPROVEMENTS

5.1 Existing Utility Considerations

A general overview of the existing utilities and field conditions is discussed in **Section 2.3**. This section presents features and locations of existing utilities specific to the improvements along Malcolm Avenue.

Sanitary Sewer: The City owns the SS along Malcolm Avenue. An 8-inch SS runs along the southbound lane on the western side of the street. Sewer flows travel north along Malcolm Avenue.

Storm Drain: The City owns the SD running along portions of Malcom Avenue. A 12-inch SD runs down the middle of Ruth Avenue, presumably collecting flows from the portion of Malcolm Avenue between Ruth Avenue and Anita Avenue. An 8-inch SD runs between Ruth Avenue and Anita Avenue along the western edge of Malcolm Avenue. The portion of Malcolm Avenue between North Road and Ruth Avenue does not appear to contain buried SD. Buried SD infrastructure collects surface runoff at Ruth Avenue and then travels east towards ECR.

Water: There is an existing 8-inch PVC water pipeline running along the eastern edge of Malcolm Avenue. At the northern end of Malcolm Avenue, the 8-inch PVC water pipeline turns west along North Road. At Ruth Road, the water pipeline branches off to the east with a 6-inch CI pipe and to the west with an 8-inch PVC pipeline.

Gas: A 2-inch high-pressure steel gas pipeline exists along the western side of Malcolm Avenue. Each of the cross streets also have high-pressure steel gas pipelines. North Road and Anita Avenue each have 2-inch pipelines, and Ruth Avenue has a 3-inch pipeline.

Electric: The electrical lines in the Malcolm Avenue area are overhead.

Communication: Review of the communication record drawings received by HydroScience indicate that there are no buried communication lines in the area of the Malcolm Avenue improvements.

5.1.1 Existing Utility Considerations

The vertical and horizontal alignment of the new 8-inch water pipeline will be optimized during the design phase to minimize utility crossings and meet separation requirements where possible. Based on survey data and record drawing information, we expect that the new water pipeline will meet all pipeline separation criteria. **Table 5-1** provides a summary of the utility crossings, showing approximate cover and indicating whether vertical separation requirements are expected to be met.

Table 5-1: Malcolm Avenue Utility Crossing Summary

Station	Crossing Utility [1]	Existing Cover (FT)
0+09	8" SS	4.4
0+24	2" STL HP Gas	Unknown
0+36	8" PVC Water	Unknown
1+39	6" SS	6.1
2+58	3" STL HP Gas	Unknown
2+69	18" SD	6.8
2+84	8" PVC Water	Unknown

Table Notes

1. Overhead electrical lines exist in the Project area but are not shown in the table.

The District requires 36-inches of cover over any new water main. Separation requirements (see **Section 3.5**) require new water mains to be installed with at least 24-inches of separation between the new water main and any existing utility. Therefore, any existing utility that is shallower than 4.8-feet will require an exception to either:

1. Install the new 8-inch water main with less than 36-inches of cover; or
2. File for an exception to install the water main under an existing SS or SD.

The California Waterworks Standards (California Code of Regulations (CCR), Title 22, Division 4, Chapter 16, § 64572) establish criteria for the separation of new water mains from non-potable pipelines. Public water systems should ensure that these distances are met, whenever feasible, for all new construction. The Division of Drinking Water (DDW) recognizes that certain conditions may call for the installation of pipelines with less separation distance than what is required by the regulations. In these situations, the District may propose an alternative pursuant to CCR, Title 22, § 64551.100.

5.2 Pipeline Alignment

The Malcolm Avenue alignment can be seen on **Figure 1D**.

The new 8-inch DI water pipeline will tie into the existing 8-inch PVC water main at North Road and the existing 8-inch water pipeline at Anita Avenue. The new water pipeline is approximately 550 LF in length and parallels the existing 8-inch PVC water pipeline, which currently serves Malcolm Avenue. The existing 8-inch PVC water pipeline will be abandoned in-place once connections are moved to the new 8-inch water main.

The vertical and horizontal alignment of the new 8-inch water main will be optimized during the design phase to minimize utility crossings and meet separation requirements when possible. Based on survey and existing utility information, we expect the new water pipeline to meet the District's horizontal separation requirements (see **Section 3.5**) along Malcolm Avenue. **Table 5-1** provides a summary of the utility crossings, showing approximate cover and indicating whether vertical separation requirements are expected to be met.

5.3 Water Service Connections

There are a total of five (5) service connections on Malcolm Avenue, including four (4) residential connections and one (1) fire hydrant. These are all located on Malcolm Avenue, near North Road.

During the design phase, a water service schedule and service connection map will be developed. See the preliminary drawing list in **Table 7-1**. A site walk will be scheduled with the District after the 60% design submittal to confirm the physical locations of each connection.

SECTION 6

PROJECT IMPLEMENTATION

This section discusses the environmental documentation, permitting, and restoration requirements for the Project.

6.1 Environmental Documentation

This Project involves the replacement of approximately 4,650 LF of 8-inch water main and is categorically exempt from the provisions of the California Environmental Quality Act (CEQA) as set forth in CCR §15300 et seq. of Title 14 of the California Administrative Code as a Class 2 exemption in CCR §15302

Pursuant to CCR §15062, HydroScience will prepare a Notice of Exemption which will include a project description, project location, a finding that the project is exempt, reasons supporting the finding, and the applicant's name. The notice will be provide to the District who will file it with the San Mateo County Clerk's office.

6.2 Permitting

An overview of coordination requirements is presented in **Section 6.4**. The purpose of this section is to discuss permitting agencies. The permitting agencies with jurisdiction over this project include:

- Caltrans
- City of Belmont
- Silicon Valley Clean Water
- Regional Water Quality Control Board

6.2.1 Caltrans

HydroScience will prepare and submit an encroachment permit package to Caltrans for work within ECR in accordance with Caltrans' Manual for Encroachment Permits on California State Highways. In preparation of developing the permit package, HydroScience staff met with Caltrans inspectors on January 9, 2018.

Traffic control plans will be required and will include closure dates and hours. Caltrans' Standard Plans can be used to the extent feasible. Traffic control plans will be reviewed and approved by the City, District, or Caltrans depending on jurisdiction.

The following items and assumptions will be used to develop the draft permit:

- Assume a 12-inch asphalt pavement replacement section
- Trench will be required to be backfilled with slurry or controlled low strength material
- Trenches will be required to be backfilled within five (5) days. Trench plates may not be allowed to remain over the weekend. These are preferred practices and are negotiable.
- Work hours will be 9 am -3 pm

- This Project will require ADA certification (Caltrans form TR-0405).

According to the Caltrans Inspector, the sidewalks, median landscaping, and irrigation lines in the medians and back of walks fall under the jurisdiction of the City of Belmont.

The new 8-inch water pipeline will be installed in the public ROW and jurisdiction is divided between Caltrans ROW and the public streets of the City. Surface features will be restored per the governing agency's requirements and is likely to include the following items:

- Asphalt paving
- Concrete bus pads
- Concrete curb and gutter
- Concrete medians
- Striping and pavement markings
- Traffic control systems and traffic loops
- Landscaping and irrigation lines

6.2.2 City of Belmont

HydroScience will prepare an encroachment permit application to submit to the City. The District will pay and file all fees with the City. HydroScience will provide full size plan sets for review and coordination. The ECR is within Caltrans ROW, but the sidewalks, median landscaping along ECR, and irrigation lines in the Caltrans ROW are operated and maintained by the City. Behind the back of walk is also City ROW.

6.2.3 Silicon Valley Clean Water

Trench dewatering operations will discharge to the City's sanitary sewer. The excavations for this Project are expected to be relatively shallow, and in general will be no more than 5 feet deep. Geotechnical information currently available (see **Appendix C**) indicates that groundwater can be found at depths of about 7.5 feet.

The City's sewer conveyance system discharges to a wastewater treatment facility owned and operated by Silicon Valley Clean Water (SVCW), which provides wastewater treatment and disposal. Dewatering operations will be required to comply with discharge requirements of the SVCW discharge permit. The contractor will be required to submit a groundwater management and dewatering plan. The City will charge capacity and connection fees. SVCW does not charge fees but does require a permit. SVCW will likely require batch discharge to the sewer. Discharge will be allowed after the water has been sampled and analyzed for the following constituents:

1. Volatile Organic Compounds (VOC) – EPA Method 8260
2. Polychlorinated Biphenyls (PCB) – EPA Method 8082
3. CA Title 22 Metals (CAM-17) – EPA Method 200.8, 6010, and 7470
4. Salinity – Standard Method 2520B

Discharge to storm drain systems require an NPDES permit. Groundwater will not be allowed to be discharged to the storm drain for this Project.

6.2.4 Regional Water Quality Control Board

This project will disturb less the one acre of land and is therefore exempt from the Construction General Permit (Order 2009-0009-DWQ) but is covered by the San Mateo Countywide Water Pollution Prevention Program (SMCWPPP). San Mateo County is a large urban area and discharges storm water into the San Francisco Bay and the Pacific Ocean and is thereby required to have an NPDES permit. The SMCWPPP helps to ensure the harmful pollutants are not discharged into local waterbodies by providing guidance and best management practices for discharges to the Bay.

This project is a Linear Underground/Overhead Project (LUP) involving the replacement of an existing water main. The total area disturbed by this project is shown in **Table 6-1**. The Project will not require a SWPPP but the contractor will be required to submit a plan to control water pollution effectively during construction. The plan will include storm water best management practices per the SMCWPPP.

TABLE 6-1: Disturbed Area by Location

Location	Width (feet)	Length (feet)	Disturbed Area	
			Square Feet	Acres
ECR North	2	3900	7800	0.18
ECR South	2	450	900	0.02
Malcolm Avenue	2	550	1100	0.03
	Totals	**4900**	**9800**	**0.22**

6.3 Public Outreach

The District will lead two public meetings. The first meeting will introduce the project to the public. The second meeting will provide greater detail on the schedule and other project specifics. There will also be a meeting with the impacted businesses. HydroScience will provide support for these District-led meetings.

6.4 Project Sequencing and Coordination

Project sequencing and coordination will be impacted by multiple agencies and is related to permitting, which is discussed in **Section 6.2**. This section provides a general discussion of Project coordination efforts. Coordination with the following agencies is expected:

- Mid-Peninsula Water District
- Caltrans
- City of Belmont
  - Engineering Department
  - Police Department
  - Fire Department
- PG&E
- SamTrans
- United States Postal Service

Any project sequencing or coordination efforts currently known or discovered during the design phase will be included in the final plans and specifications for the Project. Permitting requirements are discussed in **Section 6.2**.

The contractor will be required to notify the City of Belmont Police Department at least 48 hours prior to the start of construction.

The contractor will also be required to notify the City of Belmont Fire Department in advance of any road closures, water main shutdowns, and fire hydrant removal or replacement work.

6.4.1 Mid-Peninsula Water District

The District's water system will remain in service throughout the Project. Interruptions to service will be minimized and will be coordinated with the District. The contractor is not allowed to operate District owned valves and hydrants.

The District will be notified at least 72 hours in advance for any scheduled tie-ins. No tie-ins or shutdowns will be allowed on Fridays, or the day preceding a holiday.

6.4.2 Caltrans

HydroScience's past experience with Caltrans' encroachment permits indicates that the following project sequencing and coordination requirements could potentially impact the project:

1. Sidewalk closures will comply with the Americans with Disabilities Act (ADA). When used, sidewalk closures are required to be designed and constructed in accordance with Caltrans' Design Information Bulletin 82 (DIB 82).
2. Trenches are generally required to be closed within five (5) days. Trench plates should not be left over the weekend.
3. Lane closures will be limited to the hours of 9 am – 3 pm.
4. If approved, night work hours are between 10 pm and 6 am.
5. Night work will be required if more than one lane will be closed. Detours will be required for ECR if both lanes are closed.

6.4.3 City of Belmont

An encroachment permit will be required for work for work outside the Caltrans ROW and for work along sidewalks and medians within the Caltrans ROW. Standard City permit conditions include:

1. Hours of Work:
    a. Weekdays: 8 am – 5 pm
    b. Saturdays: 10 am – 5 pm
    c. No work is allowed on Sundays
2. All contractors will obtain a City of Belmont business license prior to performing any work.

There are three projects adjacent to the Projects limits. These project are noted on **Figure 1**. Project details and potential impacts are listed below:

North Road Sewer Pump Station Rehabilitation Project: The City is planning a rehabilitation project for their SS pumps station located at the northwest corner of ECR and North Road. This pump station is noted on Figure 1. Although not within the limits of this Project, equipment movement and traffic controls and street closures will need to be coordinated. The timeline for this rehabilitation project is unknown.

Development at 490 El Camino Real: This project is a commercial development for mixed-use and includes construction of a four story 73-unit residential condominium building and a stand-alone 4,909 square foot single story commercial building. The project is owned by Sares Regis Group. This development may overlap with this Project when new sidewalks or service connections are installed. The timeline for this development project is unknown.

Development at 576-600 El Camino Real: This project is a commercial development for a mixed-use building located on three lots. The three story building will include about 11,000 square feet of retail space and 32 residential units. The project is owned by CHS Development Group. This development may overlap with this Project when new sidewalks or service connections are installed. The timeline for this development project is unknown.

6.4.4 PG&E

A stand-by PG&E employee is required when excavation occurs within 10-feet of any transmission pipeline. If the Project requires modifications to a PG&E gas pipeline, the cost of the stand-by employee will be paid by the project owner. Conflicts between the new water main and any PG&E gas pipeline will be identified during the design phase and coordination requirements will be incorporated into the Project plans and specifications.

6.4.5 SamTrans

SamTrans will be contacted during the design phase. Bus pads or stop shelters disturbed during this project will be coordinated with and requirements will be included on the Project plans and specifications.

6.4.6 United States Postal Service

Project plans and specifications will include requirements for coordination with the local Postmaster. If required, relocation of mailboxes will be performed per USPS construction standards.

SECTION 7

PRELIMINARY DESIGN (30 PERCENT)

7.1 Recommendations

HydroScience prepared initial plans for the pipeline alignment assuming that the District would design and construct the pipeline to conform to their established separation standards. In some areas, this is feasible, while in other areas it is not. The preliminary plans are not included as part of this Report.

HydroScience will sit down with the District and determine the recommended alternative for each project segment. Any recommendations affecting this Report will be incorporated into the final BODR.

7.2 Drawings

Table 7-1 lists the plan sheets anticipated for this Project. The plan sheets included in the 30-percent design are bolded in the table.

