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Business, Transportation and Housing Agency

Memorandum

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To: MR. Arturo Jacobo – 11

Date: October 5, 2005

File: 11-SD-5
PM R28.4/R55.3
EA 235800

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design - South

Subject: Preliminary Geotechnical Report (PGR), Interstate 5 Widening

This Preliminary Geotechnical Report presents the results of geotechnical reconnaissance, research, and analysis by the Caltrans Office of Geotechnical Design (OGDS) South II to provide preliminary recommendations relevant to the planning, design and construction of the Interstate 5 widening projects. The proposed improvements would construct two general purpose lanes and a High Occupancy Vehicle (HOV) lane in each direction between Del Mar Heights Road to Encinitas Blvd., and add one general purpose lane and an HOV lane in each direction between Encinitas Blvd. and Camp Pendelton/Vandegrift Blvd. Auxiliary lanes would be added to the freeway in areas where projected operational constraints warrant their use.

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CALIFORNIA DEPARTMENT OF TRANSPORTATION

PRELIMINARY GEOTECHNICAL REPORT

Construct State Route 5 Freeway in San Diego County from The 5/805 Interchange to North of State Route 76

11-SD-5, PM R28.428/R55.396
11-235800

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1. INTRODUCTION

1.1 General

Interstate 5 through Northern San Diego County is one of the regions most significant transportation facilities. The I-5 Freeway is a vital link between San Diego, north county beach cities, Camp Pendleton, Los Angeles and beyond. Capacity improvements are needed to alleviate current and projected traffic congestion due to ever increasing demand by commuters and commercial vehicles. The proposed improvements would construct two general purpose lanes and a High Occupancy Vehicle (HOV) lane in each direction between Del Mar Heights Road to Encinitas Blvd., and add one general purpose lane and an HOV lane in each direction between Encinitas Blvd. and Camp Pendelton/Vandegrift Blvd. Auxiliary lanes would be added to the freeway in areas where projected operational constraints warrant their use. According to the Project Study Report dated January 2000, the Environmental Document target date is Dec 2005. The project delivery schedule will be set during the environmental process.

This Preliminary Geotechnical Report presents the results of geotechnical reconnaissance, research, and analysis performed by the Caltrans Office of Geotechnical Design (OGDS) South II to provide preliminary recommendations relevant to the planning, design, and construction of the Interstate 5 widening project.

1.2 Purpose and Scope of Work

The purpose of this report is to preview surface and subsurface geotechnical conditions, provide analyses of anticipated site conditions as they pertain to this project, and to provide preliminary geotechnical recommendations for the design and construction of the roadway portions of the I-5 widening project. This report provides a geotechnical baseline to be used in project development and project related geotechnical investigations. This report is intended for use by the project planners, designers, and geotechnical staff. Specifically, our scope of work included:

1. Review of existing data, including published maps, reports, as-built plans, aerial photographs, and other pertinent geotechnical information.
2. Site reconnaissance and geologic mapping.
3. Engineering analyses based on archived data and assumed parameters.
4. Preparation of this report.

The analysis and recommendations presented in this report are in accordance with current Caltrans standards and practices.

2. EXISTING FACILITIES AND PROPOSED IMPROVEMENTS

2.1 Background

Interstate 5 is the major north-south interregional highway in San Diego County connecting to Orange County and Los Angeles. It is the most western interstate highway and runs from the Mexican border to the Canadian border. Construction of the freeway in the project area primarily occurred in the mid 1960's and early 70's. The analyses and recommendations provided in this report are based on the alignment and profile drawings that were presented to OGDS. The submittal to OGDS is presumed to be a preliminary design. Significant design changes will likely occur prior to PS&E, which may alter the preliminary findings presented in this report.

2.2 Existing Facilities

The project site is located in San Diego County on Interstate 5 from La Jolla Village Drive Overcrossing to 1.6 km north of the Harbor Drive Undercrossing in the city of Oceanside and on Route 805 from 0.3 km north of the Mira Mesa Boulevard Undercrossing to the junction of I-5 (Figure 1).

Existing facilities in the project area include bridges, graded slopes, buried utilities and surrounding commercial/residential development. In general, the existing freeway has four 3.65 m wide Portland cement concrete lanes in each direction with a 10.8 m wide median. Some spot improvements have been made to relieve specific operation problems.

Project Location along I-5 and Route 805

	From	To
I-5	STA 467+00 KP R45.750 (PM R28.428)	STA 901+00 KP R89.149 (PM R55.396)
Route 805	STA "A" 449+00 KP 43.954 (PM 27.312)	To Junction of I-5

2.2.1 Existing Roadways

Existing I-805 and I-5 are eight-lane, Portland cement concrete paved freeways with asphalt concrete paved shoulders.

2.2.2 Existing Cut, Fill and Natural Slopes

In northern San Diego county Interstate 5 traverses lagoons, mesas, small canyons, and arroyos in a series of through-cuts and fill embankments. Natural slopes along the

corridor demonstrate a maximum slope inclination of about 1:3 (vertical to horizontal). These slopes are typically vegetated by native scrub with some intrusion from exotic species. Steeper natural slopes exist locally within the project corridor where sandstone is moderately to well cemented and where resistant terrace formation overlies softer sedimentary formations, slopes displaying a "badlands" type weathering surface are not in equilibrium with the environment and are experiencing excessive erosion. Seeps, springs and streams occur at the toe of some slopes and within some cut slope faces.

Existing Cut Slopes

Existing cut slopes are typically inclined at 1:2 (vertical to horizontal) and are up to 45 m high. The cut slopes primarily expose Torrey Sandstone of Eocene age and are relatively stable. They are vegetated with indigenous and exotic plants. Cut slopes typically include a brow ditch around the upper perimeter and a wide drainage bench midway up slope. The bench feeds numerous down-drains that collect runoff and pipe it to the paved roadway below. Some cut slopes along the corridor are relatively bald and display a "badlands" type surface indicating erosional instability. Other slopes in indurated sandstone have a smooth appearance and remain relatively bare of vegetation even after several decades.

Existing Fill Slopes

Existing fills vary in thickness along the travel way. Fill slope angles are typically 1:2 or flatter; however, there are a few locations where fill slope angles are steeper. Several large embankments rest on relatively young, soft lagoonal deposits. Material used in the embankments was generated in cuts notched through the adjoining mesa. Embankment material, therefore, is similar in composition to material forming cut slopes. Archived Log of Test Borings reveal that the sandy embankment fills are generally medium dense and presumably compacted to Caltrans Standards. Fill slopes are generally well vegetated with native scrub and exotic species.

2.2.3 Existing Development

Beyond the right-of-way, the freeway corridor is moderately to densely developed with residential and light commercial properties. Most mesa tops have been terraced by cut and fill grading operations. Development and grading has taken place up to the State right-of-way. Some agricultural land and open space buffers still exist along the freeway. At the lagoons, I-5 is bounded by wetland preserves.

2.2.4 Existing Utilities

Numerous buried and overhead utilities are present in the project area. These include, but are not limited to, buried culverts and sewer lines, buried and overhead electric, gas, and telecommunications facilities. Existing utilities conflicting with construction activities will require protection or relocation during construction. The location of all utilities should be verified prior to subsurface investigation or construction. A list of existing culverts noted

during project reconnaissance, with old stationing taken from As Built plans, has been produced and presented in Table 2.

2.3 Proposed Improvements

The project will consist of cut and fill grading, construction of earth retaining structures, and widening or reconstruction of bridge structures. Soundwalls may be constructed to mitigate noise impacts. Drainage improvements including culvert extensions or replacements will be necessary to facilitate embankment modifications.

2.3.1 Proposed Roadways

Proposed improvements include the widening of I-5 and part of Route 805 by adding two to four general-purpose lanes, two HOV lanes, and auxiliary lanes in certain segments where necessary. The proposed widening along the project alignment is summarized in Table 4. Example cross sections are shown in Figure 5.

2.3.2 Proposed Bridges

Bridges at lagoons and undercrossings will be widened. According to the Project Study Report the following four bridges, with zero horizontal clearance will be replaced:

Bridge # 57-529 @ Birmingham Dr. KP 64.09 Need to read to 22 bridges
Bridge # 57-530 @ McKinnon Av. KP 64.55
Bridge # 57-532 @ Request St. KP 66.26
Bridge # 57-702 @ 4th St. / Bush St. KP 85.89

2.3.3 Proposed Retaining Walls

Retaining walls will be necessary to accommodate widening along the I-5 alignment. The currently proposed retaining walls are summarized in Table 1. Retaining walls may be added or eliminated from the project during final design. Additionally, the height, length, and type or retaining wall may change during final design.

2.3.4 Proposed Soundwalls / Sound Berms

Soundwall locations for the project have not yet been identified. Soundwalls may be constructed along portions of the freeway adjacent to residential areas. Depending on the conditions at the soundwall locations, foundations may consist of spread footings, trench footings, or Cast-in-Drilled-Hole (CIDH) piles. The type of foundation may be selected based on soil parameters, slope geometry, cost, and construction considerations.

3. PERTINENT REPORTS AND INVESTIGATIONS

M.P. Kennedy, CDMG (publication 200), 1975.

Caltrans Materials Report, September 22, 1959.
Caltrans Slope Recommendations, June 22, 1988.
Caltrans Geologic Hazard Review, June 23, 1997.
Caltrans Geotechnical Investigation Report EA 11-0301U1, April 12, 2001.
Caltrans Memorandum, Hydro geologic Assessment (I-5 Detention Basin), July 20, 2003.
Division of Highways, (December 1, 1959) *Supplemental Materials Report, For the Construction of a Freeway on State Highway 2 Between Sorrento Road and Sen Elijo Lagoon Sta 1124+/- to 1416+/- Road XI-SD-2-SD, A Net Length = 5.5+/- Miles.*
Division of Highways, (March 13, 1961), *Supplemental Materials Report, For the Construction of a Freeway on State Highway 2 form Carmel Valley Road to Cannno Road Sta. 1075+/- to 1895+/- "Cbd" Road XI-SD-2-SD, A, Cbd Net Length = 15.7 Miles.*
Division of Highways, (June 4, 1964), *Supplemental Materials Report, For the Construction of a Freeway on State Highway 2 (New Route 5) form San Marcos Road to 4.4 Miles South of Rte. 196 (New Route 78) Sta. 1554+/- to 1835+/- "Cbd" Road XI-SD-2-A (SD-5) Net Length = 5.4+/- Miles.*
Caltrans, (April 12, 2001), *Geotechnical Investigation Report, Interstate 5 and 805 Interchange, Proposed Retaining Walls,* 11-Sd-5/805, KP 48.9-51.2/43.9-46.5, 11-0301U1.
Dokken Engineering , (February 27, 2004), *Geotechnical Investigation Manchester Avenue at Interstate 5 interchange Bridge No. 57-0458 and 57-New,* 11-SD-5, KP R61.58, 11-241400.
Dokken Engineering , (June 9, 2003), *Structural Foundation Investigation Manchester Avenue at Interstate 5 Interchange Bridge No. 57-0458 and 57-New.*
Kleinfelder, (March 12, 1991), *Final Report of Geotechnical Investigation Palomar Airpoart Road Overpass Widening at Interstate 5 and Associated Improvements Carlsbad, California* ,11-SD-5, PM R46.6/R47.9, 11203-153911, Project No. 51-1417-03.
Caltrans, (November 22, 1991), *Foundation Recommendation San Dieguito River Bridge (Widening and Retrofit) Bridge No. 57-0488R/L,* 11-SD-5, PM 35.66, 11222-189151.
Caltrans, (December 16, 1992), *Earth Retaining Structure Design,* 11-SD-5, PM R31.8/R35.0, 11-030111.

4. PHYSICAL SETTING

4.1 Climate

A review of 2002 climatic data for the general project area within San Diego County indicates that the alignment is in a semiarid region with mean temperatures ranging from approximately 21°C in September to approximately 13°C in January. Temperature data from the National Climatic Data Center indicate a mean annual temperature of 17°C. Precipitation data indicate a mean annual rainfall of about 300 mm per year. Rainfall primarily occurs during the months of November through March. The site may be considered frost-free, with fewer than five days per year recording temperatures considered to be freezing.

4.2 Topography and Drainage

In Northern San Diego County, Interstate 5 runs roughly parallel to the coast within just a few kilometers. The landforms traversed are comprised of a series of uplifted and incised wave cut terraces (mesas) that parallel the existing coastline. East-west trending river valleys and arroyos dissect these terraces and conduct ephemeral streams and perennial rivers and streams west to the ocean. Terrace elevations are typically 100 meters or less while stream and lagoon elevations are at or slightly above sea level.

The lagoons and rivers crossed by I-5 represent broad topographic lows that occur at semi regular intervals along the freeway corridor. These topographic lows are subject to tidal flow and episodic flooding arising from hinterland storm runoff.

4.3 Man-Made and Natural Features of Engineering and Construction Significance

The man-made and natural features of engineering and construction significance along the proposed I-5 widening project consist of the following:

Overcrossings
- Del Mar Heights Road
- Via De La Valle
- Birmingham Dr.
- Mackinnnon Ave.
- Requezast St.
- Leucadia Blvd.
- La Costa Ave.
- Poinsettia Ln.
- Palomar Airport Rd.
- Cannon Rd.
- Chinquapin Ave.
- Tamarack Ave.
- Las Floras Dr.
- 78/5 Separation
- Cassidy St.
- California St.
- Oceanside OH
- Brooks St.
- Fourth St.
- Camp Del Mar
- Fallbrook Wye OH
- Stuart OH
- Fallbrook OH

Undercrossings
- Via De La Valle
- Lomas Santa Fe
- Manchester Ave.
- Santa Fe Dr.
- Encinitas Blvd.
- Chestnut Ave.
- Carlsbad Village Dr.
- Mission Ave.
- 76/5 Separation
- Camp Pendelton

Lagoons and Rivers (Embankment Fills and Bridges)
- San Dieguito River/Lagoon
- San Elijo Lagoon
- Batiquitos Lagoon
- Aqua Hedionda Lagoon
- Buena Vista Lagoon
- San Luis Rey River

Major Cuts
- Del Mar Heights area
- North of Lomas Santa Fe
- North of Manchester Ave.
- Leucadia Blvd. area

Major Culverts
78 inch RCP 1465+75 A
66 inch RCP 1598+20 A
84 inch RCP 1682+22 A

Existing Retaining Walls
-Del Mar Heights Rd. NB/SB on ramps (Type 1 wall)
-Encinitas Blvd. NB on ramp (concrete crib wall)
-Tamarack NB/SB on ramps (concrete crib wall/Type1 wall)
-Northbound connector 5/78 (Type 1 wall)
-Mission Ave. SB off ramp (Type 1 wall)
-Leucadia SB on ramp (Type 1 wall

4.4 Regional Geology and Seismicity

4.4.1 Regional Geology

The project site lies within the coastal plain section of the Peninsular Ranges Geomorphic Province of California. The coastal plain generally consists of subdued landforms underlain by Cenozoic sedimentary formations. The Peninsular Ranges Province is characterized by northwest trending ridges and valleys, and several similarly trending faults in the region.

The southern portion of the Peninsular Ranges Geomorphic Province is known as San Diego Embayment. The San Diego Embayment consists of thick sequences of marine and non-marine sediments. These sedimentary rocks form an eastward-thinning wedge of continental margin deposits extending from Oceanside, California southward to the Mexican border.

The general geologic units in the vicinity consist of the Eocene age Ardath Shale, Torrey Sandstone and Scripps Formation. At the northern extent of the San Diego Embayment the contacts between the Eocene units are not distinct and therefore the three units have been treated as one formation, the Santiago Formation, by some authors. Pleistocene age terrace deposits and artificial fill overlie the Eocene units. The terrace deposits consist of red-brown near-shore marine and non-marine clayey and silty sandstones. The terrace deposits are widespread and well exposed in areas adjacent to the present-day coastline

The Ardath Shale, Torrey Sandstone and Scripps Formation form a wedge of channeled deep-water deposits in the study area (Lamar, et al, no date). The Ardath Shale generally consists of olive-gray, weakly fissile shale. Clay stone locally comprises up to 25 percent of the formation, and landslides are commonly associated with the clay stone beds (Kennedy and Peterson, 1975).

The Torrey Sandstone consists of white to light brown, medium-grained sandstone. The formation is broadly cross-bedded and well indurated.

The Scripps Formation consists of pale yellowish brown medium-grained sandstone with local siltstone and cobble conglomerate interbeds.

Published geologic maps indicate that three distinct terraces exist in the site area. The lowest terrace unit in the general site area crops out between elevations 0 and 20 meters. The intermediate terrace generally crops out between elevations 20 and 60 meters. The uppermost terrace is exposed between approximate elevations of 60 and 75.

Two principal rock units generally underlie the project area: a Mesozoic igneous and metamorphic rock basement and superjacent late Cretaceous, Eocene, Pliocene, Pleistocene, and Holocene sedimentary succession of strata. The basement is composed of

Upper Jurassic Santiago Peak Volcanics and mid-Cretaceous granitic rocks of the Southern California Batholith. The post-batholith superjacent sedimentary succession includes Upper Cretaceous Rosario Group, Eocene La Jolla and Poway Groups, Pliocene and Pleistocene San Diego, Lindavista, and Bay Point Formations. Holocene is represented by alluvium, slopewash, landslide, stream, terrace, and beach deposits. In addition artificially compacted fill was placed in some areas (Kennedy and Peterson, 1975).

Kennedy and Peterson CDMG (publication 200) mapped the North County geology at a scale of 1:24,000. The units observed and mapped (Figure 6) along the proposed project are consistent with those presented by Kennedy. These units include: Artificial Fill; Colluvium; Alluvium; Quaternary Lagoonal Deposits, Quaternary Terrace Deposits, Quaternary Bay Point Formation; Quaternary Lindavista Formation, Tertiary San Mateo, Santiago Formations, Torrey Sandstone, and San Onofre Breccia. These units are described below (after Kennedy and Weber):

Artificial Fills
Fills created from the activities of man derived from local materials and placed either consistent with current engineering practices or placed without regard to current engineering practices.

Lagoonal Deposits
Fine, silty, clayey, organic rich deposits adjacent to lagoons. Poorly consolidated, relatively soft and loose.

Alluvial and Colluvial Deposits
Silty, sandy, gravelly river and stream deposits and clayey, silty, sandy, gravelly slope wash.

Quaternary Bay Point Formation
Marine, and nonmarine, poorly consolidated, pale brown, fossiliferous, fine and medium grained sandstone.

Quaternary Lindavista Formation
Nearshore marine and nonmarine sediments comprised of moderate reddish-brown, ferruginous cemented, interbedded sandstone and conglomerate.

Tertiary San Mateo Formation
Pale yellowish-gray and brown, marine sand and gravel. This unit is subject to rilling when exposed in cut slopes.

Tertiary San Onofre Breccia
Dark greenish-brown breccia-conglomerate with average clasts 6 inches long comprised of rocks of the Catalina Schist. This unit is well indurated that forms stable steep natural and artificial slopes.

Tertiary Santiago Formation
Bedded sandstones, claystones, and siltstones. Colors range from pale gray, white, dark gray, green, and brown. Landslides and surficial slope failures are frequently associated with this unit.

Scripps Formation
Sandstone with moderately well defined bedding that locally contains interbeds of conglomerate and sandy siltstone.

Ardath Shale
Richly fossiliferous impermeable silty shale. Expandable claystone often composes up to 25% of this unit and landslides are commonly associated with these areas. Susceptible to bedding plane failures.

Torrey Sandstone
White to light brown, medium to coarse grained, sub-angular, moderately well indurated, broadly cross-bedded (near shore depositional environment), arkosic (quartz rich) sandstone. Generally horizontal formation with slight dip to the west and north.

Delmar Formation
Pale gray to white, marine, sandstone, clayey siltstone, and claystone (organic shale). Generally horizontal formation with slight dip to the west and north. Landslides and surficial slope failures are frequently associated with this unit.

4.4.2 Seismicity

Tectonically, San Diego County rides atop the eastern margin of the Pacific Plate, grinding along the edge of the North American Plate towards the northwest at an average annual rate of about 2.5 cm per year. As a result, the region is characterized by complex systems of active northwest trending faults and associated seismicity (Figure 3).

Major fault expressions near the project alignment include the San Andreas, San Jacinto, Elsinor, and Rose Canyon Fault Zones. Additionally, a complex system of northwest trending faults offshore from San Diego, which include the Coronado Banks and San Diego Trough Faults, are potential seismic sources that may cause minimal to moderate shaking at site.

A list of all active faults (based on 1996 Caltrans Seismic Hazard Report) within 70 km of the site is provided in Table 5.

4.5 Soil Survey Mapping

For our study we reviewed the Soil Survey of San Diego Area, California prepared by U.S.

Department of Agriculture, Soil Conservation Service and Forest Service (1973).

Our review of the Soil Survey Report indicates that there are 8 different soil units (Associations) identified within the alignment study area. These units are classified in Table 6.

5. EXPLORATION

This report is preliminary and is based on review of archived information and field reconnaissance. Except for infiltration testing, no subsurface exploration or laboratory testing was conducted specifically for this report.

5.1 Geologic Mapping

A geologic map of the alignment has been prepared for the I-5 widening project and is presented in Figure 6. The map is based on the results of field reconnaissance, review of pre-existing geologic maps, and data from archived material.

6. GEOTECHNICAL TESTING

No testing was performed specifically for this report. Applicable soil behavior parameters for the various geologic units present have been developed from preceding investigations, reports, and local knowledge. A summary of existing tests and analyses conducted on soil from within the project area along with copies of individual test results has been presented in Appendix B.

7. GEOTECHNICAL CONDITIONS

7.1 Site Geology

Along the 43.4 km length of the proposed project on I-5, the freeway traverses terrain comprised of three predominate and repetitive geologic features: 1) through cuts in relatively young marine terrace, sandstone, and shale formation, 2) unconsolidated lagoonal alluvium, and 3) artificial fills. These features can be observed in Figure 2.

<u>Formation</u>

The natural and cut slopes along the project alignment are primarily composed of Torrey Sandstone and Delmar Formation. These formations are described in Sections 4.4.1 and 7.1.1. These units are generally capable of supporting large stable cut slopes at a 1:2 inclination. These units may support much steeper temporary excavations. The borrow soil derived from these units is generally well suited for use as engineered embankment fill.

Artificial Fill

Four major lagoons are spanned by freeway embankment fill ranging in height from 4 to 24 meters. Strut fills are incorporated at lagoons for additional stabilization. Numerous smaller fills exist elsewhere along the alignment. Exploratory borings show the embankment fills to have the general composition of medium dense silty sand, consistent with locally derived borrow. The roadway fills have slopes inclined at 1:2 and appear to be performing well. Some large areas of embankment settlement have been previously determined to be the result of settlement of the underlying alluvium. Settlement may also result from the presence of collapsing shales.

Lagoonal Alluvium

The lagoon sediments are composed of weak, poorly consolidated, sand, silt, clay, and gravel with more consolidated soil at depth. Within the project limits, lagoon alluvium ranges in depth up to 40 meters. These relatively weak soils may be subject to consolidation settlement and bearing capacity failure upon the application of additional overburden that will result from freeway widening. During early freeway construction, embankment fills were placed gradually to avoid failing the weak alluvium, and as much as two to three meters of settlement of the finished embankment were recorded. The overlying fills have acted to densify and strengthen the alluvial soils, however, it remains necessary to analyze and mitigate the consequences of additional loads.

With reference to Caltrans Geotechnical Investigation Report dated April 12, 2001, the following 6 geotechnical units have been encountered underlying the alignment between KP 48.3 - KP 54.9 along the I-5 and KP 44.5 to the junction of I-5 along I-805: Artificial Fill, Alluvium, Bay Point Formation, Ardath Shale, Torrey Sandstone, and Delmar Formation.

7.1.1 Lithology

Fill Soils (Qf)

Primarily engineered freeway embankment fill.

Alluvium (Qal) and Slope wash (Qsw)

Poorly consolidated silt, clay, sand and gravel. Primarily soft/loose lagoonal deposits.

Terrace Deposit (Qt)

Reddish brown, poorly bedded, poorly- to moderately indurate sandstone and conglomerate. The three lower levels have been correlated with the Bay Point Formation and the highest level with the Linda Vista Formation.

Santiago Formation (Tsa)

Light-colored, poorly-bedded, poorly indurate, fine to medium grained Sandstone interbedded with landslide-prone siltstone. Local coarse grained sandstone and conglomerate. Renamed from Scripps Formation in Encinitas (Tan, 1986) and Rancho Santa Fe (Tan, 1987) quadrangles. It interfingers with Torrey Sandstone. There are massive to thinly-bedded small crossbeds and calcite (calcium carbonate) cemented concretions with silty claystone layers laminated to thinly bedded, green, purple, and gray and minor gravel conglomerate.

Torrey Sandstone (Tt)

Part of the La Jolla Group. Light colored, massive and thick bedded, well indurate, medium to coarse-grained arkosic sandstone. Resistant to landsliding. It interfingers with Santiago Formation. Torrey Sandstone is porous and permeable and therefore very susceptible to erosion. The unit is generally stable at 1:1.5 slopes but unprotected slopes are subject to rilling from ground water and severe sloughing.

Del Mar Formation (Td)

Part of the La Jolla Group. Poorly bedded, poorly indurate, landslide prone, sandy claystone, interbedded with medium to coarse grained, gray sandstone. Because the unit is rich in expansive clay, it expands when wet and contracts when dry thus causing structural damage to any development built on it. The unit stands poorly at 1:1.5 slopes and rilling occurs on unplanted slopes. A similar greenish colored claystone also occurs locally in the Santiago Formation.

7.1.2 Natural Slope Stability

Natural slopes along the corridor are gentle and demonstrate a maximum slope inclination of about 1:3. Many of these slopes are greater than 100 meters in height. No landslides were mapped within the project limits. Steep slopes in the project area (1:2 and greater) exist naturally in arroyos or where hard cemented terrace formation forms a resistant cap over softer sediments creating a "hogback" morphology. These slopes are bald and display a "badlands" type weathering surface indicating that they are not in equilibrium with the environment and are experiencing excessive erosion.

At some locations, bedding plains can be seen dipping two to three degrees westward. As a result, west facing natural slopes and cuts may have the adverse condition of beds dipping out of slope. Seeps, springs and streams occur at the toe of some slopes and at the contact between permeable sandstone and impermeable shale. The resulting accumulation of hydrostatic pore pressure may also contribute to slope instability. The catastrophic effect from the combination of adverse bedding and excessive pore water pressure on west facing slopes can be viewed in the sea cliffs just west of the I-5 in the City of Encinitas. Here, large landslides and the various schemes to mitigate them can be viewed from the beach.

7.2 Subsurface Soil Conditions

Our characterization of the subsurface conditions along the alignment is based on the results of our site observations, local knowledge, and archived subsurface information derived from previous geotechnical investigations within the project limits.

The subsurface conditions along the alignment consist of a succession of relatively competent near horizontal sedimentary strata at cut locations; weak, poorly consolidated alluvial deposits at the lagoons; and sandy engineered embankment fill. The formations within the project limits, and the fill material derived from cuts in those formations, generally provide good subgrade for roadways and retaining walls. The soft lagoonal deposits may be subject to settlement and bearing capacity failure due to the placement of additional surcharge. Preliminary stability and settlement analyses based on estimated soil parameters are provided in this report. However, specific and detailed analysis of final project features will be necessary during final design.

Shrink-swell behavior may be associated with some of the clay beds within the sedimentary deposits. These materials shrink and swell in response to changing soil moisture. Shrink and swell could adversely affect the structural section, predispose slope faces to erosion, and compromise slope stability.

Based on our review of previous investigation reports that were performed by Caltrans and various consultants (Yazdani, 1995; Woodward-Clyde, 1993; Leighton & Associates, 1992; Ninyo & Moor, 1996 and 1990), we have established generalized soils parameters that were used in our foundation analyses. The foundation analyses were based on procedures outlined in the FHWA manual (Cheney and Chassie, 1993). Table 7 below lists the pertinent geologic units and their geotechnical parameters used in the preliminary analyses.

Table 7: Archival Soil Strength Parameters

GEOTECHNICAL UNIT	COHESION (kPa)	ANGLE OF INTERNAL FRICTION (degree)	IN-SITU DRY DENSITY (kN/m^3)
Ardath Shale	14.3	28	18.9
Torrey Sandstone	9.6	33	18.9
Bay Point Formation	24.0	38	19.6
Existing Fill	9.6	32	18.9
Structural Fill/Backfill	9.6	36	18.9
Sand - Alluvium	0.00	26	18.9*
Lagoon Alluvium (short term loading)	19.1*	0*	18.9*
Lagoon Alluvium (long term loading)	28.7*	15*	18.9*

*Soil strength parameters are based on engineering judgment and local knowledge. These strength parameters are a rough approximation and are for preliminary design only.

7.3 Water

7.3.1 Surface Water

Along Interstate 5 in North San Diego County, surface water is encountered in four lagoons, two rivers, and several smaller drainages. The major surface water features are listed below as they exist in order of south to north.

Feature	Approx. Length of Freeway Crossing
• San Dieguito River/Lagoon	1900 m
• San Elijo Lagoon	450 m
• Batiquitos Lagoon	900 m
• Aqua Hedionda Lagoon	350 m
• Buena Vista Lagoon	250 m
• San Luis Rey River	

The lagoons are subject to tidal flow from the ocean and storm runoff from inland valleys so they are periodically inundated. They are shallow and primarily have soft muddy bottoms except at the main flow channels where the water depth may be a few meters and the channel bed my contain some sand.

At the freeway crossings the rivers are narrow with existing bed widths of about 60 meters. However, the alluvial valleys of relatively soft sediment beneath the rivers are significantly broader. Most of the year these rivers are small streams fed by urban and rural drainage and groundwater seepage. During the wet season flows within these rivers are greatly increased. Dams and/or sand mining operations occur on these rivers up stream of I-5; therefore sediment loads are not consistent with historic levels and riverbed degradation may be occurring.

Within the project limits, several small drainages and culverts convey minor year round flows. The flows are attributable to urban runoff and/or perched groundwater seepage. The existing culverts and storm drains are listed in Table 2. Many of these drainage features must be rerouted, upgraded, and/or extended to accommodate freeway widening.

7.3.2 Groundwater

Seeps, springs, ephemeral streams, and perched water have been identified within the project limits. These phenomena often occur at the toe of slopes and embankments, at the contact between permeable sandstone and impermeable shale, within cut slope faces, at grade, and within canyons crossed or traversed by I-5.

One such seepage location is on the east cut slope of northbound I-5 at Encinitas, between Manchester Ave. On-Ramp and Birmingham Drive Off-Ramp. Rainwater infiltration and the irrigation of the residential complex at the top of the slope contribute to the groundwater seepage throughout the year. The occurrence of groundwater in slopes can significantly influence slope stability.

In areas adjacent to the Lagoons depth to groundwater is anticipated to be shallow with groundwater being encountered at or slightly above mean sea level. Excavations at and below lagoon surface elevations will be prone to inundation from groundwater infiltration. Saturated soils and cyclic pore pressure fluctuations will predispose excavations in poorly consolidated deposits at or below the water table to collapse.

7.4 Project Site Seismicity

Due to the proximity of active fault zones the project site is subject to seismicity. The following section describes the seismic considerations for use in design of the project.

7.4.1 Ground Motion

Ground shaking due to nearby and distant earthquakes should be anticipated during the life of the facilities. The closest active major fault to the site is the Newport Inglewood/Rose Canyon East Fault, which runs offshore in a northwest trend at a distance of about 7 km west of the site. A map of peak ground acceleration contours based on the maximum credible earthquake is presented in Figure 3. A summary of nearby faults is given in Table 5. Selection of the design ground motion parameters is discussed in Section 8.1.1.

7.4.2 Ground Surface Rupture and Displacement Due to Faulting

Ground surface rupture due to active faulting is considered unlikely within the project limits due to absence of known active fault traces. The proposed project is outside any Alquist-Priolo special study zones. The potential for cracking of surface as a result of nearby or distant events is also considered unlikely. In general, seismic hazards might include strong ground motion, liquefaction, seismically induced settlement, and embankment spreading. Each of these potential hazards is discussed in the following sections.

8. GEOTECHNICAL ANALYSIS AND DESIGN

8.1 Dynamic Analysis

8.1.1 Parameter Selection

The proximity of the project area to the Rose Canyon Fault establishes the potential for the

area to be impacted by a significant seismic event. The Rose Canyon Fault displaces Holocene sediment and is therefore considered active. The Maximum Credible Earthquake on this fault has been estimated to be of magnitude 7.0. The Peak Bedrock Acceleration at the project site could range up to 0.5g and have a duration of 15 to 20 seconds (from the California Seismic Hazard Map 1995 by Lalliana Mualchin and DMG OFR92-1).

The effective seismic horizontal coefficient, k_h, used in pseudo-static slope stability analysis is specified in Caltrans Guidelines for Foundation Investigation and Reports (Version 1.2) as 1/3 of the peak ground acceleration.

8.1.2 Analysis of Seismic Effects

A significant seismic event could cause lateral spreading, cracking and slumping, of both existing and proposed embankments. Embankments and facilities built over loose, sandy, saturated foundation soil (i.e. river beds and lagoons) may also be subject to the effects of liquefaction. Liquefaction involves a sudden loss in strength of a saturated, cohesionless soil (predominantly sand) caused by cyclic loading such as an earthquake. This results in temporary transformation of the soil to a fluid mass. Typically, liquefaction occurs in areas where groundwater is less than about 15 m from the surface and where the soils are composed predominantly of poorly consolidated fine sands, silty sands, and non-plastic silts. Seismically induced liquefaction could cause embankment settlement and structural failure. Areas that would mostly be affected by seismically induced liquefaction are the embankment fills and structures at the lagoon and river crossings.

Embankment failures due to earthquakes are difficult to prevent. These failures are manifested as excessive total and differential settlement and damage to pavement structural section. Currently, the existing fill embankments at the lagoons are supported by strut fills. These strut fills act to restrain the embankment from potential slumping or spreading. Additionally, the strut fills, up to 9 meters high, have helped to densify the native soils beneath, thereby lowering the liquefaction potential. In addition they would help to contain liquefied soil during a seismic event.

Previous liquefaction testing and analyses have been performed along the project corridor. Reports addressing liquefaction were found for the San Diequito River Bridge and Manchester Avenue Bridge. The results for the Manchester Avenue analyses are listed in the Table 8 below. For preliminary design purposes, it should be concluded that the soils at all lagoons and river valleys are predisposed to liquefaction.

Table 8: Archival Liquefaction Data

Location	Liquefaction Analyses	Lateral Deformation & Spreading	Prepared By	Year of Analyses
Manchester Ave. at I-5 KP R61.58	240 mm of settlement	3 m	Southern California soil & Testing, Inc.	2004

8.2 Cuts and Excavation

Cuts and excavations, both temporary and permanent, will be utilized to gain the additional roadway width necessary to construct the I-5 widening project. The locations of planned cut slopes are provided in table 3.

8.2.1 Cut Slope Stability

Slope stability is a function of slope geometry, soil or rock strength parameters, geologic structure, saturation and pore water-pressure, and external loading. Additionally, slope faces are subject to consideration of surficial stability and erosion. Cut slopes inclined at 1:2 (vertical to horizontal) are generally considered stable and suitable as permanent slopes on freeway projects unless some geologically adverse condition is present such as weak adversely oriented bedding, expansive clay, or an ancient landslide. Steeper permanent cut slopes may be acceptable in the presence of favorable conditions such as cuts in well indurate sedimentary formation or massive rock.

Caltrans criteria for slope stability on newly designed non-existing permanent slopes dictate that slopes meet a minimum static factor of safety of 1.5 and a pseudo static (seismic) factor of safety of 1.1.

The global stability of various representative slope geometries was evaluated using the computer programs STEDWIN and GSTABL7. The soil strength parameters provided in Section 7.2 were used in the analyses. A summary of the global stability analyses is presented in Table 9. The results of computer program analyses are contained in Appendix C. From Table 9 it can be seen that 1:2 slopes can be assured of meeting the slope stability requirements for permanent slopes. Slightly steeper slopes up to 1:1.75 may be appropriate on a case by case basis where favorable soil conditions exist and relatively small slope heights of five meters or less are proposed. For preliminary design, the allowable inclination of cut slopes should be 1:2. It should be noted that slopes steeper than 1:2 are difficult to landscape and maintain.

8.2.1.1 Temporary Cut Slopes

Caltrans criteria for slope stability on temporary slopes dictates that slopes meet a minimum static factor of safety of 1.2 under the anticipated conditions throughout the life of the temporary slope. For preliminary design, the allowable inclination of temporary cut slopes as a function of slope height in various soils can be derived from Table 10. In general, the maximum allowable temporary cut slope inclination in competent formation (sandstone) should be limited to no steeper than 1:1. The maximum allowable temporary cut slope in all other areas should be limited to no steeper than 1:1.5.

Temporary cut slopes are prone to surface erosion. Slope erosion may supply an unacceptable sediment load to the watershed. Prolonged slope surface erosion may result in more pronounced slope instability leading to soil sloughing and potential slide failures. Temporary slopes should not be left unprotected throughout the wet season. Concentrated flow should not be allowed on slopes. Appropriate construction scheduling, soil tackifiers, geosynthetic mats, and plastic sheeting are some of the techniques that may be used to avert excessive slope erosion.

8.2.2 Cut Slope Benches

Higher cut slopes in sedimentary materials (Ts) are in general more susceptible to surface erosion and surficial sloughing. We recommend that all cut slopes in sedimentary materials (Ts) higher than 20 meters be constructed with mid-slope benches. Benches should be constructed in accordance with section 304.3 of Caltrans Highway Design Manual. Benches are not necessary where slope drainage is interrupted by mid-slope retaining walls designed to intercept surface runoff. Rock cuts do not require benches.

8.2.3 Rippability - Drillability

The project area is predominately underlain by Quaternary and Tertiary sedimentary units. These materials are covered, in some areas, by soil and recent colluvial deposits. The native soils range from friable to indurated with some areas being well cemented. For the most part, these materials are rippable by conventional heavy-duty grading equipment and are drillable by auger drill rigs. The cemented units (Torrey Sandstone and Scripps Formation for example) may yield oversized blocks of rock-like material and concretions. These lens and spheroid shaped masses have very high compressive strengths and can present a serious obstacle in the excavation of narrow trenches and tunnel borings. These hard units are a minor component of the stratigraphy within the project limits, but occasional difficult hard rock excavation should be anticipated. The anticipated hard material ranges from cobbles size up to and possibly exceeding three meters in dimension.

8.2.4 Earthwork Grading Factors

The cut areas are composed of stratified marine sediments and for the most part are sand or silty sands which are interspersed with lenses or pockets of silty or clayey materials of

an adverse nature.

Earthwork factors relate the in-place volume of material to be excavated to the in-place volume of the material after placement as fill. The factors are defined as in-place volume of compacted fill divided by in-place volume of material to be excavated.

$$G_f = V_{fill}/V_{exc}$$

Archived data indicate that on average the soil locally derived from cut areas will shrink during recompaction. It is recommended that the following grading factors be applied to the project:

Sedimentary Formation

a) Placed at 90% relative compaction: $G_f = 0.96$
b) Placed at 95% relative compaction: $G_f = 0.94$

8.3 Embankment

8.3.1 General Description

Much of the proposed I-5 widening will be accomplished by gaining additional roadway width through the placement of embankment fill. These fills will be keyed into the shoulders of existing embankment fill. It is anticipated that the majority of the soil needed to construct the fills will be derived from cuts in nearby formational strata. These strata will yield predominantly granular soil well suited for roadway embankment. Lesser quantities of clayey soil generated by roadway excavation may be mixed with the sandy soil to produce a more workable, stable embankment.

The approximate proposed fill areas, described with respect to stationing and proposed northbound/southbound roadway, are listed in Table 3.

8.3.2 Embankment Stability

As with cut slopes, embankment stability is a function of slope geometry, soil strength parameters, structure, saturation and pore water pressure, and external loading. Embankment stability is also a function of the stability of the underlying soil in response to the additional overburden presented by the fill. Fill slopes inclined at 1:2 (vertical to horizontal) are generally considered internally and surficially stable and suitable as permanent slopes on freeway projects. However, adverse conditions such as weak (lagoonal or alluvial) foundation soils may compromise embankment stability.

Caltrans criteria for slope stability on newly designed permanent embankment slopes dictate that slopes meet a minimum static factor of safety of 1.5 and a pseudo static (seismic) factor of safety of 1.1.

The slope stability of representative embankment fills placed over alluvium in lagoon areas was evaluated using the computer programs STEDWIN and GSTABL7, using circular failure surfaces and Bishop's Modified Method. The strength parameters listed in Section 7.2 were used in the analysis. Idealized stratigraphic profiles were utilized in the preliminary analysis because site specific exploration and testing was not performed for this phase of the project. The results of the computer analysis are contained in Appendix C.

To analyze the viability of various design concepts, representative stability simulations were chosen to reflect various embankment widening scenarios over lagoon alluvium. These scenarios included:

1. Stability of the existing embankment
2. Embankment widening with 1:2 fill slope (standard footprint)
3. Embankment widening with retaining walls (minimized footprint)
4. Embankment widening with 1:1.5 reinforced soil slope (compromise footprint)

Both short term (unconsolidated undrained) and long term (consolidated drained) loading conditions were considered when modeling fill placed over lagoon alluvium. The results of the embankment stability analysis may be summarized as follows:

- Embankment fills with slopes inclined at 1:2 may be used at all fill locations.
- Embankment fills with reinforced slopes (Section 8.3.3) inclined at 1:1.5 may be used at all fill locations.
- Embankment fills placed over lagoons should be placed in stages to allow excess pore water pressures to dissipate and take advantage of the resultant increase in foundation soil strength.
- Large retaining walls placed over lagoon alluvium are not likely to satisfy stability criteria without significant ground improvement of the foundation soil (Section 8.6).

8.3.3 Reinforced Soil Slopes (RSS)

Embankment fill slopes inclined steeper than 1:2 can be designed and constructed to be stable by incorporating layers of geosynthetic soil reinforcement into the compacted fill. These reinforced soil slopes provide the following advantages:

- Smaller fill footprint and impact compared to standard 1:2 slope.
- Lower cost compared to retaining walls.
- Can tolerate far more total and differential settlement compared to retaining walls.
- Relatively rapid construction compared to retaining walls.
- Global stability criteria satisfied with less difficulty for sloped embankment (as opposed to large retaining walls) placed over soft foundation soils.
- The slope face can support vegetation.
- Slopes are not considered structures.

Erosional stability and plant establishment at the slope face is a primary concern for the design of RSS slopes in arid and semi-arid environments. This concern is minimized when slope inclinations are no steeper than 1:1.5. Several vendors have provided proprietary slope facing systems. Crib wall members can also be used as slope facing systems. As proposed, RSS fills often do not extend beyond the limits of existing strut fills.

RSS fills have been implemented by Caltrans in southern California on the difficult terrain of mountain highways. OGDS supports the use of RSS fills and recommends they be considered for embankment widening over lagoons where it is desired to reduce the fill footprint.

8.3.4 Fill Slope Benches

Higher fill slopes are in general more susceptible to surface erosion and surficial sloughing and have a lower factor of safety. We recommend that all fill slopes higher than 20 meters be constructed with mid-slope benches constructed in accordance with Section 304.3 of Caltrans Highway Design Manual.

8.3.5 Settlement of Embankment

The construction of embankments will cause settlement where the foundation soils are compressible. The majority of foundation soil along the project is formation therefore little settlement will occur in conjunction with most fill placement. Placement of embankment over lagoon and alluvial soils will result in significant settlement. The amount of settlement depends on the height and width of the additional embankment and on the depth and compressibility of the foundation soil. The existing embankment fills have acted to consolidate and strengthen the underlying soft soils thereby reducing the anticipated settlement from additional loading. However, embankment settlement from the proposed loads may have minor impact on existing freeway lanes.

Analysis and prediction of settlement is typically based on site specific sampling and laboratory testing of the foundation soils. Such sampling and testing is beyond the scope of this report. Relatively accurate settlement calculations may be performed during final design following a program of subsurface exploration and testing, and when final embankment cross sections have been established. Records of previous geotechnical testing or actual settlement resulting from the original embankment placement could not be located and have likely been discarded. Recovered archived information provided settlement predictions for three locations along the project. At one location, the San Dieguito River crossing, settlement was said to have exceeded prediction by several feet. Rough estimates of anticipated settlement for soft soil locations are provided below. These estimates are based on the surmised settlement resulting from placement of the existing embankment multiplied by the ratio of additional embankment to existing embankment. For locations where no archived settlement information was found, the

anticipated settlement has been interpolated based on soil type and thickness. These estimates are preliminary in nature. Final settlement estimates should be based on newly developed site specific data from soil borings, laboratory consolidation testing, actual additional embankment loads, and calculations.

Location	Max. Predicted Settlement (1960's)	Compressible Alluvial Thickness	Estimated Max Anticipated Settlement
San Dieguito River	3 to 5 ft (0.9 to 1.5 m)	40 m	0.3 m
San Elijo Lagoon	1 ft (0.3 m)	27 m	0.1 m
Batiquitos Lagoon	3 ft (0.9 m)	33 m	0.2 m
Aqua Hedionda Lagoon	no data	14 m	0.1 m
Buena Vista Lagoon	no data	15 m	0.1 m
San Luis Rey River	no data	24 m	0.1 m

Previous reports for the design and construction of Interstate 5 recommended settlement waiting periods of up to two years before establishment of final grade. Settlement waiting periods will be necessary at all soft soil locations. The installation of wick drains prior to surcharging should greatly accelerate settlement of the foundation soil. Wick drains are discussed further in Section 8.6. It should be anticipated that even with the use of wick drains, settlement waiting periods of six months to one year should be accounted for in construction scheduling.

Various earth retaining systems have varying tolerances to differential settlement. These tolerances may greatly influence the chosen method of gaining additional roadway width. The settlement tolerance for various systems is provided in Section 8.4.

8.3.6 Embankment Placement and Subgrade Preparation

Where additional embankment is to be placed to accommodate freeway widening, subgrade preparation should follow Sections 16 and 19 of the Caltrans Standard Specifications. Where additional embankment will be placed directly on top of lagoon alluvium, a permeable drainage layer wrapped with a separating sheet of filter fabric will be required at the interface between the soft saturated lagoon soil and the new embankment. Where further geotechnical investigation reveals that lagoon alluvium is capped by organic laden mud, it will be necessary to excavate the mud cap and replace it with sand prior to placement of the drainage layer.

The rapid placement of embankment over saturated lagoon alluvium is likely to cause failure of the foundation soil as excessive pore pressures build with the increasing overburden. To avoid these failures, additional embankment should be placed in stages and sufficient time should be allowed for excess pore pressures to dissipate between stages.

8.3.7 Surface and Subsurface Drainage

Drainage for the proposed improvements should be constructed in accordance with Chapter 800 of Caltrans Highway Design Manual. Embankments should be protected from potential damage due to surface water or ground water. Surface runoff should be directed away from the top of slopes, and should not be allowed to discharge over the top of slopes. Surface water should be conveyed offsite by appropriate erosion-reducing devices. Where groundwater is present, subsurface drainage devices should be installed.

8.4 Earth Retaining Systems

Numerous retaining walls have been proposed along the I-5 alignment. The walls are listed in Table 1 and shown on the layout sheets presented in Figure 2. In general, Caltrans standard retaining walls (Type 1 through Type 5) or crib walls may be used without special design subject to the suitability of the foundation subgrade as determined by OGDS. Non standard retaining walls such as Mechanically Stabilized Earth (MSE) walls, Type 1 walls on pile foundations, or soil nail walls may be utilized in suitable locations, but will require a structure specific Foundation Report and special design by Structure Design during the project design phase. Preliminary geotechnical design recommendations for standard retaining walls, MSE walls and soil nail walls are provided herein. The wall type listed in Table 1 is the recommended type for each planned wall location.

Retaining walls must satisfy Caltrans requirements for internal and external (global) stability. For internal stability calculations, the minimum static sliding factor of safety is 1.5. Under seismic loading, a minimum sliding factor of safety of 1.1 is required. The factor of safety against overturning is considered acceptable if the resultant force on the base of the foundation falls within the middle 1/3 of the footing.

For external (global) stability consideration, the retaining wall and adjacent embankment geometry must be viewed and analyzed as a slope stability problem and evaluated according to the criteria presented in Sections 8.2 and 8.3. The wall and embankment geometry must also be viewed and analyzed for potential bearing capacity failure if soft foundation soils lay beneath the embankment. The anticipated differential settlement must also be within the tolerable limits for the type of retaining system.

Wall Type	Differential Settlement Tolerance (S/L)
Concrete Gravity	1/500
Concrete Cantilever	1/500
Concrete Crib	1/300
MSE (Modular Block Facing)	1/200
MSE (Precast Facing)	1/100
Reinforced Soil Slope	1/60

Preliminary slope stability calculations including cut slopes, fill slopes (unreinforced /reinforced), MSE Walls and Soil Nail Walls are contained in Appendix C. Global stability analyses simulating embankment widening with retaining walls over soft lagoon sediment was analyzed in Section 8.3.2.

Standard Retaining Walls

Caltrans Standard Retaining Walls Type 1 through 6 are designed for use at both cut and fill locations. Caltrans Standard Crib walls are designed for use at fill locations only. Applicable design criteria for these walls are presented in the following report sections. Designers must also consider the stability and extent of temporary back cuts necessary for wall construction and how back cuts may impact the existing roadway or right-of-way. Limitations on temporary cut slopes are presented in Section 8.2.1.1

The selection of wall type and the allowable wall height is highly dependant on the foundation soil. For preliminary design consideration, Type 1 Retaining Walls up to 5.5 meters in height may be placed on compacted embankment fill. Type 1 Retaining Walls up to 9 meters in height may be placed on sedimentary formation. Crib walls may be selected from the Standard Plans for placement on either fill or formation. Standard cast-in-place retaining walls and crib walls are not recommended for use over lagoon alluvium where large differential settlement is anticipated.

Mechanically Stabilized Earth Walls (MSE)

MSE walls are appropriate for fill locations only. These walls are generally considered economical where wall heights are greater than 3 meters. Applicable design criteria for these walls are presented in the following report sections. Designers must consider the stability and extent of temporary back cuts necessary for wall construction and how back cuts may impact the existing roadway or right-of-way. Designers should also consider potential conflicts between underground features such as storm drains and utilities and the embedded soil reinforcement behind the MSE wall face.

Due to the potential for corrosive soil conditions, it is likely that steel reinforcing strips or grids will not be suitable for soil reinforcement on the project. Geosynthetic soil reinforcement will be a likely component of MSE wall design.

For preliminary design consideration, MSE walls up to 4 meters in height may be suitable for placement above lagoon alluvium provided the wall foundation is kept within the limits of the existing embankment and strut fills. A more accurate determination is dependant on the final design cross sections and the results of subsurface exploration and testing. MSE walls greater than 4 meters in height placed above lagoon alluvium may necessitate ground improvement of the underlying alluvium (section 8.6). At all other fill locations, MSE walls of significant height may be considered for the project.

Soil Nail Walls

Soil nail walls are appropriate for cut locations only. These walls are constructed from the top down and have no footing. They are well suited as retaining structures in the competent sedimentary formations that are common on this project, particularly where mid slope walls are desired. Soil nail walls are highly economical for wall heights exceeding two meters. They are most economical when finished with a sculpted shotcrete face. The wall appearance is generally considered to be more aesthetic when the walls are slightly battered. Designers must consider the impact of the nail lengths on existing underground facilities and right-of-way requirements.

Exact retaining wall geometry is not yet known. Several anticipated slope and soil nail wall configurations were modeled for internal and global stability. For the purpose of preliminary design, the length of soil nails (L) may be determined as follows:

$L = 1.25(H)$, H = Wall Height
$L_{min} = 3$ m

The nail length may be less based on final wall cross section geometry and more precise site specific soil parameters. The preliminary findings were based on mid slope walls up to nine meters in height in competent sedimentary formation. Preliminary soil nail wall calculations are contained in Appendix C.

8.4.1 Wall Subgrade Preparation

Concrete spread footings, crib walls, or MSE walls may be founded on new compacted fill, competent sedimentary formations, or competent rock. Materials that can not be proof rolled or recompacted should be removed to competent material and replaced with compacted fill in accordance with Section 19-3.06 of Caltrans Standard Specifications. All foundation excavation should be observed by competent personnel to confirm the foundation subgrade meets the requirements of the geotechnical design report prior to placing steel or concrete.

8.4.2 Wall Embedment

Concrete footings founded on level ground should have minimum bottom-of-footing embedment of 0.6m below the lowest adjacent grade. MSE wall foundations on level ground should have a minimum embedment of 0.6 m or 10% of the wall height whichever is greater. All concrete or MSE wall foundations located on or adjacent to slopes should have minimum bottom-of-footing embedment of 1.5 meters at the slopeward edge of foundation. Crib walls should have minimum embedment and slope setback as specified in the Caltrans Standard Plans.

8.4.3 Allowable Bearing Pressure

The following Allowable Bearing Pressures may be assumed for the purpose of preliminary wall design.

Wall Type	Sedimentary Formation	Engineered Fill
Standard CIP	385 kPa	200 kPa
Crib	385 kPa	200 kPa
MSE	385 kPa	265 kPa

8.4.4 Wall Drainage

All of the above recommendations assume that the walls have adequate drainage provisions to prevent the buildup of hydrostatic pressures in the soil backfill. The drainage system for Type 1 walls shall be designed in accordance with Caltrans Standard Plan BO-3, Detail 3-1. MSE walls shall have an appropriate underdrain system. Soil nail walls shall have appropriate vertical strip drains between nail columns.

8.5 Soundwalls

The preliminary project plans received by OGDS do not include potential soundwall locations. However, soundwalls will be a likely project feature. The following information can be used for preliminary soundwall design.

The soundwalls will generally be supported on Cast-in-Drilled-Hole (CIDH) piles when located in embankment fill or at the slope hinge line. CIDH pile, trench footings or spread footing foundations may be used in sedimentary formation when soundwalls are located two meters or more from the slope hinge, with foundation type selection being based on economics. For Caltrans Standard soundwall designs (XS Sheets) we recommend an ultimate lateral soil pressure (SP) of 70.5 kPa/m for design of CIDH piles or trench footings in sedimentary formations. For soundwall founded in compacted fill, we recommend an ultimate soil pressure (SP) of 47.1 kPa/m. For spread footings, ultimate bearing capacity may be taken as 3 times the allowable values recommended in Section 8.4.2.2. All three of the above foundation types are located in the Caltrans Standard Plans 2004 (Figure B15-1, page 291 and Figure B15-3, page 293). For preliminary design of the soundwall piles a $\phi = 30$ degrees should be used with the pile data tables located on page 295 of the 2004 Standard Plans unless Ardath Shale is predominant. In such a case a ϕ angle of 25 should be used.

Soundwall foundations should be readily excavated in either fill or sedimentary formation using conventional equipment. Occasional hard cemented lenses and concretions should be anticipated during footing or pile excavation. Due to difficult access and lack of existing data along possible soundwall alignments, a foundation study to confirm final foundation type may be performed once the soundwall locations are determined.

8.6 Ground Improvement

Soft foundation soils, such as the alluvial deposits at lagoons, may require ground improvement prior to the placement of additional freeway embankment. Typical ground improvement methods for loose, soft, and weak foundation conditions include:

- Wick Drains
- Stone Columns (Vibro Replacement)
- Dynamic Compaction
- Soil Mixing
- Grouting (Jet and Compaction)

Of the listed methods; wick drains, soil mixing, and stone columns have been used in the project corridor. With the possible exception of wick drains, ground improvement techniques are very costly. It should be anticipated that widening the embankment slopes over the lagoons will require the use of wick drains to speed the dissipation of excess pore pressure in soft clayey foundation soil and accelerate settlement. It should also be anticipated that the design of large, near vertical retaining structures greater than four meters in height to accommodate embankment widening over lagoons would likely dictate that an extensive program of ground improvement be implemented in order to preclude wall failure and excessive settlement. This likelihood is evident through the results of the preliminary stability analysis conducted. Any size retaining wall placed on lagoon sediment beyond the current embankment footprint would likely require extensive ground improvement of the underlying soil. Such ground improvement programs would have a large impact footprint, be cost prohibitive, and may result in excessive construction delays and claims. It is therefore recommended that the use of large retaining structures to accommodate embankment widening over lagoons be avoided during project planning.

8.7 Lightweight Fill

The instability and settlement problems of soft/weak foundation soils may often be minimized through the use of lightweight fill. Many types of lightweight fill have been used for roadway embankment construction. These include geofoam (expanded polystyrene), tire shreds, and fly ash. The use of lightweight fill is not prevalent within Caltrans. The use of lightweight fills is generally confined to situations of special circumstances, such as where a lightweight material is available as a nearby waste product, or where the settlement produced by a conventional fill is intolerable. For I-5 widening, all such light weight fill material would need to be imported over large distances and likely require special processing and placement techniques. The use of lightweight fill should not be incorporated into the preliminary project design.

8.8 Corrosion

The corrosion potential of soils along the project alignment varies widely. Lagoons and lagoonal sediment represent a salt-water environment and are therefore very corrosive.

Torry Sandstone is generally non-corrosive while Ardath Shale is corrosive. The formational units are marine sediments in origin and can be expected to contain varying amounts of chlorides. Specific testing of soil corrosivity should be conducted during the project geotechnical investigation. For preliminary design purposes, all soils should be considered to be corrosive.

8.9 Infiltration / Detention Basins

Several potential infiltration and detention basin sites have been identified within the project limits. Soil sampling and infiltration testing is ongoing at these sites.

9 MATERIAL SOURCES

Material sources for the project will consist of locally excavated soil and rock materials, and possibly imported materials. No off site material sources have been identified for the project. On site excavations will consist mostly of sandstone with lesser volumes of shale. On average, the soil derived on-site will make suitable roadway embankment.

Materials used as pavement subgrade (upper 1.2 meters below finish grade) should be tested during construction to confirm they meet the R-Value requirements used in the structural section design. Soils with Expansion Index (EI) greater than 90 should not be used within 1.2 meters of finished grade. Materials used as backfill for culverts should be tested for corrosion potential to confirm the proper selection of culvert materials.

10. MATERIAL DISPOSAL

At this preliminary stage, the project was not mapped for the presence of material unsuitable for embankment subgrade or fill such as non-engineered fill, organic mud, highly expansive clay, stockpiled trash, or debris. Such material may be discovered during detailed geotechnical investigation. Some material may be reworked and utilized on the project. Any material generated during construction that is found to not be suitable as roadway subgrade, embankment, backfill, or topsoil should be properly disposed of off site.

11. PRELIMINARY DESIGN CONSIDERATIONS

11.1 Design Advisories

1. The soil at lagoon and river crossings is likely to be predisposed to liquefaction during seismic events. The selection of project features such as wall types and structure foundations should include consideration of liquefaction potential.

2. The allowable inclination of permanent cut slopes is 1:2 (vertical to horizontal). Slightly steeper cut slopes up to 1:1.75 may be suitable based on a site specific finding of favorable soil conditions such as well cemented sandstone with no adverse bedding

present.

3. The allowable inclination of temporary cut slopes is 1:1 in formation and 1:1.5 in fill. Steeper temporary cut slopes may be permitted based on a site specific soil properties, slope geometry, and analysis. Temporary slopes should not be allowed to stand unprotected during the wet season.

4. Cut and fill slopes higher than 20 meters should be designed with mid-slope benches. Benches may not be necessary where the slope is interrupted by retaining walls with appropriate slope drainage features.

5. The on site soils are expected to be rippable and drillable. It should be anticipated that hard cemented lenses and concretions will be encountered sporadically during excavation. Trenching, boring, and tunneling operations should be employ equipment and methods capable of handling random occurrences of hard rock.

6. The predominantly granular cut soils will be suitable for embankment fill. Clayey soil may be mixed with granular soil to produce suitable roadway embankment.

7. For embankment material generated on site, the following grading factor should be applied:

   Placed at 90% relative compaction: $G_f = 0.96$
   Placed at 95% relative compaction: $G_f = 0.94$

8. Unreinforced embankment fill slopes may be inclined at 1:2 or flatter.

9. Reinforced embankment fill slopes may be inclined at 1:1.5. Slope facing should be designed to provide adequate erosion control.

10. Embankment placed over lagoon and river alluvium will cause settlement. Embankment settlement should have minimal impact on existing freeway lanes. Settlement must be taken into account during the selection of earth retaining structures.

11. The rate of embankment settlement will vary with subsurface soil conditions. A settlement waiting period of six months to one year may be necessary before final roadway features can be constructed. The waiting period may be reduced by the installation of wick drains.

12. Over lagoon and river sediments it may be necessary to place embankments in stages to allow pore water pressures to dissipate and prevent embankment failure.

13. Due to stability, settlement, and cost considerations, embankment fills and reinforced soil slope fills (RSS) are recommended for roadway widening over soft lagoon and

river sediments.

14. Relatively rigid cast-in-place walls, such as Type 1, are not recommended as earth retaining systems above soft soil locations.

15. Mechanically Stabilized Earth (MSE) walls greater than 4 meters in height are not recommended as retaining systems above soft soil locations.

16. Retaining wall selection and preliminary design should follow the guidelines presented in Section 8 of this report.

17. Wall construction features such as temporary back cuts or soil nail lengths may impact existing facilities and right-of-way requirements.

18. Large, near vertical earth retaining systems located above soft lagoon and river alluvium are likely to necessitate ground improvement of the foundation soil. Such a ground improvement program would have a large impact footprint, be cost prohibitive, and may result in excessive construction delays and claims.

19. The corrosion potential of on site soils varies greatly. Final design of project features should be based on site specific corrosion testing.

11.2 Construction Monitoring and Instrumentation

Geotechnically trained personnel should be present during project construction to observe all cuts, foundation subgrade, and embankment subgrade to assure that the provisions set forth in the documents are appropriately enforced. When and if unanticipated conditions are encountered, the geotechnical personnel should make recommendations to the Resident Engineer who will in turn direct the contractor. Instrumentation for measuring settlement or slope distress is likely to be included in final geotechnical recommendations. A program of periodic surveying for ground movement should be included in project construction where the potential for ground movement and failure exists.

11.3 Hazardous Waste Consideration

No hazardous waste or hazardous site conditions were discovered during the preparation of this report. However, an environmental investigation was outside the scope of work.

11.4 Differing Site Conditions

Characterization of the geotechnical conditions along the project corridor is based on the review of preliminary plans, as-built plans, geologic maps, geologic literature, and archived reports and files. Interpolation and analysis was based on the information discovered. Except for field reconnaissance, no exploration was specifically conducted for this report. Sampling and testing was only performed for possible

infiltration/detention basins sites. Final geotechnical recommendations contained in Geotechnical Design Reports and Foundation Reports should be based on final project plans and feature specific exploration, sampling, testing, and analysis.

12. RECOMMENDATIONS AND SPECIFICATIONS

All grading and roadway work should be performed in accordance with the Caltrans Standard Plans and Specifications. Final recommendations and Special Provisions should be based on the findings of subsurface exploration, testing, and analysis as presented in final Geotechnical Design Reports and Foundation Reports. These reports should be based on accurate project features and alignments as they are established.

TABLES

TABLE 1 PROPOSED RETAINING WALLS I-5 WIDIENING

Proposed North Bound Retaining Walls					
Location	Retaining wall Reference # / Proposed Type	Approximate Max Height	Approximate Length	Station	
(between interchanges)		(meters)	(meters)	Begin	End
Camel Mountain / 56	34 / T1	6.7	1325	542+00	555+25
Del Mar Heights / Via De La Valle	35 / T1, SN	9.1	810	560+10	568+20
Via De La Valle / Lomas Santa Fe	36 / T1, SN	10.3	1587	593+69	609+56
Lomas Santa Fe / Manchester	37 / SN	9.1	1280	612+40	625+20
Manchester / Birmingham	38 / SN	3	69	629+95	630+64
	39 / T1, SN	10.9	980	631+80	641+60
	40 / T1	6.7	510	643+30	648+40
Birmingham / Santa Fe	41 / T1, MSE	4.2	160	651+80	653+40
	42 / T1	9.1	250	658+00	660+50
Santa Fe / Encinitas	43 / T1	3.6	30	664+20	664+50
	44 / T1	6.7	380	670+40	674+20
	45 / T1	4.2	170	675+30	677+00
Encinitas / Leucadia	46 / T1, SN	9.1	1560	679+20	694+80
Leucadia / La Costa	47 / T1, SN	7.9	200	696+00	698+00
	48 / T1, SN	7.3	2045	698+00	718+45
La Costa / Poinsettia	49 / T1, SN	7.9	1040	731+40	741+80
Poinsetta / Palomar Airport	50 / SN	5.5	355	744+45	748+00
	51 / SN	6.1	420	760+80	765+00
	52 / SN	4.8	100	765+60	766+60
Palomar Airport / Cannon	53 / TI	3.6	275	767+40	770+15
	54 / T1	4.2	90	780+50	781+40
Cannon / Tamarack	55 / T1	9.1	470	796+80	801+50
Tamarack / Carlsbad Village	56 / T1	5.5	250	803+40	805+90
	57 / T1	4.8	295	806+85	809+80
	58 / T1	5.5	465	810+15	814+80
Carlsbad Village / Las Flores	59 / T1	3	40	815+60	816+00
	60 / T1	3.6	245	821+85	824+30
Las Flores / 78	61 / T1	10.9	245	825+40	827+85

Proposed North Bound Retaining Walls					
Location	Retaining wall Reference # / Proposed Type	Approximate Max Height	Approximate Length	Station	
(between interchanges)		(meters)	(meters)	Begin	End
78 / Cassidy	62 / T1, SN	7.3	200	835+20	837+20
Cassidy / California	63 / T1, SN	4.8	290	840+00	842+90
	64 / T1	5.5	20	843+20	843+40
California / Oceanside	65 / T1	5.5	320	845+40	848+60
	66 / T1	3	10	849+25	849+35
	67 / T1	10.3	155	849+60	851+15
Oceanside / Mission	68 / T1	7.9	580	859+50	865+30
	69 / T1	10.9	65	865+35	866+00
	70 / T1	4.8	120	866+50	867+70
Mission / 76	71 / T1	8.5	720	871+00	878+20
76 / Harbor	72 / T1, SN	3	150	881+30	882+80
	73 / T1, SN	3	140	883+20	884+60
Harbor	74 / T1, SN	4.2	165	887+00	888+65
	75 / SN	3	70	890+80	891+50

TABLE 1 PROPOSED RETAINING WALLS I-5 WIDIENING

Proposed South Bound Retaining Walls					
Location	Retaining wall Reference # / Proposed Type	Approximate Max Height	Approximate Length	Station	
(between interchanges)		(meters)	(meters)	Begin	End
State Route 56 / Del Mar Heights	1 / T1	6.0	434	551+75	556+10
	2 / T1	8.0	324	556+06	559+30
Del Mar Heights / Via De La Valle	3 / T1,SN	9.0	875	561+05	569+80
	4 / T1, SN	10.0	414	589+20	593+34
Via De La Valle / Lomas Santa Fe	5 / T1	6	60	593+80	594+40
	6 / T1	6	528	595+92	601+20
	7 / T1	8	910	601+40	610+50
Lomas Santa Fe / Manchester	8 / SN	9.7	1348	611+72	625+20
Manchester / Birmingham	9 / T1, MSE	4.2	50	631+60	632+40
	10 / T1, MSE	9.7	220	634+60	636+80
	11 / T1, MSE	19.3	1140	638+80	650+20
Birmingham / Santa Fe	12 / SN	8.6	115	653+05	654+20
	13 / T1	7.3	260	658+60	661+20
Santa Fe / Encinitas	14 / T1	9.2	1160	664+80	676+40
Encinitas / Leucadia	15 / TI, MSE	6.7	920	680+70	689+90
	16 / T1	4.8	220	693+80	696+00
Leucadia / La Costa	17 / T1, MSE	5.5	580	701+00	706+80
	18 / T1,SN	7.9	140	717+30	718+70
La Costa / Poinsettia	19 / T1, SN	2.4	280	735+20	738+00
	20 / T1, SN	4.8	280	738+40	741+20
Poinsetta / Palomar Airport	21 / T1, SN	9.1	1440	751+00	765+40
Palomar Airport / Cannon	22 / T1, SN	4.8	1800	769+00	781+00
Cannon / Tamarack	23 / SN	2.4	690	789+20	790+10
	24 / T1	8.5	580	796+40	802+20
Tamarack / Carlsbad Village	25 / T1	6.7	400	805+80	809+80
	26 / T1	6.7	550	810+20	815+70
Carlsbad Village / Las Flores	27 / T1	5.5	800	816+70	824+70
Las Flores / 78	28 / T1	7.3	240	826+20	828+60
	29 / T1	3.6	60	832+80	833+40

Proposed South Bound Retaining Walls					
Location	Retaining wall Reference # / Proposed Type	Approximate Max Height	Approximate Length	Station	
(between interchanges)		(meters)	(meters)	Begin	End
78 / Cassidy	26 / T1, SN	5.5	310	834+70	837+80
Cassidy / California	27 / T1	2.4	135	838+60	839+95
California / Oceanside	28 / T1	7.3	460	842+40	847+00
	29 / T1	7.3	220	847+00	849+20
Oceanside / Mission	30 / T1	14.1	140	853+80	855+20
	31 / T1	9.4	720	856+40	863+60
Mission / 76	32 / T1	5.5	40	867+40	867+80
	33 / T1	8.5	500	869+00	874+00

T1: Caltran Type 1 retaining wall
SN: Soil Nail retaining wall
MSE: Mecahnically Stabilized Earth retaining wall

Table 2

Existing Underground Culverts, RCP's and CMP's

"As Built" EA #	Approximate Location Station	Type			Location			Remarks
		RCP	CMP	As Described	Right of CL	Left of CL	On Median	
11-022444	1084+00 "SD"	24"			X			
11-022484	1090+00 "SD"			Triple 12' x 10' RCB			X	
11-022444	1099+50 "SD"	24"					X	
11-022444	1101+00 "SD"	24"	18"		X			
11-022444	1109+70 ? "SD"	30"					X	
11-022444	1117+50? "SD"	30				X		
11-022444	1117+50? "SD"	48"			X			Skewed
11-022444	1120+44 "SD" to 1124+00 "SD" ?	48"					X	
11-022444	1124+00 "SD"	30"	30"			X		
11-022444	1130+04 "SD"	30"				X		
11-022444	1130+77 "SD"		30"			X		
	1135+31 "SD"	24"				X		
11-022444	1124+00 "SD" to 1140+70 "SD"	42"					X	

"As Built" EA #	Approximate Location Station	Type			Location			Remarks
		RCP	CMP	As Described	Right of CL	Left of CL	On Median	
11-022444	1140+70 "SD" to 1146+70 "SD"	36"					X	
11-022444	1140+70 "SD" ?	24"			X			
11-022444	1140+70 "SD" ?	36"				X		
11-022444	1141+20 "SD" ?		36"			X		
11-022444	1140+70 "SD" ? to 1146+70 "SD" ?	36"					X	
11-022444	1147+40 "SD" ?		36"			X		
11-022444	1146+70 "SD" ? to 1150+30 "SD" ?	24"					X	
11-022444	1150+30 "SD" ?	24"				X		Skewed
11-022484	1156+25 "SD"	42"			X	X		
11-022484	1157+43 "DFS" to 1158+75 "DFS"	48"			X			
11-022484	1162+00 "SD"	24"			X	X		
11-022484	1163+00 "DFS" to 1167+40 "SD"	48"			X	X		
62-11V13C14-I	1165+26 "SD" to 1167+61 "DFS"	48"			X	X		
11-022484	1172+44 "SD"	24"			X			
11-022484	1172+42 "SD" to 1174+98 "SD"	24"					X	
11-022484	1174+98 "SD"	24"				X		

"As Built" EA #	Approximate Location Station	Type			Location			Remarks
		RCP	CMP	As Described	Right of CL	Left of CL	On Median	
11-022484	1174+98 "SD" to 1179+50 "SD"	24"					X	
11-022484	1179+50 "SD"	24"			X	X		
11-022484	1179+50 "SD" to 1187+20 "SD"	24"					X	
62-11V13C14-I	1187+00 "SD		18"		X	X		
11-022484	1187+20 "SD"	24"	18"		X	X		
11-022484	1187+20 "SD" to 1193+15 "SD"	30"					X	
62-11V13C14-I	1190+40 "SD"		18"			X		
11-022484	1193+15 "SD"	24"	18"		X	X		
11-022484	1193+15 "SD" to 1198+50 "SD"	36"					X	
11-022484	1198+50 "SD" to 1201+80 "SD"	36"			X			Skewed
11-022444	1220+00 "SD"	24"	18"			X		
62-11V13C14-I	1220+00 "SD		18"		X			
11-022444	1226+00 "SD"		12"		X			
11-022444	1233+00 "SD"	24"	18"			X		
62-11V13C14-I	1233+00 "SD		12"		X	X		
62-11V13C14-I	1239+00 "SD"		12"		X	X		
11-022444	1244+00 "SD"		12"		X	X		