Table 7-1: Preliminary Drawing List

Sheet No	Drawing	Title
1	**G1**	**Title Sheet, Location Map, Drawing Index, and List of Drawings**
2	**G2**	**General Notes, Legend, Survey Control, and Abbreviations**
3	G4	Water Service Schedule
4	G5	Service Connection Map
5	**C1**	**El Camino Real – Plan and Profile STA 0+00 to 4+78**
6	**C2**	**El Camino Real – Plan and Profile STA 4+78 to 10+05**
7	**C3**	**El Camino Real – Plan and Profile STA 10+05 to 15+61**
8	**C4**	**El Camino Real – Plan and Profile STA 15+61 to 20+68**
9	**C5**	**El Camino Real – Plan and Profile STA 20+68 to 26+14**
10	**C6**	**El Camino Real – Plan and Profile STA 26+14 to 31+20**
11	**C7**	**El Camino Real – Plan and Profile STA 31+20 to 36+22**
12	**C8**	**El Camino Real – Plan and Profile STA 36+22 to 38+73**
13	**C9**	**El Camino Real – Plan and Profile**
14	**C10**	**Malcolm Avenue – Plan and Profile STA 0+00 to 3+86**
15	**C11**	**Malcolm Avenue – Plan and Profile STA 3+86 to 5+32**
16	C12	Civil Details I
17	C13	Civil Details II
18	C14	Civil Details III
19	C15	Traffic Control Plan I
20	C16	Traffic Control Plan II
21	C17	Traffic Control Details

Table Notes

1. **Bold** = Drawings included on the 30% design and in Appendix B.
2. Profiles are not included on the 30% design drawings.

7.3 Specifications

The front-end and technical specifications will be based on HydroScience's standard specifications. The technical specifications will be based on Caltrans and the City of Belmont standard specifications and other published standards. **Table 7-2** presents a preliminary list of technical specifications anticipated for this project. Technical specifications will be submitted as part of the 60 percent submittal.

Table 7-2: Preliminary Technical Specification List

Section	Title
DIVISION 0 – PROCUREMENTS AND CONTRACTING	
	Title Page
	Table of Contents
Bidding Requirements	
00020	Invitation to Bid
00100	Instructions to Bidders
00200	Information Available to Bidders
00300	Bid
00310	Bid Schedule
00410	Bid Bond
00411	Bid Security Form
00416	Bidder's References
00420	Bidder's Statement of Qualifications
00430	Subcontractor List
00480	Non-Collusion Affidavit
Contract Forms	
00610	Performance Bond
00620	Payment Bond
Contract Conditions	
	General Provisions
DIVISION 1 – GENERAL REQUIREMENTS	
01010	Summary of Work
01150	Definition of Bid Items
01300	Submittals
01400	Quality Control
01500	Temporary Facilities and Controls
01520	Traffic Control Plan
01530	Water Pollution Control Plan
01700	Project Closeout
DIVISION 2 – SITEWORK	
02055	Demolition and Site Preparation
02140	Dewatering
02200	Earthwork
02350	Sheeting, Shoring, and Bracing
02500	Paving and Resurfacing Work

Section	Title
DIVISION 3 – CONCRETE	
03310	Cast-In-Place Sitework Concrete
03315	Grout
DIVISION 15 – MECHANICAL	
15060	Piping
15100	Valves and Appurtenances
15140	Valve Operators
APPENDIX	
	Sample Contract

7.4 Engineer's Opinion of Probable Construction Cost

The level of estimate accuracy at each stage of design is dependent on the level of detail known about the project at each stage. The 30% design construction cost estimate is shown in **Table 7-3**, and detailed in **Appendix A**. The Alignment Alternative 1 for ECR is used as the basis for the estimate, which will be updated should a different alignment alternative be chosen. Vendor quotes were obtained for the DIP pipe and for the slurry backfill. Piping costs reflect the District's standards. Other costs were obtained from RS Means or based on professional opinion.

The conceptual construction cost for the 30% design is based on current understanding of the project scope. The engineer's opinion of probable construction costs for this project is: $1,731,000. This opinion of probable construction cost has an accuracy of -20% to +30%. The total cost includes the following markups and taxes:

Division 1 – General Requirements Markup: 10%

Taxes on Materials: 8.75%

Contractor Markup on Subcontractors: 15%

Contractor Overhead and Profit: 15%

Contingency: 30%

Escalation: 5%

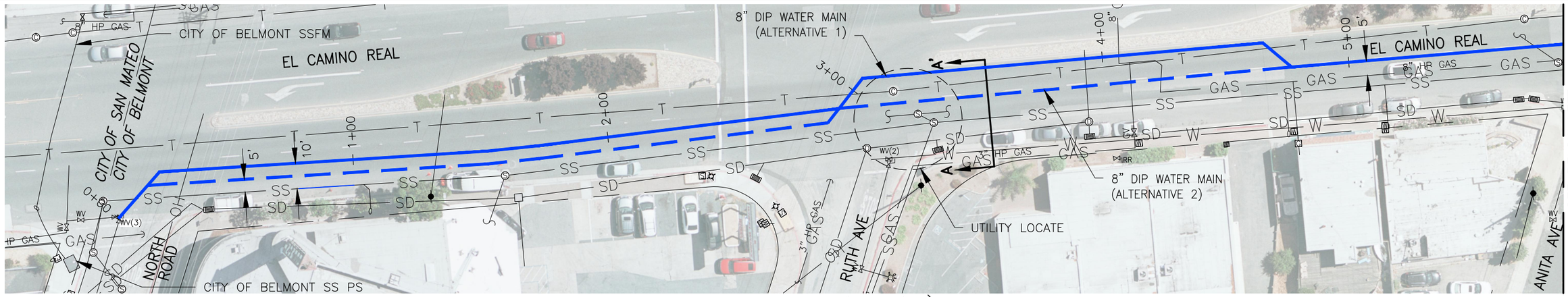
Table 7-3: Engineer's Opinion of Probable Construction Cost

No	Item	Estimated Cost
1	Mobilization/Demobilization	$60,000
2	Permits	$4,780
3	Temporary Traffic Control	$20,000
4	Storm water Control and BMPs	$15,000
5	Trenching	$188,400
6	Trench Backfill	$358,290
7	Piping	$288,780
	Subtotal	**$935,250**
Division 1 Costs (10%)		$93,520
Taxes on Materials (8.75%)		$47,109
Contractor Markup on Subs (15%)		$40,991
Contractor OH&P (15%)		$120,390
Contingency (30%)		$371,177
Escalation (5%)		$122,128
	Total Estimate	**$1,731,000**
	Estimated Range of Probable Cost (-20% to +30%)	$1,384,800 to $2,250,300

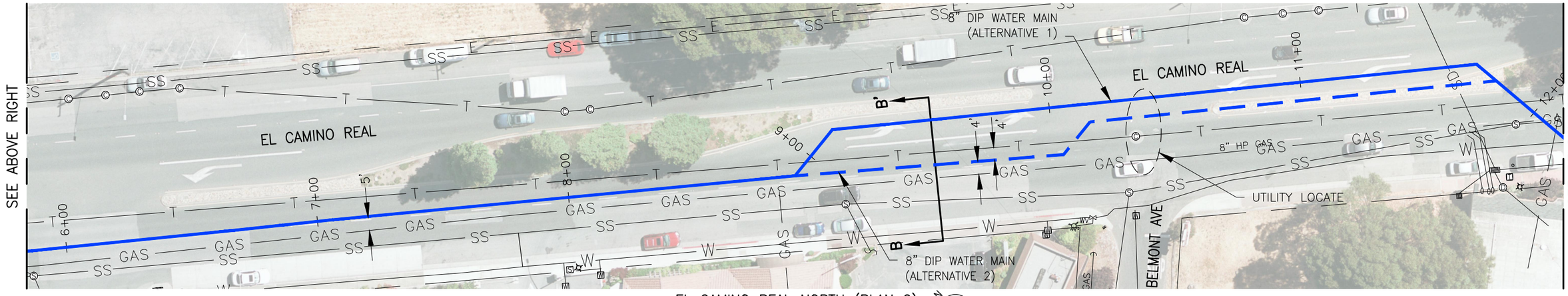
Table Notes

1. Months to midpoint of construction = 18 months

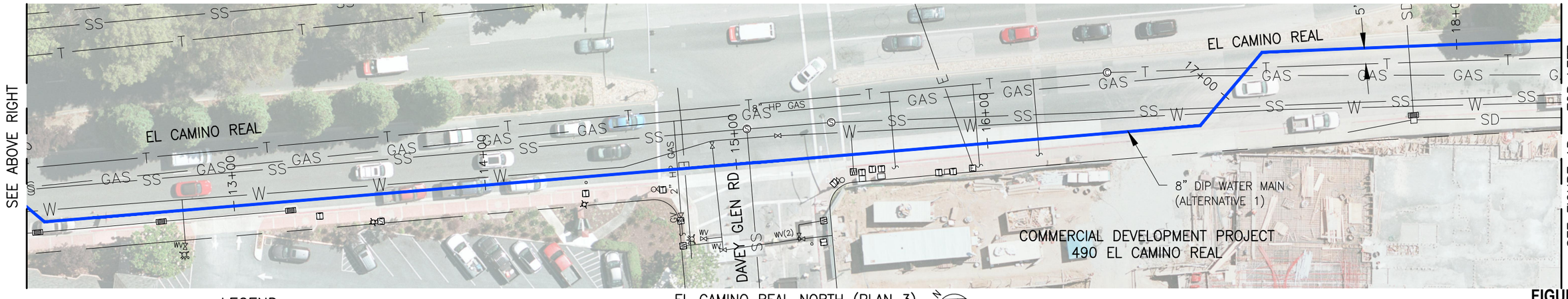
FIGURES



EL CAMINO REAL NORTH (PLAN 1)
SCALE: 1" = 40'



EL CAMINO REAL NORTH (PLAN 2)
SCALE: 1" = 40'



EL CAMINO REAL NORTH (PLAN 3)
SCALE: 1" = 40'

LEGEND:

NEW 8" DIP WATER MAIN – ALTERNATIVE 1

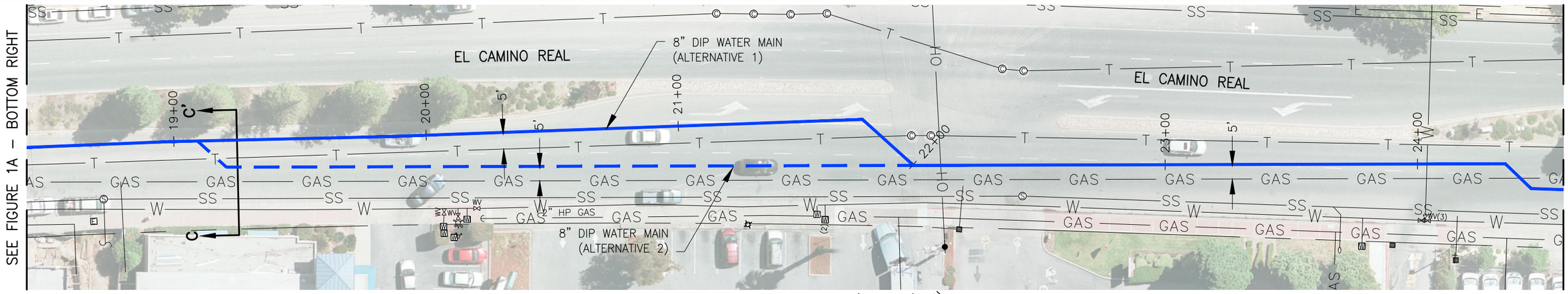
NEW 8" DIP WATER MAIN – ALTERNATIVE 2

NOTE: SEPARATION DIMENSIONS ARE MINIMUM

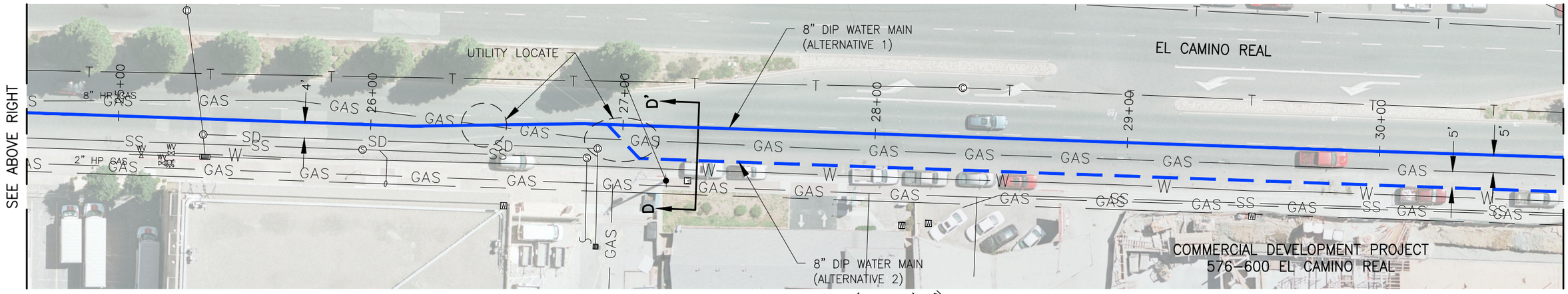
0 40' 80'

HydroScience

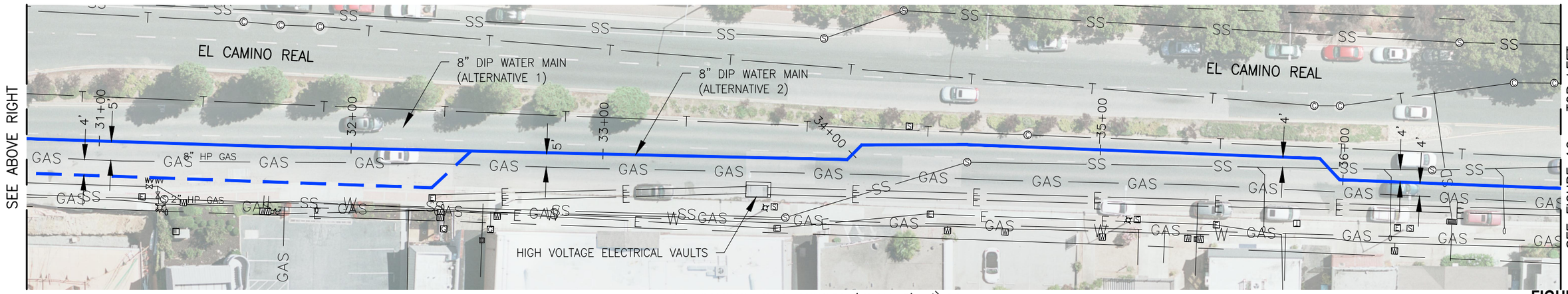
FIGURE 1A
MID-PENINSULA WATER DISTRICT
EL CAMINO REAL AND MALCOLM AVENUE IMPROVEMENTS
PIPELINE ALIGNMENT ALTERNATIVES



EL CAMINO REAL NORTH (PLAN 4)
SCALE: 1" = 40'



EL CAMINO REAL NORTH (PLAN 5)
SCALE: 1" = 40'



EL CAMINO REAL NORTH (PLAN 6)
SCALE: 1" = 40'

LEGEND:

NEW 8" DIP WATER MAIN – ALTERNATIVE 1

NEW 8" DIP WATER MAIN – ALTERNATIVE 2

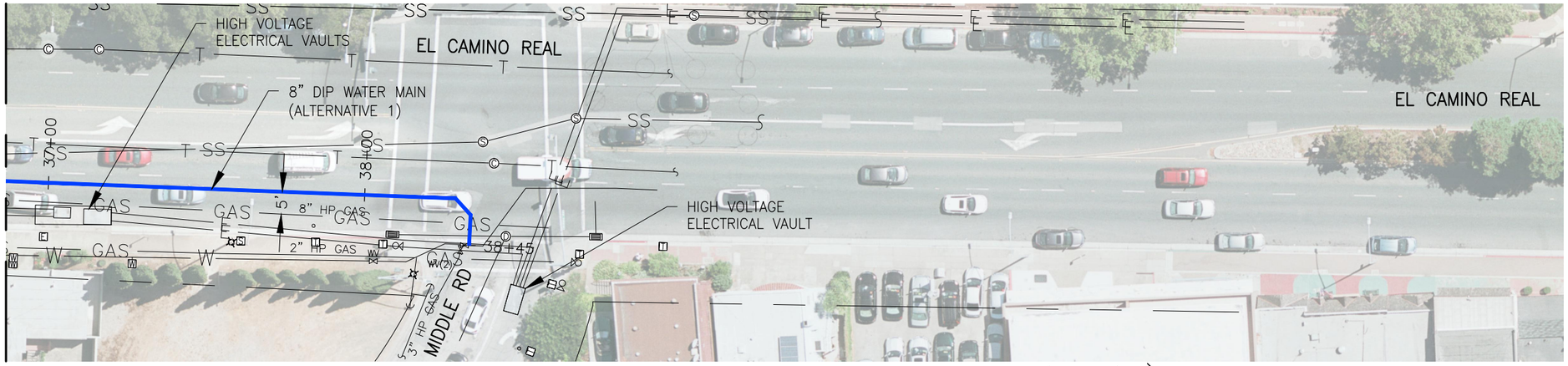
NOTE: SEPARATION DIMENSIONS ARE MINIMUM

0 40' 80'

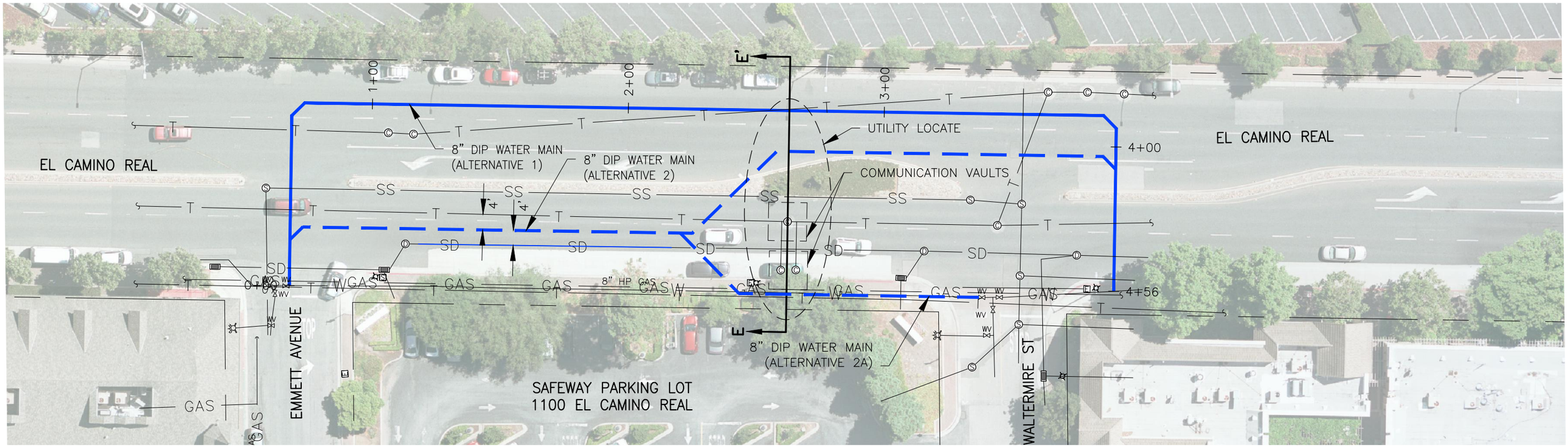
HydroScience

FIGURE 1B
MID-PENINSULA WATER DISTRICT
EL CAMINO REAL AND MALCOLM AVENUE IMPROVEMENTS
PIPELINE ALIGNMENT ALTERNATIVES

SEE FIGURE 1B – BOTTOM RIGHT



EL CAMINO REAL NORTH (PLAN 7)
SCALE: 1" = 40'



EL CAMINO REAL SOUTH
SCALE: 1" = 40'

LEGEND:

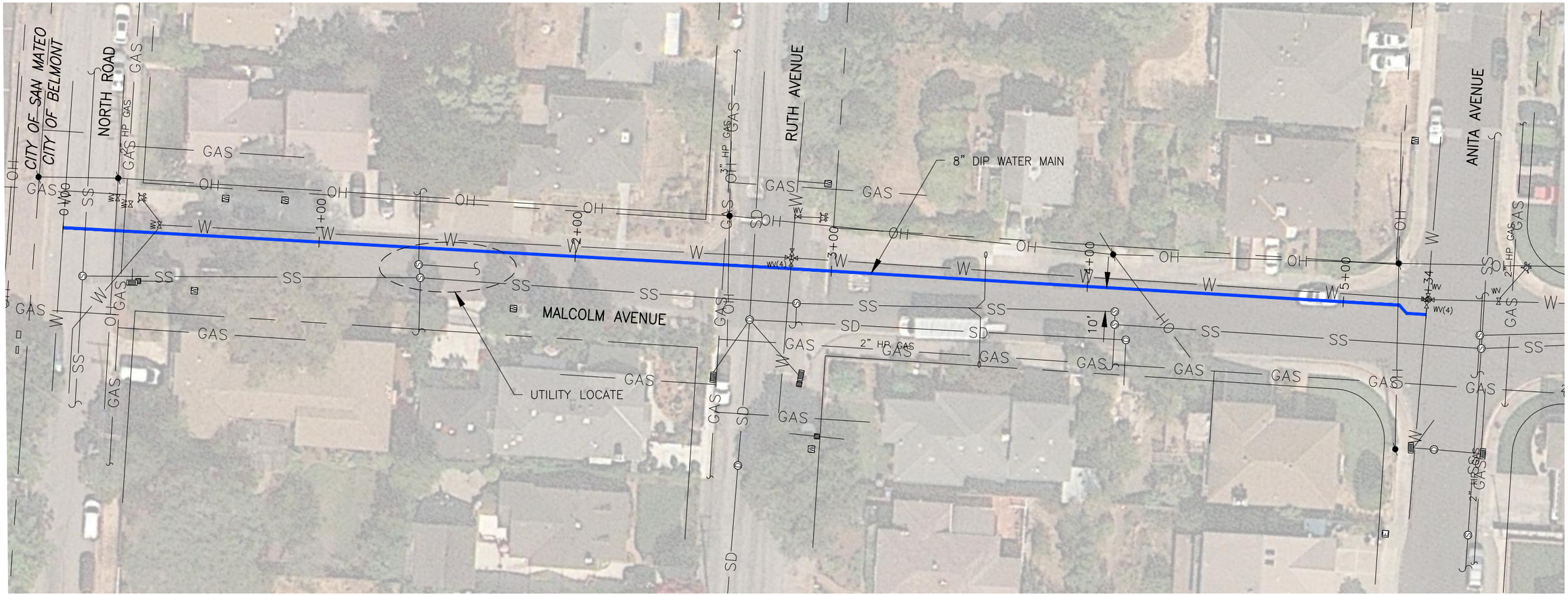
NEW 8" DIP WATER MAIN – ALTERNATIVE 1
NEW 8" DIP WATER MAIN – ALTERNATIVE 2 AND 2A

NOTE: SEPARATION DIMENSIONS ARE MINIMUM

0 40' 80'

HydroScience

FIGURE 1C
MID-PENINSULA WATER DISTRICT
EL CAMINO REAL AND MALCOLM AVENUE IMPROVEMENTS
EL CAMINO REAL



MALCOLM AVENUE
SCALE: 1" = 40'

LEGEND:

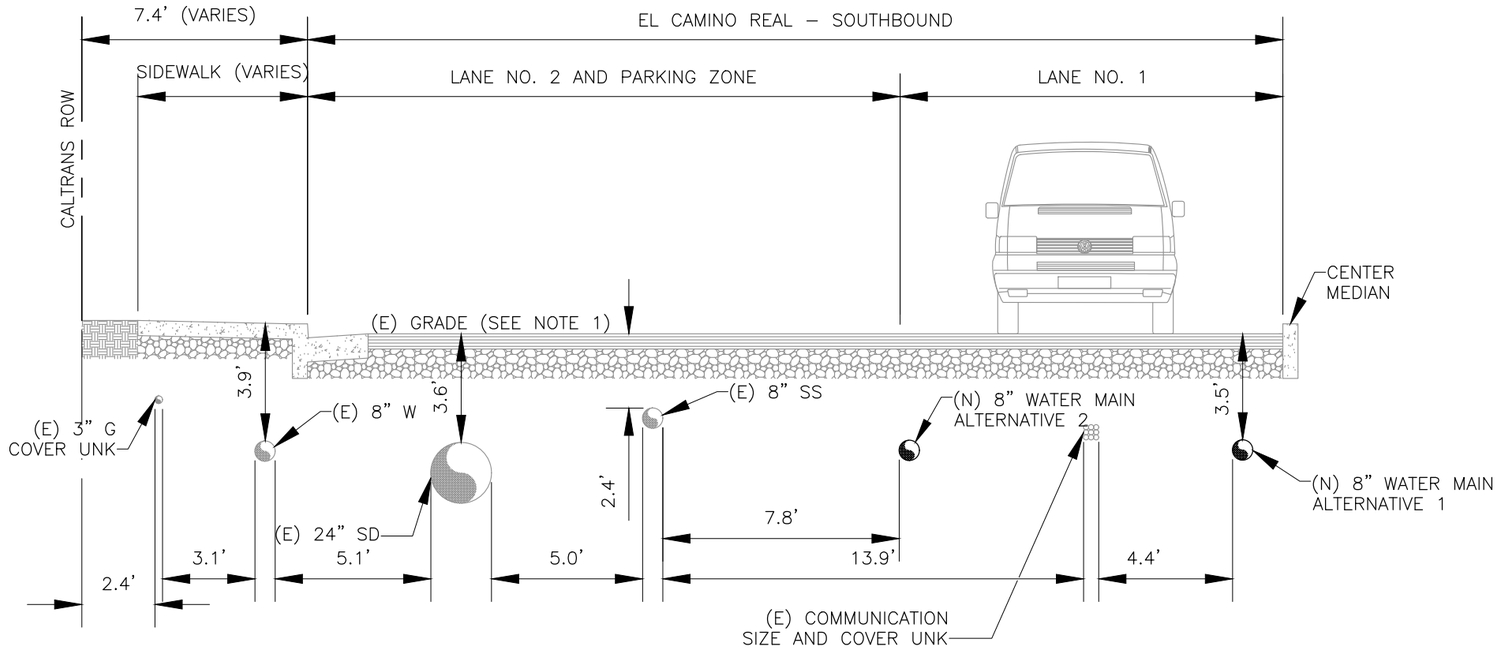
NEW 8" DIP WATER MAIN

NOTE: SEPARATION DIMENSIONS ARE MINIMUM

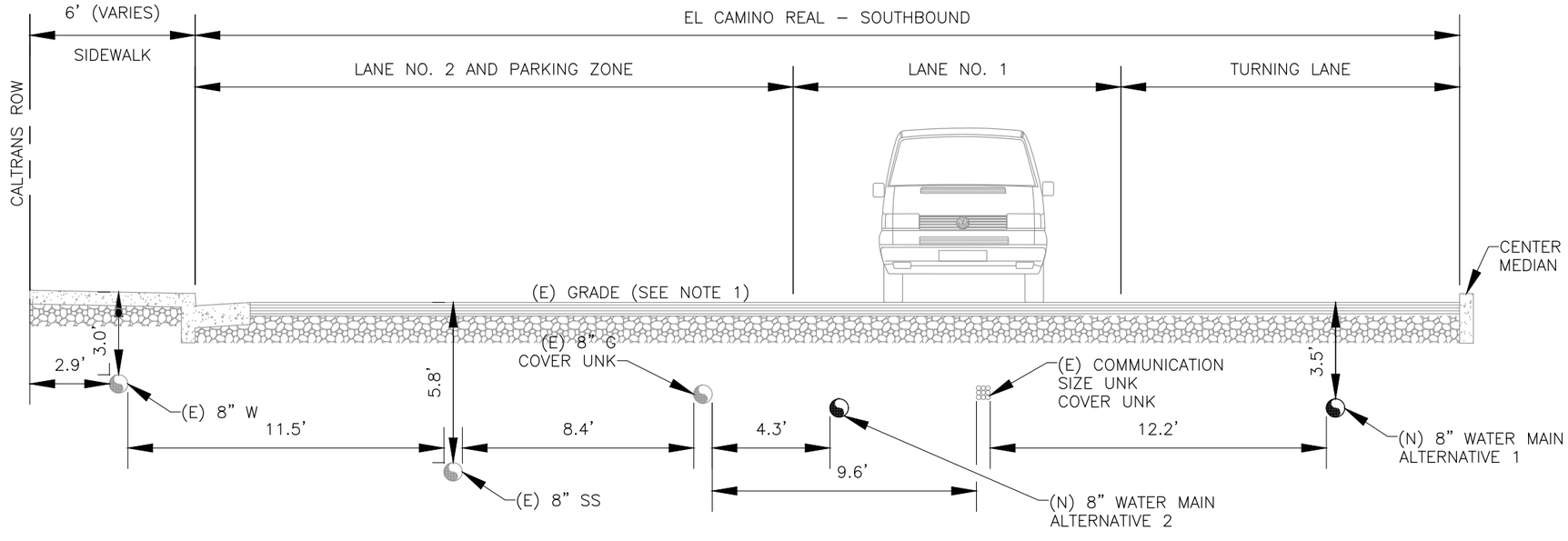
0 40' 80'