"As Built" EA #	Approximate Location Station	Type			Location			Remarks
		RCP	CMP	As Described	Right of CL	Left of CL	On Median	
11-022444	1262+70 "SD"		18"			X		
11-022444	1262+94.50 "SD"	24"	18"		X			
11-022444	1278+50 "SD"	24"			X	X		
62-11V13C14-I	1289+00 "A"	24"			X	X		
11-022484	1289+09.5 "A" to 1293+50 "A"	24"					X	
11-022484	1293+50 "A"	24"			X	X		
11-022484	1293+50 "A"		18"		X			
11-022484	1293+50 "A" to 1300+90 "A"	24"					X	
11-022484	1296+00 "A"	24"			X			
11-022484	1300+90 "A"	24"			X	X		
11-022484	1300+90 "A"		18"		X			
	1301+00	24"	18"		X			
11-022484	1309+95 "A"	24"			X	X		
	1310+00	24"			X	X		
11-022484	1312+58 "A"	36"			X	X		
	1312+70		12"			X		
11-022484	1319+32 "FL" to 1320+00 "A"	24"				X		Skewed
11-022484	1320+00 "A"	24"			X			

"As Built" EA #	Approximate Location Station	Type			Location			Remarks
		RCP	CMP	As Described	Right of CL	Left of CL	On Median	
	1320+00	24"				X		
11-022484	1329+45.65 "A"	24"			X	X		Skewed 26° Right
11-022484	1329+80 "SL-3"	24"	24"			X		
	1329+80	24"			X			
62-11V13C7-I	1332+55	60"			X	X		
62-11V13C7-I	1334+65	60"			X	X		
62-11V13C7-I	1337+25	18"			X	X		
62-11V13C7-I	1343+00	30"			X	X		
62-11V13C7-I	1343+00		30"			X		
11-022414	1349+25	24"			X	X		
	1359+80	24"				X		
	1359+80		18"		X			
62-11V13C7-I	1360+00 "A"	24"			X	X		
62-11V13C7-I	1360+00 "A"		18" 24"			X		
62-11V13C7-I	1360+00 "A" to 1365+00 "A"	24"					X	
62-11V13C7-I	1360+00 "A"	24"			X			
62-11V13C7-I	1360+00 "A"	30"	18"			X		
62-11V13C7-I	1365+40 "A" to 1373+00 "A"	30"					X	

"As Built" EA #	Approximate Location Station	Type			Location			Remarks
		RCP	CMP	As Described	Right of CL	Left of CL	On Median	
	1373+00 "A"							
62-11V13C7-I	1373+00 "A"	30"				X		Skewed
62-11V13C7-I	1380+00 "A"	18"	18"			X		
11-022414	1386+75 "A"	24"			X	X		
11-022414	1386+75 "A"		24"			X		
11-022414	1394+05 "A"	24"				X		
11-022414	1394+05 "A"		18"			X		
11-022414	1398+00 "A"	24"			X	X		
11-022414	1398+00 "A"		18"			X		
11-022414	1412+00 "A"	30"			X	X		
11-022414	1412+00 "A"		24"		X			
11-022414	1416+22 "A"	48"			X	X		
11-022414	1417+98 "A"	24"	18"		X			
11-022414	1427+05 "A"	24"			X	X		
11-022414	1427+05 "A"		18"		X			
11-022414	1431+15 "A"		12"		X			
11-022414	1437+60 "A"	30"			X	X		
11-022414	1441+50 "A"	48"			X	X		
11-022414	1449+00 "A"	24"			X			

"As Built" EA #	Approximate Location Station	Type			Location			Remarks
		RCP	CMP	As Described	Right of CL	Left of CL	On Median	
11-022414	1449+00 "A"		18"			X		
11-022414	1453+70 "A"	24"				X		
11-022414	1453+71.75 "A" to 1456+04 "BD-2"	24"			X	X		
11-022414	1456+04 "BD-2"		12"		X			
11-022414	1456+04 "BD-2" to 1456+45 "BD-2"	24"	12"		X			
11-022414	1458+50 "A"	24"			X	X		
11-022414	1458+50 "A"	30"			X			
11-022414	1465+75 "A"	72"				X		Skewed
11-022414	1465+75 "A"	78"			X			Skewed
11-022414	1465+78.81 "A"	24"			X			
11-022414	1471+00	24"			X	X		
11-022414	1471+00 "A" to 1474+00 "A"	24"					X	
11-022414	1474+00 "A"	24"			X	X		
11-022414	1474+00 "A" to 1479+50 "A"		24"				X	
11-022414	1479+50 "A"	24"			X	X		
11-022414	1486+50 "A"	24"			X	X		Skewed
11-022414	1486+50 "A"		18"		X			

"As Built" EA #	Approximate Location Station	Type			Location			Remarks
		RCP	CMP	As Described	Right of CL	Left of CL	On Median	
11-022414	1494+68 "A"			5'x 5' RCB	X	X		
11-022414	1505+00 "A"	24"				X		
11-022414	1516+00 "A"	24"			X			
11-022414	1526+31 "A"	48"			X			Skewed
11-022414	1533+00 "A"	24"			X	X		
11-022414	1533+00 "A"		18"			X		
11-022414	1540+50 "A"	24"			X	X		
11-022414	1540+50 "A"		18"			X		
11-022414	1540+50 "A" to 1545+75 "A"	24"					X	
11-022414	1545+75 "A"	24"	18"			X		
11-022414	1545+75 "A"	24"			X			
11-022414	1552+12.5 "A"	24"			X	X		
11-022414	1552+12.5 "A"		18"			X		
11-022414	1552 + 14 "A"			10' x 713' RC Arch	X	X		Skewed
11-022464	1562+00 "A"	24"			X	X		
11-022464	1567+00 "A"	18"	24"		X	X		
11-022464	1571+00 "A"	24"	24"			X		
11-022464	1571+00 "A"	18"	24		X			

"As Built" EA #	Approximate Location Station	Type			Location			Remarks
		RCP	CMP	As Described	Right of CL	Left of CL	On Median	
11-022464	1579+66 "A"	54"			X	X		Skewed 20° Left
11-022464	1586+83 "A"	24"			X	X		
11-022464	1586+83 "A"		18"		X			
11-022464	1586+83 "A"		12"		X			
11-022464	1592+00 "A"	30"			X			
11-022464	1592+00 "A"	30"	12"			X		Skewed 20° Left
11-022464	1598+20 "A"	66"			X	X		Skewed 35° Left
11-022464	1599+00 "A"		12"			X		
11-022464	1609+00 "WR-2" to 1611+38 "A"	24"			X			
11-022464	1611+38 "A"	24"				X		
11-022464	1611+38 "A" to 1615 +85 "A"	24"					X	
11-022464	1615+85 "A"	24" 30"			X			
11-022464	1615+85 "A"	24"				X		
11-022464	1615+85 "A" to 1620+00 "A"	30"					X	
11-022464	1620+00 "A"	24"			X	X		
11-022464	1620+00 "A" to 1623+30 "A"	30"					X	
11-022464	1623+30 "A"	24"			X			

"As Built" EA #	Approximate Location Station	Type			Location			Remarks
		RCP	CMP	As Described	Right of CL	Left of CL	On Median	
11-022464	1624+80 "WR-4"	24"	18"			X		
11-022464	1626+00 "WR-1"		12"		X			
11-022464	1631+00 "NR"	18"			X			
11-022464	1623+30 "A" to 1628+70 "A"	30"					X	
11-022464	1628+70 "A"	54"			X	X		
11-022464	1628+70 "A"	30"			X			
11-022464	1625+31 "FR"	36"			X			
11-022464	1630+06 "FL"	18"				X		
11-022464	1633+80 "FL"	24"				X		Skewed 30° Left
11-022464	1636+40 "GS"	18"			X			
11-022464	1636+30 "A"	48"			X			
11-022464	1636+30 "A"	54"			X	X		
11-022464	1640+00 "FL"		18"			X		
11-022464	1640+55 "A"	30"			X	X		
11-022464	1640+55 "A"	24"			X			
11-022464	1648+10 "OS"	24"			X			
11-022464	1647+15 "A"	36"			X	X		
11-022464	1651+90 "A"	24"	18"		X	X		

"As Built" EA #	Approximate Location Station	Type			Location			Remarks
		RCP	CMP	As Described	Right of CL	Left of CL	On Median	
11-022464	1658+10 "A"	42"			X	X		
11-022464	1658+10 "A"	36"			X			
11-022464	1661+50 "FL"	36"				X		Skewed 48° Left
11-022464	1664+60 "OA"	18"			X			
11-022464	1664+50 "A"	36"			X	X		
11-022464	1664+50 "A"	30"			X			
11-022464	1673+10 "A"	24"			X	X		
11-022464	1673+10 "A"	18"	18"		X			
11-022464	1682+22.69 "A" to 1694+00 "LC"	84"						Skewed 41° Left
11-022464	1682+63 "LC-2"		18"		X			
11-022464	1689+50 "A"	24"			X	X		
11-022464	1689+50 "A"		12"					
11-022464	1689+50 "A" to 1696+50 "A"	24"					X	
11-022464	1696+50 "A"	24"			X	X		
11-022464	1696+50 "A"		24"		X			
11-022464	1696+75 "LC-1"	24"			X			
11-022464	1693+00 "LC-4"		12"			X		
11-022464	1700+71 "LC-4"		8"			X		

"As Built" EA #	Approximate Location Station	Type			Location			Remarks
		RCP	CMP	As Described	Right of CL	Left of CL	On Median	
11-022464	1700+75.5 "LC-4"		8"			X		
11-022464	1701+00 "LC-1"		12"		X			
11-022464	1706+50 "A"	24"	18"			X		
62-11V13C7-I	1727+66.75 "A"	30"				X		Skewed
62-11V13C7-I	1727+66.75 "A" to 1733+50 "A"	30"					X	
62-11V13C7-I	1733+50 "A"	18"	18"		X	X		
62-11V13C7-I	1733+50 "A" to 1739+50 "A"	30"					X	
62-11V13C7-I	1739+50 "A"	30"	18" 30"		X			
62-11V13C7-I	1739+50 "A"	18"				X		
62-11V13C7-I	1751+06 "A"	30"			X	X		
62-11V13C7-I	1751+06 "A"		18" 30"		X			
11-022464	1755+78 "A"	24"						Skewed 45° Right
11-022464	1761+62.61 "A"	24"			X	X		
11-022464	1765+10 A"	36"			X	X		
11-022464	1773+72 "A"	24"			X	X		
11-022464	1777+00.25 "PL-4"	24"				X		
11-022464	1781+00 "PL-1"		8"		X			

"As Built" EA #	Approximate Location Station	Type			Location			Remarks
		RCP	CMP	As Described	Right of CL	Left of CL	On Median	
11-022464	1788+00 "A"	24"			X			
11-022464	1795+00 "A"	24"			X			
11-022464	1806+00 "A"	24"			X	X		
11-022464	1817+00 "A"	24"			X			
11-022474	1820+86 "A"	24"				X		
11-022474	1820+86 "A"		18"		X			
11-022464	1822+30 "CBD"			Triple 10' x 5' RCB	X	X		
11-022464	1828+50 "CBD" to 1835+60 "CBD"	39"					X	
11-022474	1835+67 "PA-3" to 1835+67 "CBD"	24"				X		
11-022474	1836+00 "PA-2" to 1835+67 "CBD"	24"			X			
11-022474	1835+67 "CBD to 1837+50 "CBD"	39"					X	
11-022474	1837+50 "PA-3" to 1837+50 "CBD"	24"				X		
11-022474	1838+50 "PA-2" to 1837+50 "CBD"	30" 24"	24"		X			
11-022474	1837+50 "CBD" to 1844+00 "CBD"	30"					X	
11-022474	1844+00 "CBD" to 1845+75 "CBD"	30"					X	

"As Built" EA #	Approximate Location Station	Type			Location			Remarks
		RCP	CMP	As Described	Right of CL	Left of CL	On Median	
11-022474	1845+75 "CBD"	24"			X			
11-022474	1845+75 "CBD" to 1848 +50 "CBD"	30"					X	
11-022474	1849+20 "PA-4" to 1848+50 "CBD"	24"				X		
11-022474	1848+50 "CBD" to 1851+50 "CBD"	24"					X	
11-022474	1851+50 "PA-1" to 1851+50 "CBD"	24"			X			
11-022474	1851+50 "CBD" to 1854+50 "CBD"	24"					X	
11-022474	1855+75 "PA-5" to 1854+50 "CBD"	24"				X		
11-022474	1859+.06.7 "CBD"	24"			X	X		Water Line Casing
11-022474	1869+69 "CBD"	15"			X	X		Water Line Casing
11-022474	1870+00 "CBD			Double 5'x5'-A RCB	X	X		
11-022474	1880+00 "CBD"	24"			X	X		

TABLE 3

SUMMARY OF PROPOSED CUT/FILL SLOPES

From Station	To Station	Southbound Side	Northbound Side
[redacted]			
540+80	541+90		Edge of Shoulder connected to the Ramp's left Edge of Shoulder. Slight cut on Fwy side.
541+90	542+60		Fill between Ramp and Fwy.
542+60	556+40		Pavement connecting Ramp and Fwy
560+00	560+30	Fill	Cut
560+30	561+00	Cut	Cut
561+00	561+40	Minor Cut at Fwy ES;Cut at Ramp ES	Minor Cut at Fwy ES;Cut at Ramp ES w/t Ret. Wall
561+40	562+78	Same	Fwy ES connects to Ramp; Cut at Ramp ES w/t Ret. Wall
562+80	563+00	Fwy ES connects to Ramp; Cut on Ramp ES	Fwy ES connects to Ramp; Cut on Ramp ES
563+00	565+80	Cut	Cut
565+80	568+80	Cut Slope w/t Ret. Wall	Cut Slope w/t Ret. Wall
568+80		Same	2:1 Cut
569+80	570+40	Cut	2:1 Fill
570+40	583+20	Fill	2:1 Fill
602+00	602+60	Fill w/t Ret. Wall	Cut
602+60	603+20	Same	Fill w/t 4:1 slope
603+20	604+40	Same	Fill w/t Ret. Wall
604+40	608+40	Same	Cut w/t Ret. Wall
608+40	609+00	Fill	Connects to Ramp.
609+00	609+20	Fill	Cut
609+20	610+40		Fill w/t 4:1 slope.
610+40	612+00		Connects to Ramp.
612+00	612+60	Fill w/t 4:1 slope	Fill w/t 4:1 slope.
612+60	613+40	Same	NB connects to Ramp w/t Ret. Wall.
613+40	613+80		Same, except right Edge of Shoulder of the Ramp in Cut.
613+80	616+80	ES connects to Ramp; Cut slope on side w/t Ret. Wall	ES connects to Ramp; Cut slope on side w/t Ret. Wall
616+80	619+00	Same except no Ret. Wall	Same
619+00	622+40	Cut	Cut
622+60	623+00	Cut	Fill
623+00	628+80	Cut	Cut
634+40	634+90	Fill	Cut
634+90	637+00	Cut	Cut
637+00	638+60	Edge of Shoulder flush with exist ground	Cut
638+60	640+80	Edge of Shoulder connects to Ramp	Cut
651+00	652+40	Cut	Cut

From Station	To Station	Southbound Side	Northbound Side
652+40	653+00	Cut	Edge of Shoulder flush with exist ground
653+00	653+00	Edge of Shoulder connects to Ramp; Cut slope w/t Ret. Wall	Edge of Shoulder connects to Ramp; Retaining Wall
653+00	656+60	Cut	Cut
656+60	656+80	Edge of Shoulder flush with Ground	Cut
656+80	657+60	Fill	Cut
657+60	662+60	Fill	Fill
663+40	663+60		Fill
663+40	665+00	Fill	Fill
665+00	665+40	Fill	Edge of Shoulder is flush with the exist ground.
665+40	665+60	Edge of Shoulder is flush with the exist ground.	Edge of Shoulder is flush with the exist ground.
665+60	666+00	Same	Edge of Shoulder connects to Ramp. Side slope in Fill.
666+00	670+20	Edge of Shoulder connects to Ramp. Side slope in Fill.	Same
670+20	671+00	Cut	Fill
671+00	671+80	Fill w/t Ret. Wall	Fill
672+20	674+20	Cut	Cut
674+20	675+20	Edge of Shoulder connects to Aux Lane; side slope in Cut,	Edge of Shoulder connects to Aux Lane; side slope in Cut,
675+20	676+00	Cut	Fill
676+00	677+60	Fill	Fill
677+60	678+00	Cut	Cut
678+00	679+80	Fill	Fill
679+80	680+80	Fill	Edge of Shoulder connects to Ramp. Side slope in Cut.
680+80	685+40	Edge of Shoulder connects to Ramp. Side slope in Fill.	same
685+40	686+20	Fill	Fill
686+20	690+80	Fill	Cut
691+00	692+00	Fill	Fill
692+00	692+20	Fill	Cut (Minor)
692+20	692+40	Cut	Cut
692+40	693+20	Fill	Cut
693+20	699+20	Cut	Cut
699+20	707+00	Fill	Cut
707+00	713+40	Fill	Cut w/t Ret. Wall
714+60	715+37	Fill	Cut
715+40	716+40	No major Cut or Fill	No major Cut or Fill
716+40	720+20	Fill	Fill
FromStation	To Station	South Bound	Slope Description
720+20	721+10.81	Cut	No side slope
721+10	722+40	Same	Edge of Shoulder connects to Ramp.
722+40	722+60	Edge of Shoulder connects to Ramp.	Same.

From Station	To Station	Southbound Side	Northbound Side
722+80	730+00	Fill	Fill
730+10	730+40	Cut	Fill
732+00	737+60	Cut	Cut
737+70	740+00	Fill (minor)	Cut
740+00	741+60	Minor Cut or Fill at ES; Ramp's side slope in Fill	Minor Cut or Fill at ES; Ramp's side slope in Cut
741+60	742+40	Minor Cut	Minor Cut
742+40	743+60	Cut	Cut
743+60	744+80	Minor Cut	Minor Cut
744+80	745+80	Minor Cut or Fill	Minor Cut or Fill
745+80	748+20	No side slope	Minor Fill
748+20	751+00	Minor Fill	Minor Fill
751+00	751+20	No side slope	Minor Fill
751+20	755+40	Cut	Minor Fill
755+40	755+80	Cut	Cut
755+80	758+00	Cut	Minor Cut or Fill
758+10	759+90	Fill	Fill
759+90	760+60	Fill	No side slope
760+60	761+70	Fill	Minor Cut
761+70	767+00	Cut	Cut
767+00	768+80	No side slope	Cut
769+80	771+60	Cut (Ramp)	Minor Cut or Fill
771+60	773+80	No side slope	Minor Fill
774+00	780+00	Minor Fill	Minor Fill
780+00	783+00	Minor Cut or Fill	Minor Cut or Fill
783+00	790+00	Fill	Same
790+00	791+20	Minor Cut or Fill	Cut
791+20	792+70	Cut	Minor Cut
792+70	793+00	Fill	Fill
793+00	793+40	Minor Cut	Minor Cut
793+50	796+20	Fill	Fill
796+30	797+80	Cut	Same
797+90	804+80	Cut	Cut
804+80	805+06	Cut on ES; Fill on Ramp	Cut
805+10	806+00	Fill	Cut
806+00	806+40	Fill	Minor Cut
806+50	809+60	Fill	Fill
809+60	810+10	Minor Cut or Fill	Minor Cut or Fill
810+10	815+30	Fill	Fill
815+40	815+80	Fill w/t Ret Wall	Fill
816+40	821+80	Minor Cut or Fill	Minor Cut or Fill
821+40	821+80	ES connects to Ramp; Cut on Ramp side	Cut
821+80	822+80	Same	ES connects to Ramp; Cut on Ramp side
822+80	823+40	Same	Minor Cut on Fwy ES; Cut on Ramp side
823+40	824+60	Same w/t Ret. Wall	Cut on Fwy ES & Ramp ES
824+60	825+00	Same	Cut – No Ramp

From Station	To Station	Southbound Side	Northbound Side
825+00	825+15	Cut	Cut w/t Ret. Wall
825+15	826+20	Cut	Cut
826+20	826+80	Cut on Fwy ES & Ramp ES	Cut on Fwy ES & Ramp ES
826+80	827+60	Same	Fwy ES connects to Ramp; Ramp side slope in Cut
827+60	828+00	Fwy ES connects to Ramp; Ramp side slope in Cut	Same
828+00	828+30	Minor Cut	Same
828+30	828+70	Same	Fill
828+70	829+40	Fill	Fill
829+40	829+60	Minor Cut	Minor Cut
829+60		Fill	Fill

This summary is an approximation of the proposed cut/fill slopes. This table is based on information provided by district 11.

Table 4

Proposed Widenings on I-5

Location	From STA to STA	Proposed Widening (Max)	
		North Bound [m]	South Bound [m]
Del Mar Heights to Via De La Valle	562+00 to 589+00	18.7	15.1
Via De La Valle to Lomas Santa Fe Drive	589+00 to 609+00	14.5	11.5
Lomas Santa Fe Drive to Manchester Ave	613+80 to 628+00	15.1	15.1
Manchester Ave. to Birmingham Drive	628+00 to 648+00	15.1	11.5
Birmingham Drive to Santa Fe Drive	648+00 to 661+00	15.1	15.1
Santa Fe Drive to Encinitas Blvd	661.00 to 675+00	11.5	14.5

Table 5

SUMMARY OF NEARBY FAULTS

Fault Name	Fault Type	Approx. Closest Distance to Site (km)	Maximum Credible Earthquake Magnitude
Newport-Ingelwood-Rose Canyon East (NIE)	ST	5	7.0
Newport-Ingelwood-Rose Canyon West (NIW)	ST	5	7.0
Point Loma (PTL)	XX	20	6.5
Palos Verdes Hills-Coronado Bank (PVC)	ST	32	7.8
San Diego Trough (SDT)	XX	45	7.5
Whittier Elsinor (WEE)	ST	45	7.5
Earthquake Valley (EQV)	ST	70	6.5
San Clemente (SCE)	ST	90	7.3

Notes:

1. Fault data is from Caltrans Seismic Hazard Map1996.
2. Closest distance is scaled from Caltrans Seismic Hazard Map1996.
3. Fault Type:

   ST = Strike-Slip

   XX = Not Known / Published

Table 6

Reference: Soil Survey (1973) and General Soil Map (1971), San Diego Area, California
United States Department of Agriculture

SOIL ASSOCIATIONS

Group Number	Soil Association	Approximate Location
6	Salinas-Corralitos association: Moderately well drained to somewhat excessively drained clays, clay loams, and loamy sands on alluvial fans.	I-5, STA 467+00 and Route 805 STA 449+ 00 to I-5, STA 500+00
		I-5, STA 500+00 to STA 540+ 00
		I-5 STA 540+00 to STA 640+00
9	Marina – Chesterton association: Somewhat excessively drained to moderately well-drained loamy coarse sands and fine sandy loams that have a subsoil of sandy clay over a hardpan.	I-5, STA 467+00 and Route 805 STA 449+ 00 to I-5, STA 500+00
		I-5, STA 500+00 to STA 540+ 00
		I-5 STA 540+00 to STA 640+00
		I-5 STA 640+00 to STA 901+00
12	Redding-Olivenhain association: Well-drained gravelly loams and cobbly loams that have a subsoil of gravely clay and very cobbly alluvium.	I-5, STA 500+00 to STA 540+ 00
32	Rough broken land-Terrace escarpments. Sloping gullied land association: Steep and very steep dissected land, escarpments, and gullied land.	I-5, STA 467+00 and Route 805 STA 449+ 00 to I-5, STA 500+00
		I-5, STA 500+00 to STA 540+ 00
		I-5 STA 540+00 to STA 640+00

Table 7: Archival Soil Strength Parameters

GEOTECHNICAL UNIT	COHESION	ANGLE OF INTERNAL FRICTION	IN-SITU DRY DENSITY
	(kPa)	(degree)	(kN/m3)
Ardath Shale	14.3	28	18.9
Torrey Sandstone	9.6	33	18.9
Bay Point Formation	24	38	19.6
Existing Fill	9.6	32	18.9
Structural Fill/Backfill	9.6	36	18.9
Sand - Alluvium	0	26	18.9*
Lagoon Alluvium (short term loading)	19.1*	0*	18.9*
Lagoon Alluvium (long term loading)	28.7*	15*	18.9*

*Soil strength parameters are based on engineering judgment and local knowledge. These strength parameters are a rough approximation and are for preliminary design only.

Table 8: Archival Liquefaction Data

Location	Liquefaction Analyses	Lateral Deformation & Spreading	Prepared By	Year of Analyses
Manchester Ave. at I-5 KP R61.58	240 mm of settlement	3 m	Southern California soil & Testing, Inc.	2004

TABLE 9

PRELIMINARY SLOPE STABLITY CALCULATIONS

PRELIMINARY CUT SLOPES

X-Section Sta.	Slope Height (m)	Slope Inclination	Soil Type	Factor of Safety	Analysis Type
828+00	10	1:1.5	combination	1.7	Block
828+00	10	1:1.5	combination	1.7	circular
828+00	10	1:1.5	sandstone	1.7	circular
828+00	10	1:1.5	shale	1.7	circular
828+00	15	1:1.5	sandstone	1.6	circular
828+00	15	1:1.5	shale	1.5	circular
828+00	10	1:2	sandstone	2.1	circular
828+00	10	1:2	shale	2.0	circular
828+00	15	1:2	sandstone	1.9	circular
828+00	15	1:2	shale	1.8	circular

combination soil = Sandstone and Shale

PRELIMINARY FILL SLOPES

X-Section Sta.	Slope Height (m)	Slope Inclination (B / no B)	Soil Type	Factor of Safety	Analysis Type
580+00	6	1:1.5 (no B)	combination	1.7	circular
580+00	12	1:1.5 (no B)	combination	1.6	circular
580+00	12	1:1.5 (B)	combination	1.9	circular
580+00	20	1:1.5 (B)	combination	1.6	circular
580+00	30	1:1.5 (B)	combination	1.6	circular
580+00	6	1:2 (no B)	combination	1.9	circular
580+00	12	1:2 (no B)	combination	1.7	circular
580+00	12	1:2 (B)	combination	2.1	circular
580+00	20	1:2 (B)	combination	2.0	circular
580+00	30	1:2 (B)	combination	1.8	circular

(B) = Bench
(no B) = no Bench
combination soil = Structural fill, Existing fill, and Lagoonal Alluvium

PRELIMINARY MSE WALLS

X-Section Sta.	Total Slope Height (m)	Wall Height (m)	Soil Type	Factor of Safety	Short/Long Term Stability	Embedment Depth (m)
580+00	10	4	combination	1.4	Long (c-d)	4
580+00	10	4	combination	1.1	Short (u-u)	4
580+00	10	6	combination	1.3	Long (c-d)	7
580+00	10	6	combination	0.9	Short (u-u)	7
580+00	10	8	combination	1.3	Long (c-d)	8
580+00	10	8	combination	0.8	Short (u-u)	8

combination soil = Structural fill, Existing fill, and Lagoonal Alluvium

PRELIMINARY SOIL NAIL WALLS

Total Slope Height (m)	Wall Height (m)	Slope Height Below Wall/Above Wall (m)	Soil Type	Factor of Safety	Nail Depth (m)
21	3	6/12	sandstone	2.2	4.0
21	3	6/12	shale	2.3	4.0
12	3	3/6	shale	1.7	2.0
12	3	3/6	sandstone	1.9	3.0
15	6	3/6	shale	1.9	7.5
15	6	3/6	sandstone	1.9	7.5
15	9	0/6	sandstone	1.7	11.5
15	9	0/6	shale	1.6	11.0
18	9	3/6	shale	1.6	11.5
18	9	3/6	sandstone	1.7	11.5

TABLE 10

TEMPORARY CUT SLOPES

Soil Type	Approximate Temporary Slope Height (m)	Factor of Safety	Slope Inclination (H:V)
Ardath Shale	9	1.4	1:1
	12	1.2	1:1
	15	1.2	1:1.2
	20	1.2	1:1.2
	30	1.2	1:1.5
Torrey Sandstone	9	1.3	1:1
	12	1.2	1:1
	15	1.2	1:1
	20	1.2	1:1.2
	30	1.3	1:1.5
Bay Point Formation	9	2.2	1:1
	12	1.9	1:1
	15	1.8	1:1
	20	1.7	1:1.2
	30	1.6	1:1.3
Existing Fill	9	1.3	1:1
	12	1.2	1:1
	15	1.2	1:1.2
	20	1.2	1:1.2
	30	1.3	1:1.5

*This table is to be used for preliminary design only. The table is based on an ideal situation. Adverse bedding planes may exist.

Table 11: Existing Log of Test Borings

BORING No.	LOCATION	DRILLING METHOD	EA NUMBER	Area / KP, PM
3A-B1	8 Lt, 544+52 "CM" Line	Mud Rotary	11-0301U1	I-5 / 805 KP 48.9 - 51.2 / 43.9 - 46.5
6-B1	8 Lt, 544+52 "CM" Line			
545A-B1	8 Lt, 544+52 "CM" Line			
545A-B2	2 Rt, 545+05 "CM4" Line			
545A-B3	18 Lt, 545+45 "CM" Line			
527-B3	5 Rt, 527+11 "SB" Line			
527-B2	5Rt, 527+99 "SB" Line			
527-B1	5 Rt, 528+51 "SB" Line			
543-896-8	40 Lt, 541+40 "SB" Line			
543-896-7	45 Lt, 542+35 "SB" Line			
543-B2	8 Rt, 542+98 "SB" Line			
543-896-6	50 Lt, 543+28 "SB" Line			
543-B1	8 Rt, 543+70 "SB" Line			
4-996-10	41 Lt, 543+99 "SB" Line			
543-996-10	41 Lt, 543+99 "SB" Line			
545B-B5	22.2 Lt, 544+68.5 "SB" Line			
3A-B2	11 Lt, 545+18 "SB" Line			
545B-B1	11 Lt, 545+18 "SB" Line			
545B-B2	15 Lt, 545+63 "SB" Line			
545B-B3	1 Rt, 546+21 "SB" Line			
545B-B4	3 Rt, 546+82 "SB" Line			
456-B1	22 Rt, 456+62 "A" Line			
456-B4	27 Rt, 457+15 "A" Line			
456-B3	49 Rt, 458+39 "A" Line			
456-B2	24 Rt, 458+66 "A" Line			
456-B5	52 Rt, 460+51 "A" Line			
456-B6	26 Rt, 461+52 "A" Line			
456-B7	26 Rt, 462+94 "A" Line			
456-B8	52 Rt, 463+79 "A" Line			
466-B1	21 Rt, 466+68 "NT805" Line			
466-B2	16 Rt, 466+91 "NT805" Line			
470-6101	27 Rt, 470+70 "NT 805" Line			
470-6103	41 Rt, 471+15 "NT 805" Line			
470-6102	15 Rt, 471+27 "NT 805" Line			
470-6104	28 Rt, 471+54 "NT 805" Line			
512-B1	21 Rt, 512+55 "SD" Line"			
512-B2	21 Rt, 513+14 "SD" Line			
512-B3	21 Rt, 513+65 "SD" Line			
516-B1	25 Rt, 515+42 "SD" Line			
516-B2	31 Rt, 515+84 "SD" Line			
565-B2	44 Lt, 564+82 "SD" Line			
565-B1	36 Lt, 566+02 "SD" Line			
569-B6	23 Lt, 567+30 "SD" Line			
569-B1	21 Lt, 568+97 "SD" Line			
569-B2	21 Lt, 570+60 "SD" Line	Flight Auger	11-0301U1	I-5 / 805 KP 48.9 - 51.2 / 43.9 - 46.5
569-B3	21 Lt, 571+61 "SD" Line			
569-B4	21 Lt, 572+61 "SD" Line			
569-B5	21 Lt, 573+61 "SD" Line	Mud Rotary		
527-6108	48 Lt, 527+41 "SDL" Line			
527-6109	44 Lt, 528+73 "SDL" Line			
527-61015	41 Lt, 529+52 "SDL" Line			
544-B1	8 Lt, 543+63 "NB" Line			
544-B2	8 Lt, 544+26 "NB" Line			
544-B3	8 Lt, 544+68 "NB" Line			
546-B2	9 Lt, 545+30 "NB" Line			
546-B1	8 Lt, 545+80 "NB" Line			

BORING No.	LOCATION	DRILLING METHOD	EA NUMBER	Area / KP, PM
CPT-1	20 Lt, 611+10	Cone Penetrometer	11-224300	Bridge No. 57-0479 R/L / 11-SD-5-KP 37.58 Lomas Santa Fe Solona Beach
CPT-2	20 Rt, 610+80			
CPT-3	20 Rt, 611+50			
B-3	20 Lt, 599+70	Mud Rotary		
B-4	20 Rt, 602+10			
B-5	20 Lt, 604+00			
B-6	20 Rt, 604+40			
B-7	15 Lt, 607+60			
B-8	75 Rt, 609+40			
B-1	20 Rt, 611+05			
B-2	20 Lt, 611+60			
B-9	85 Rt, 611+50			
B-10	80 m Rt, 611+10			
B-12	85 m Lt, 612+45			
B-13	95 m Lt, 613+10			
B-11	15 m Lt, 615+10			
T-1	50 m Lt, 612+40	Trench		
T-2	70 m Rt, 610+45			
P-1	125 m Lt, 615+30	Hand-Pit		
P-2	125 m Lt, 614+65			
P-3	148 m Lt, 613+85			
P-4	95 m Lt, 613+25			
P-5	145 m Lt, 613+00			
B-4	17 m Rt, 619+60	Mud Rotary	11-241400	Bridge No. 57-0458 & 57-New 11-SD-KP R61.58 @ Manchester Av. / Encinitas
B-5	17 m Lt, 621+00			
B-6	17 m Rt, 622+60			
B-7	17 m Lt, 625+00			
B-8	17 m Rt, 627+00			
B-1	50 Rt, 628+60			
B-1	75 m Rt, 628+60			
B-2	30 m Rt, 630+30			
B-2	40 Rt, 630+40			
B-3	40 Lt, 630+40		11-241400	Bridge No. 57-0458 & 57-New 11-SD-KP R61.58 @
B-9	17 m Rt, 631+80			
B-10	17 m Rt, 635+20			
B-11	34 m Rt, 639+00	Mud Rotary	11-241400	Bridge No. 57-0458 & 57-New 11-SD-KP R61.58 @ Manchester Av. / Encinitas
B-12	360 m Rt, 631+00			
B-13	300 m Rt, 629+80			
B-14	200 m Rt, 629+80			
B-15	180 m Rt, 631+55			
B-16	80 m Lt, 630+40			
B-17	50 m Lt, 631+60			
B-18	160 m Lt, 630+65			
CPT-1	40 Rt, 630+00	Cone Penetrometer		
CPT-2	30 m Lt, 629+80			
CPT-2	40 Lt, 630+00			
B-1	7 m Lt, 802+60 "RMP" Line		11-059100	
SD-7			97-1019	La Costa Ave
B2	68' Lt, 323+17 "O" Line	Mud Rotary	11-039734	Oceanside Blvd Overhead
B3	90' Lt, 323+65 "O" Line			
B4	90' Rt, 323+74 "O" Line			
B1	74' Lt, 324+27 "O" Line			
B5	98' Rt, 324+36 "O" Line			
B6	101' Rt, 324+77 "O" Line			
B7	109' Rt, 325+27 "O" Line			

BORING No.	LOCATION	DRILLING METHOD	EA NUMBER	Area / KP, PM
B15	122' Lt, 413+87 "O" Line	Mud Rotary	11-206904	San Luis Rey River Bridge (L) 2
B13	102' Lt, 415+09 "O" Line			
B12	13' Lt, 415+25 "O" Line			
B14	89' LT, 415+92 "O" Line			
B3	29' Lt, 415+96 "O" Line			
B2	85' Lt, 416+ 43 "O" Line			
B7	48' Lt, 417+27 "O" Line			
B-4	14' Lt, 418+57 "O" Line	Mud Rotary	11-206904	San Luis Rey River Bridge (L) 1
B-6	17' Lt, 418+74 "O" Line			
B-1	15' Lt, 419+67 "O" Line			
B5	34' Lt, 419+84 "O" Line			
B8	31' Lt, 420+99 "O" Line			
B9	79' Lt, 421+10 "O" Line			
B11	06' Lt, 421+87 "O" Line			
B6	08' Rt, 415+11 "O" Line	Mud Rotary	11-206904	San Luis Rey River Bridge (R) 1
B7	72' Rt, 415+47 "O" Line			
B13	11' Rt, 415+ 59 "O" Line			
B3	78' Rt, 415+79 "O" Line			
B5	81' Rt, 415+92 "O" Line			
B1	39' Rt, 415+98 "O" Line			
B4	29' Rt, 417+40 "O" Line			
B2	89' Rt, 417+40 "O" Line			
B9	88' Rt, 419+00 "O" Line			
B18	102' Rt, 420+14 "O" Line"			
B11	45' Rt, 420+16 "O" Line			
B17	21' Rt, 421+35 "O" Line			
BORING No.	**LOCATION**	**DRILLING METHOD**	**EA NUMBER**	**Area / KP, PM**
B15	108' Rt, 421+39 "O" Line	Mud Rotary	11-206904	San Luis Rey River Bridge (R) 2
B16	43' Rt, 421+43 "O" Line			
B14	103' Rt, 421+55 "O" Line			
B10	26' Rt, 421+98 "O" Line			
B12	87' Rt422+09 "O" Line			
B8	63' Rt, 422+11 "O" Line			

Log of Test Borings listed above are located in Appendix A

Existing Tes. .nd Analyses

Table 12

Location / Project	Contract Number / EA Number or Consulting Firm	Log of Test Boring	Moisture Contents & Dry Density Test	Grain Size Distribution	Atterberg Limits	One-Dimensional Consolidation Test	Direct Shear Test	In-Situ Field Test	R-Value Test	Corosivity Test	Liquefaction Potential	Slope Stability	Fill Settlement	Fill Suitability Test	Loaded Swell Test	Plasticity Test	Estimation of Peak Horizontal Acceleration	Compaction Test	Percolation Test
Manchester Ave at I-5 Bridge No. 57-0548 and 57-NEW	SCST	X	X	X	X	X	X	X		X	X								
Lomas Santa Fe Drive at I-5 Bridge No. 57-0479 R/L	SCST	X	X	X		X	X	X	X	X		X	X						
Carmel Mountain Rd & Sorrento Hills Way	Woodward-Clyde Consultants	X	X	X										X	X				
Torrey Reserve Heights in Sorrento Valley	GEOCON	X	X	X		X	X				X	X				X	X	X	
On I-805 from 0.9 km North of Sorrento Valley Blvd UC and I-5 from 0.5 km North of Genesse Ave OC through 0.7 km South of Del Mar Height Rd OC	EA 11-0301U1	X	X	X		X	X					X				X			
I-5 / La Costa Ave proposed Infiltration Basin in Leucadia	RBF	X																	
I-5 Palomar Airport Rd OC in Carlsbad	Kleinfelder	X	X	X	X	X	X		X	X								X	
I-5 STA 802+60 in Oceanside		X																	
I-5 Basin adjacent to San Dieguito River in Del Mar R56.0 / 57.5	EA 11-065101																		X
R045.754 La Jolla Village Rd OC	11028454	X																	
R46.815 Voigt Drive OC	11022434	X																	
R47.411 Genesee Ave OC	11022454	X																	
R48.972 Sorrento Viaduct	11067804	X																	
R48.988 Sorrento Viaduct	11067804 11022454	X																	
KP R49.310 Route 5/805 Separation	11022454	X																	
KP R49.326 Los Penasquitos Creek	11022454	X																	
KP R51.177 Carmel Mtn Rd UC	110301J4 11022454	X																	
KP R52.657 N5E56 / Carmel Valley Ck	11030114	X																	
KP R52.899 N5-E56 / E Carmel Valley Spur	11030114	X																	
KP R52.915 Carmel Valley Rd UC	11030114	X																	
KP R52.947 Carmel Valley Rd UC	110301J4 11022484	X																	
KP R52.947 W56-S5 Connector Separation	11030114																		
KP R54.926 Del Mar Heights Rd OC	11189354	X																	
KP R57.389 San Dieguito River	11189154	X																	
KP R58.370 Via Dela Valle UC	11022484	X																	
KP R60.757 Lomas Santa Fe Drive UC	6211V13C	X																	
KP R61.943 San Elijo Lagoon	6211V13C	X																	
KP R64.100 Birmingham Dr OC	11022414	X																	
KP R64.566 Mackinnon Ave. OC	11206804 11022414	X																	
KP R65.339 Santa Fe Dr UC	11022414	X																	
KP R66.273 Leucadia St OC	11022414	X																	
KP R66.804 Encinitas Blvd UC	11022414	X																	
KP R68.735 Leucadia Blvd OC	11022414	X																	
KP R70.924 La Costa Ave OC	1196194 11058404 11166214 11022464	X																	
KP R71.712 Batiquitos Lagoon	11022464	X																	
KP R73338 Poinsettia Lane OC	11167844 11022464	X																	

EA 235800

Existing Tes. .d Analyses

Table 12

Location / Project	Contract Number / EA Number or Consulting Firm	Log of Test Boring	Moisture Contents & Dry Density Test	Grain Size Distribution	Atterberg Limits	One-Dimensional Consolidation Test	Direct Shear Test	In-Situ Field Test	R-Value Test	Corosivity Test	Liquefaction Potential	Slope Stability	Fill Settlement	Fill Suitability Test	Loaded Swell Test	Plasticity Test	Estimation of Peak Horizontal Acceleration	Compaction Test	Percolation Test
KP R75.687 Palomar Airport Rd OC	11153914 11022474	X																	
KP R76.4 Retaining Wall	EA 11-059100	X																	
KP R77.216 Cannon Rd UC	11039724	X																	
KP R78.343 Agua Hedionda Lagoon	11039744 5311VC1F	X																	
KP R79.050 Chinquapin Ave OC	11206904	X																	
KP R79.308 Tamarack Ave OC	11039724	X																	
KP R80.033 Chestnut Ave UC	11039 724	X																	
KP R80.644 Carlsbad Village Dr UC	11039724	X																	
KP R81.561 Las Flores Dr OC	11039724	X																	
KP R81.851 Jefferson St OC	11206904	X																	
KP R81.980 Buena Vista Lagoon	11039744 11VC1F	X																	
KP R82.398 Route 78/5 Separation	11039734	X																	
KP R82.833 Cassidy St OC	11039734	X																	
KP R83.444 California St OC	11206904 11039734	X																	
KP R83.975 Loma Alta Creek	11039744 5211VC10	X																	
KP R84.168 Oceanside Blvd OH	11039734 11049304 5211VC10	X																	
KP R85.021 Brooks St OC	11206904 11039744	X																	
KP R85.633 Route 76 / 5 Separation	11206904 11039734	X																	
KP R85.907 Fourth St OC	11206904 11039744	X																	
KP R86.502 Eighth St OC	11206904 11039734	X																	
KP R86.760 Route 5 / 76 Separation	11159024 11039734	X																	
KP R86.969 San Luis Rey River	11206904 11039734	X																	
KP R87.001 N5-W76 / San Luis Rey River	11039734	X																	
KP R87.532 Camp Pendelton UC	11039734 5511VC16	X																	
KP R88.175 Camp Del Mar OC	11035724	X																	
KP R89.141 Fallbrook Junktion OH	11035724	X																	

FIGURES

11-SD-5,805
SD-5 - K.P. R 46.8/R 89.1
SD-805- K.P. 44.0/45.9

IN SAN DIEGO COUNTY, IN SAN DIEGO, SOLANA BEACH, ENCINITAS, CARLSBAD AND OCEANSIDE ON ROUTE 5 FROM LA JOLLA VILLAGE DRIVE OVERCROSSING TO 1.6 KM NORTH OF THE HARBOR DRIVE UNDERCROSSING AND ON ROUTE 805 FROM 0.3 KM NORTH OF MIRA MESA BOULEVARD UNDERCROSSING TO THE JUNCTION OF ROUTE 5

CONSTRUCT HOV / GENERAL PURPOSE / AUX. LANES

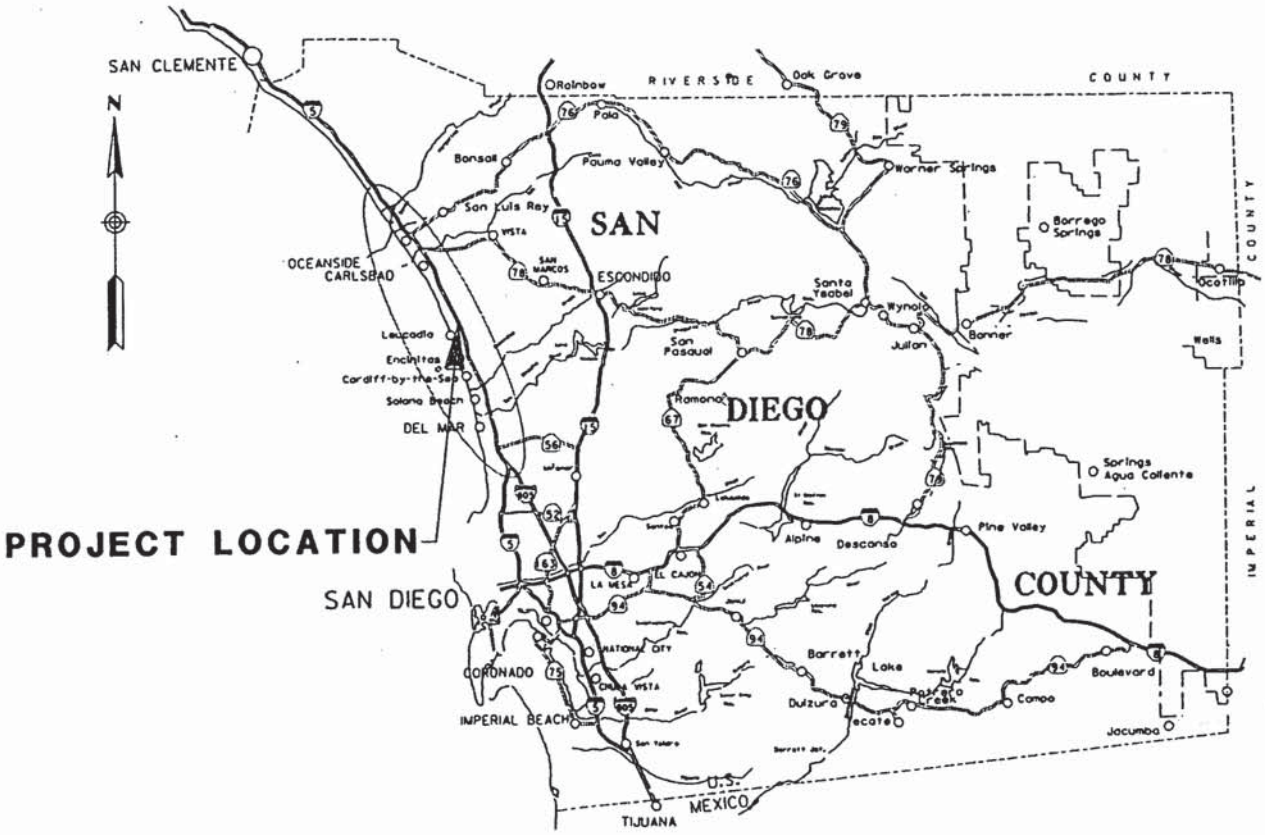


FIGURE 1

u:\shawn\23580-figure1.dgn Aug. 12, 2004 09:04:22

GEOLOGY OF THE DEL MAR QUADRANGLE
SAN DIEGO COUNTY, CALIFORNIA

by Michael P. Kennedy

SCALE 1:24 000

1 MILE — 1000 0 1000 2000 3000 4000 5000 6000 7000 FEET — 1 KILOMETER

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOWER LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 4 FEET

1975

EXPLANATION

QUATERNARY — Holocene

Qaf — Artificial fill

Qb — Beach sand

Qal + Qsw — Alluvium and slopewash undifferentiated

Qls — Landslide deposits

QUATERNARY — Pleistocene

Qt — Stream-terrace deposits

Qbp — Bay Point Formation

Qln, Qlb — Lindavista Formation
Qln, nearshore deposits; Qlb, beach deposits.

TERTIARY — Eocene

Tmv, Tscu, Tsc, Ta, Tt, Td, Tf — Poway and La Jolla Groups
Tmv, Mission Valley Formation; Tsl, Stadium Conglomerate; Tf, Friars Formation; Tscu, Scripps Formation (upper tongue); Tsc, Scripps Formation; Ta, Ardath Shale; Tt, Torrey Sandstone; Td, Delmar Formation; Td & Tf, Delmar and Friars Formation undifferentiated. Conglomerate marked by circle pattern, sandstone marker bed shown by dot pattern.

CRETACEOUS — Upper Cretaceous

Kl — Lusardi Formation

Kgd — Gabbro

JURASSIC

Js — Santiago Peak Volcanics

SYMBOLS

Contact
(dashed where approximately located; dotted where concealed)

Fault, showing dip
(dashed where approximately located; dotted where concealed; U, upthrown side; D, downthrown side; shear zone).

Anticline, showing direction of plunge.

Syncline, showing direction of plunge.

Strike and dip of bedding.

FIGURE 2 – EXISITNG BORINGS AND PROJECT LAYOUTS (GEOLOGY INCULDED)

FIGURE 2 – EXISITNG BORINGS AND PROJECT LAYOUTS (GEOLOGY INCULDED)

DIVISION OF MINES AND GEOLOGY
JAMES F. DAVIS, STATE GEOLOGIST

GEOLOGIC MAPS OF THE NORTHWESTERN PART OF SAN DIEGO COUNTY, CALIFORNIA

PLATE 2
GEOLOGIC MAP OF THE ENCINITAS AND RANCHO SANTA FE 7.5' QUADRANGLES, SAN DIEGO COUNTY, CALIFORNIA

By

Siang S. Tan and Michael P. Kennedy

1996

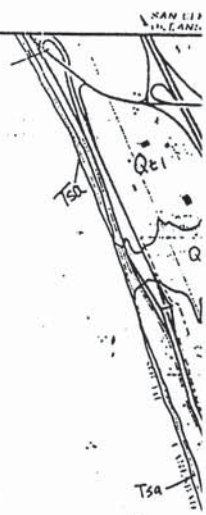
SCALE 1 : 24,000

1 1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL



AUTHORS' NOTE

This geologic mapping was conducted as part of several earlier Division of Mines and Geology investigations in northern San Diego County. The most recent and most comprehensive of these studies resulted in the release of Open-File Report 95-04 --Landslide hazards in the northern part of the San Diego metropolitan area, San Diego County, California (Tan and Giffen, 1995). Because a geologic map was not published as part of OFR 95-04 and significant geologic revisions were made to earlier mapping during the course of that investigation, we felt it important that this map be made available at this time.

An attempt has been made here to clarify the relationship of Paleogene rocks of the Santa Ana Mountains and the San Diego Embayment. Coeval nearshore marine, lagoonal, and terrestrial sedimentary rocks interfinger along the margin of the San Diego embayment with similar rocks of the southern Santa Ana Mountains in the Encinitas, Carlsbad, and Oceanside areas. Facies

MAP UNITS

QUATERNARY

Holocene

- **Qal** — Alluvium and colluvium. Unconsolidated clay, sand and gravel.
- **Qb** — Beach deposits: unconsolidated sand.
- **Ql** — Lake, reservoir and pond deposits; partly submerged, unconsolidated clay, silt, sand and grav
- **√/?** — Landslide deposits (includes headscarp area). Se further California Division of Mines and Geolog Open-File Report 95-04.

Pleistocene

- **Qt1-4** — Terrace deposits; reddish brown, poorly bedded, poorly-to moderately-indurated sandstone, siltstone and conglomerate. Subscripts indicate relative level with 1 the lowest elevation (young age). The three lower levels have been correlate with the Bay Point Formation and the highest level with the Linda Vista Formation; see Kenne (1975), Weber (1982), and Wilson (1972).

changes are rapid and lithologies extremely variable which together with low relief, compound the effort to draw clear boundaries between some of the units.

The Mid-Cretaceous batholithic rocks are labeled on the map as "Kg" with subscripts indicating the map symbols (rock types) used by Larsen (1948). We have not changed the designation of most of Larsen's rock types but have remapped most of the contacts in order to provide accurate delineations of these rock units at this much increased scale and far improved topographic base.

The earlier work by Tan, S.S. (1986 and 1987) was modified as part of this study. No new detailed geologic field work was done to revise this mapping. Most of the revised contacts are approximate and the result of reconnaissance mapping and air photo interpretation. Man-made fill material (residential, mining, waste disposal/landfill, road fill, etc.) is not shown on this map. Landslides and other geologic features have been mapped as they existed prior to development.

MAP SYMBOLS

Contact (boundary) between map units. Most boundaries are not exposed and are inferred.

Strike, and dip of inclined beds. Most bedding attitudes are estimated.

Horizontal beds.

Fault; dotted where concealed. Arrow and number indicate direction and amount of dip of exposed fault plane. U indicates upthrown side; D indicates downthrown side.

Strike, direction, and amount of dip of minor fault (shear joint) plane. Most fault displacements are less than 5 feet.

Landslide; arrows indicate general direction of movement. Both the headscarp area and debris deposit are included within the map symbol. Landslides are depicted prior to urban development. Only landslides larger than 300 feet across are shown on the map. For further information see California Division of Mines and Geology Open-File Report 95-04.

Questionable landslide.

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Geology modified after Tan (1986 and 1987)

TERTIARY

Pliocene

Tsm — San Mateo Formation; light colored, massive to poorly bedded, poorly- to moderately-indurated, fine-grained sandstone with some conglomerate. Possibly correlative with the Niguel Formation in the Santa Ana Mountains.

Miocene

Tso — San Onofre Breccia; greenish red, poorly-to moderately-bedded, well-indurated, breccia with Catalina Schist clasts. Resistant to landsliding.

Tda — Dacite stock; small bodies of igneous rock of dacitic and basaltic composition.

Late Eocene

Tmv — Mission Valley Formation (Poway Group); light-colored, poorly-bedded, poorly-indurated, fine-to medium-grained sandstone.

Tst — Stadium Conglomerate (Poway Group); poorly-bedded, poorly-to moderately-indurated, cobble conglomerate with coarse-grained sandstone matrix.

Middle Eocene

Tsa/Tt — Santiago Formation; light-colored, poorly-bedded, poorly-indurated, fine-to medium-grained sandstone interbedded with landslide-prone siltstone and claystone. Local coarse-grained sandstone and conglomerate. Renamed from Scripps Formation in the Encinitas (Tan, 1986) and Rancho Santa Fe (Tan, 1987) quadrangles. It interfingers with Torrey Sandstone.

Torrey Sandstone (La Jolla Group); light-colore massive and thick-bedded, well-indurated, med to coarse-grained arkosic sandstone. Resistant landsliding. It interfingers with Santiago Forn tion.

Tf — Friars Formation (La Jolla Group); poorly-bedded, poorly-indurated, landslide-prone claystone, fine- to medium-grained sandstone and some conglomerate.

Td — Del Mar Formation (La Jolla Group); poorly-bedded, poorly-indurated, landslide-prone sandy claystone interbedded with medium- to coarse-grained sandstone. A similar greenish colored claystone also occurs locally in the Santiago Formation.

LATE-CRETACEOUS

Kp — Point Loma Formation (Rosario Group); well-bedded, well-indurated siltstone and fine-grained sandstone.

Kl — Lusardi Formation (Rosario Group); poorly-bedded, moderately-indurated cobble and boulder conglomerate with thin lenses of medium-grained sandstone. Possibly correlative with the Trabuco Formation in the Santa Ana Mountains.

MID-CRETACEOUS

Kg — Undivided granitic rocks of the Southern California batholith, includes: fine-to medium-grained granodiorite, tonalite and gabbro. Subscripts indicate the map symbols used by Larsen (1948).

Kg (e) — Escondido Creek Leucogranodiorite (Larsen, 1948); light-colored, fine-grained granodiorite and tonalite, with locally abundant inclusions.

Kg (wm) — Woodson Mountain Granodiorite (Larsen, 1948); medium-to coarse-grained granodiorite. It weathers into distinctive boulders of disintegration.

Kg (b) — Bonsall Tonalite (Larsen, 1948); medium-grained tonalite, characterized by abundant inclusions.

Kg (gv) — Green Valley Tonalite (Larsen, 1948); medium-grained tonalite (similar to Bonsall Tonalite, but it lacks the abundant inclusions).

Kg(sm) — San Marcos Gabbro (Larsen, 1948); medium-grained gabbro and norite.

JURASSIC-CRETACEOUS

KJsp — Undifferentiated Santiago Peak Volcanics, mildly metamorphosed volcanic, volcaniclastic and interbedded sedimentary rocks. Volcanic rocks range from basalt to rhyolite, but are predominantly andesite. It also contains some rock types listed under KJm (mentioned below).

KJm — Metavolcanic and metasedimentary rocks, with fine-grained granodioritic and other plutonic rocks. The map unit contains schist, quartzite, argillite, slate, phyllite, amphibolite, metamorphosed tuff-breccia, gneiss and metabasalt. It also consists of some rock types listed under KJsp (mentioned above) but it generally does not contain dark-colored andesitic rocks.

Topographic Base by U.S. Geological Survey

FIGURE 2 – EXISITNG BORINGS AND PROJECT LAYOUTS (GEOLOGY INCULDED)

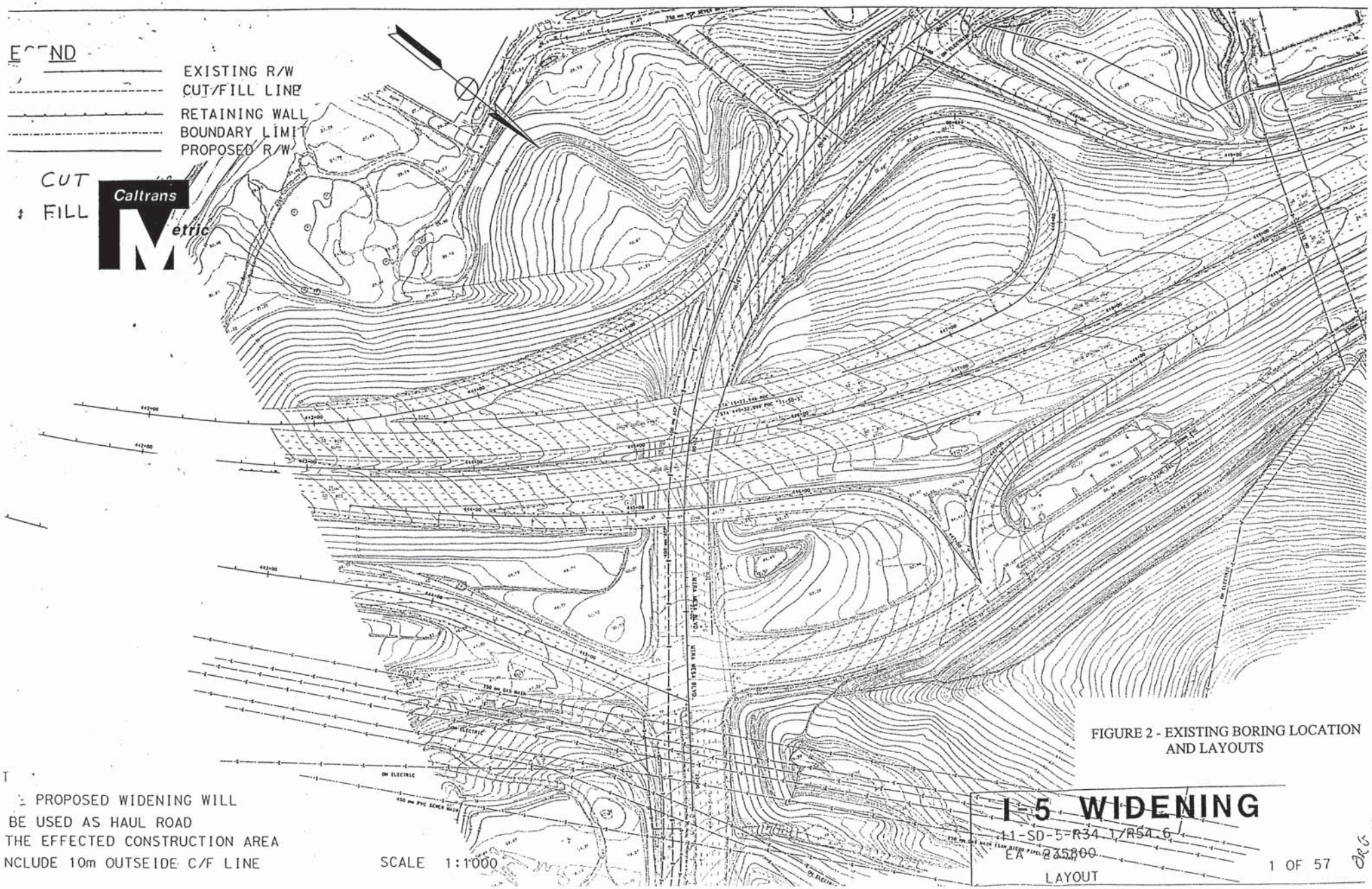
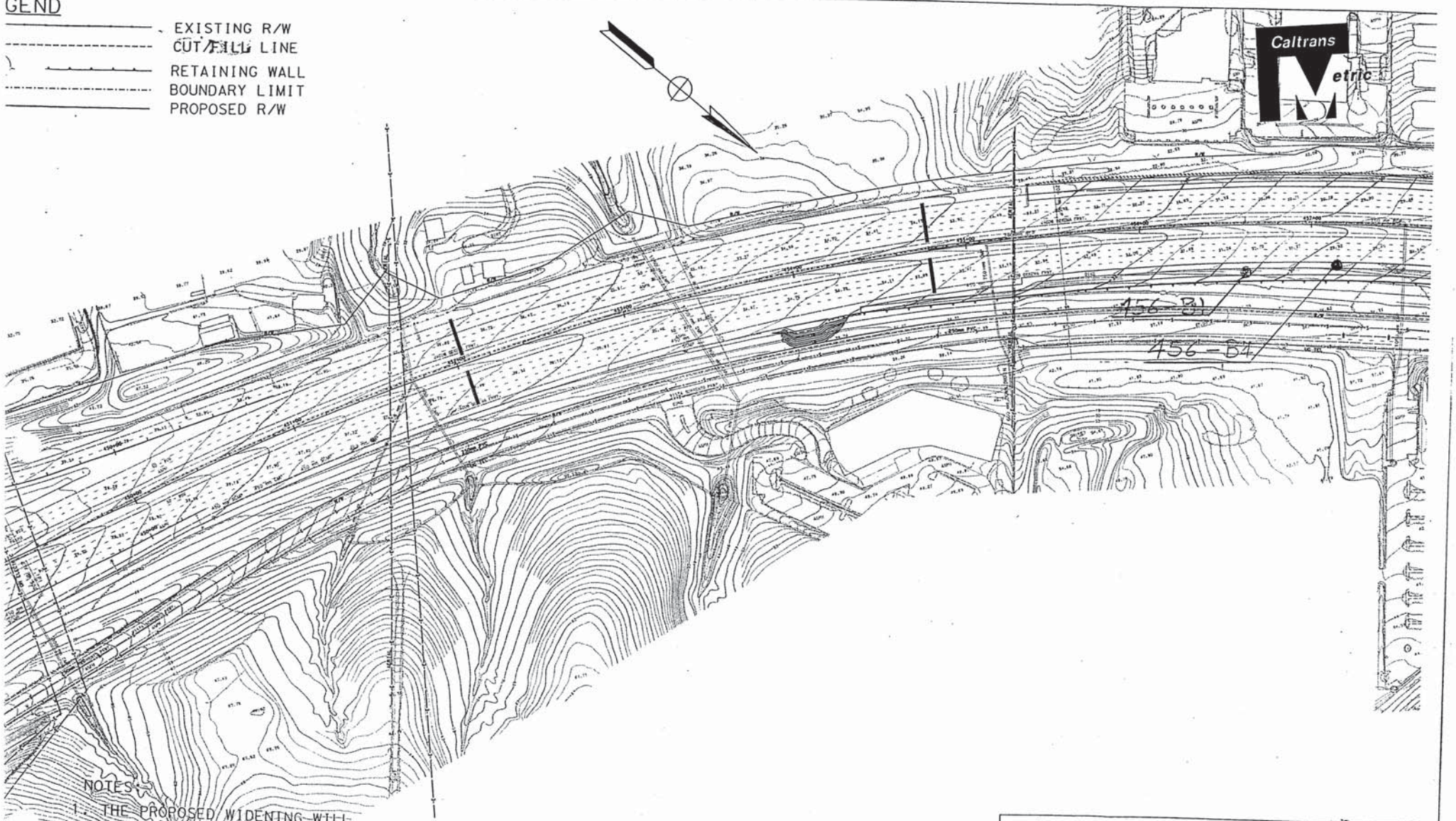


FIGURE 2 - EXISTING BORING LOCATION AND LAYOUTS

GEND

- EXISTING R/W
- CUT/FILL LINE
- RETAINING WALL
- BOUNDARY LIMIT
- PROPOSED R/W



NOTES:

1. THE PROPOSED WIDENING WILL BE USED AS HAUL ROAD
2. THE EFFECTED CONSTRUCTION AREA INCLUDE 10m OUTSEIDE C/F LINE

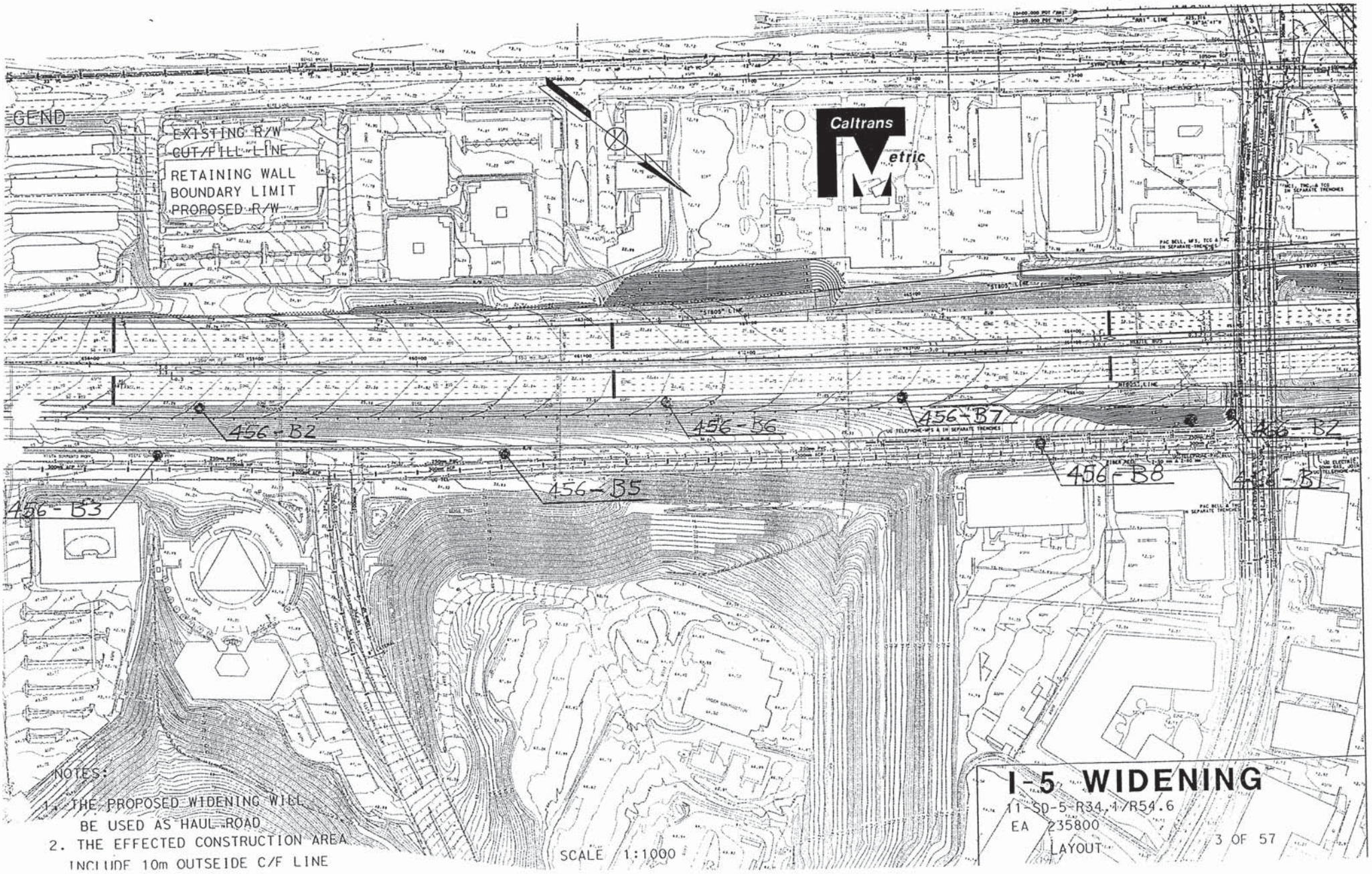
SCALE 1:1000

I-5 WIDENING

11-SD-5-R34.1/R54.6

EA 235800

LAYOUT



NOTES:

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I-5 WIDENING

11-SD-5-R34.4/R54.6

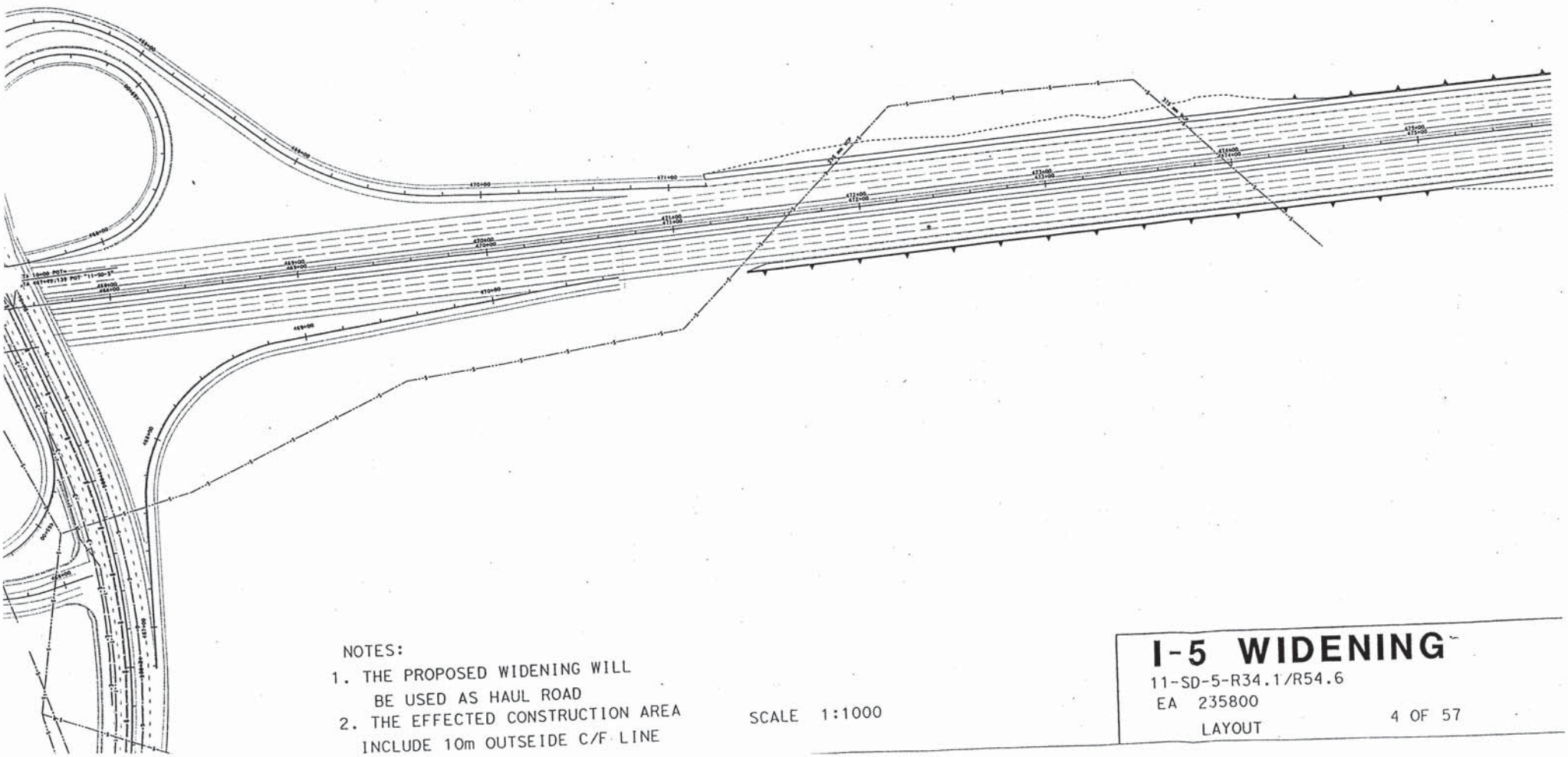
EA 235800

LAYOUT

LEGEND

EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
PROPOSED R/W

Caltrans Metric



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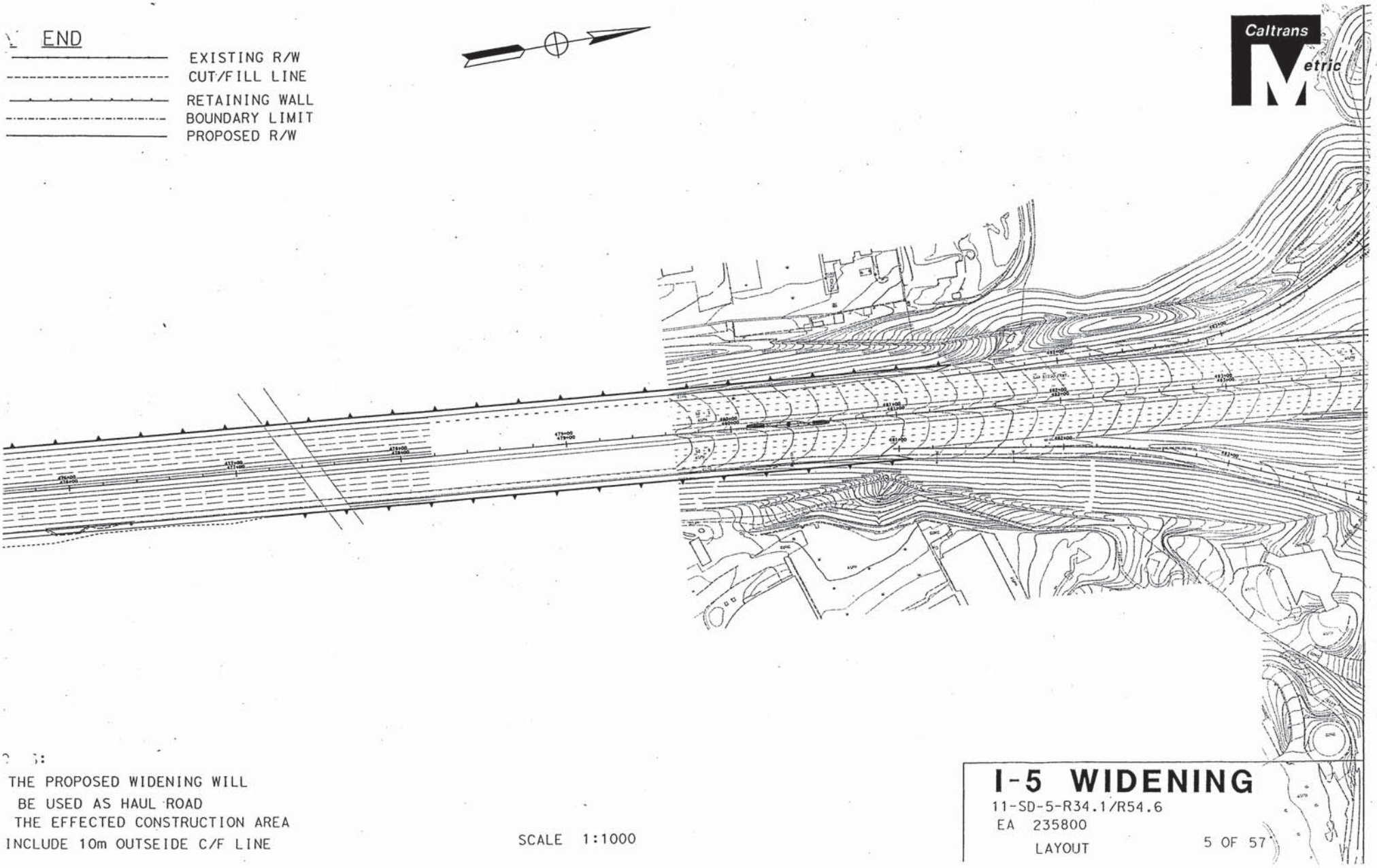
SCALE 1:1000