HydroScience

FIGURE 1D
MID-PENINSULA WATER DISTRICT
EL CAMINO REAL AND MALCOLM AVENUE IMPROVEMENTS
MALCOLM AVENUE PIPELINE ALIGNMENT



EL CAMINO REAL – SECTION A–A'
SCALE: 1" = 5'



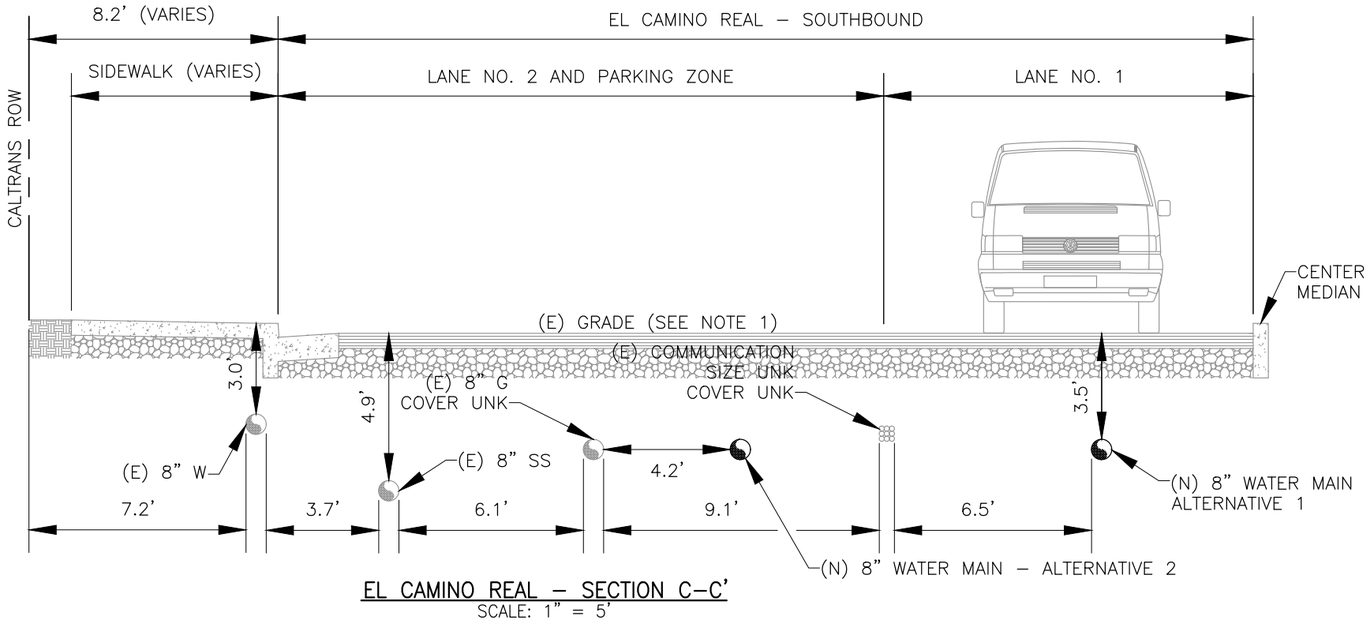
EL CAMINO REAL – SECTION B–B'
SCALE: 1" = 5'

NOTES:
1. EXISTING GRADE SHOWN IS APPROXIMATE.
2. EXISTING PAVEMENT VARIES IN THICKNESS AND MATERIAL.
3. ABBREVIATIONS:
   - NO. = NUMBER
   - (E) = EXISTING
   - (N) = NEW
   - SS = SANITARY SEWER
   - UNK = UNKNOWN
   - SD = STORM DRAIN
   - ROW = RIGHT–OF–WAY
   - W = WATER
   - G= GAS

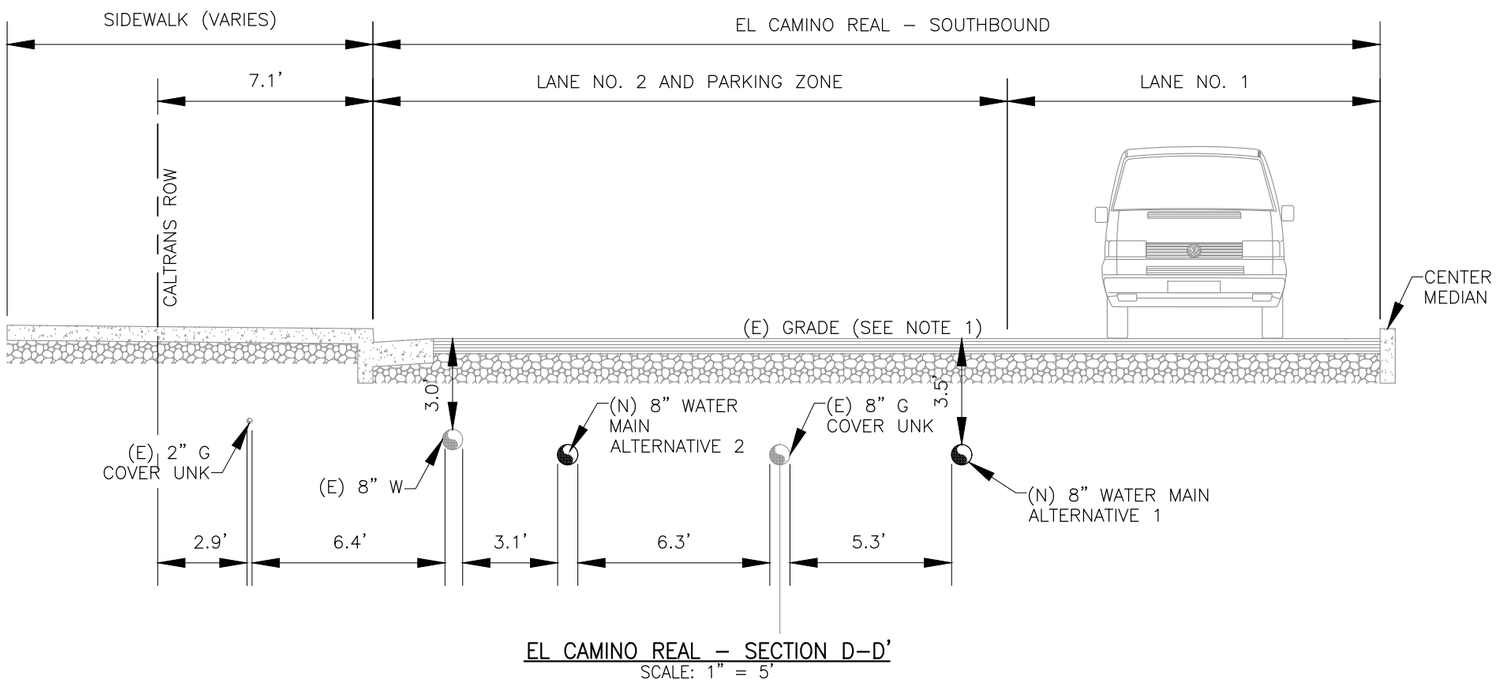
HydroScience

FIGURE 2
MID-PENINSULA WATER DISTRICT
EL CAMINO REAL AND MALCOLM AVENUE IMPROVEMENTS
ROADWAY SECTIONS A AND B

NOTES:
1. EXISTING GRADE SHOWN IS APPROXIMATE.
2. EXISTING PAVEMENT VARIES IN THICKNESS AND MATERIAL.
3. ABBREVIATIONS:
   NO. = NUMBER
   (E) = EXISTING
   (N) = NEW
   SS = SANITARY SEWER
   UNK = UNKNOWN
   SD = STORM DRAIN
   ROW = RIGHT-OF-WAY
   W = WATER
   G = GAS



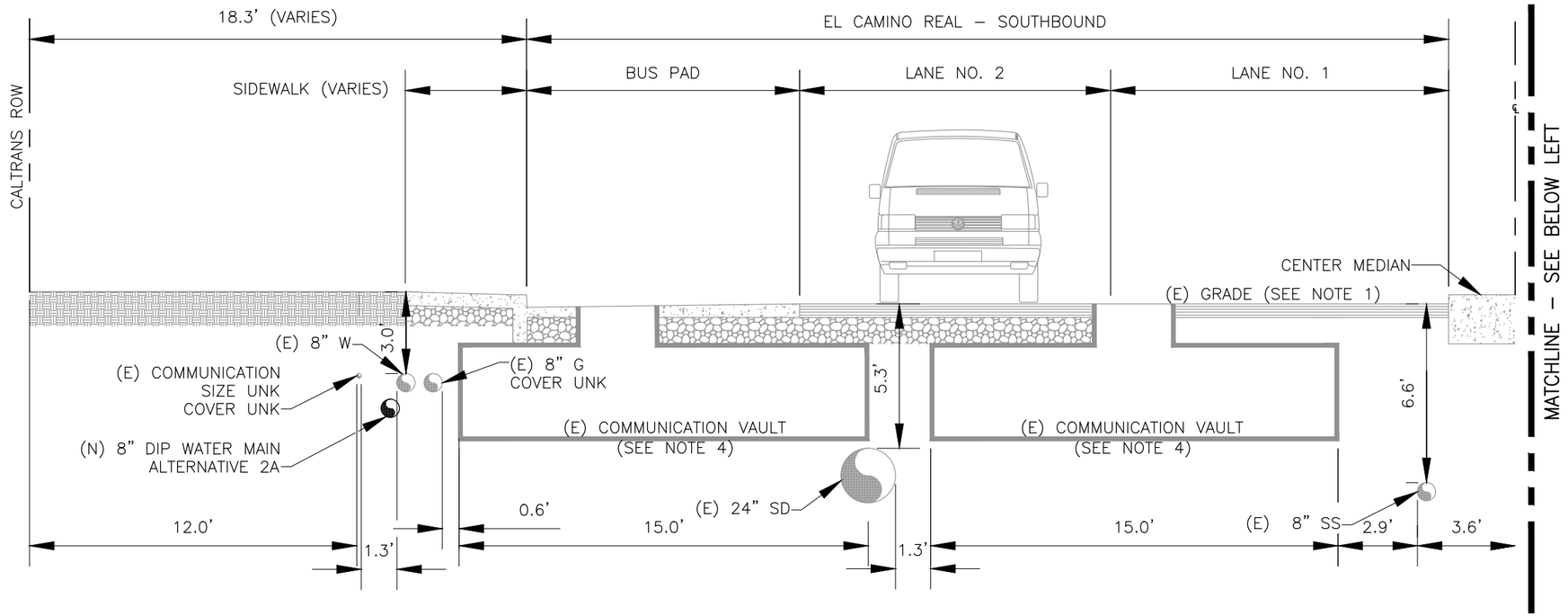
EL CAMINO REAL – SECTION C–C'
SCALE: 1" = 5'



EL CAMINO REAL – SECTION D–D'
SCALE: 1" = 5'

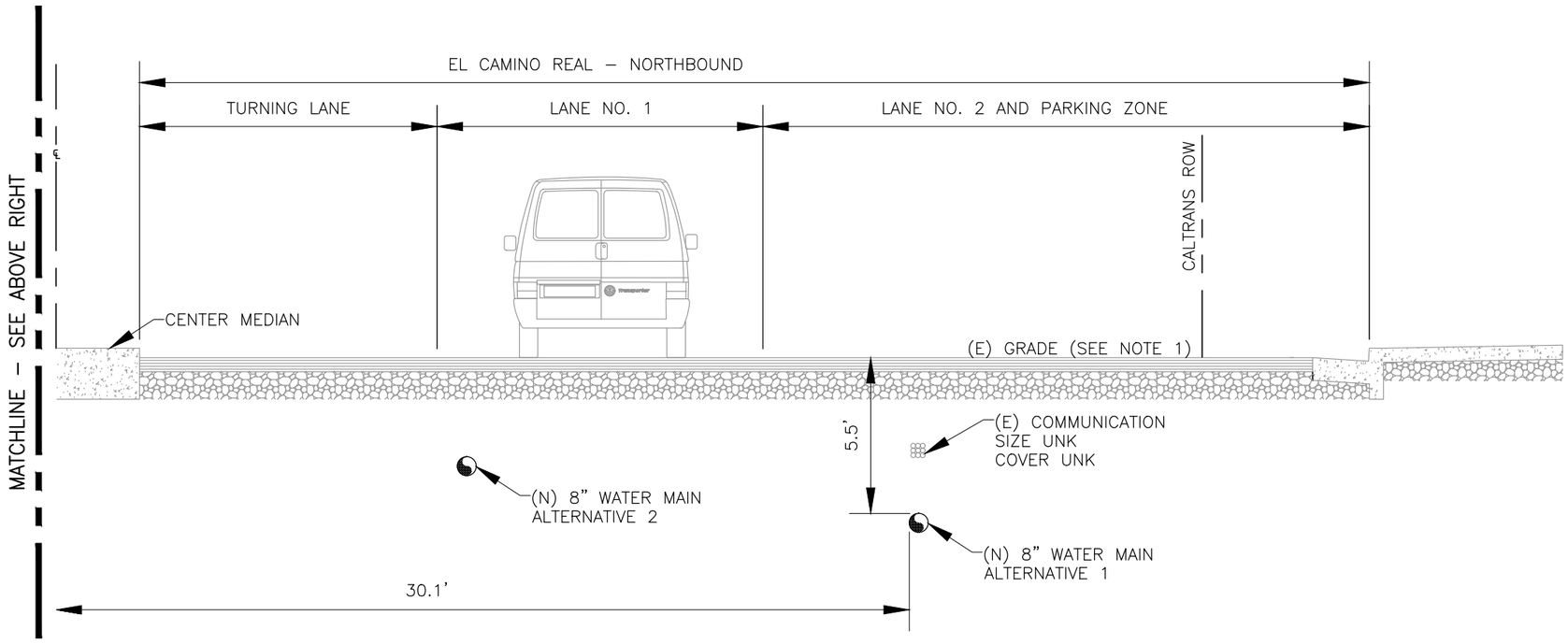
HydroScience

FIGURE 3
MID-PENINSULA WATER DISTRICT
EL CAMINO REAL AND MALCOLM AVENUE IMPROVEMENTS
ROADWAY SECTIONS C AND D



NOTES:

1. EXISTING GRADE SHOWN IS APPROXIMATE.
2. EXISTING PAVEMENT VARIES IN THICKNESS AND MATERIALS.
3. ABBREVIATIONS:
   - NO. = NUMBER
   - (E) = EXISTING
   - (N) = NEW
   - SS = SANITARY SEWER
   - UNK = UNKNOWN
   - SD = STORM DRAIN
   - ROW = RIGHT–OF–WAY
   - W = WATER
   - G = GAS
4. THE ACTUAL DIMENSIONS OF THE COMMUNICATION VAULTS ARE UNKNOWN. USA NORTH UTILITY LOCATION MARKINGS INDICATE THAT THE HORIZONTAL LIMITS ARE AS SHOWN. ACTUAL DEPTH IS UNKNOWN.