I-5 WIDENING

11-SD-5-R34.1/R54.6
EA 235800
LAYOUT

END

EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
PROPOSED R/W



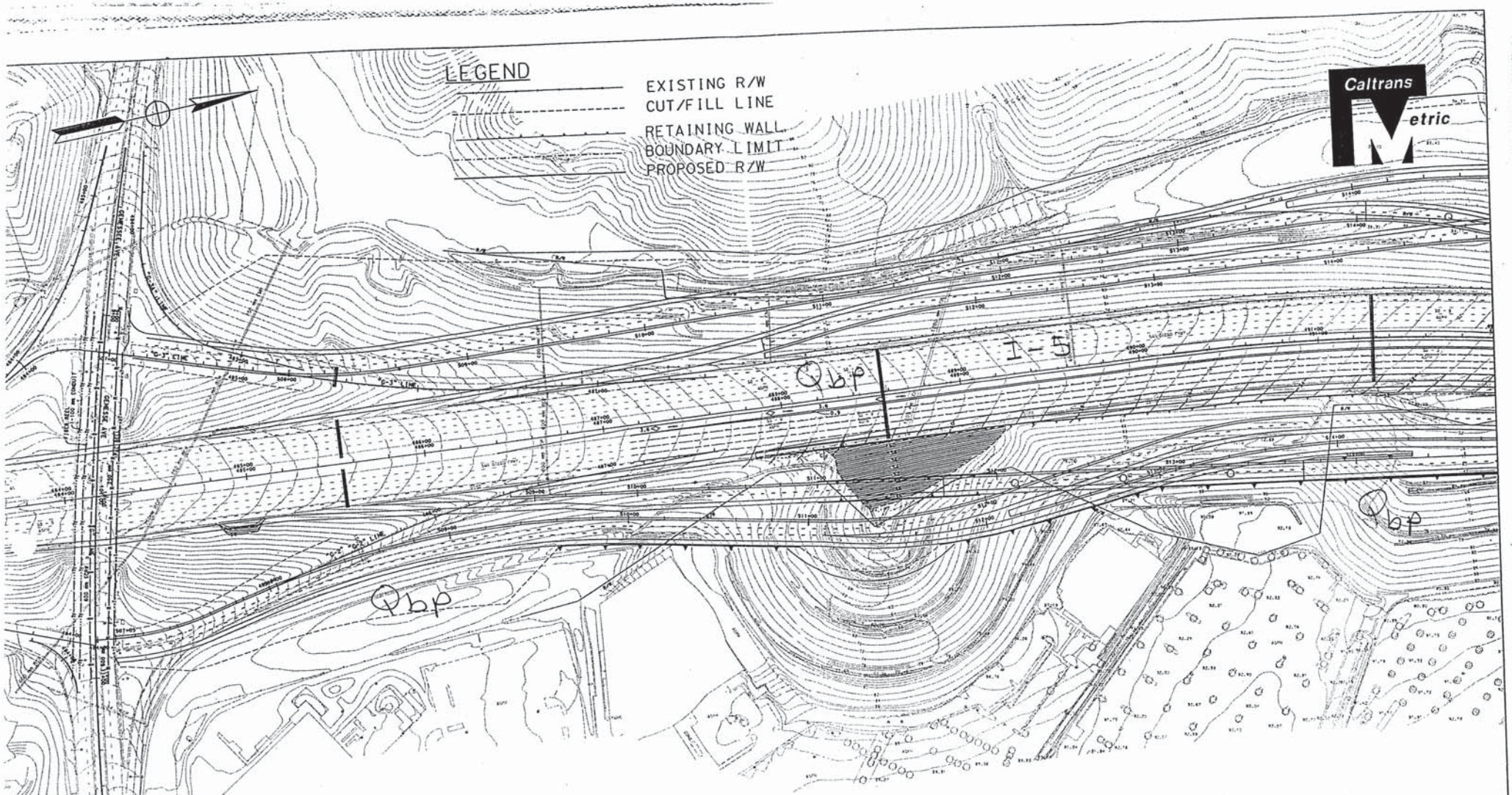
Caltrans Metric

THE PROPOSED WIDENING WILL
BE USED AS HAUL ROAD
THE EFFECTED CONSTRUCTION AREA
INCLUDE 10m OUTSEIDE C/F LINE

SCALE 1:1000

I-5 WIDENING

11-SD-5-R34.1/R54.6
EA 235800
LAYOUT



NOTES:
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2. THE EFFECTED CONSTRUCTION AREA INCLUDE 10m OUTSEIDE C/F LINE

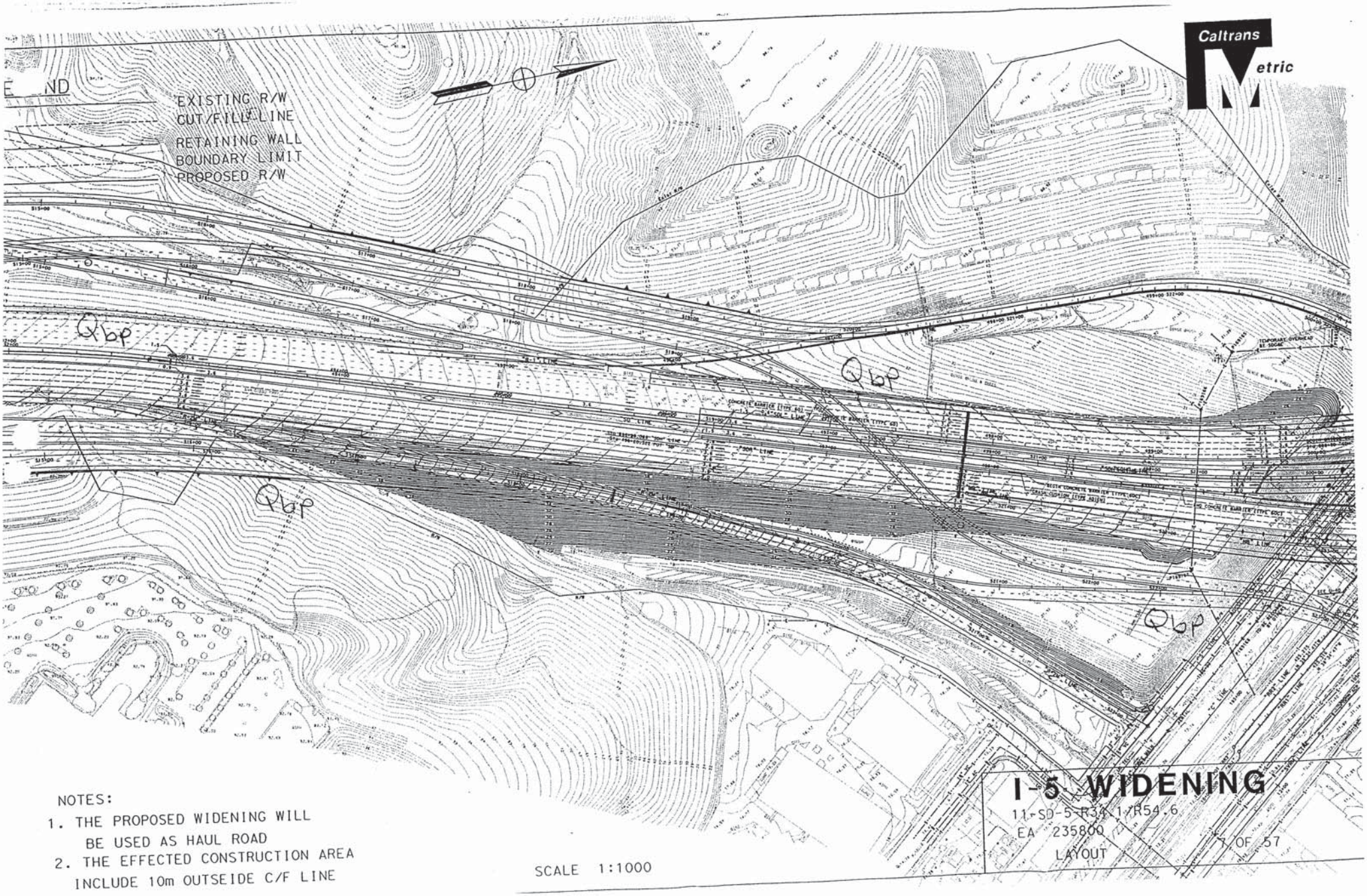
SCALE 1:1000

I-5 WIDENING

11-SD-5-R34.1/R54.6

EA 235800

LAYOUT



NOTES:

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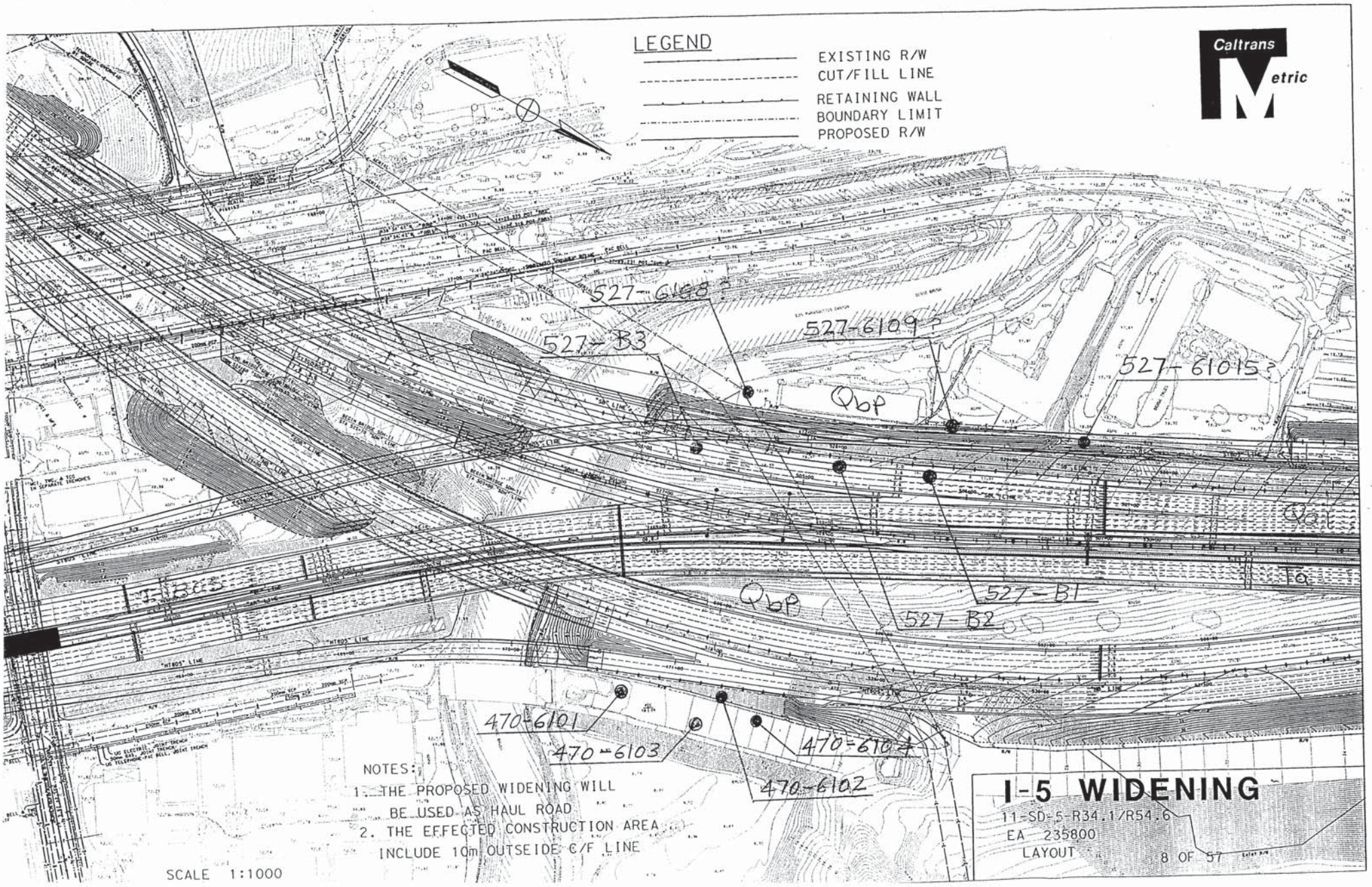
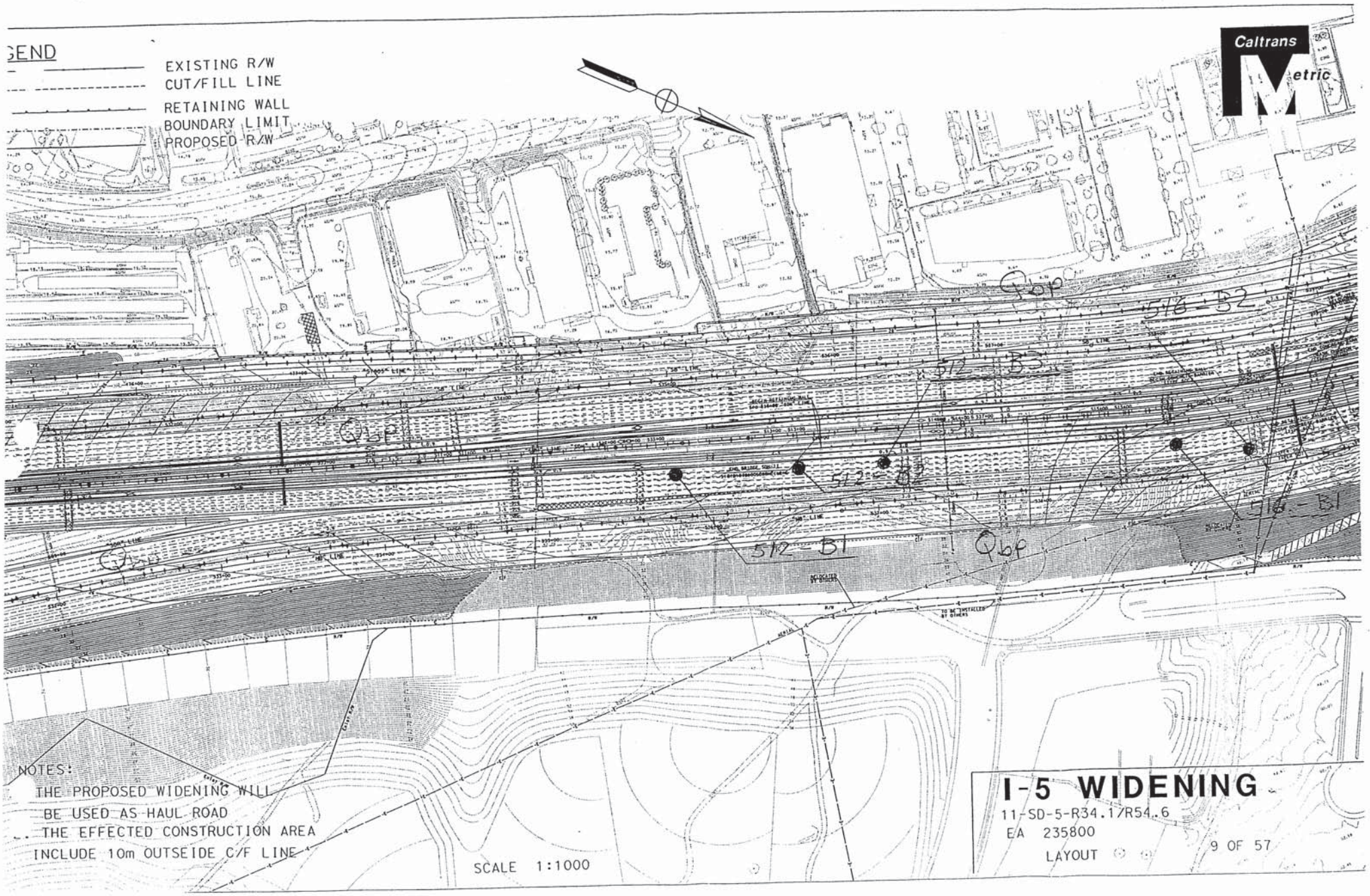
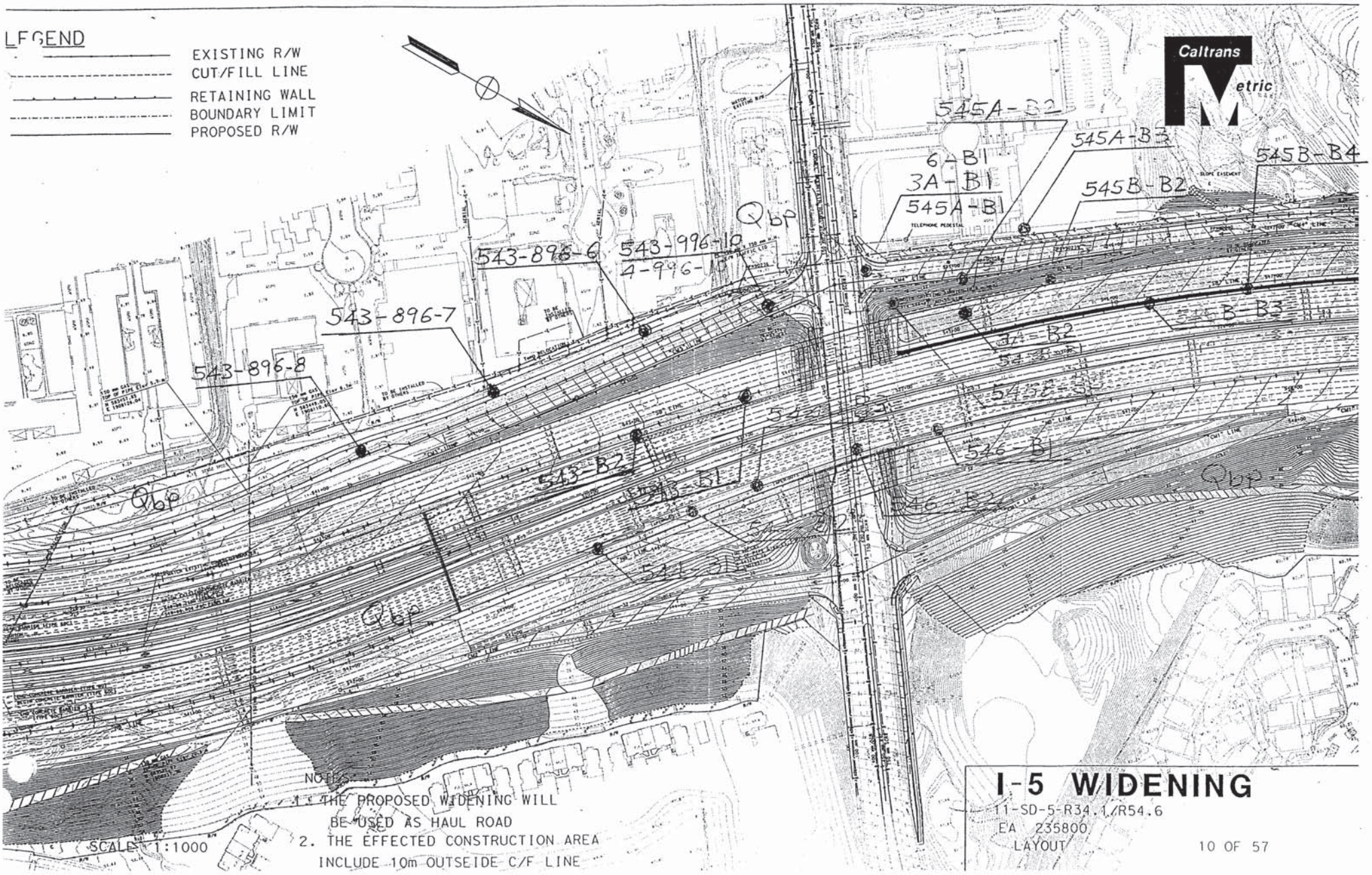
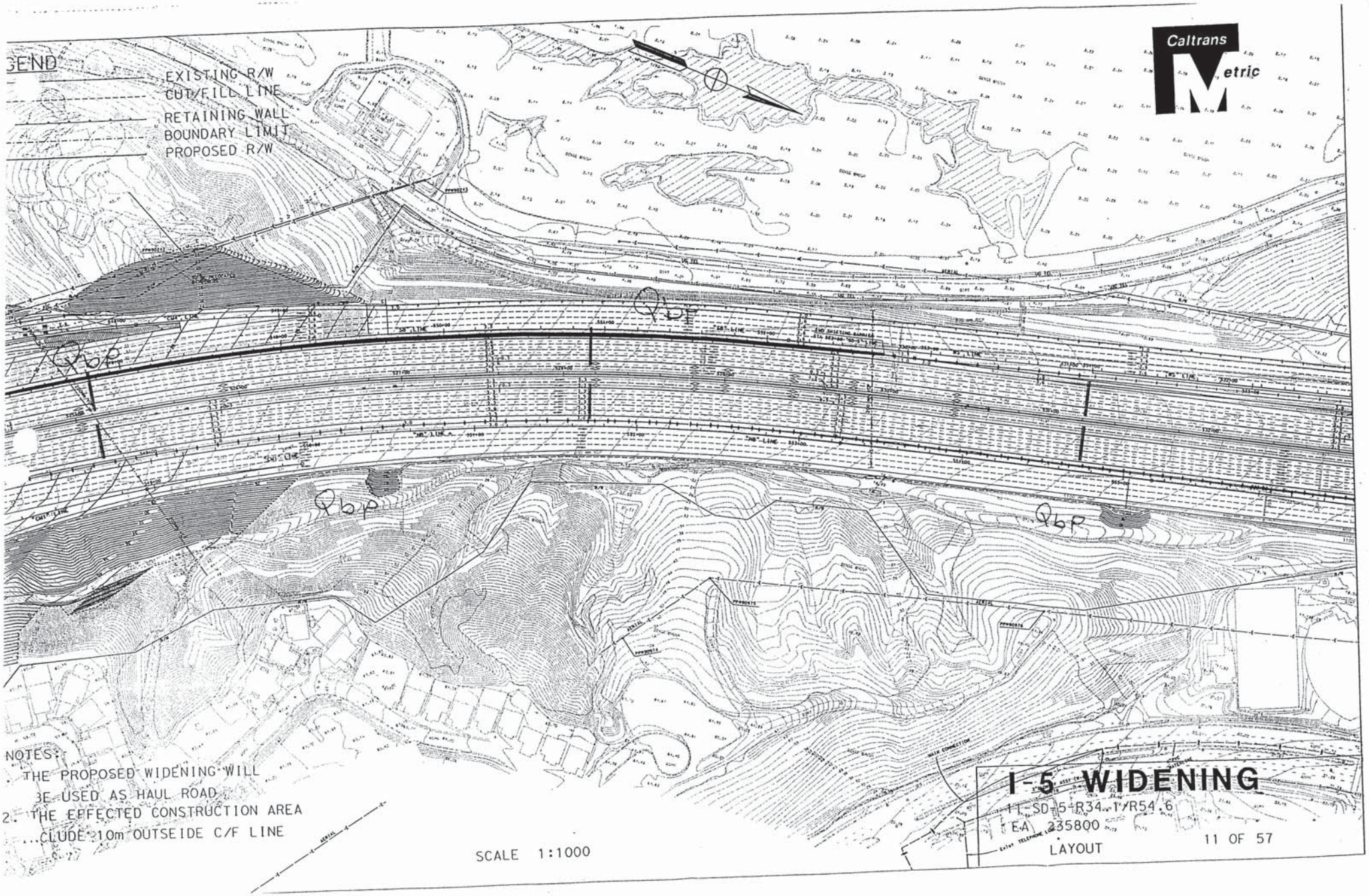
2. THE EFFECTED CONSTRUCTION AREA INCLUDE 10m OUTSEIDE C/F LINE

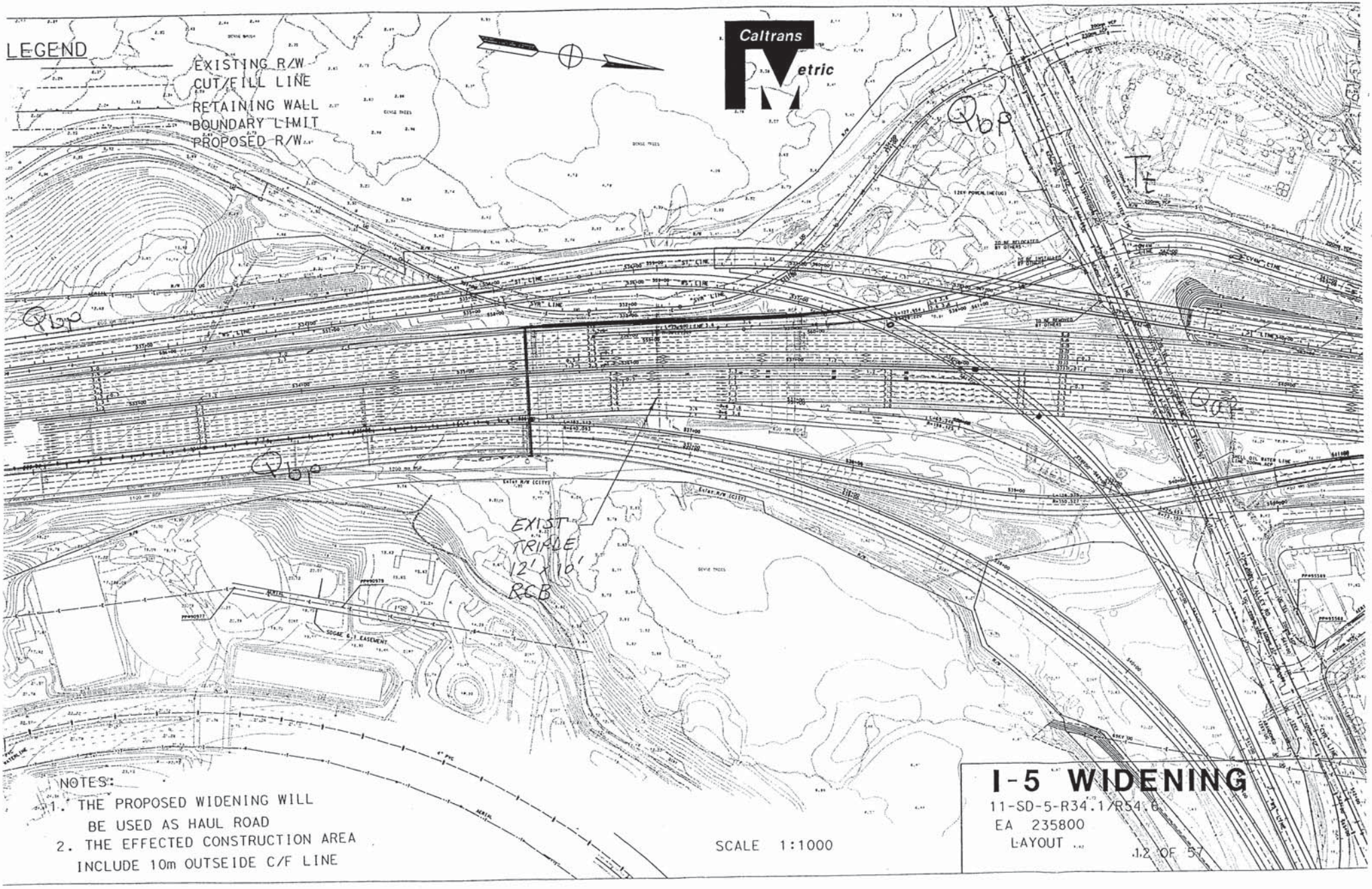
SCALE 1:1000

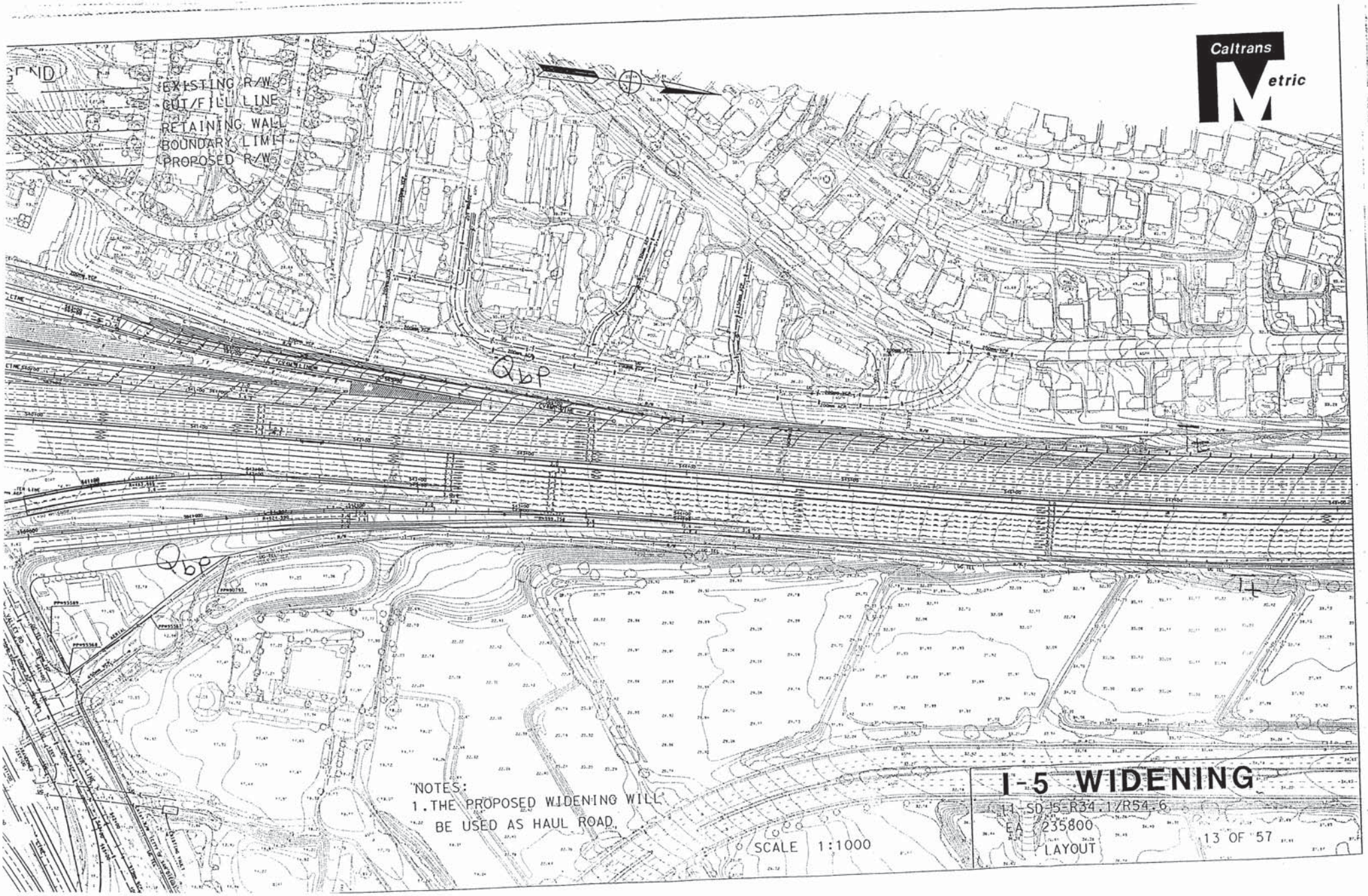

LEGEND
EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
PROPOSED R/W
Caltrans
Metric
527-6108
527-B3
527-6109
527-6101
Qbp
Qal
Tq
527-B1
527-B2
470-6101
470-6103
470-6104
470-6102
NOTES:
1. THE PROPOSED WIDENING WILL BE USED AS HAUL ROAD
2. THE EFFECTED CONSTRUCTION AREA INCLUDE 10m OUTSEIDE C/F LINE
SCALE 1:1000
I-5 WIDENING
11-SD-5-R34.1/R54.6
EA 235800
LAYOUT 8 OF 57

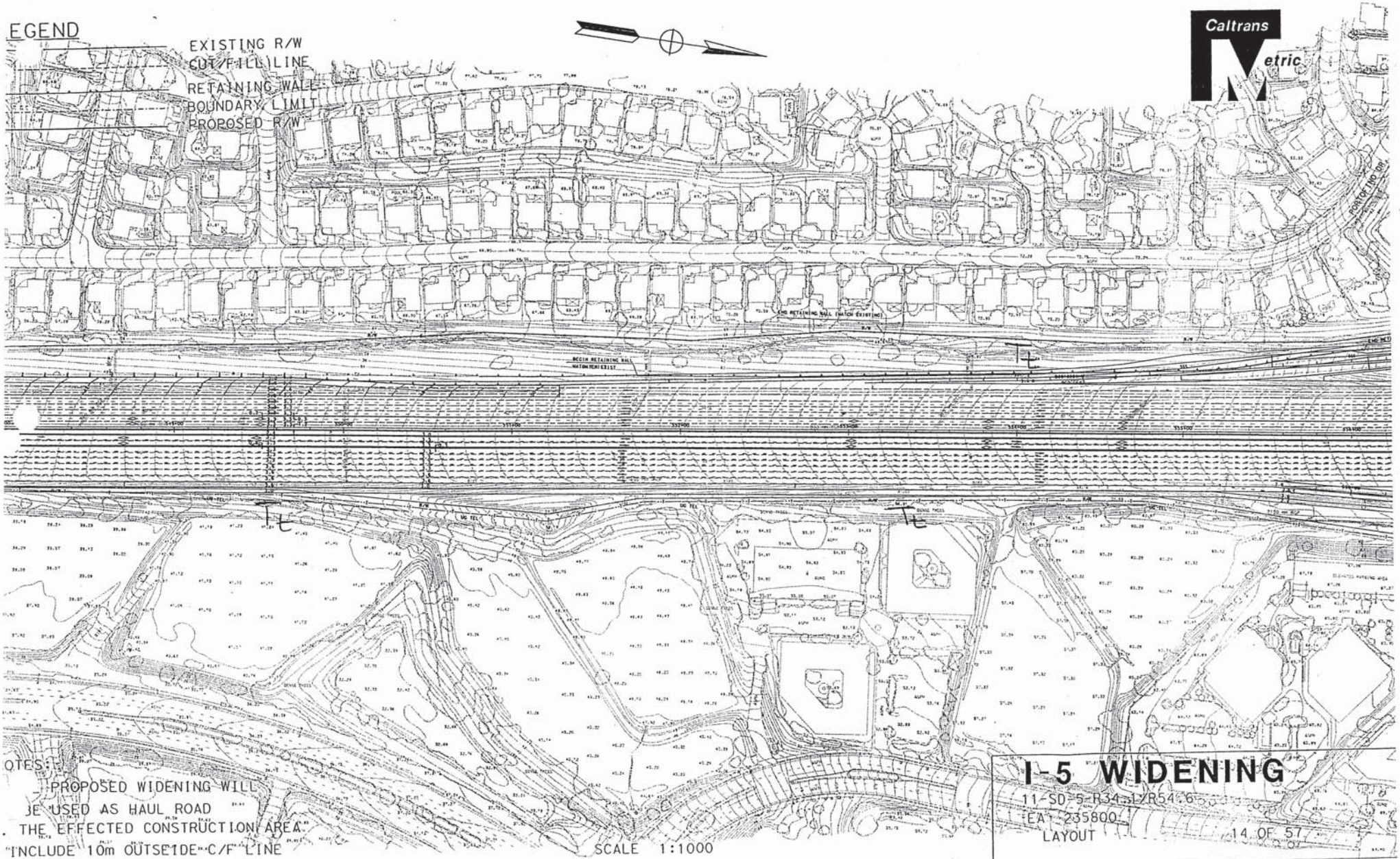

GEND
EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
PROPOSED R/W
Caltrans
Metric
Qbp
516-B2
512-B3
512-B2
512-B1
516-B1
NOTES:
THE PROPOSED WIDENING WILL
BE USED AS HAUL ROAD
THE EFFECTED CONSTRUCTION AREA
INCLUDE 10m OUTSEIDE C/F LINE
SCALE 1:1000
I-5 WIDENING
11-SD-5-R34.1/R54.6
EA 235800
LAYOUT
9 OF 57

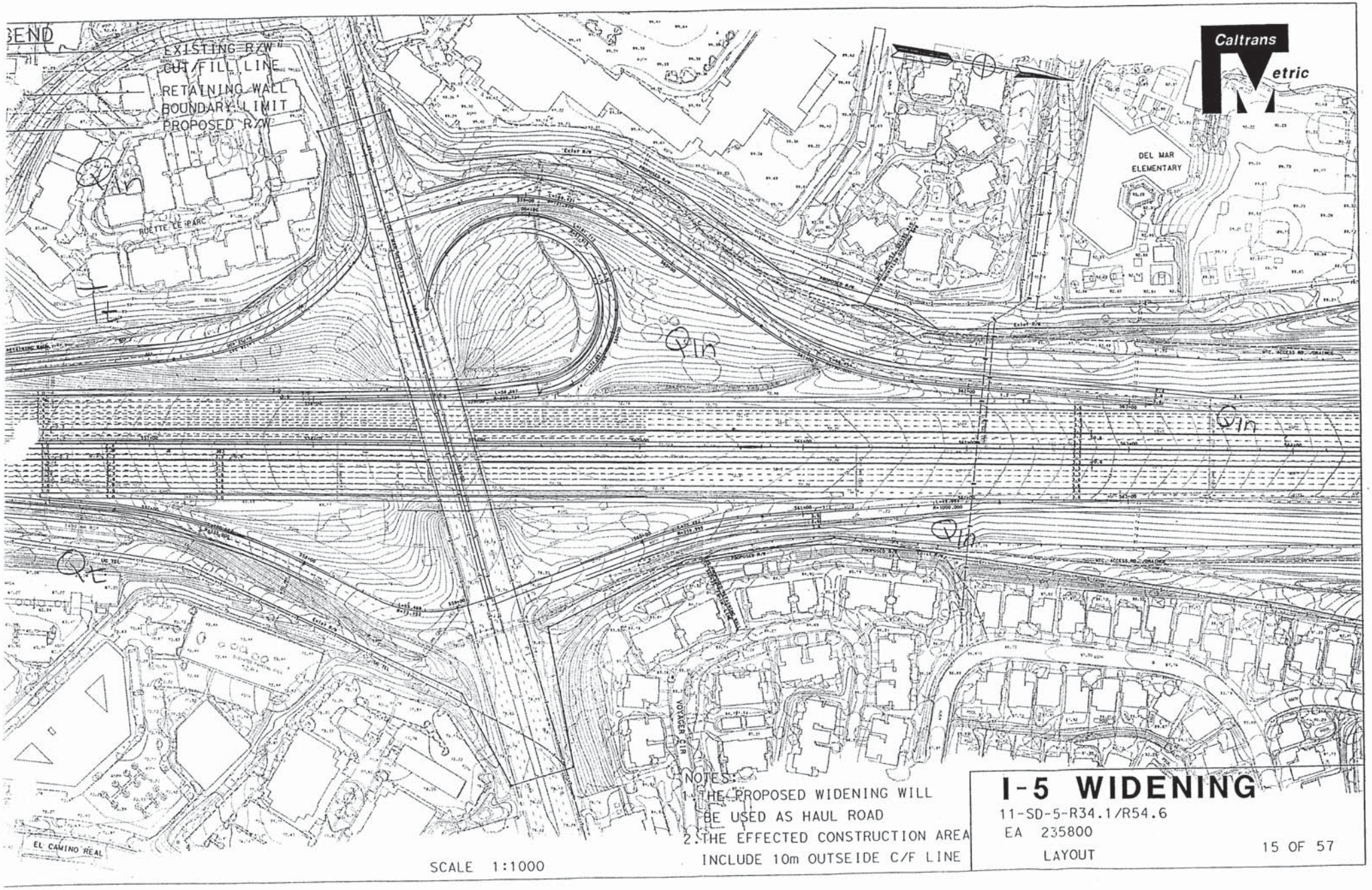

LEGEND
EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
PROPOSED R/W
Caltrans Metric
545A-B2
545A-B3
6-B1
3A-B1
545A-B1
545B-B4
545B-B2
Qbp
543-896-6
543-996-10
4-996-10
543-896-7
543-896-8
545B-B3
3A-B2
546-B1
543-B2
543-B1
546-B2
Qbp
Qbp
Qbp
NOTES:
1. THE PROPOSED WIDENING WILL BE USED AS HAUL ROAD
2. THE EFFECTED CONSTRUCTION AREA INCLUDE 10m OUTSEIDE C/F LINE
SCALE 1:1000
I-5 WIDENING
11-SD-5-R34.1/R54.6
EA 235800
LAYOUT
10 OF 57


Caltrans
Metric
GEND
EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
PROPOSED R/W
Qbp
Qbp
Qbp
Qbp
NOTES:
. THE PROPOSED WIDENING WILL
BE USED AS HAUL ROAD
2. THE EFFECTED CONSTRUCTION AREA
...CLUDE 10m OUTSEIDE C/F LINE
SCALE 1:1000
I-5 WIDENING
11-SD-5-R34.1/R54.6
E.A. 235800
LAYOUT
11 OF 57


LEGEND
EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
PROPOSED R/W
Caltrans Metric
Qbp
EXIST TRIPLE 12' x 10' RCB
NOTES:
1. THE PROPOSED WIDENING WILL BE USED AS HAUL ROAD
2. THE EFFECTED CONSTRUCTION AREA INCLUDE 10m OUTSEIDE C/F LINE
SCALE 1:1000
I-5 WIDENING
11-SD-5-R34.1/R54.6
EA 235800
LAYOUT
12 OF 57


Caltrans
Metric
EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
PROPOSED R/W
Qbp
Qbp
NOTES:
1. THE PROPOSED WIDENING WILL
BE USED AS HAUL ROAD.
SCALE 1:1000
I-5 WIDENING
11-SD-5-R34.1/R54.6
EA 235800
LAYOUT
13 OF 57


EGEND
EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
PROPOSED R/W
Caltrans
Metric
OTES:
PROPOSED WIDENING WILL
BE USED AS HAUL ROAD
THE EFFECTED CONSTRUCTION AREA
INCLUDE 10m OUTSEIDE C/F LINE
SCALE 1:1000
I-5 WIDENING
11-SD-5-R34.1/R54.6
EA 235800
LAYOUT
14 OF 57



NOTES:
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2. THE EFFECTED CONSTRUCTION AREA INCLUDE 10m OUTSEIDE C/F LINE

SCALE 1:1000

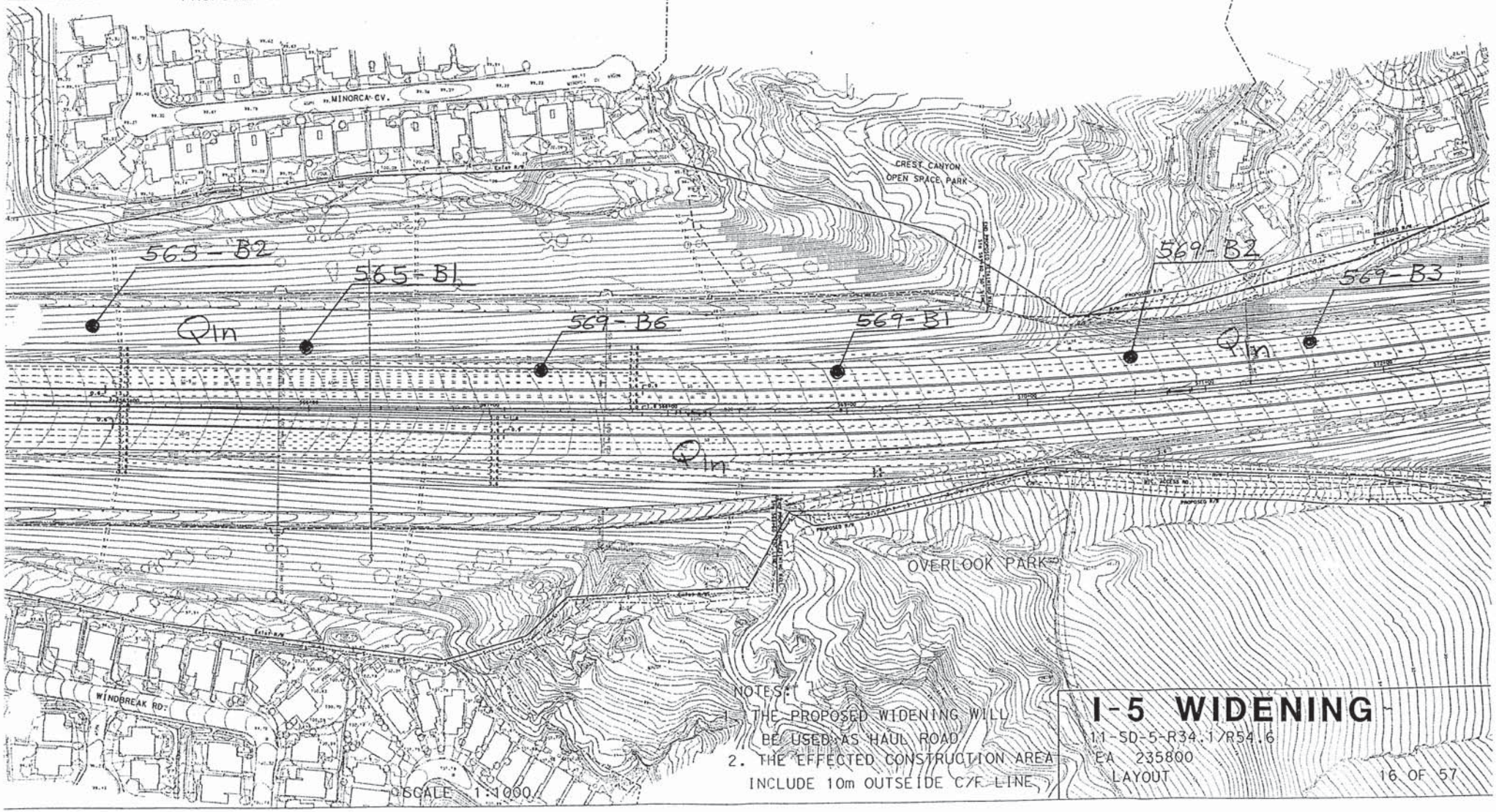
I-5 WIDENING

11-SD-5-R34.1/R54.6
EA 235800
LAYOUT

GEND

EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
PROPOSED R/W

Caltrans Metric



NOTES:
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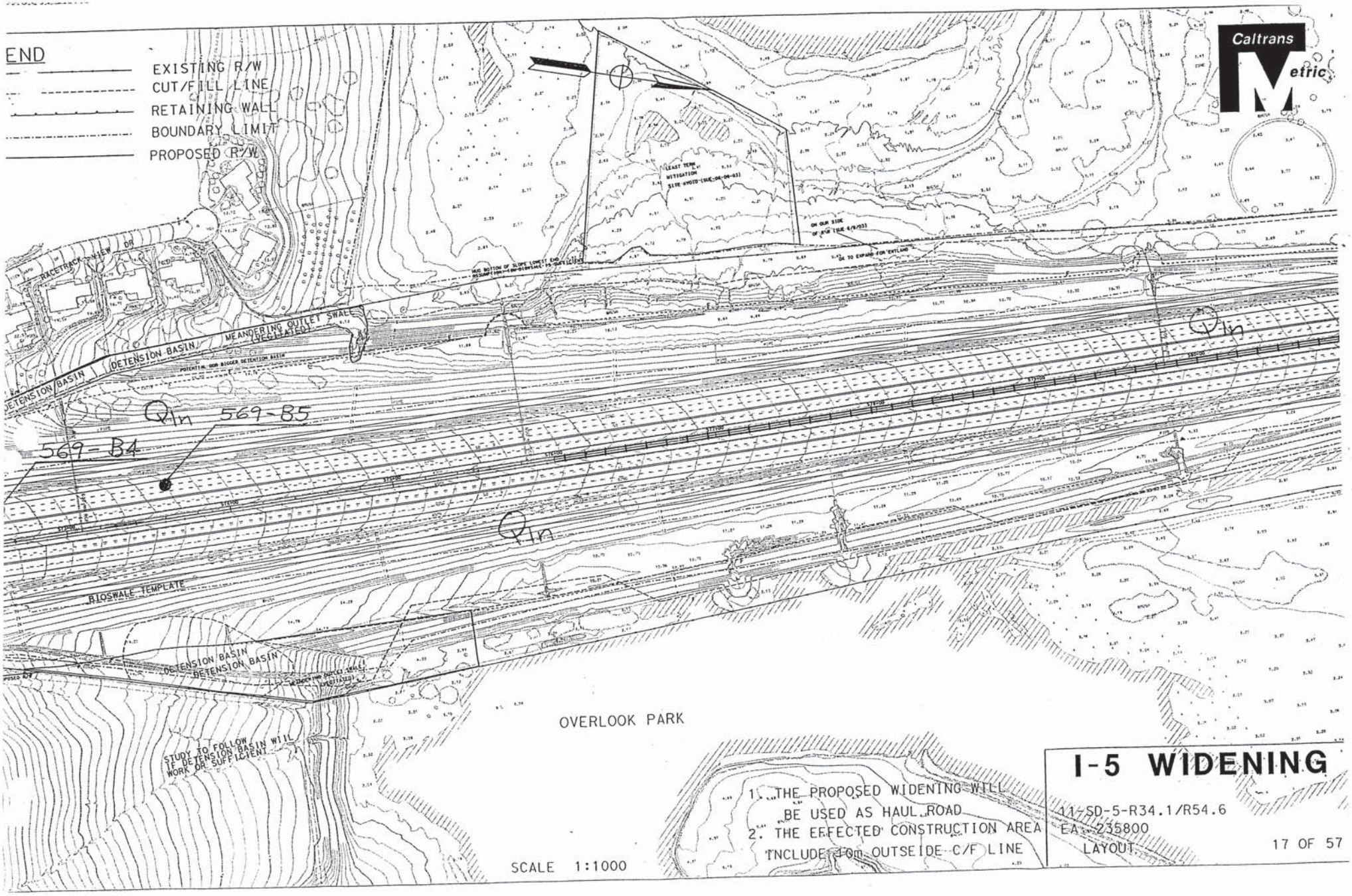
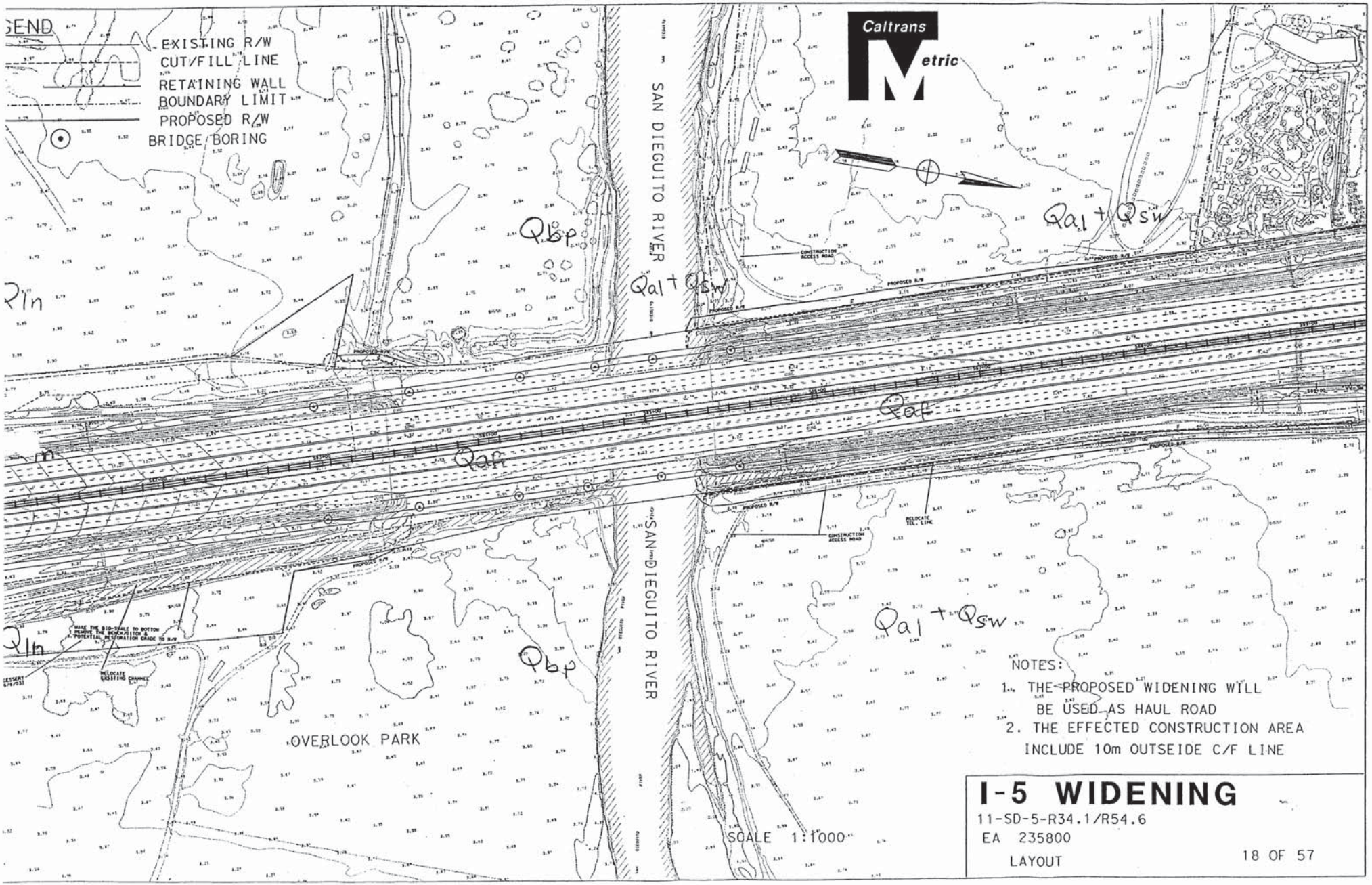
I-5 WIDENING

11-SD-5-R34.1/R54.6
EA 235800
LAYOUT


END
EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
PROPOSED R/W
Caltrans
Metric
RACETRACK VIEW DR
DETENSION BASIN
DETENSION BASIN
MEANDERING OUTLET SWALE (VEGETATED)
POTENTIAL FOR BIGGER DETENTION BASIN
Qin
569-B5
569-B4
Qin
Qin
BIOSWALE TEMPLATE
DETENSION BASIN
DETENSION BASIN
OVERLOOK PARK
STUDY TO FOLLOW IF DETENSION BASIN WIL WORK OR SUFFICIENT
1. THE PROPOSED WIDENING WILL BE USED AS HAUL ROAD
2. THE EFFECTED CONSTRUCTION AREA INCLUDE 10m OUTSEIDE C/F LINE
SCALE 1:1000
I-5 WIDENING
11-SD-5-R34.1/R54.6
EA: 235800
LAYOUT
17 OF 57



NOTES:

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2. THE EFFECTED CONSTRUCTION AREA INCLUDE 10m OUTSEIDE C/F LINE

I-5 WIDENING

11-SD-5-R34.1/R54.6

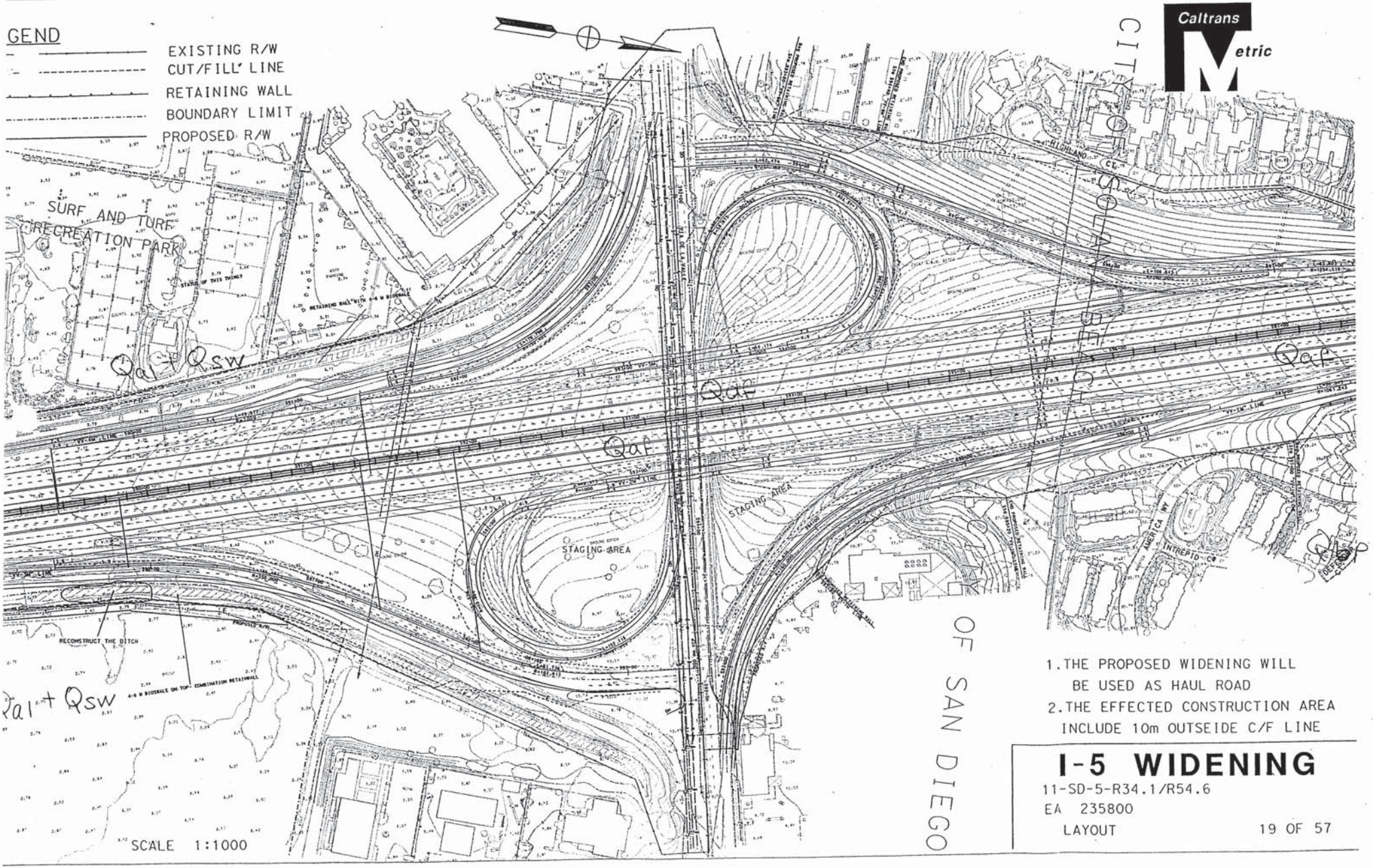
EA 235800

LAYOUT

GEND

EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
PROPOSED R/W

Caltrans Metric



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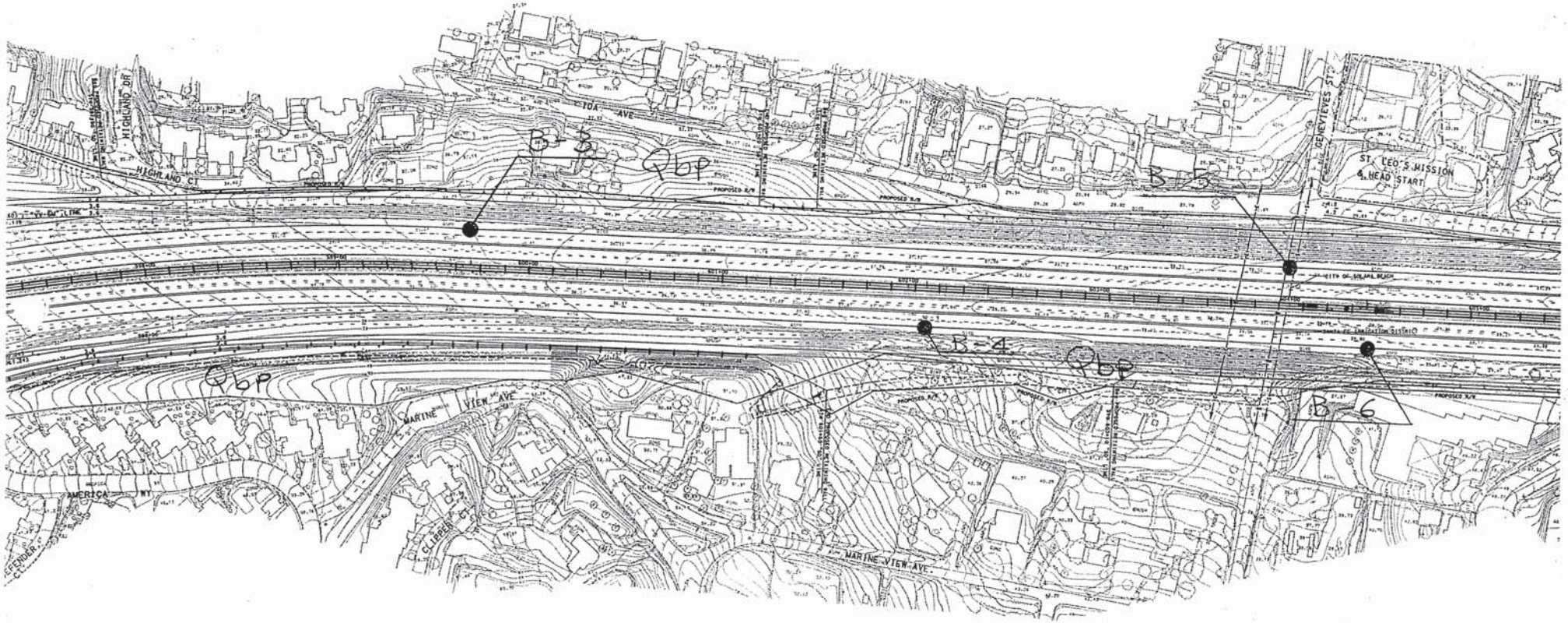
I-5 WIDENING

11-SD-5-R34.1/R54.6
EA 235800
LAYOUT

GEND

- EXISTING R/W
- CUT/FILL LINE
- RETAINING WALL
- BOUNDARY LIMIT
- PROPOSED R/W

Caltrans Metric



NOTES:

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2. THE EFFECTED CONSTRUCTION AREA INCLUDE 10m OUTSEIDE C/F LINE

SCALE 1:1000 SCALE 1:1000

I-5 WIDENING

11-SD-5-R34.1/R54.6
EA 235800
LAYOUT

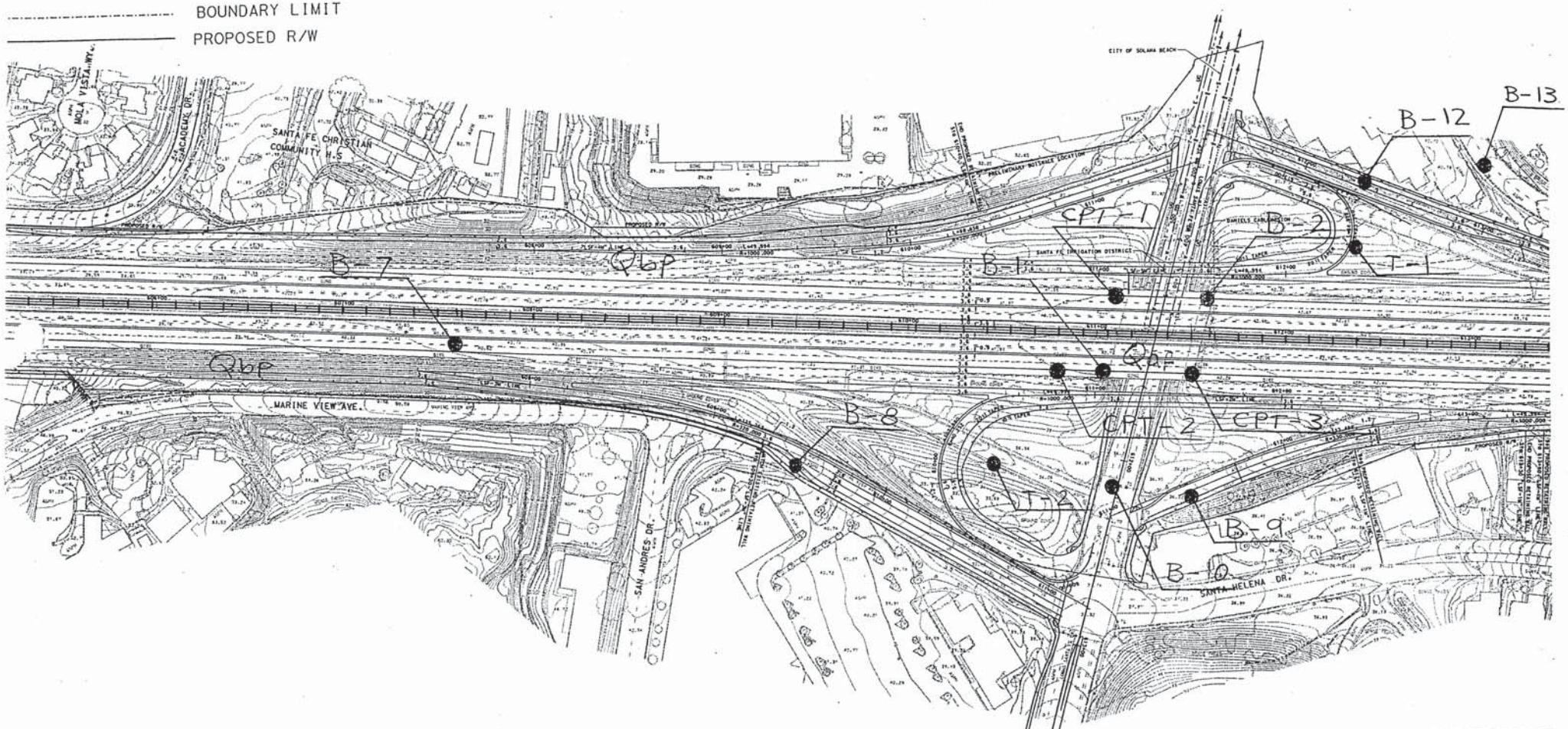
ROUTE 5 FINISHER FILE

FROM ALI

Caltrans Metric

LEGEND

- EXISTING R/W
- CUT/FILL LINE
- RETAINING WALL
- BOUNDARY LIMIT
- PROPOSED R/W



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SCALE 1:1000

I-5 WIDENING

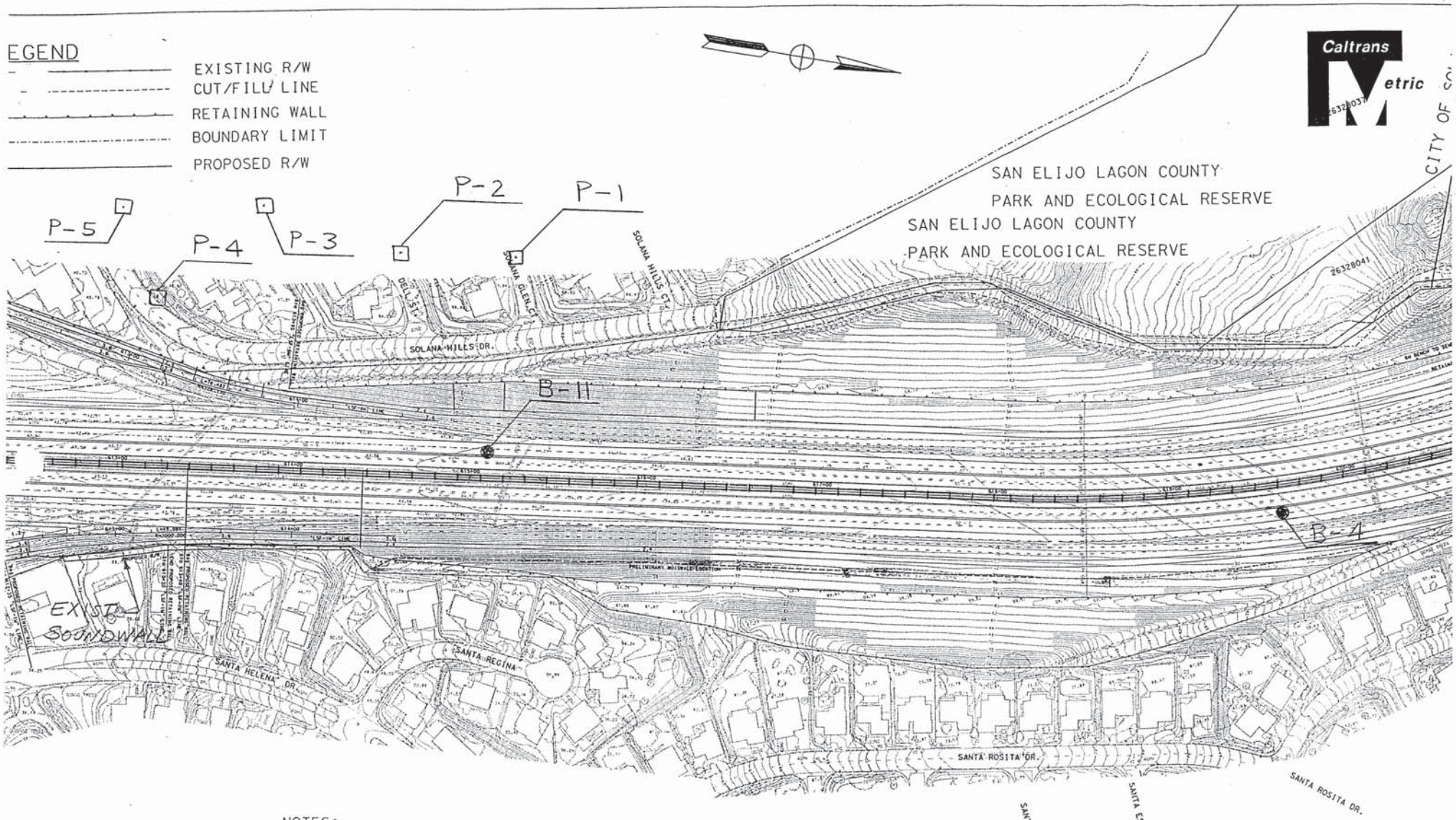
11-SD-5-R34.1/R54.6

EA 235800

LAYOUT

EGEND

EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
PROPOSED R/W



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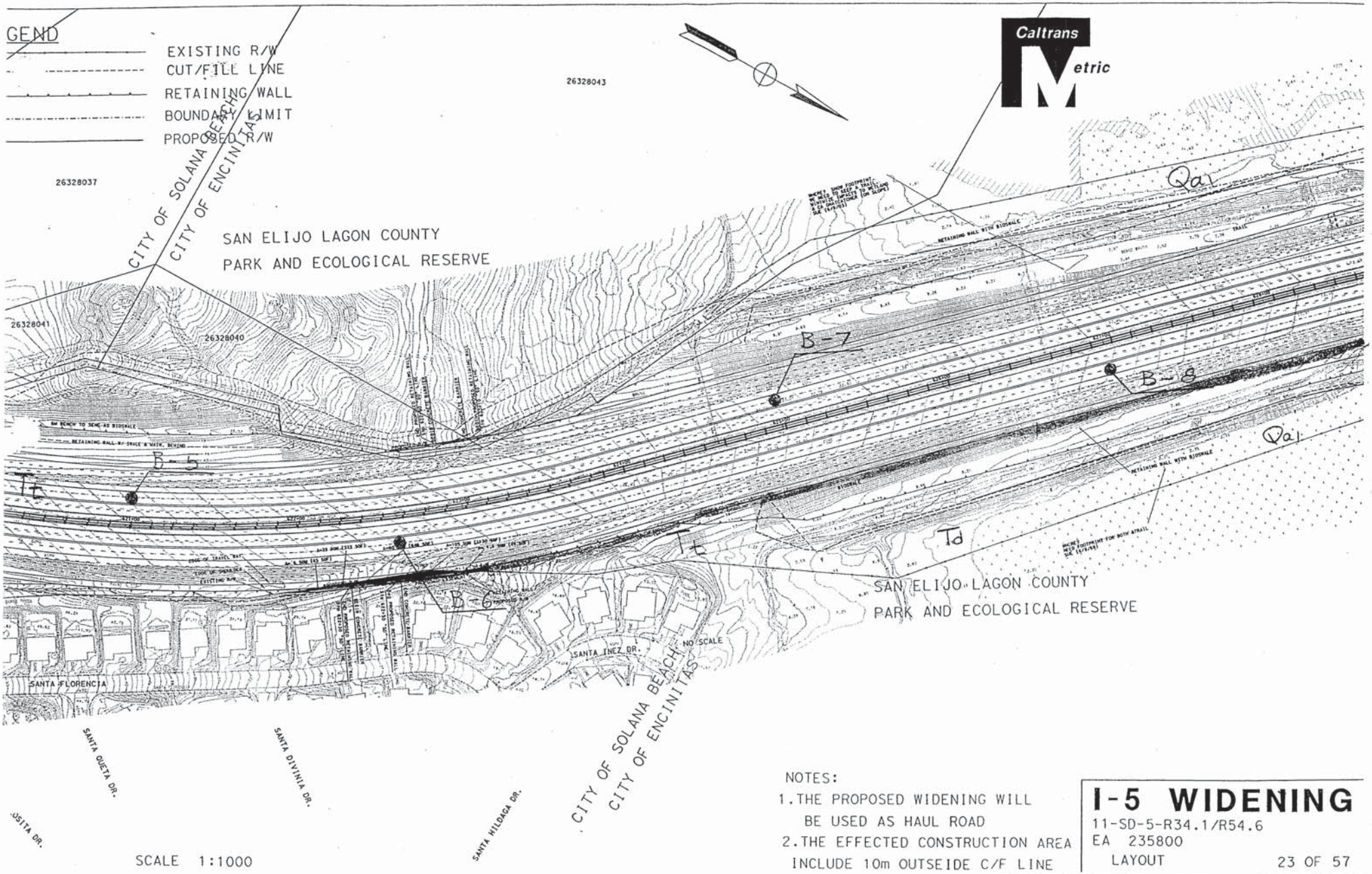
I-5 WIDENING