EL CAMINO REAL – SECTION E–E'
SCALE: 1" = 5'

HydroScience

FIGURE 4
MID-PENINSULA WATER DISTRICT
EL CAMINO REAL AND MALCOLM AVENUE IMPROVEMENTS
ROADWAY SECTION E

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

HYDROSCIENCE ENGINEERS, INC.

Project: El Camino Real and Malcolm Avenue Improvements
Building, Area: El Camino Real and Malcolm
Estimate Type: Conceptual

Prepared By: DJM
Date: 1/24/2018
HSE Proj. No.: 425-001

Current at ENR:
Escalated to ENR:
Months to Midpoint of Construction: 18

Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-Contractor $/Unit	Sub-Contractor Total	Total
1	*Mobilization*				*$0*		*$60,000*		*$0*	*$60,000*
	Mobilization	1	LS		$0	$30,000	$30,000		$0	$30,000
	Demobilization	1	LS		$0	$30,000	$30,000		$0	$30,000
2	*Permits*				*$0*		*$4,780*		*$0*	*$4,780*
	CALTRANS	40	HR		$0	$82	$3,280		$0	$3,280
	City of Belmont	1	LS		$0	$1,500	$1,500		$0	$1,500
3	*Temporary Traffic Control*				*$10,000*		*$10,000*		*$0*	*$20,000*
	Temporary Traffic Control	1	LS	$10,000	$10,000	$10,000	$10,000		$0	$20,000
4	*Stormwater Control and BMPs*				*$5,000*		*$10,000*		*$0*	*$15,000*
	Stormwater BMPs	1	LS	$5,000	$5,000	$10,000	$10,000		$0	$15,000
5	*Trenching*				*$0*		*$22,605*		*$165,794*	*$188,399*
	Sawcut	9800	LF		$0		$0	$4	$36,848	$36,848
	Excavation	1664	BCY		$0	$6	$10,081		$0	$10,081
	Rock Excavation	200	BCY		$0	$34	$6,764		$0	$6,764
	Short Haul	2423	LCY		$0		$0	$8	$18,945	$18,945
	Disposal (Asphalt)	708	TON							
	Disposal	88	LOAD		$0		$0	$100	$8,847	$8,847
	Disposal (Native Soil)	2890	TON		$0		$0	$35	$101,153	$101,153
	Dewatering	30	DAY		$0	$192	$5,760		$0	$5,760
6	*Trench Backfill*				*$288,818*		*$0*		*$69,467*	*$358,285*
	Sand Bedding	1104	LCY	$39	$43,403		$0		$0	$43,403
	Controlled Low-Strength Material	1200	CY	$135	$162,000		$0		$0	$162,000
	Sawcut	9800	LF		$0		$0	$4	$36,848	$36,848
	Short Haul	2304	LCY		$0		$0	$8	$18,018	$18,018

	Disposal (Asphalt)	177	TON		$0		$0		$0	$0
	Disposal	22	LOAD		$0		$0	$100	$2,212	$2,212
	Asphalt	1633	SY	$51	$83,414		$0	$6	$9,751	$93,165
	Compaction Testing	15	EA		$0		$0	$176	$2,638	$2,638
7	*Piping*				*$185,625*		*$89,982*		*$13,171*	*$288,779*
	8" DI Pipe (Pressure Class 350)	4900	LF	$17	$80,850	$17	$82,712		$0	$163,562
	8" Field Lok Gaskets	300	EA	$90	$27,000		$0		$0	$27,000
	8" DI 45 deg Bend	45	EA	$332	$14,940		$0		$0	$14,940
	8" DI 90 deg Bend	18	EA	$410	$7,380		$0		$0	$7,380
	8" x 8" DI Tee	12	EA	$590	$7,080		$0		$0	$7,080
	8" Tapping Saddle	27	EA	$300	$8,100		$0	$488	$13,171	$21,271
	8" DI Gate Valves	23	EA	$1,751	$40,275	$316	$7,270		$0	$47,545
	Subtotals				$489,443		$197,367		$248,433	$935,243
	Division1 Costs	@	10%		$48,944		$19,737		$24,843	$93,524
	Subtotals				$538,387		$217,104		$273,276	$1,028,767
	Taxes - Material Costs	@	8.75%		$47,108.90					$47,109
	Subtotals				$585,496		$217,104		$273,276	$1,075,876
	Taxes - Labor Costs	@	0%				$0			$0
	Subtotals				$585,496		$217,104		$273,276	$1,075,876
	Contractor Markup for Sub	@	15%						$40,991	$40,991
	Subtotals				$585,496		$217,104		$314,267	$1,116,867
	Contractor OH&P	@	15%		$87,824.45		$32,566			$120,390
	Subtotals				$673,321		$249,669		$314,267	$1,237,257
	Estimate Contingency	@	30%							$371,177
	Subtotals									$1,608,435
	Escalate to Midpoint of Construction	@	5%							$122,128
	Estimated Bid Cost									$1,730,563
	Total Estimate									$1,731,000

Estimate Accuracy	
30%	-20%

Estimated Range of Probable Cost		
30%	Total Estimate	-20%
$2,250,300	$1,731,000	$1,384,800

GEOTECHNICAL INVESTIGATION FOR 572-600 EL CAMINO REAL

GEOFORENSICS INC. **Consulting Soil Engineering**

561-D Pilgrim Drive, Foster City, CA 94404 Phone: (650) 349-3369 Fax: (650) 571-1878

File: 213084
June 27, 2013

Belmino LLC
c/o CHS Development Group
1528 S. El Camino Real, Suite 406
San Mateo, CA 94402

Attention: Chi-Wha Shao

Subject: **Belmino Property**
572-600 El Camino Real
Belmont, California
GEOTECHNICAL INVESTIGATION FOR
PROPOSED MIXED-USE STRUCTURE

Dear Mr. Shao:

In accordance with your authorization, we have performed a subsurface investigation into the geotechnical conditions present at the location of the proposed new mixed-use structure. This report summarizes the conditions we measured and observed, and presents our opinions and recommendations for the design and construction of the proposed new building.

Site Description

The subject site is a gently to steeply sloping set of rectangularly-shaped parcels located on the southwestern side of El Camino Real (at the approximate location shown on Figure 1). The property is bounded by other developed commercial properties to the sides, residential lots to the rear, and the street to the northeast.

The site is currently occupied by two single story commercial structures. These structures include concrete block perimeter walls, with the rear walls also acting as retaining walls. The buildings have concrete slab on grade floors. Asphalt parking areas are located between and in front of the structures, and a covered concrete slab parking area is located on the southern building (600 El Camino).

The ground surface in the site vicinity has an overall slope down towards the northeast (as shown on Figure 2). At the site, the ground surface at the rear of the property slopes down to the north east, but grading work at the front of the property has resulted in relatively level parcels at the elevation of the street. Grading work at the site appears to have consisted entirely of cuts into the original hillside materials. No significant amounts of fill appear to have been placed to create the existing level portions of these sites.

Proposed Construction

We understand that the current development for the site proposes the demolition of the existing two buildings, and the subsequent construction of a new single building which will have below grade parking, street level commercial units, and upper story residences. The parking level is to consist of a full depth basement. The building construction will likely incorporate concrete basement retaining walls (up to 12 feet tall), above grade retaining walls (of similar height), and wood frame construction. New foundation loads are expected to be typical for this type of structure (i.e. light to moderate).

Excavation work at the site is expected to include basement excavations, and probable excavation into the rear slope. No significant fill placement is anticipated as part of this work.

INVESTIGATION

Scope and Purpose

The purpose of our investigation was to determine the nature of the subsurface soil conditions so that we could provide geotechnical recommendations for the construction of the proposed structure and associated improvements. In order to achieve this purpose, we have performed the following scope of work:

1 - visited the property to observe the geotechnical setting of the area to be developed;

2 - reviewed relevant published geotechnical maps;

3 - drilled 3 borings near the location of the proposed improvements;

4 - performed laboratory testing on collected soil samples;

5 - assessed the collected information and prepared this report.

The findings of these work items are discussed in the following sections of this report.

Site Observations

We visited the site on June 13, 2013 to observe the geotechnically relevant site conditions. During our visit, we noted the following conditions:

A - The existing buildings appear to be supported on concrete slabs with concrete block retaining walls supporting the cuts into the rear slope. The foundation and walls appeared to be in good condition with no signs of distress readily apparent from the exterior.

B - The building at 572 El Camino Real has been cut further back into the natural hillside, which has resulted in a full story height wall at its rear. The other structure at 600 El Camino was built closer to the street, and has its rear wall only supporting about 6 feet of soil. Due to these construction geometries, there is a gentle partially cut slope on the back portions of the 600 El Camino lot, while the slope behind the building at 572 El Camino Real slopes naturally but steeply up to the rear of the lot.

C - Drainage of the sites is predominantly by sheet flow across the parking lots. Roof downspouts currently discharge onto the paved areas for flow out to the street.

Geologic Map Review

We reviewed the *Geologic Map of the Montara Mountain and San Mateo 7½' Quadrangles, San Mateo County, California (USGS Map I-2390)*, by Earl H. Pampeyan (1994). The relevant portion of the Pampeyan map has been reproduced in Figure 3.

The Pampeyan map indicates that the site is underlain by Franciscan Sandstone (map symbol "fs") towards the rear of the lot (under the slope), and Slope wash (symbol "Qsr") toward the front of the lot. Pampeyan's descriptions of these materials are included on Figure 3. Our subsurface exploration (see below) encountered similar materials to those just described, and we would consider the site to be underlain at shallow depth by Fransciscan sandstone with localized seams of claystone interbedded in the sandstone.

The active San Andreas fault is mapped approximately 5.5 km southwest of the site.

Subsurface Exploration

On June 13, 2013 we drilled 3 borings at the site at the locations shown on Figure 4. The borings were drilled using a Mobile B-24 truck-mounted drilling rig equipped with 4.0 inch diameter, helical flight augers. Logs of the soils encountered during drilling record our observations of the cuttings traveling up the augers and of relatively undisturbed samples collected from the base of the advancing holes. The final boring logs are based upon the field logs with occasional modifications made upon further laboratory examinations of the recovered samples and laboratory test results. The final logs are attached in Appendix A.

The relatively undisturbed samples were obtained by driving a 3.0 inch (outer diameter) Modified California Sampler and a Standard Penetration Sampler (as noted on logs) into the base of the advancing hole by repeated blows from a 140 pound hammer lifted 30 inches. On the logs, the number of blows required to drive the sampler the final 12 inches of the 18 inch drive, have been recorded as the Blow Counts. These blows have not been adjusted to reflect equivalent blows of any other type of sampler or hammer, or to account for the different samplers used.

Subsurface Conditions

The borings encountered similar subsurface soil and rock conditions. The borings first penetrated 1 to 5 feet of clayey silty Sand over either Claystone or Sandstone bedrock. The soils were in a medium dense to dense state, while the bedrock was generally of hard consistency (claystone) or weakly to well cemented (sandstones). Resistance to penetration with the auger generally increased with depth into the sandstone.

Please refer to Appendix A for a more detailed description of each boring.

Seepage was encountered in Boring 3 at a depth of 7.5 feet, but no water accumulated in the hole during drilling, nor appeared to continue to seep after the boring penetrated to a depth beyond 10 feet. The other borings did not encounter free groundwater during the drilling of the holes.

Please note that during periods of heavy rain or late in the winter, groundwater seepage may exist within the zone penetrated by the borings, most likely as perched water in the soils atop the bedrock, or as seepage from joints within the bedrock.

Laboratory Testing

The relatively undisturbed samples collected during the drilling process were returned to the laboratory for testing of engineering properties. In the lab, selected soil samples were tested for moisture content, density, and expansion potential. The results of the laboratory tests are attached to this report in Appendix B.

The expansion testing showed that the near-surface materials are of low expansion potential, as the plasticity index was only 17.

CONCLUSIONS AND RECOMMENDATIONS

General

Based upon our investigation, we believe that the proposed improvements can be safely constructed. Geotechnical development of the site is controlled by the presence of steep slopes, but is aided by good quality bedrock at relatively shallow depths.

The recommendations in this report should be incorporated into the design and construction of the proposed new mixed-use building.

Seismicity

The greater San Francisco Bay Area is recognized by Geologists and Seismologists as one of the most active seismic regions in the United States. Three major fault zones pass through the Bay Area in a northwest direction which have produced approximately 12 earthquakes per century strong enough to

cause structural damage. The faults causing such earthquakes are part of the San Andreas Fault System, a major rift in the earth's crust that extends for at least 700 miles along western California. The San Andreas Fault System includes the San Andreas, Hayward, Calaveras Fault Zones, and other faults.

During 1990, the U.S. Geological Survey cited a 67 percent probability that a Richter magnitude 7 earthquake, similar to the 1989 Loma Prieta Earthquake, would occur on one of the active faults in the San Francisco Bay Region in the following 30 years. Recently, this probability was increased to 70 percent, as a result of studies in the vicinity of the Hayward Fault. A 21 percent probability is currently attributed specifically to the potential for a magnitude 6.7 earthquake to occur along the San Andreas fault by the year 2036

Ground Rupture - The lack of mapped active fault traces through the site, suggests that the potential for primary rupture due to fault offset on the property is low.

Ground Shaking -The subject site is likely to be subject to very strong to violent ground shaking during its life span due to a major earthquake in one of the above-listed fault zones. Current (2010) building code design may be followed by the structural engineer to minimize damages due to seismic shaking, using the following input parameters from the USGS Java Ground Motion Parameter Calculator:

Site Class - C	$SM_S = 1.770$	$SM_1 = 1.178$	$SD_S = 1.180$	$SD_1 = 0.786$

Landsliding - We note that the rear slope of the subject site is moderately to steeply sloping. However, our investigation found that it is underlain by relatively good quality bedrock at shallow depth. Therefore, the hazard due to seismically-induced landsliding is, in our opinion, very low for the site.

Liquefaction - Liquefaction most commonly occurs during earthquake shaking in loose fine sands and silty sands associated with a high ground water table. Based upon the subsurface investigation, the proposed building site is underlain by resistant bedrock materials at shallow depths. Therefore, it is our opinion that liquefaction is unlikely to occur on the subject property.

Ground Subsidence - Ground subsidence may occur when poorly consolidated soils densify as a result of earthquake shaking. Since the proposed building site is underlain at shallow depths by resistant materials, the hazard due to ground subsidence is, in our opinion, considered to be low.

Lateral Spreading - Lateral spreading may occur when a weak layer of material, such as a sensitive silt or clay, loses its shear strength as a result of earthquake shaking. Overlying blocks of competent material may be translated laterally towards a free face. Such conditions were not encountered on the proposed building site, therefore, the hazard due to lateral spreading is, in our opinion, considered very low.

Site Preparation and Grading

All debris resulting from the demolition of existing improvements should be removed from the site and may not be used as fill. Any existing underground utility lines to be abandoned, should be removed from within the proposed building envelope and their ends capped outside of the building envelope.

Any vegetation and organically contaminated soils should be cleared from the building area. All holes resulting from removal of tree stumps and roots, or other buried objects, should be over-excavated into firm materials and then backfilled and compacted with native materials (if necessary).

The placement of fills at the site is expected to include: utility trench backfill, retaining wall backfill, slab subgrade materials, and finished drainage and landscaping grading. These and all other fills should be placed in conformance with the following guidelines:

Fills may use organic-free soils available at the site or import materials. Import soils should be free of construction debris or other deleterious materials and be non-expansive. *A minimum of 3 days prior to the placement of any fill, our office should be supplied with a 30 pound sample (approximately a full 5 gallon bucket) of any soil or baserock to be used as fill (including native and import materials) for testing and approval.*

All areas to receive fills should be stripped of organics and loose or soft near-surface soils. Fills should be placed on level benches in lifts no greater than 6 inches thick (loose) and be compacted to at least 90 percent of their Maximum Dry Density (MDD), as determined by ASTM D-1557. In pavement (concrete or asphalt) areas to receive vehicular traffic, all baserock materials should be compacted to at least 95 percent of their MDD. Also, the upper 6 inches of soil subgrade beneath any pavements should be compacted to at least 95 percent of its MDD.

No general site fills are anticipated for this site. Should plans change to include any fills thicker than 3 feet, our office should be contacted for further recommendations.

Deep excavations into the sandstone bedrock may encounter areas of hard, well cemented bedrock. Heavy equipment should be capable of achieving the required depths, however, extra efforts may need to be extended in these areas.

Temporary, dry-weather, vertical excavations should remain stable for short periods of time to heights of 5 feet. Deeper cuts should be evaluated for unfavorable bedrock attitudes by our personnel. All excavations should be shored or sloped in accordance with OSHA standards.

Permanent cut and/or fill slopes should be no steeper than 2:1 (H:V). However, even at this gradient, minor sloughing of slopes may still occur in the future. Positive drainage improvements (e.g. drainage swales, catch basins, etc.) should be provided to prevent water from flowing over the tops of cut and/or fill slopes.

Foundations

Where the at-grade portions of the building extend beyond any basement support, the foundation elements should consist of spread footings which bear on bedrock materials as identified by our personnel. In some areas, this may require excavations up to 5 feet below existing grades. Should the designer choose to use drilled piers for these deeper areas, please contact our office for further recommendations.

All footings should be a minimum of 12 inches wide. Strip footings should be embedded a minimum of 18 inches below exterior grade and 12 inches below interior grade, *whichever is deeper*. Stepped footings need only be embedded 12 inches below exterior grade at the toe. Isolated footings (e.g. interior pads or exterior post supports) should be embedded at least 18 inches below lowest adjacent grade.

The footings should be founded below an imaginary line projecting at a 1:1 slope from the base any adjacent, parallel utility trenches or basement walls closer than 7 feet from the foundation. Footings which will extend and connect to basement walls must be designed to span the distance between bedrock and basement walls, plus an additional 50% of this distance. The footings must be embedded so that there is a minimum of 10 feet of horizontal cover between the face of the footings and any adjacent, parallel slope.

The footings should be designed to exert pressures on the bedrock which do not exceed 4000 psf for Dead plus Live Loads. The weight of the embedded portion of the footings may be neglected when determining bearing pressures. Lateral pressures may be resisted by friction between the base of the footings and the ground surface. A friction coefficient of 0.40 may be assumed. These values may be increased 1/3 for transient loads (i.e. seismic and wind).

Footings should be nominally reinforced with four #4 bars (two at top and two at bottom). The designer should determine actual width, embedment and reinforcement for the footings.

If the above recommendations are followed, total foundation settlements should be less than 1 inch, while differential settlements should be less than ¾ inches.

Basement Foundations and Walls

Wall Forces - The basement retaining walls should be designed to resist an active pressure of 40 pcf Equivalent Fluid Weight (EFW), for retained slopes flatter than 4:1 (horizontal:vertical). If it is desired to create steeper retained slopes to reduce the heights of the walls, then the active pressure will need to be increased. An active pressure of 55 pcf EFW should be utilized for retained slopes with an inclination of 2:1 (H:V). Where retained slopes are greater than 4:1, though less than 2:1, the designer should linearly interpolate between 40 and 55 pcf EFW.

If the walls are considered to be restrained, they should be designed for an additional uniform pressure of 8H psf, where H is the height of the wall in feet. We leave it to the design professional's judgment in determining whether a wall is restrained or not. The walls should also be designed to resist a point load applied at the midpoint of the wall, equal to ½ of the maximum applied surcharge. Although our office does not recommend that any additional lateral force be applied for seismic considerations, should the structural engineer deem it appropriate, then an additional lateral force of 10H psf may be added to account for these seismic conditions.

Foundation Parameters - The basement retaining walls, and any wall or column supports at the basement level, may be supported by a mat slab, where the lateral forces are transferred across the slabs to the opposite retaining walls. It will be necessary that the slabs be able to resist buckling due to the applied forces from the walls. The slabs should bear on a 6 inch drain rock cushion over dense native or fill soils, as determined by our office in the field. Localized deepening of the subgrade/footings may be required if variable conditions are encountered during construction. A perforated collector pipe should be placed near the base of the gravel layer to collect excess free water from under the basement and transport the water to a sump for removal from the site. The sump should be located within a basement patio egress, or alternatively in a window well, for ease of maintenance and access.

The slab may be designed for a modulus of subgrade reaction of 200 pci. It may be necessary to thicken the slab/footing at various locations to account for isolated loads. The amount of slab thickening, where required, should be determined by the structural engineer.

A friction coefficient of 0.35 may be assumed to act between the base of the slabs and grade.

The mat slab should be underlain by a minimum of 4 inches of drain rock covered by a moisture barrier (e.g. moistop or stegowrap). If deemed to be appropriate by the structural engineer, the vapor barrier may be covered by a thin veneer of sand (1-2 inches). The moisture barrier should wrap up the sides of the mat slab so that it can be overlain by the exterior wall water proofing membrane. Ideally the exterior face of the mat slab should be aligned flush with the exterior wall face to make the overlap of the water proofing materials a simple procedure.

Footing Alternative – should it be undesirable to use a mat slab, then the basement walls may be founded on conventional spread footings bearing on the bedrock materials. Bearing pressures should not exceed a value of 4000 psf, and resistance to sliding may be assumed to act at a value of 0.45 for friction. Should shear keys be required, a passive resistance of 1500 psf may be assumed for a shear key located under the footing. Passive resistance and sliding friction should not be combined without our written approval based upon the design geometries. The moisture barrier under any conventional floor slab must be extended between the base of the slab and top of footing, with a minimum of 4 inches of drain rock located on the top of the footing, but under the vapor barrier. We note that moisture intrusion into the basement has a slightly higher potential to occur under this geometry.

Moisture Barrier – where the basement will consist of parking only, it would be acceptable to our office to omit the moisture barrier. Where floor covering improvements are required over a portion of the basement slab, or moisture penetration through the basement floor is not acceptable, consideration should be given to topical coatings.

Wall Drainage - The above values have been provided assuming that a back-of-wall drain system will be installed to prevent build-up of hydrostatic pressures. This drainage system may consist of a prefabricated drainage panel (i.e. Miradrain) or a gravel and filter fabric type system. The walls should be waterproofed to prevent the transmission of efflorescence through the walls, and the water proofing should overlap the moisture barrier from under the mat slab. The waterproofing should be specified by the designer.

Either drainage system should be installed with a minimum 3 inch diameter perforated pipe placed a minimum of 5 inches below the base of the mat or conventional floor slab. Perforations should be placed face-down (at 5 and 7 o'clock). The collector pipe may be located under the slab, or outside of the perimeter of the slab, and form a full "ring" around the basement. In addition, line(s) of additional drain pipes should be placed across the basement footprint (in one direction only) at a spacing not to exceed 20 feet on center.

The perforated pipes should connect to a sump pit, with a pump which will discharge water away from the building. For ease of access, the sump should be located in the garage floor where access is relatively easy to provide. Discharge from the sump should be to a nearby area drain for final disposition of the waters. The sump must be fitted with a backflow prevention device and quick release fitting (for servicing considerations).

If used, the gravel system should consist of a minimum 12 inch wide column of drain rock (¾ inch rock or 1/8 inch pea gravel) extending the full width of the wall. The rock should continue to within 6 inches of finished grade. Prior to backfilling with the drain rock, a layer of filter fabric (Mirafi 140N or approved equivalent) should be placed against all soil surfaces to separate the rock and soil. The filter fabric should wrap over the top of the gravel and then a 6 inch thick cap of native soils should be placed at the top of the drain. If concrete flatwork is to directly overlay the back-of-wall drain, then the drain rock should continue to the base of the concrete. Additionally, where the drain will be located within crawlspace area, the gravel should continue to the crawlspace ground surface without the soil cap.

If prefabricated drainage panels are used, a packet of filter fabric-wrapped drain rock should be placed around the perforated collector pipe. The tops of the panels should be sealed and secured in accordance with the manufacturer's specifications.

Site Retaining Walls

Site retaining walls should be kept structurally isolated from the building. Where these walls are located on, or within 10 feet of the crest of, slopes steeper than 4:1 (H:V), a pier and grade beam foundation system should be used.

Site retaining walls which are located in level areas (flatter than 4:1, H:V) may be supported by drilled piers or by spread footings depending upon wall type. Spread footing style walls may include segmental block walls.

Wall Forces - Any unrestrained retaining walls required for the proposed construction should be designed to resist an active pressure of 45 pcf Equivalent Fluid Weight (EFW) in supporting soils with retained slopes less than 4:1 (H:V). An active pressure of 65 pcf EFW should be utilized for retained slopes with an inclination of 2:1 (H:V). Where retained slopes are greater than 4:1, though less than 2:1, the designer should linearly interpolate between 45 and 65 pcf EFW.

Any restrained retaining walls required should be designed for the aforementioned active pressures with an additional uniform pressure of 8H psf, where H is the height of the wall in feet. We leave it to the design professional's judgment in determining whether a wall is restrained or not. Our office does not consider it necessary to apply an additional seismic force to the above wall design parameters. However, should the wall designer chose to apply such a loading condition, then we would suggest a uniform pressure of 10H psf be applied.

All retaining walls should also be designed to resist a point load applied at the midpoint of the wall, equal to ½ the maximum applied surcharge.

Drilled Piers - Any wall which is located on, or within 10 feet of the crest of, slopes steeper than 4:1 (H:V) should utilize a drilled pier foundation system. We note that pier-supported walls may not rely upon a toe footing to resist overturning forces. All vertical and lateral forces should be resisted by piers. This may require the use of a staggered, double row of piers, depending upon the wall height and any surcharges.

If used, drilled piers should penetrate a minimum of 10 feet below the lowest adjacent grade, and at least 5 feet into bedrock, *whichever is deeper.* The piers should have a minimum diameter of 16 inches. Pier should be spaced no closer than 4 diameters, center to center. Actual pier depth, diameter, reinforcement, and spacing should be determined by the structural engineer.

A friction value of 500 psf may be assumed to act on that portion of the pier below a depth of 4 feet in soil, or 750 psf where in bedrock. Lateral support may be assumed to be developed along the length of the pier using a passive pressure of 350 pcf Equivalent Fluid Weight (EFW) in soil, or 450 pcf EFW in bedrock. Passive resistance may be assumed to act over 1.5 projected pier diameters. These design values may be increased 1/3 for transient loads (i.e. seismic and wind). No vertical or lateral support may be assumed to develop above a depth where there is less than 10 feet of horizontal cover between the pier and any parallel slope .

If drilled piers are utilized beneath a concrete or block wall, they will need to be connected by a concrete grade beam. No grade beam is required for a wood lagging wall.

Spread Footings - For detached site walls in level areas (flatter than 4:1, H:V) spread footings may be used. Footings for these walls should be designed using an allowable bearing pressure of 2500 psf on soil, or 4000 psf on bedrock. All footings must be embedded a minimum of 12 inches below grade. Lateral pressures may be resisted by a passive pressure of 350 pcf EFW in soil, or 450 pcf in bedrock, assumed to be acting against the sides of the footings (or shear keys, if required). Passive resistance may start at a depth of 1 foot below exterior grade. However, for passive resistance to start, the footing must be embedded so that there is a minimum of 10 feet of horizontal cover between the face of the footing and any adjacent, parallel slope. Alternatively, lateral pressures may be resisted by friction between the base of the footings and the ground surface. A friction coefficient of 0.35 may be assumed. Frictional and passive resistance may not be used in combination. The above values may be increased 1/3 for transient loads.

Wall Drainage - The above values have been provided assuming that back-of-wall drains will be installed to prevent build-up of hydrostatic pressures behind all walls. Detailed recommendations for back of wall drains is included above in the section on basement wall drainage.

Slabs-on-Grade

The basement floors may consist of concrete slabs-on-grade. Similarly, any at grade portions of the building extending beyond the perimeter basement foundations may also consist of slabs on grade, however, they will need to be structurally designed to be capable of spanning the backfill zone behind the retaining walls (see above for at-grade foundation elements).

The driveway and any sidewalks or patios may also consist of conventional concrete slabs-on-grade. Though, it should be expected that some seasonal shifting of such slabs will occur. We have provided guidelines to help reduce post-construction movements, however, it is nearly impossible to economically eliminate such shifting.

To help reduce cracking, we recommend slabs be a minimum of 4 inches thick and be nominally reinforced with #4 bars at 18 inches on center, each way. Slabs which are thinner or more lightly reinforced may experience undesirable cosmetic cracking. However, actual reinforcement and thickness should be determined by the structural engineer based upon anticipated usage and loading.