11-SD-5-R34.1/R54.6
EA 235800
LAYOUT



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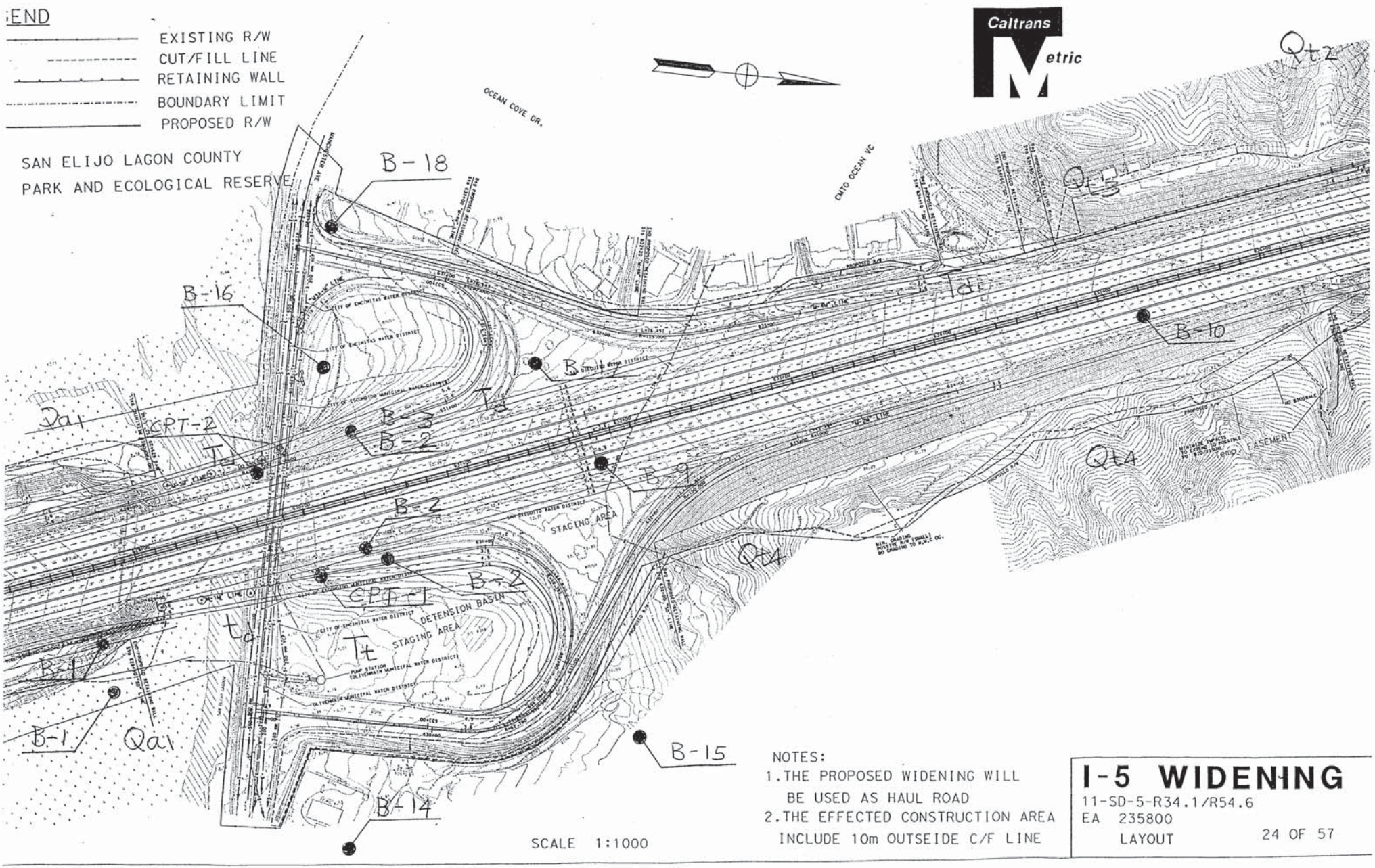
SCALE 1:1000

I-5 WIDENING

11-SD-5-R34.1/R54.6
EA 235800
LAYOUT



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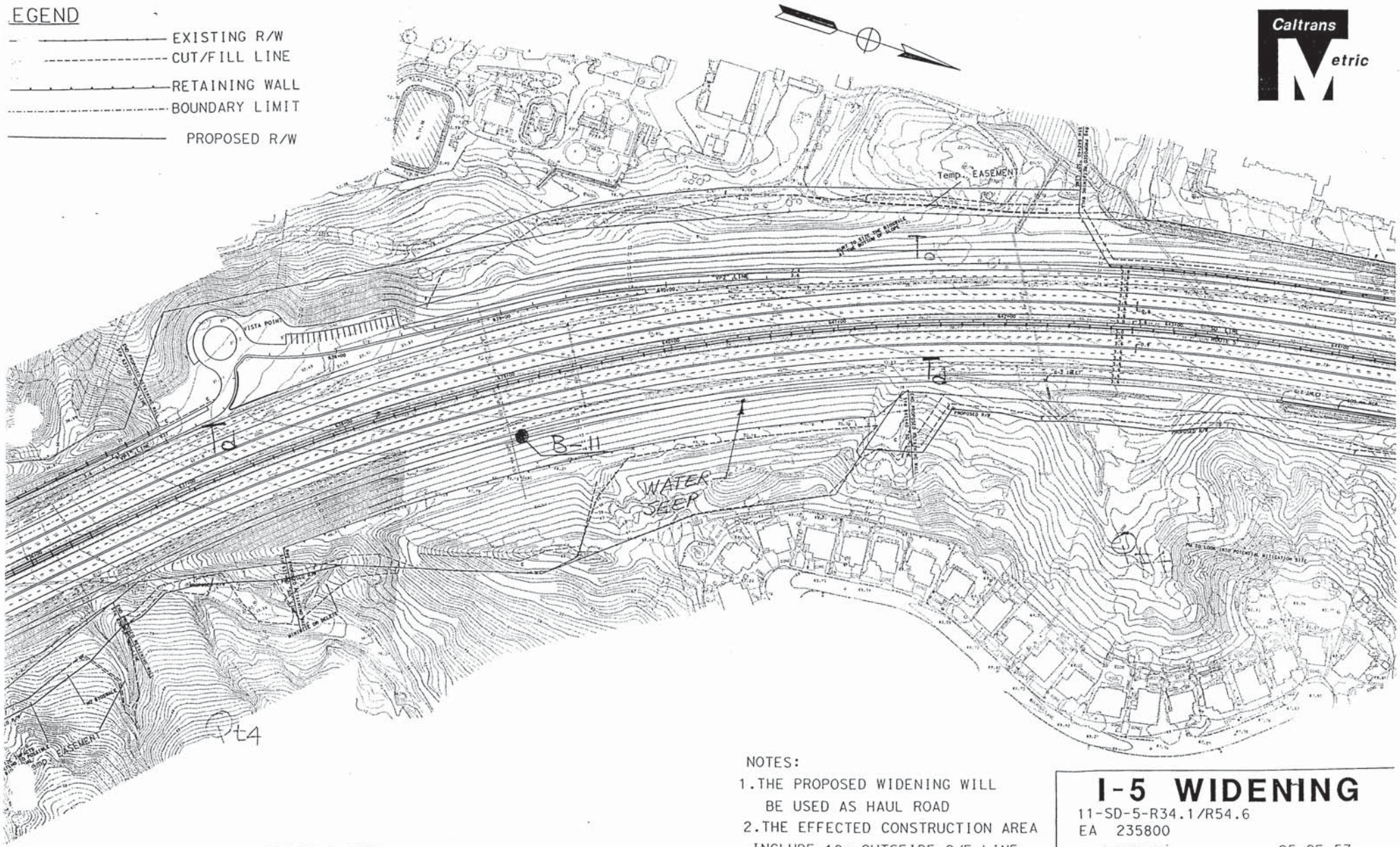
I-5 WIDENING

11-SD-5-R34.1/R54.6
EA 235800
LAYOUT

EGEND

- EXISTING R/W
- CUT/FILL LINE
- RETAINING WALL
- BOUNDARY LIMIT
- PROPOSED R/W



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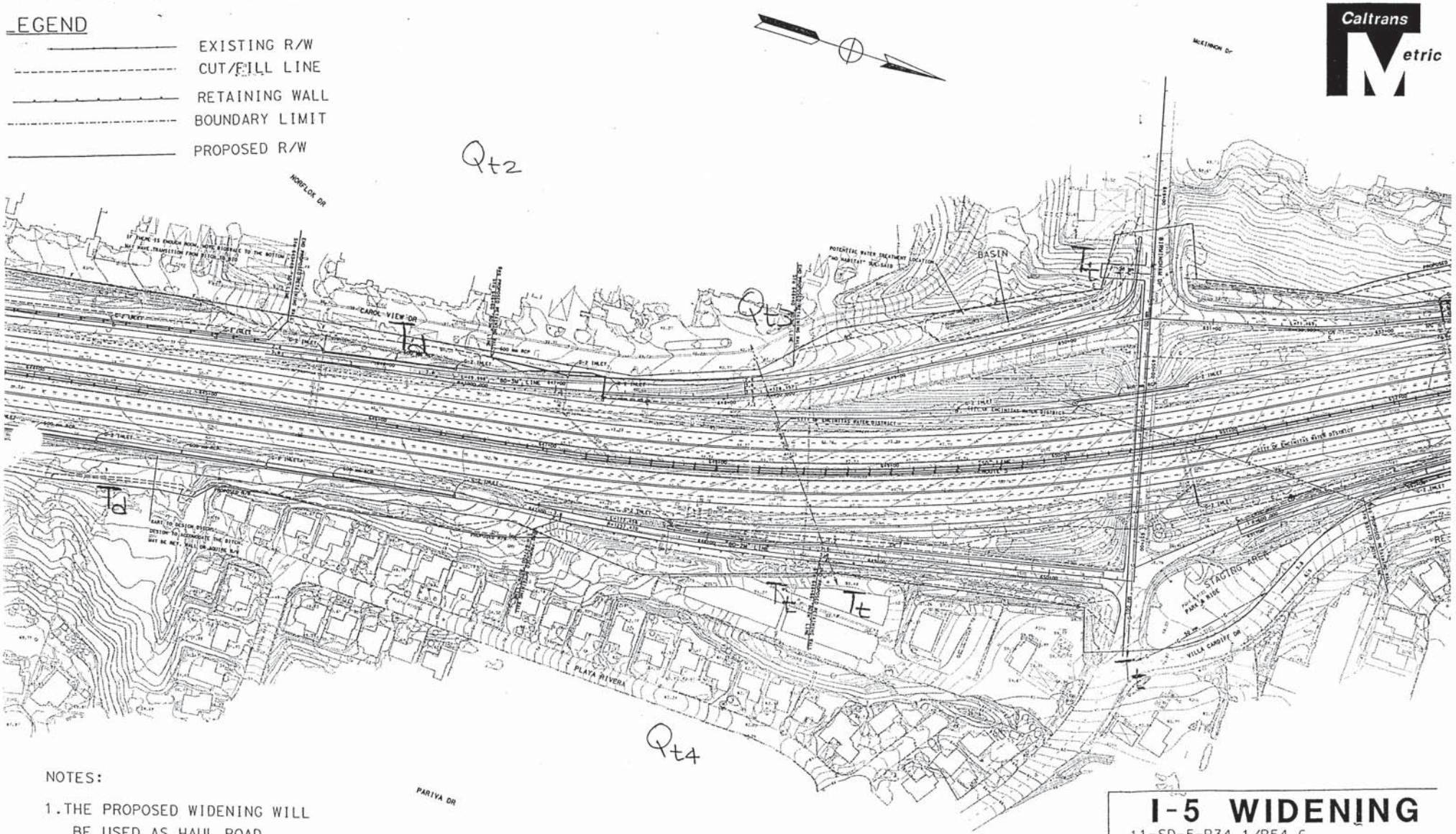
SCALE 1:1000

I-5 WIDENING

11-SD-5-R34.1/R54.6
EA 235800
LAYOUT

LEGEND

- EXISTING R/W
- CUT/FILL LINE
- RETAINING WALL
- BOUNDARY LIMIT
- PROPOSED R/W



NOTES:

1. THE PROPOSED WIDENING WILL BE USED AS HAUL ROAD
2. THE EFFECTED CONSTRUCTION AREA INCLUDE 10m OUTSEIDE C/F LINE

SCALE 1:1000

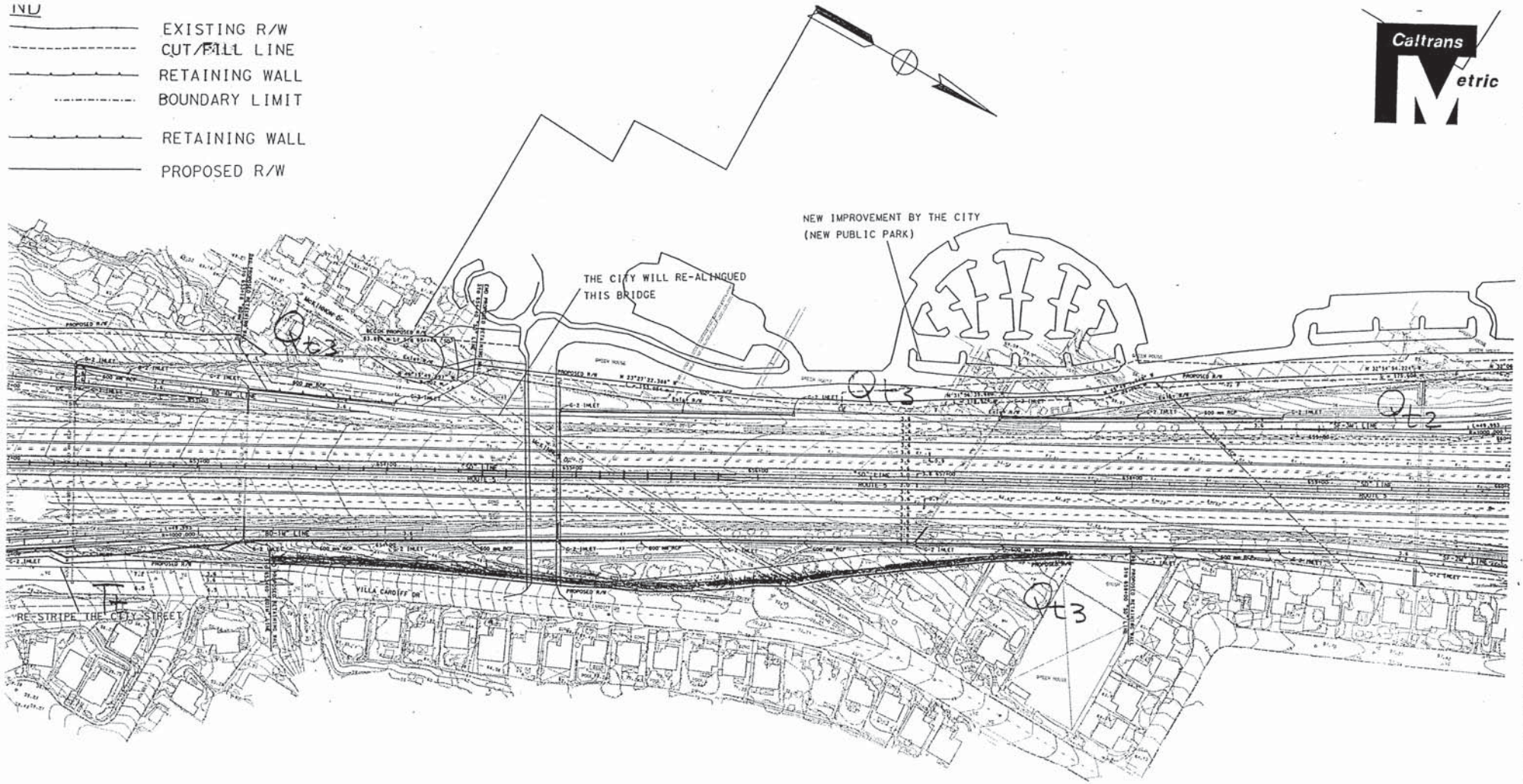
I-5 WIDENING

11-SD-5-R34.1/R54.6
EA 235800
LAYOUT

NO

EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
RETAINING WALL
PROPOSED R/W

Caltrans Metric



TES:

THE PROPOSED WIDENING WILL
BE USED AS HAUL ROAD

EFFECTED CONSTRUCTION AREA
NCLUDE 10m OUTSEIDE C/F LINE

SCALE 1:1000

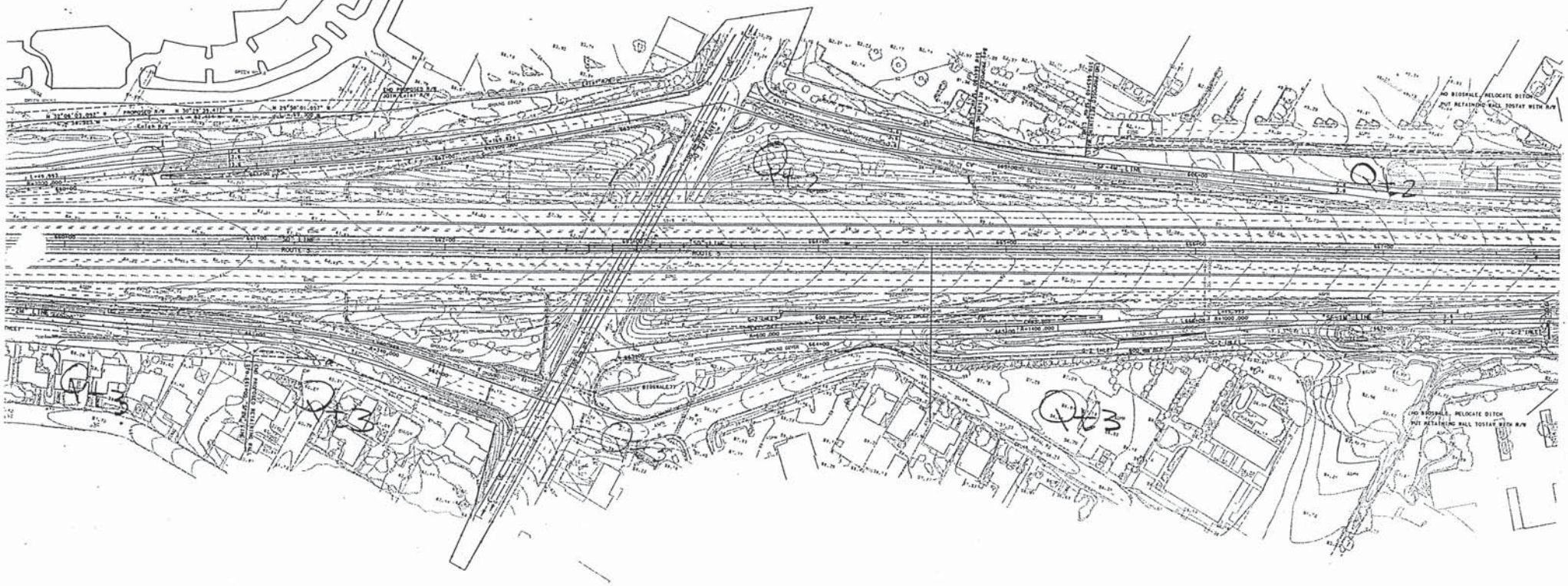
I-5 WIDENING

11-SD-5-R34.1/R54.6
EA 235800
LAYOUT

EGEND

EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
PROPOSED R/W

NEW IMPROVEMENT BY THE CITY
(NEW PUBLIC PARK)



NOTES:

1. THE PROPOSED WIDENING WILL BE USED AS HAUL ROAD
2. THE EFFECTED CONSTRUCTION AREA INCLUDE 10m OUTSEIDE C/F LINE

SCALE 1:1000

I-5 WIDENING

11-SD-5-R34.1/R54.6
EA 235800
LAYOUT

EGEND

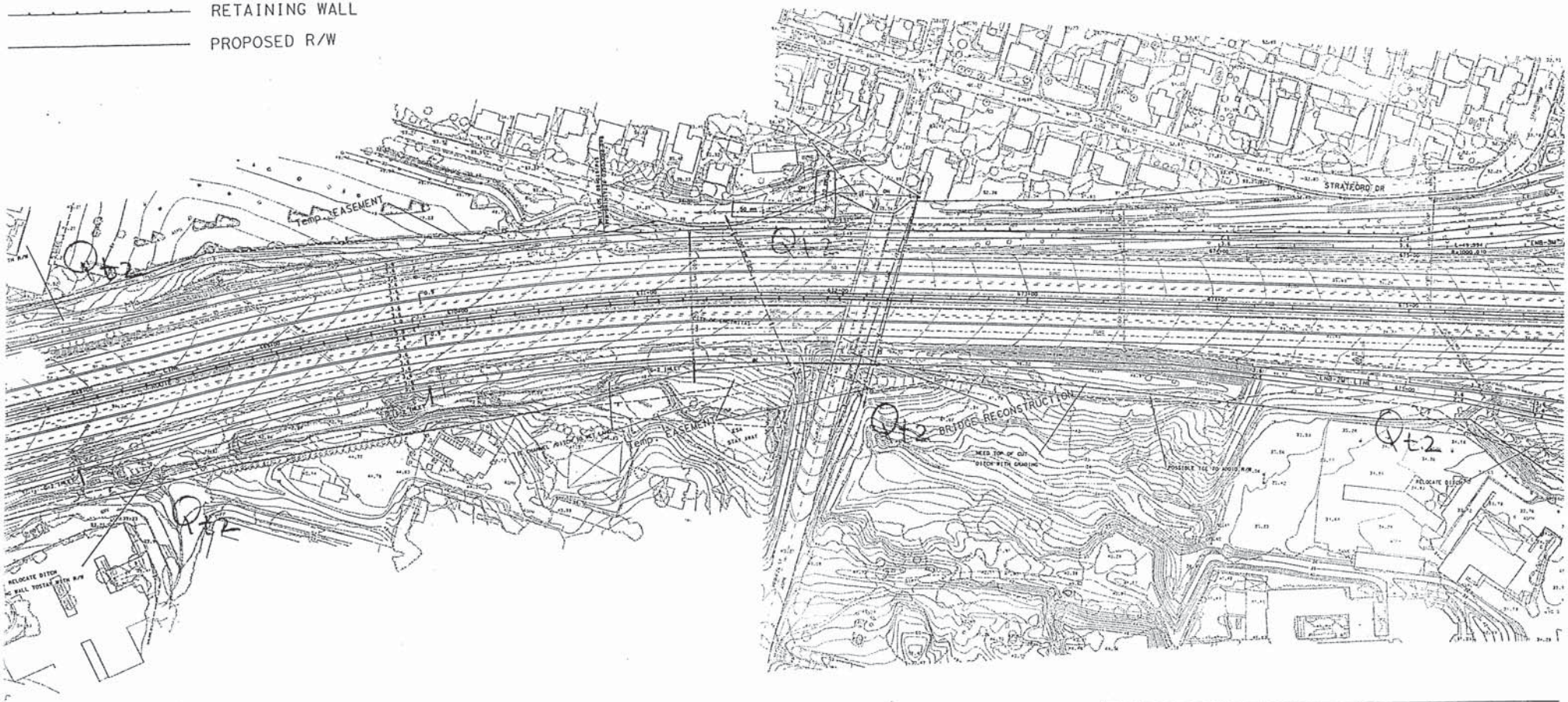
EXISTING R/W

CUT/FILL LINE

RETAINING WALL

PROPOSED R/W

Caltrans Metric



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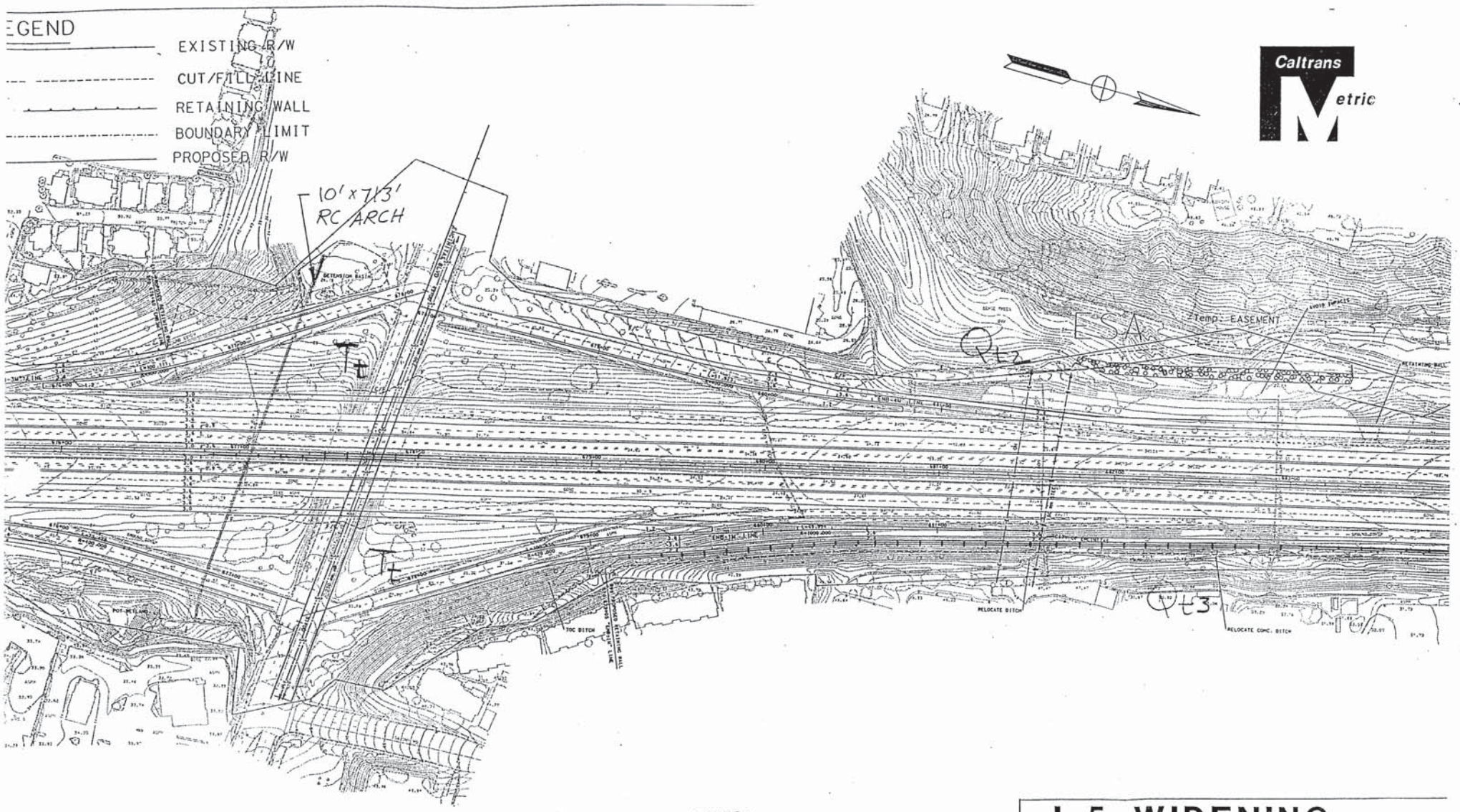
SCALE 1:1000

I-5 WIDENING

11-SD-5-R34.1/R54.6

EA 235800

LAYOUT



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SCALE 1:1000

I-5 WIDENING

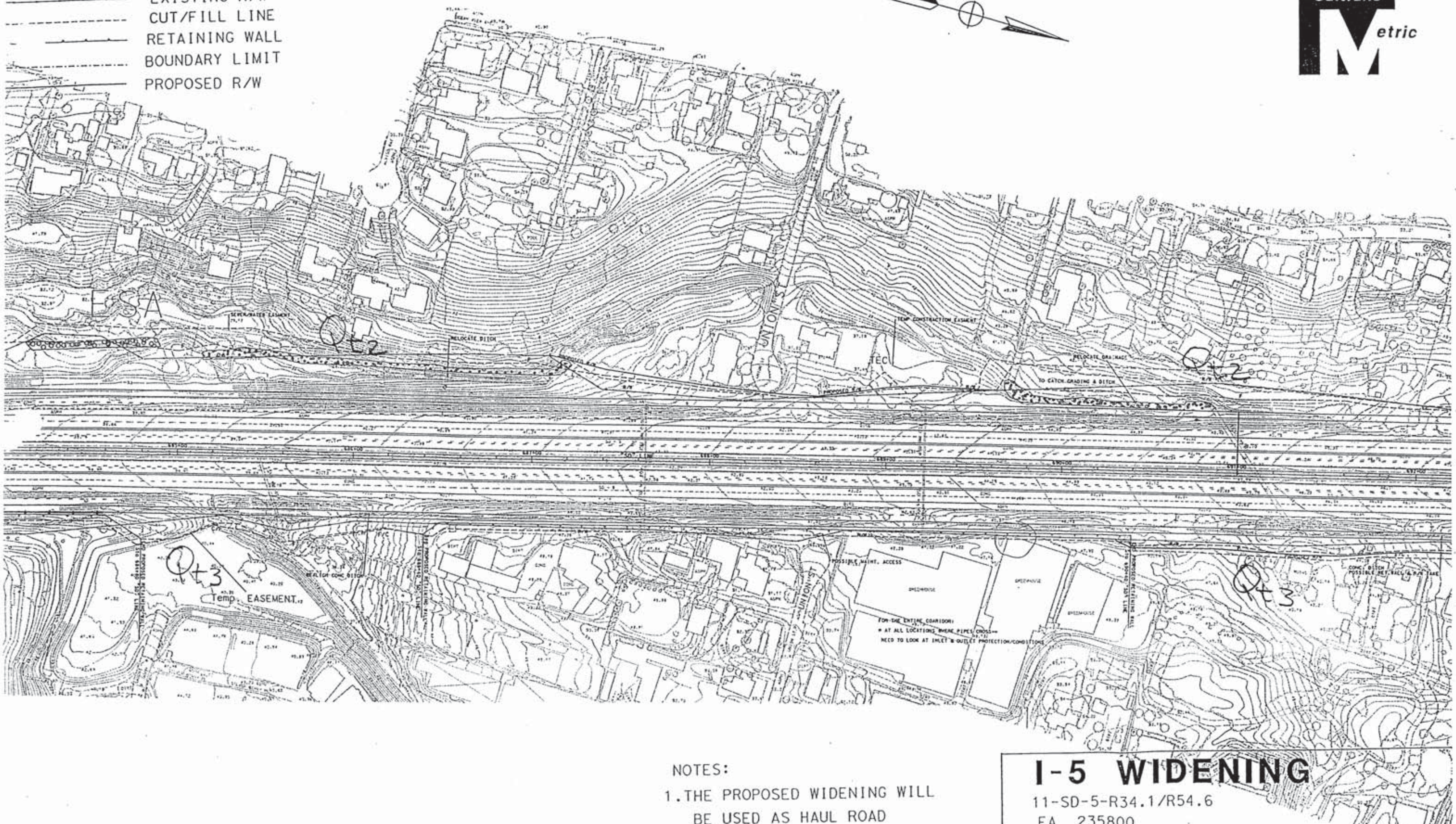
11-SD-5-R34.1/R54.6

EA 235800

LAYOUT

GEND

- EXISTING R/W
- CUT/FILL LINE
- RETAINING WALL
- BOUNDARY LIMIT
- PROPOSED R/W



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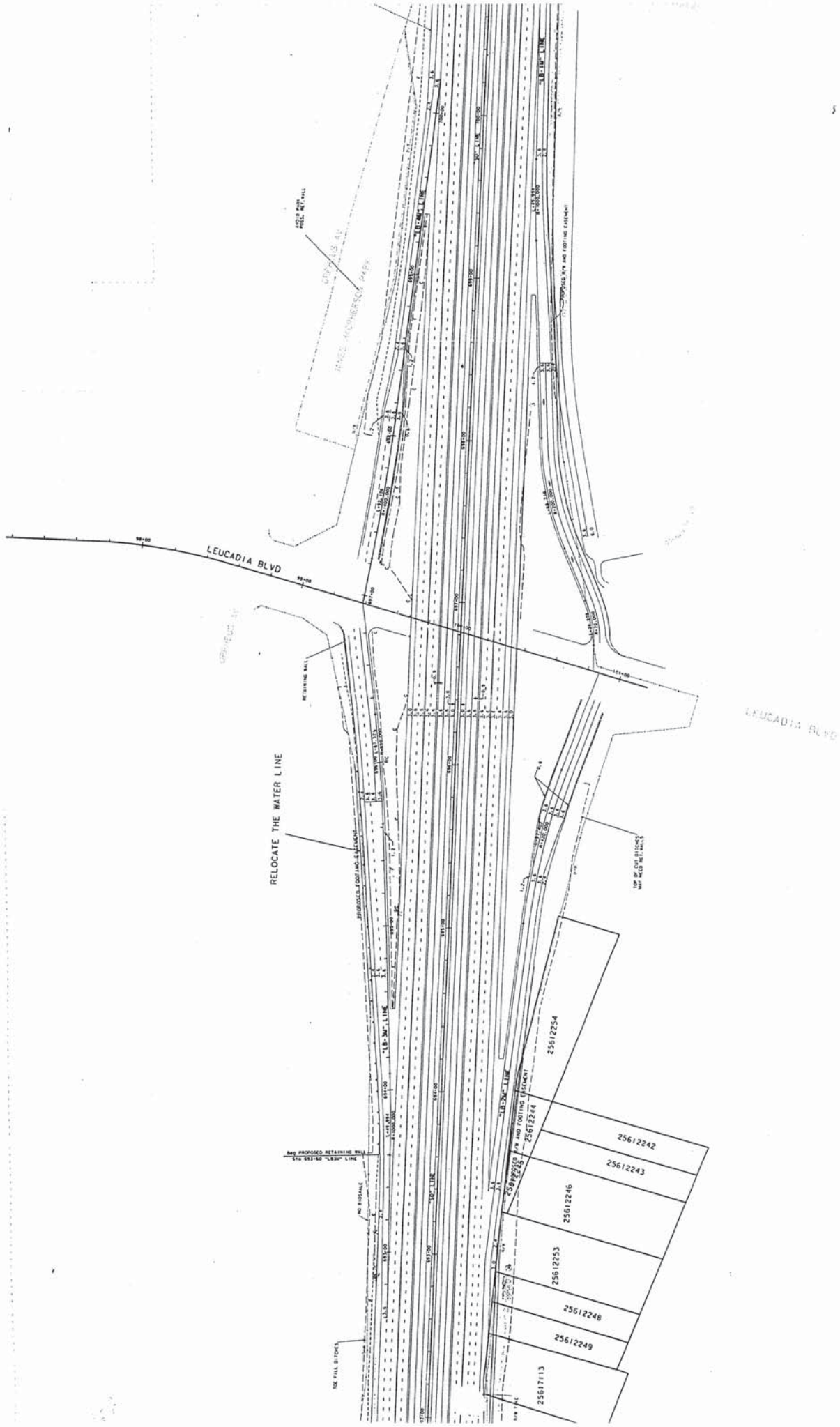
SCALE 1:1000