In large non-interior slabs (e.g. patios, garage, etc.), score joints should be placed at a maximum of 10 feet on center. In sidewalks, score joints should be placed at a maximum of 5 feet on center. All slabs should be separated from adjacent improvements (e.g. footings, porches, columns, etc.) with expansion joints. Interior slabs do not require score joints, however, sealing or patching of shrinkage cracks will likely be desirable and should be addressed by the project architect.

Interior slabs, and slabs through which moisture transmission is undesirable, should be underlain by 2 inches of sand over 4 inches of ¾ inch drain rock. The sand and drain rock should be separated by a vapor barrier (e.g. stegowrap, or other vapor barrier conforming to ASTM E-1745-97). Slabs which will be subject to light vehicular loads and through which moisture transmission is not a concern (e.g. driveway) should be underlain by at least 6 inches of compacted baserock, in lieu of the sand and gravel.

Exterior landscaping flatwork (e.g. patios and sidewalks) may be placed directly on proof-rolled soil subgrade materials (e.g. no granular subgrade), however, they will be potentially subject to shifting and moisture transmission.

As stated previously, in pavement (concrete or asphalt) areas to receive vehicular traffic, all baserock materials should be compacted to at least 95 percent of their MDD. Also, the upper 6 inches of native soil subgrade beneath any pavements should be compacted to at least 95 percent of its MDD.

Drainage

Due to the flat nature of the site and proposed below grade basement, it will be important to provide good drainage improvements at the property.

Surface Drainage - Adjacent to any buildings, the ground surface should slope at least 2 percent away from the foundations within 5 feet of the perimeter. Impervious surfaces should have a minimum gradient of 1 percent away from the foundation.

Surface water should be directed away from all buildings into drainage swales, or into a surface drainage system (i.e. catch basins and a solid drain line). "Trapped" planting areas should not be created next to any buildings without providing means for drainage.

All roof eaves should be lined with gutters. The downspouts should be connected to solid drain lines, or should discharge onto paved surfaces which drain away from the structure. The downspouts may be connected to the same drain line as any catch basins, but should not connect to any perforated pipe drainage system.

Utility Lines

All utility trenches should be backfilled with compacted native clay-rich materials within 5 feet of any buildings, unless they pass through a back of wall drain system. This will help to prevent migration of surface water into trenches and then underneath the structures' perimeter. The rest of the trenches may be compacted with other native soils or clean imported fill. Only mechanical means of compaction of trench backfill will be allowed. Jetting of sands is not acceptable. Trench backfill should be compacted to at least 90 percent of its MDD. However, under pavements, concrete flatwork, and footings the upper 12 inches of trench backfill must be compacted to at least 95 percent of its MDD.

Plan Review and Construction Observations

The use of the recommendations contained within this report is contingent upon our being contracted to review the plans, and to observe geotechnically relevant aspects of the construction.

We should be provided with a full set of plans to review at the same time the plans are submitted to the building/planning department for review. A minimum of one working week should be provided for review of the plans.

At a minimum, our observations should include: basement excavations; compaction testing of fills and subgrades; footing excavations; pier drilling; slab and driveway subgrade preparation; installation of any drainage system (e.g. back-of-wall, footing, and surface), and final grading. A minimum of 48 hours notice should be provided for all construction observations.

LIMITATIONS

This report has been prepared for the exclusive use of the addressee, and their architects and engineers for aiding in the design and construction of the proposed development. It is the addressee's responsibility to provide this report to the appropriate design professionals, building officials, and contractors to ensure correct implementation of the recommendations.

The opinions, comments and conclusions presented in this report were based upon information derived from our field investigation and laboratory testing. Conditions between, or beyond, our borings may vary from those encountered. Such variations may result in changes to our recommendations and possibly variations in project costs. Should any additional information become available, or should there be changes in the proposed scope of work as outlined above, then we should be supplied with that information so as to make any necessary changes to our opinions and recommendations. Such changes may require additional investigation or analyses, and hence additional costs may be incurred.

Our work has been conducted in general conformance with the standard of care in the field of geotechnical engineering currently in practice in the San Francisco Bay Area for projects of this nature and magnitude. We make no other warranty either expressed or implied. By utilizing the design recommendations within this report, the addressee acknowledges and accepts the risks and limitations of development at the site, as outlined within the report.

Respectfully Submitted;
GeoForensics, Inc.

Daniel F. Dyckman, PE, GE
Senior Geotechnical Engineer, GE 2145

This document has been digitally signed. Contact GFI for original signed and wet-stamped document.

cc: 1 to addressee (via email)

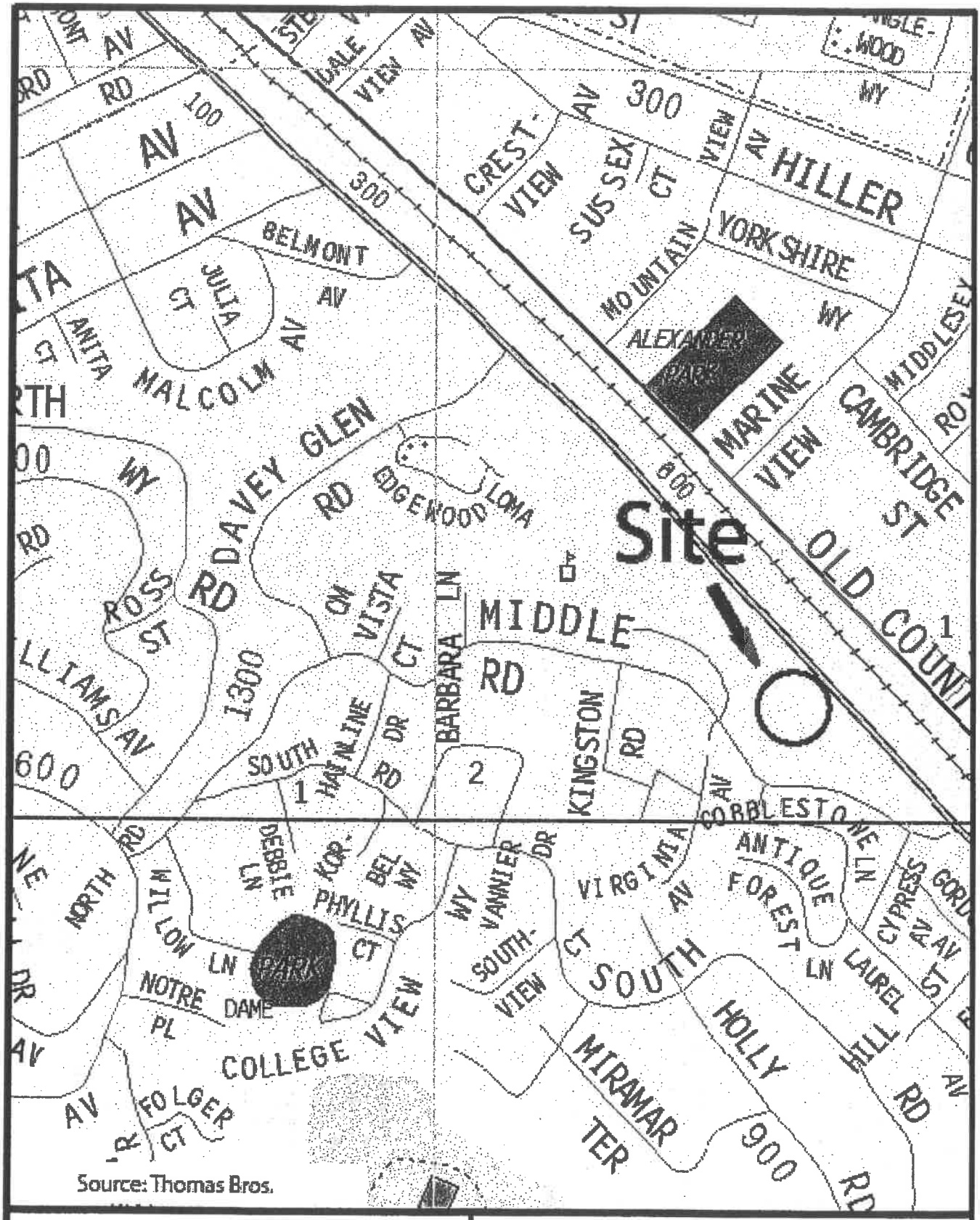


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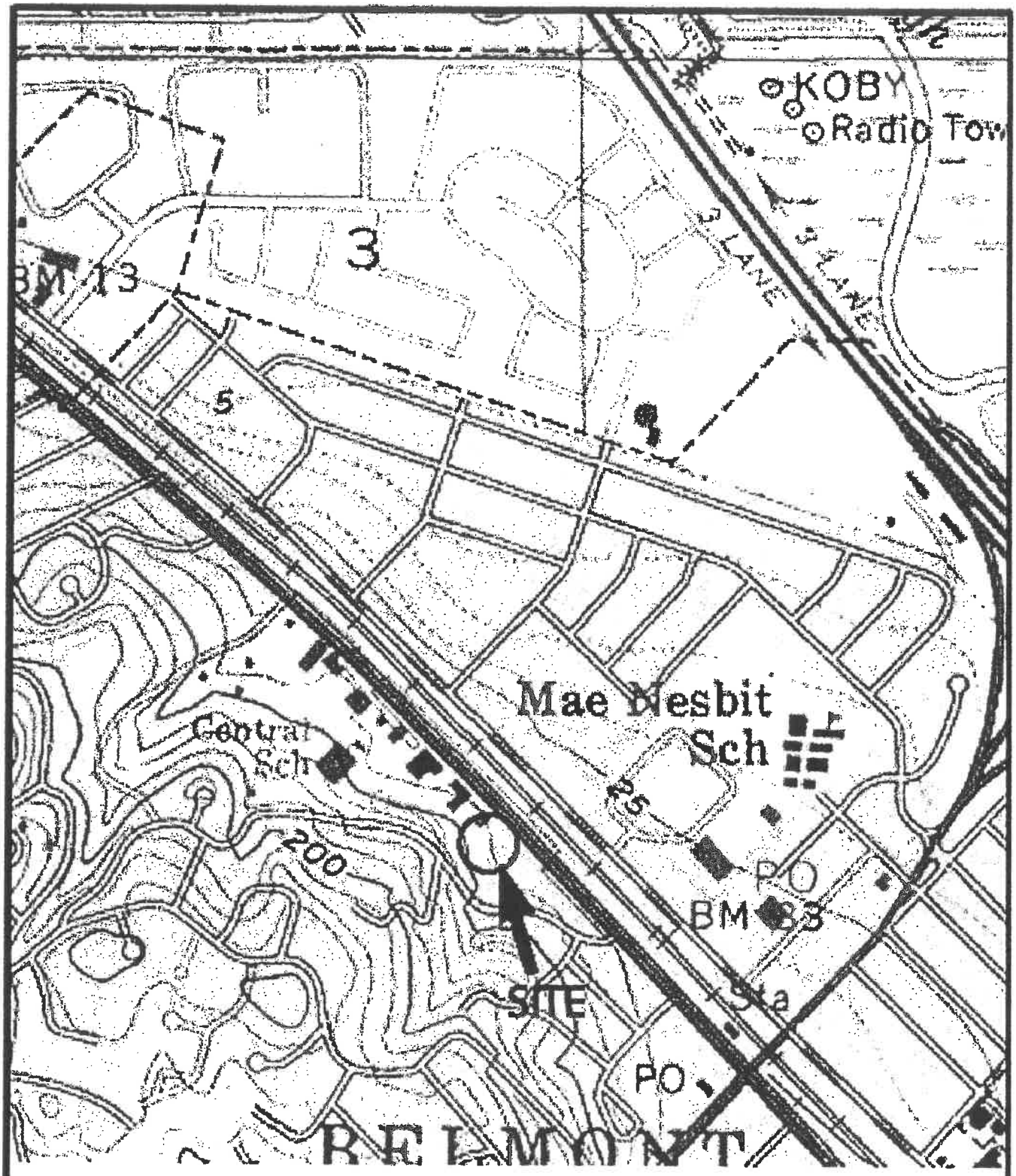
Figure 1 - Site Location



Base: Topo

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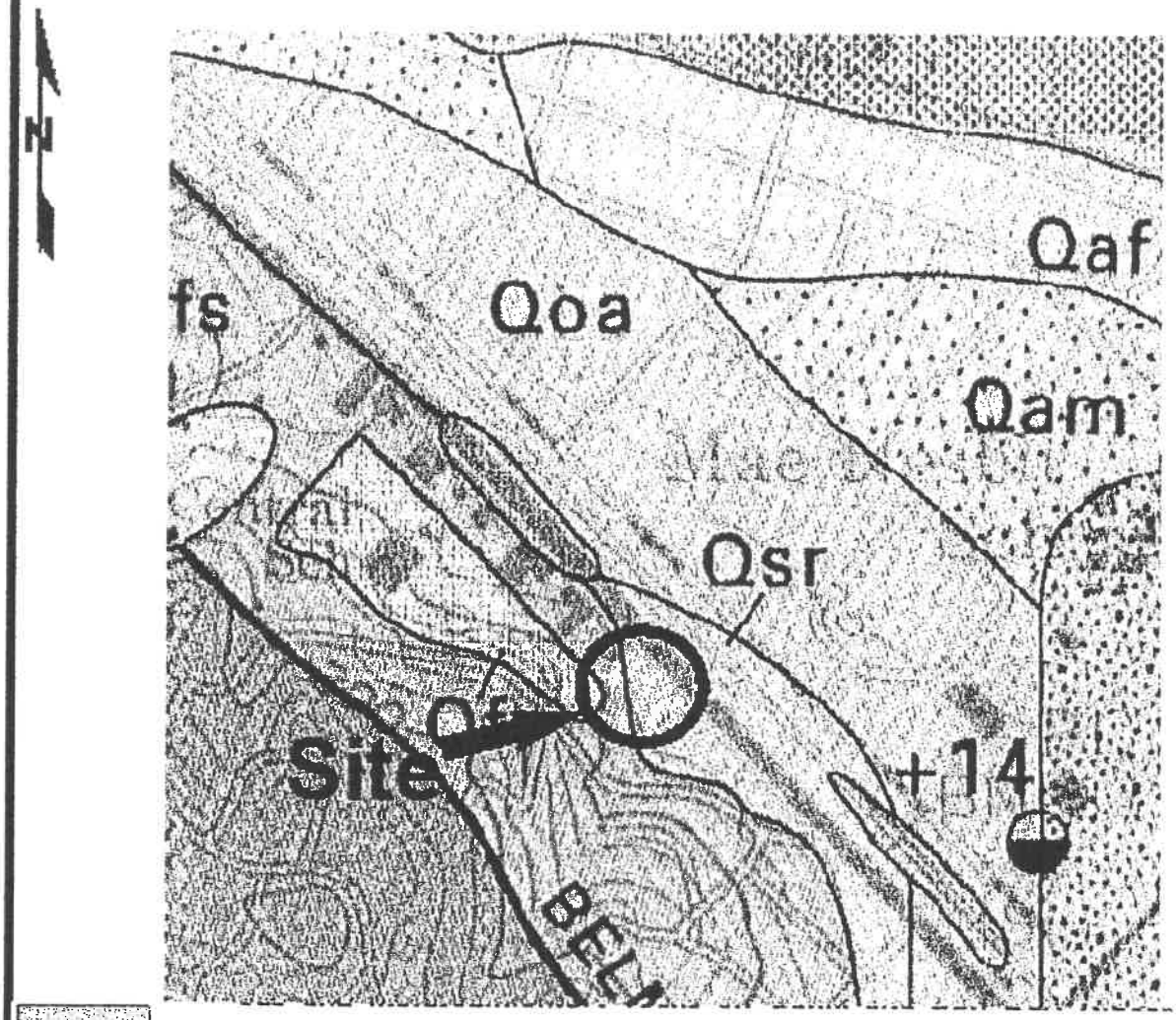
Figure 2 - Regional Topography



fs — **Sandstone**—Medium- to coarse-grained, poorly sorted; locally tuffaceous sandstone (lithic graywacke) with interbedded siltstone, shale, and sparse coal. Well indurated, hard, and dark-greenish gray when fresh; weakly indurated, soft, and grayish orange when weathered.

Qsr — **Slope wash, ravine fill, and colluvium (Holocene)**—Unconsolidated to moderately consolidated deposits of sand, silt, clay, and rock fragments accumulated by slow downslope movement of weathered rock debris and soil. Composition dependent upon underlying rocks.

Frm: Geologic Map of the Montara Mountain and San Mateo 7.5' Quadrangles, San Mateo County, California (USGS Map I-2390) by Earl H. Pampeyan (1994)

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Figure 3a - Pampeyan Geologic Map

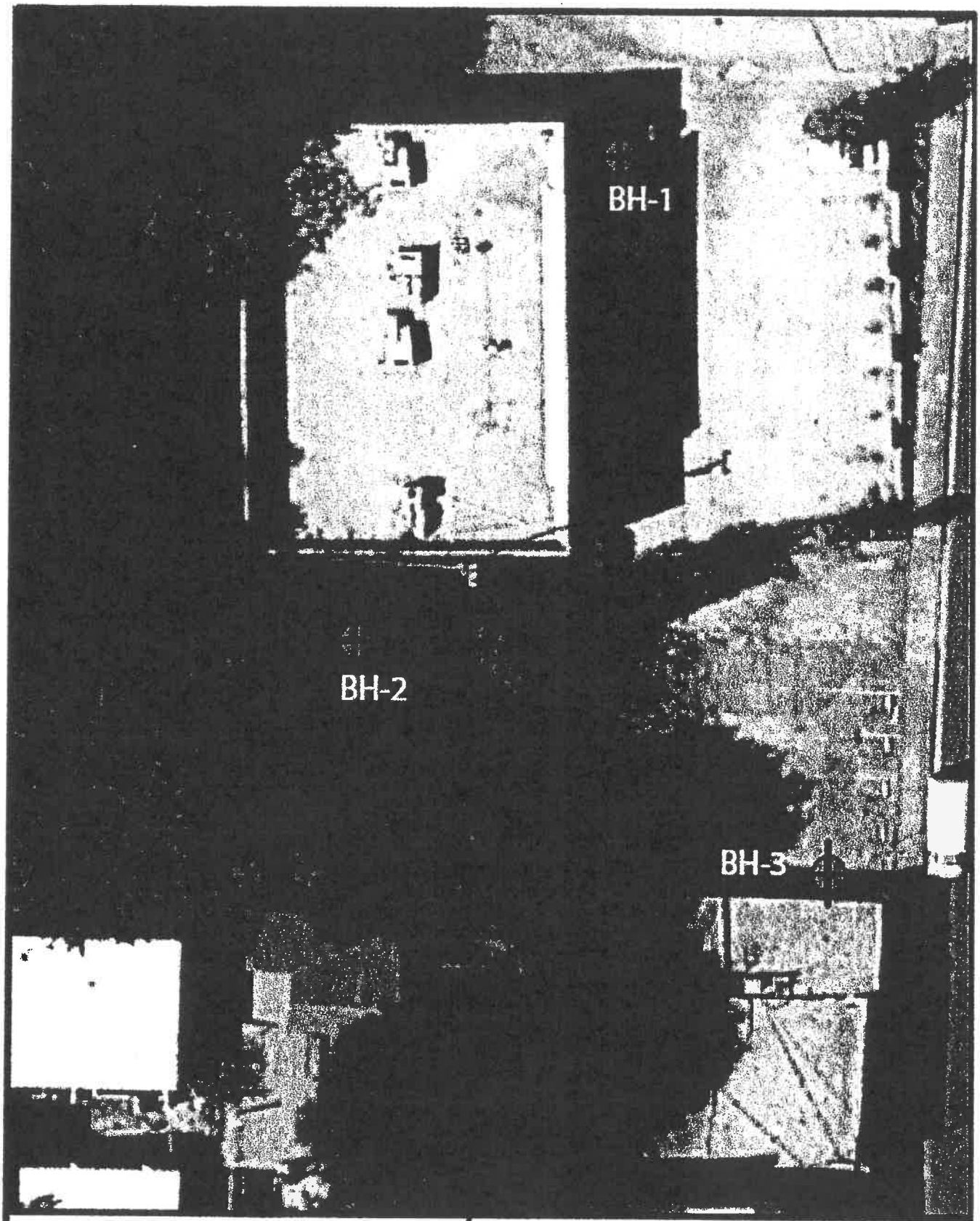

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Figure 4 - Site Plan with Borings

File: 213084
June 27, 2013

Appendix A – Logs of Borings

LOG OF BORING

DEPTH (ft)	SAMPLE NUMBER	SAMPLE LOC.	BLOW COUNTS (12 inches)	MATERIAL DESCRIPTION	DRY DENSITY (pcf)	MOISTURE CONTENT (%)
				Asphalt over Aggregate Base		
				Gravelly SAND - dark brown (SG)		
	1-1		39	Clayey Silty SAND - Orange and Tan, moist, very stiff, sandstone fragments (SC)	110.9	19.3
5						
	1-2		50/4"	Sandstone - yellowbrown and grey, hard/dense, friable medium grained		
10				As above, but well cemented, hard drilling at 10 feet		
15				Bottom of Boring @ 13 ft No Groundwater		
20						
25						
30						

Logged by: BA
Job# 213052
Drilled on 4/11/13

Minute Man Portable Drilling Rig
140 Pound Hammer
No Groundwater

Mod. Cal Sampler
SPT Sampler

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Figure A1 - Log of Boring 1

LOG OF BORING

DEPTH (ft)	SAMPLE NUMBER	SAMPLE LOC.	BLOW COUNTS (12 Inches)	MATERIAL DESCRIPTION	DRY DENSITY (pcf)	MOISTURE CONTENT (%)
5	2-1		73	Clayey Silty SAND - Yellow and Tan, moist, very stiff, sandstone fragments (SC)	125.5	6.9
				Claystone -Grey and brown, hard, sl. moist		
			50/1"	Sandstone - yellowbrown and grey, hard/dense, well cemented		
10				Bottom of Boring @ 8 ft No Groundwater		
15						
20						
25						
30						

Logged by: BA
Job# 213052
Drilled on 4/11/13

Minute Man Portable Drilling Rig
140 Pound Hammer
No Groundwater

Mod. Cal Sampler
SPT Sampler

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Figure A2 - Log of Boring 2

LOG OF BORING

DEPTH (ft)	SAMPLE NUMBER	SAMPLE LOC.	BLOW COUNTS (12 inches)	MATERIAL DESCRIPTION	DRY DENSITY (pcf)	MOISTURE CONTENT (%)
				Asphalt over Aggregate Base Over silty Sand		
	3-1		61	Sandstone - yellowbrown and grey, v.dense, friable medium grained, sl. moist		
5						
	3-2		57	As above, but with claystone seams		
10						
				Bottom of Boring @ 13 ft Seepage at 7.5 feet, but no accumulation		
15						
20						
25						
30						

Logged by: BA
Job# 213052
Drilled on 4/11/13

Minute Man Portable Drilling Rig
140 Pound Hammer
No Groundwater

Mod. Cal Sampler
SPT Sampler

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Figure A3 - Log of Boring 3

Appendix B – Laboratory Test Results

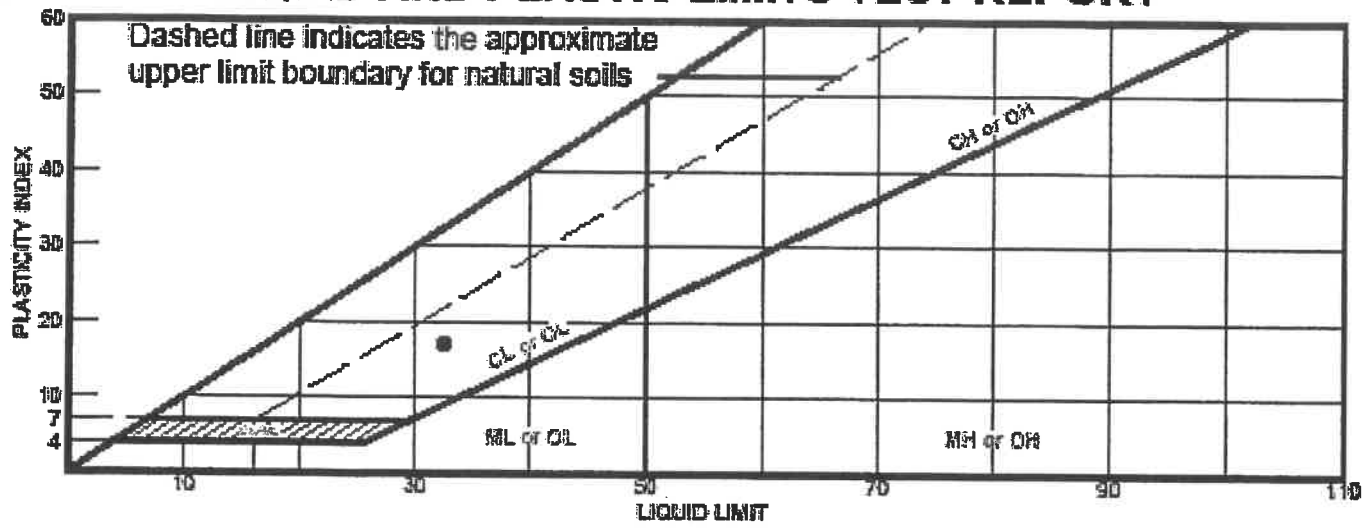
Moisture-Density-Porosity Report
Cooper Testing Labs, Inc. (ASTM D 2937)

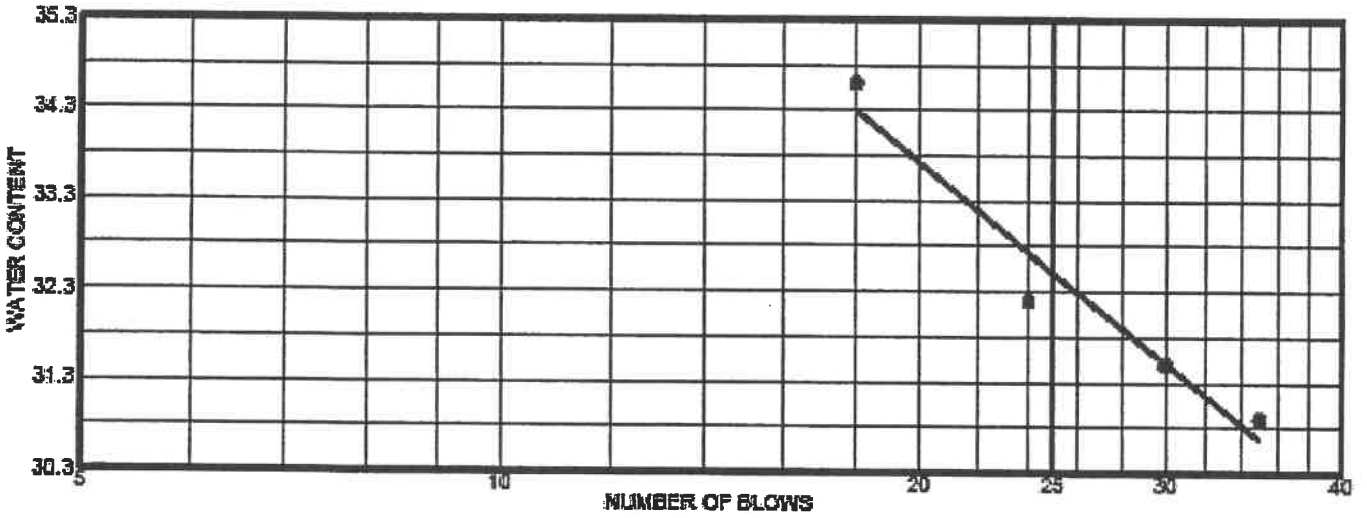
CTL Job No:	060-2196	Project No.	By: RU
Client:	GeoForensics	Date:	06/17/13
Project Name:	Belmino	Remarks:	

Boring:	1-1	2-1						
Sample:								
Depth, ft:	3	3						
Visual Description:	Light Yellowish Brown Clayey SAND	Very Dark Grayish Brown Clayey SAND						
Actual G_s								
Assumed G_s	2.70	2.70						
Moisture, %	19.3	6.9						
Wet Unit wt, pcf	132.3	134.2						
Dry Unit wt, pcf	110.9	125.5						
Dry Bulk Dens.,pb, (g/cc)	1.78	2.01						
Saturation, %	100.0	54.2						
Total Porosity, %	34.3	25.6						
Volumetric Water Cont,ew	34.2	13.9						
Volumetric Air Cont., Ea	0.0	11.7						
Void Ratio	0.52	0.34						
Series	1	2	3	4	5	6	7	8

Note: All reported parameters are from the as-received sample condition unless otherwise noted. If an assumed specific gravity (Gs) was used then the saturation, porosities, and void ratio should be considered approximate.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light Olive Brown Sandy CLAY	32.5	15.5	17.0			

Project No. 060-2196 Client: Geoforensics

Project: Belmino

● Source: 1-1 Elev./Depth: 3'

Remarks:

●

LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Figure