I-5 WIDENING

11-SD-5-R34.1/R54.6

EA 235800

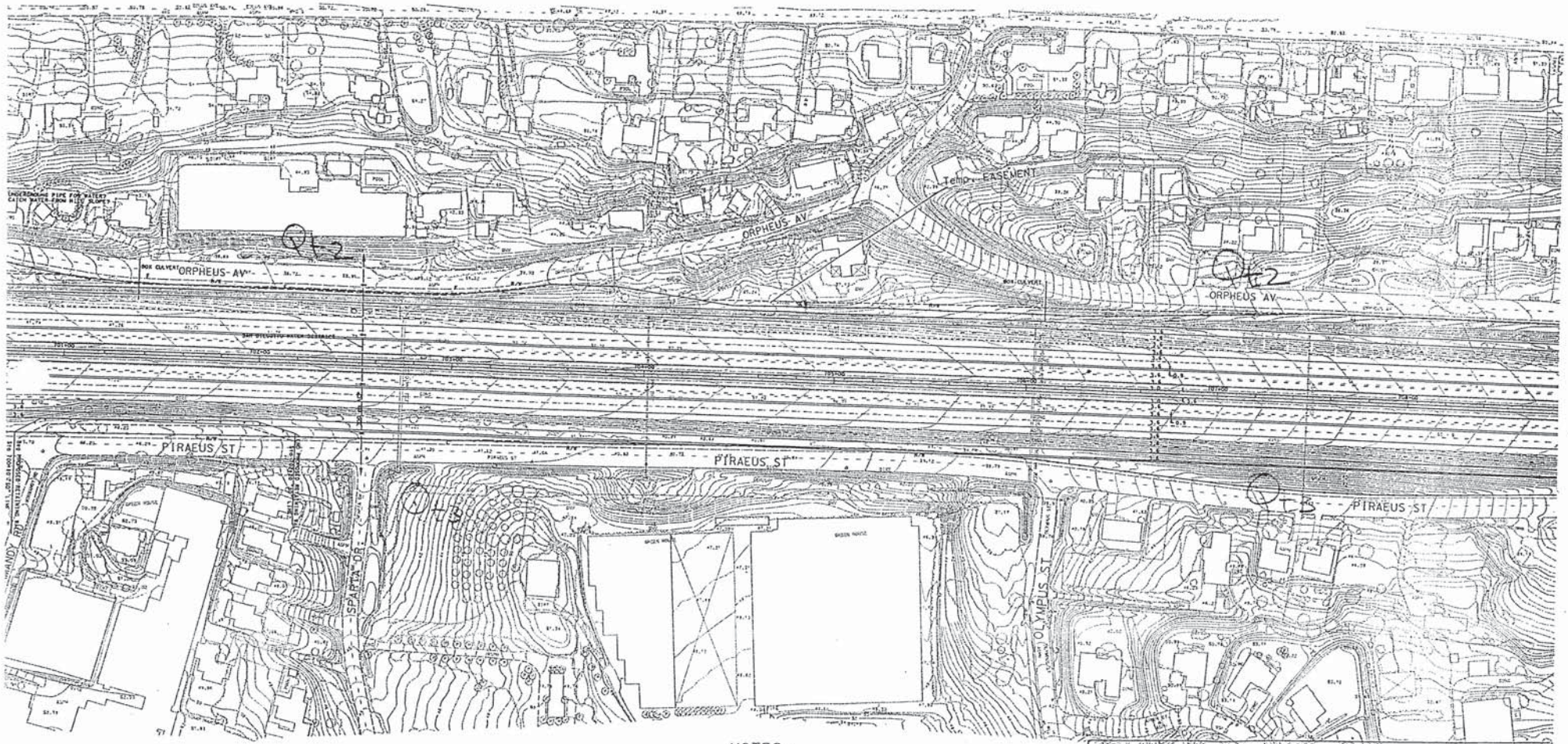
LAYOUT


LEUCADIA BLVD
RELOCATE THE WATER LINE
LEUCADIA BLVD
25612254
25612244
25612242
25612243
25612246
25612253
25612248
25612249
25617113

END

EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
PROPOSED R/W

Caltrans Metric



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SCALE 1:1000

I-5 WIDENING

11-SD-5-R34.1/R54.6
EA 235800

LAYOUT

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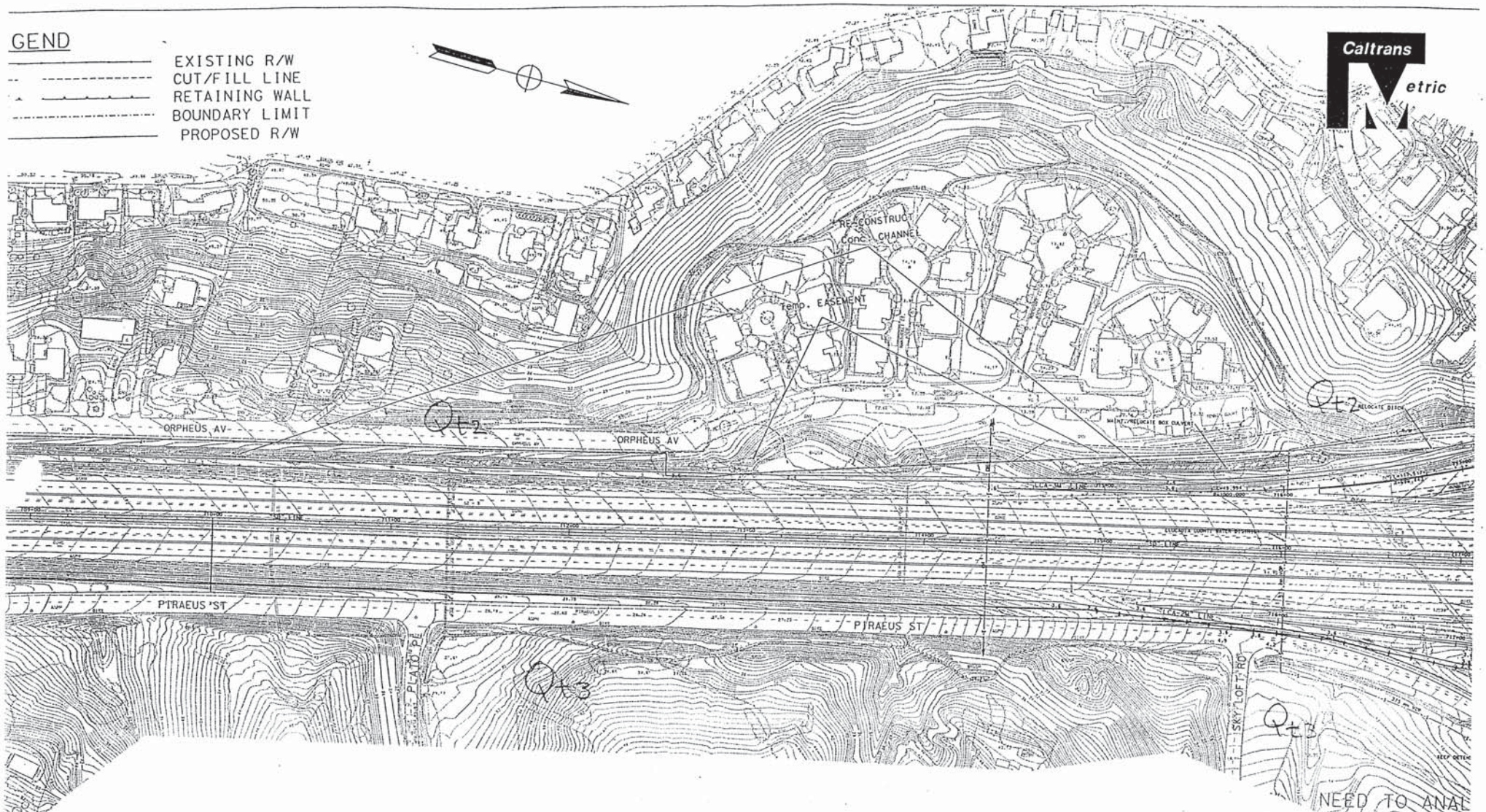
GEND

EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
PROPOSED R/W



NEED TO ANAL
TAKE BASI

NOTES:

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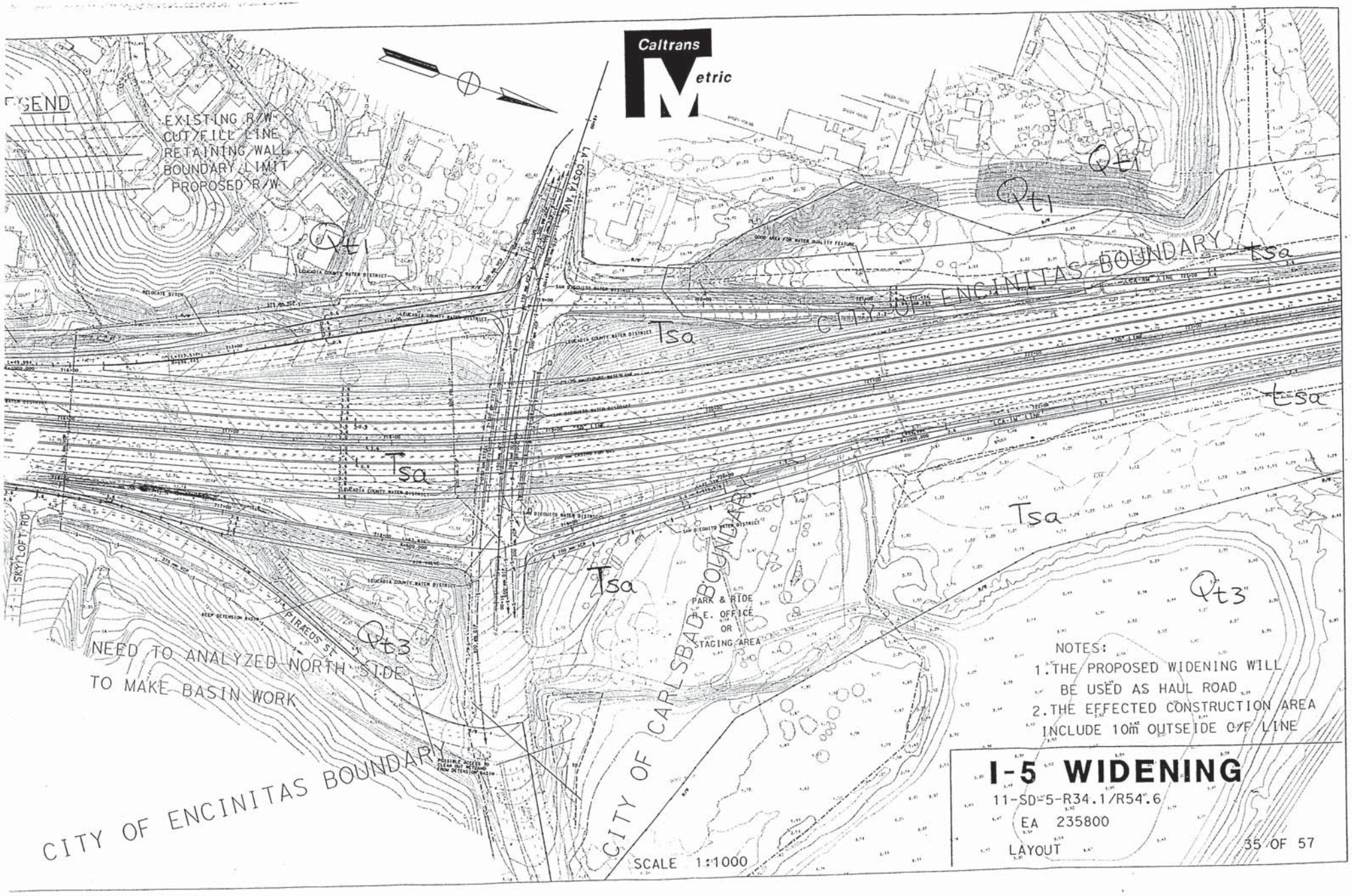
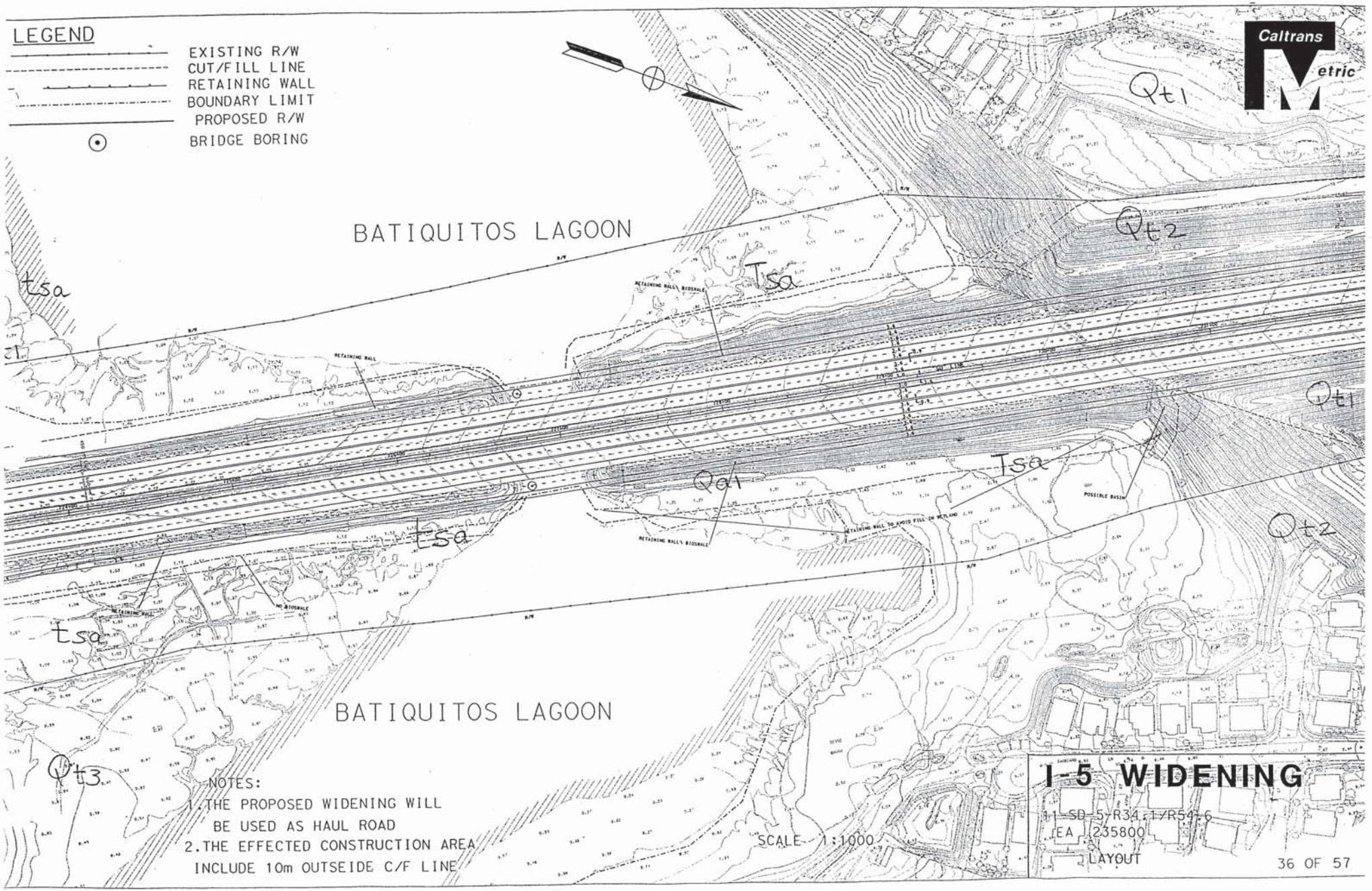
2. THE EFFECTED CONSTRUCTION AREA INCLUDE 10m OUTSEIDE C/F LINE

SCALE 1:1000

I-5 WIDENING

11-SD-5-R34.1/R54.6
EA 235800
LAYOUT


Caltrans Metric
LEGEND
EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
PROPOSED R/W
Qt1
Qt3
Tsa
CITY OF ENCINITAS BOUNDARY
CITY OF CARLSBAD BOUNDARY
PARK & RIDE
R.E. OFFICE
OR
STAGING AREA
NEED TO ANALYZED NORTH SIDE
TO MAKE BASIN WORK
SKYLOFT RD
PIRAEUS ST
LA COSTA AVE
LEUCADIA COUNTY WATER DISTRICT
SAN DIEGUITO WATER DISTRICT
NOTES:
1. THE PROPOSED WIDENING WILL BE USED AS HAUL ROAD
2. THE EFFECTED CONSTRUCTION AREA INCLUDE 10m OUTSEIDE OFF LINE
I-5 WIDENING
11-SD-5-R34.1/R54.6
EA 235800
LAYOUT
35 OF 57
SCALE 1:1000


LEGEND
EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
PROPOSED R/W
BRIDGE BORING
Caltrans
Metric
BATIQUITOS LAGOON
BATIQUITOS LAGOON
Qt1
Qt2
Qt1
Qt2
Qt3
Tsa
Tsa
Tsa
Tsa
Tsa
Qal
RETAINING WALL
RETAINING WALL BIOSWALE
RETAINING WALL BIOSWALE
RETAINING WALL TO AVOID FILL IN WETLAND
POSSIBLE BASIN
NO BIOSWALE
NOTES:
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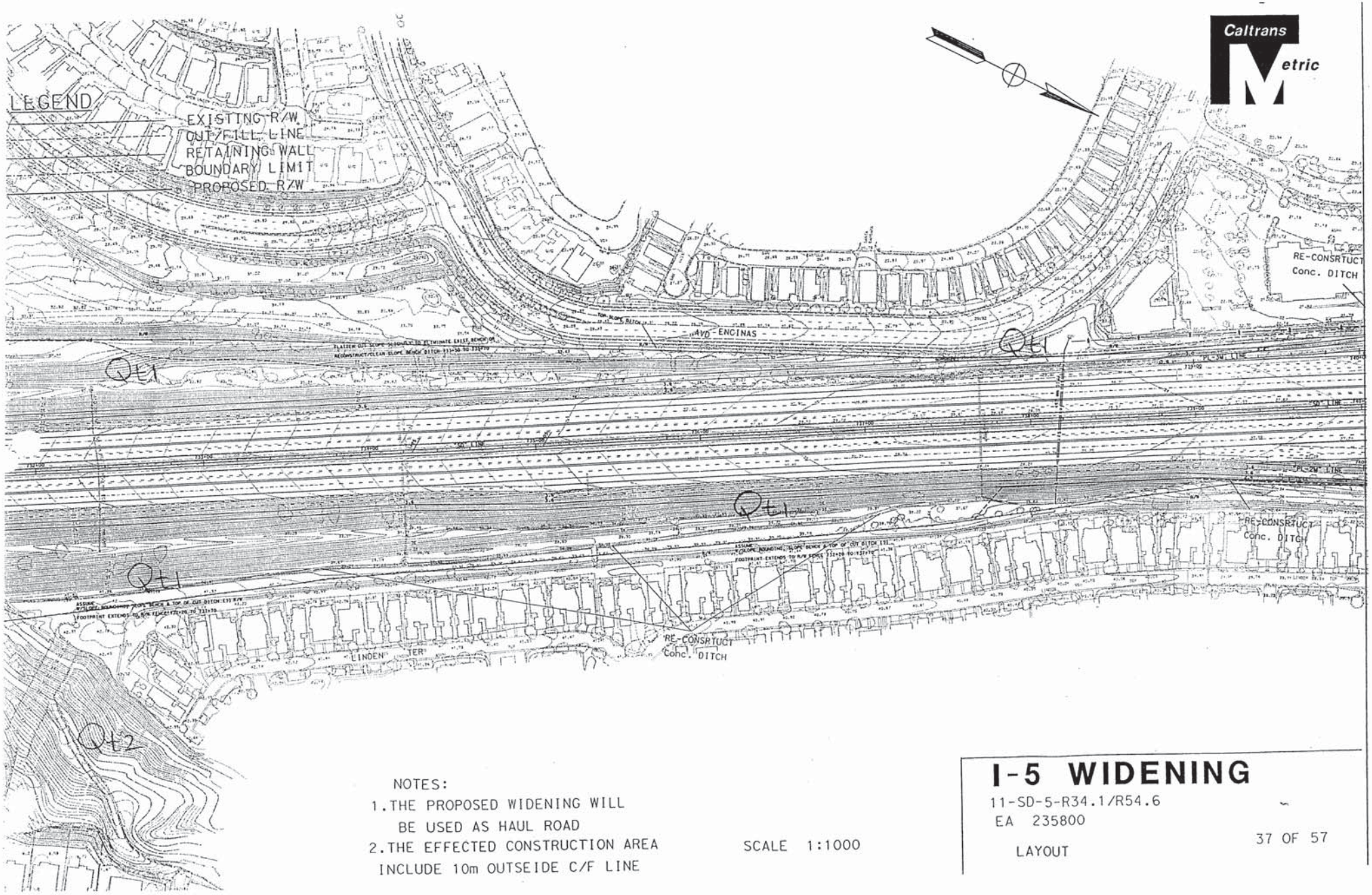
2. THE EFFECTED CONSTRUCTION AREA INCLUDE 10m OUTSEIDE C/F LINE
SCALE 1:1000
I-5 WIDENING
SD-5-R34.1/R54.6
EA 235800
LAYOUT
36 OF 57



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SCALE 1:1000

I-5 WIDENING

11-SD-5-R34.1/R54.6

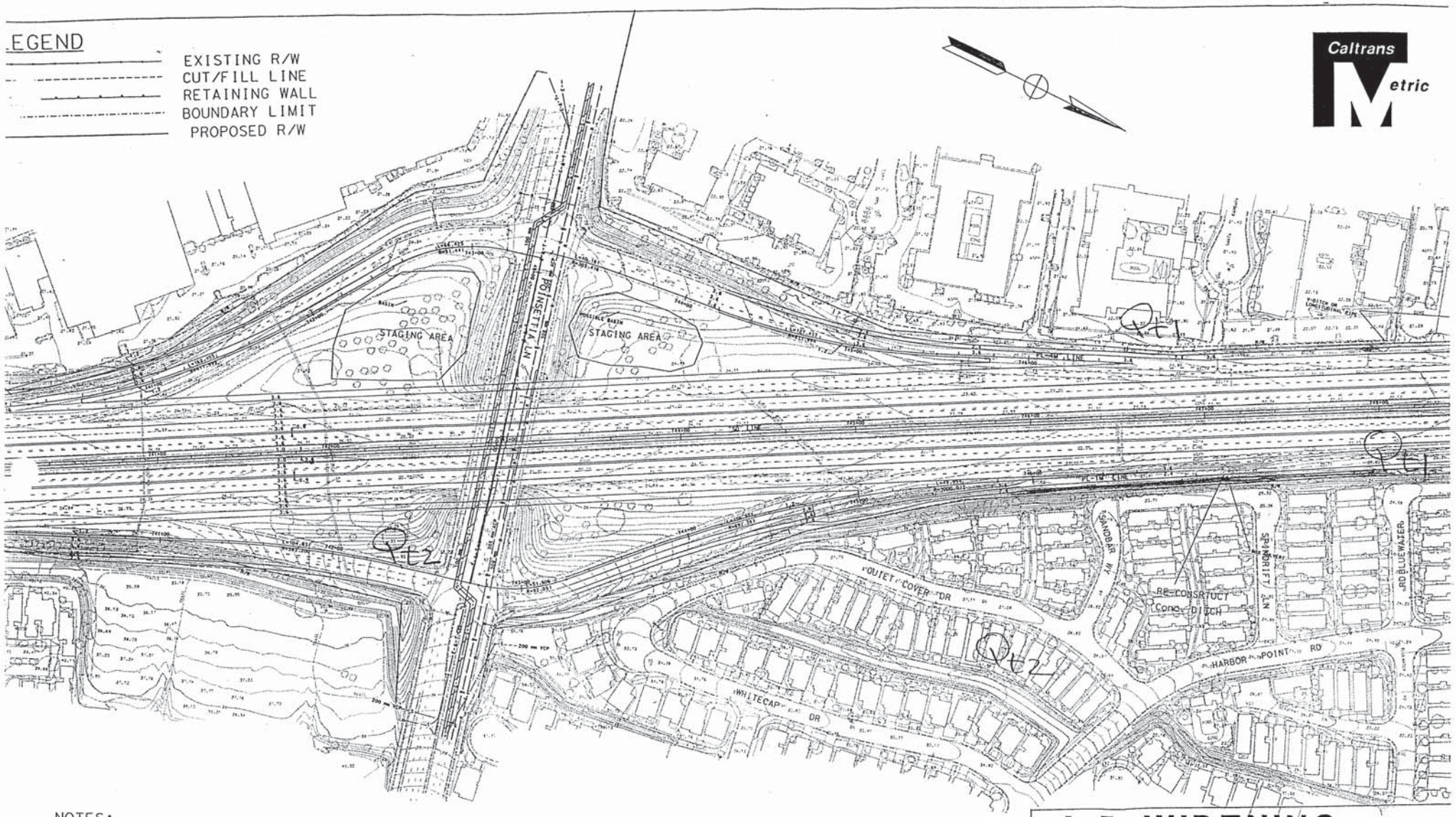
EA 235800

LAYOUT

LEGEND

EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
PROPOSED R/W

Caltrans Metric



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SCALE 1:1000

I-5 WIDENING

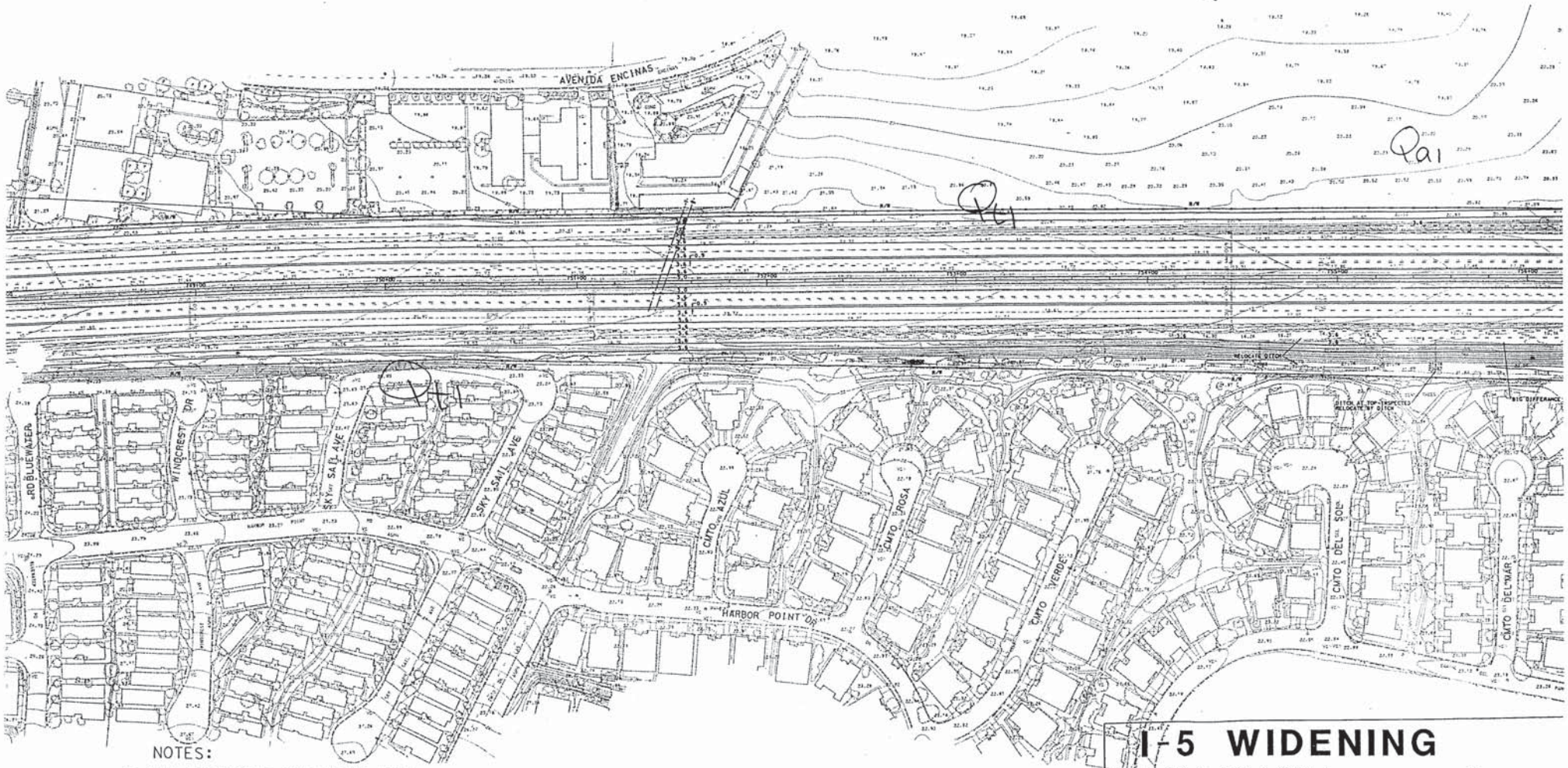
11-SD-5-R34.1/R54.6
EA 235800

LAYOUT

LEGEND

EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
PROPOSED R/W

Caltrans Metric



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SCALE 1:1000

I-5 WIDENING

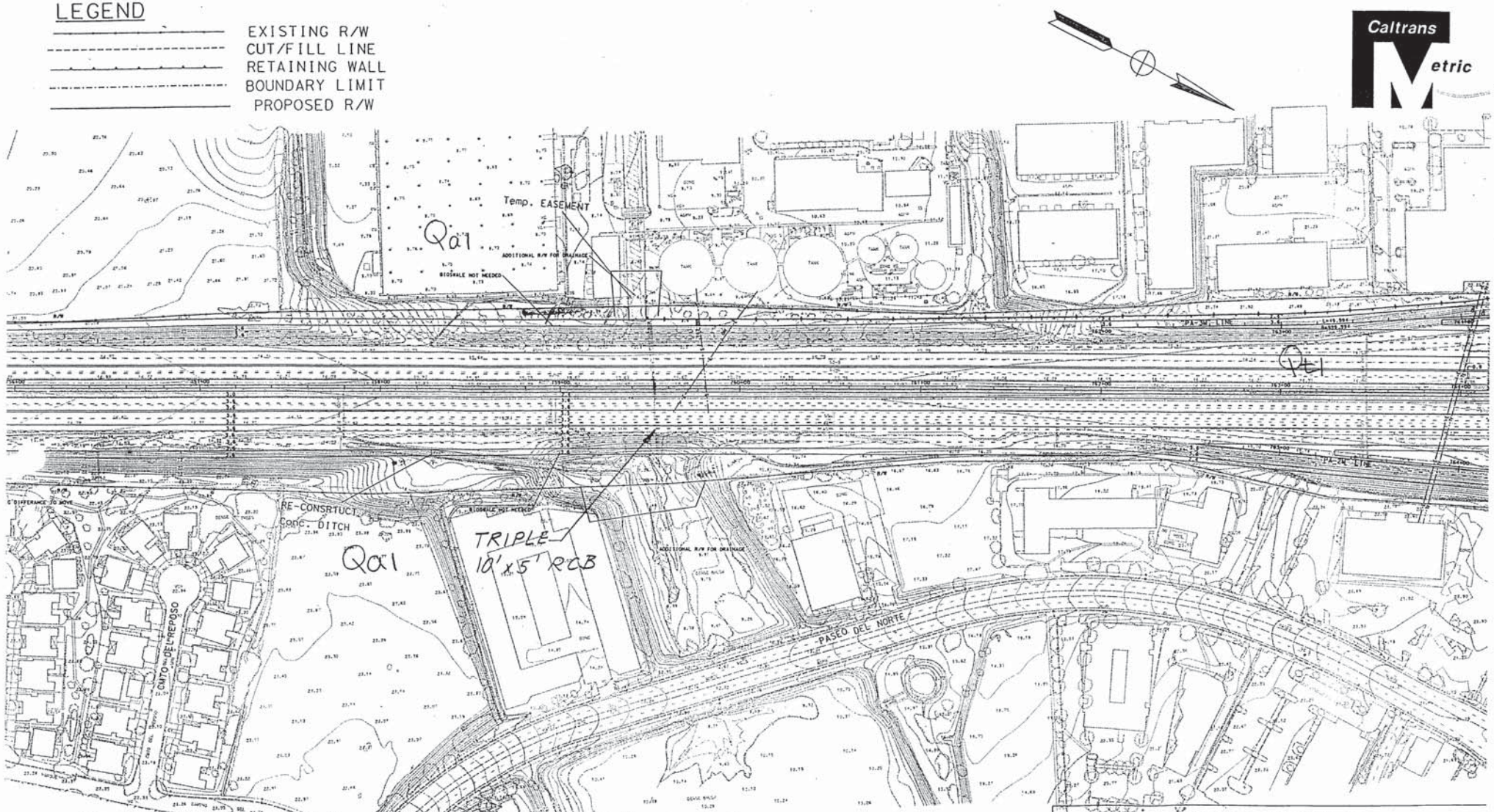
11-SD-5-R34.1/R54.6

EA 235800

LAYOUT

LEGEND

EXISTING R/W
CUT/FILL LINE
RETAINING WALL
BOUNDARY LIMIT
PROPOSED R/W



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SCALE 1:1000

I-5 WIDENING

11-SD-5-R34.1/R54.6

EA 235800

LAYOUT

EGEND

EXISTING R/W

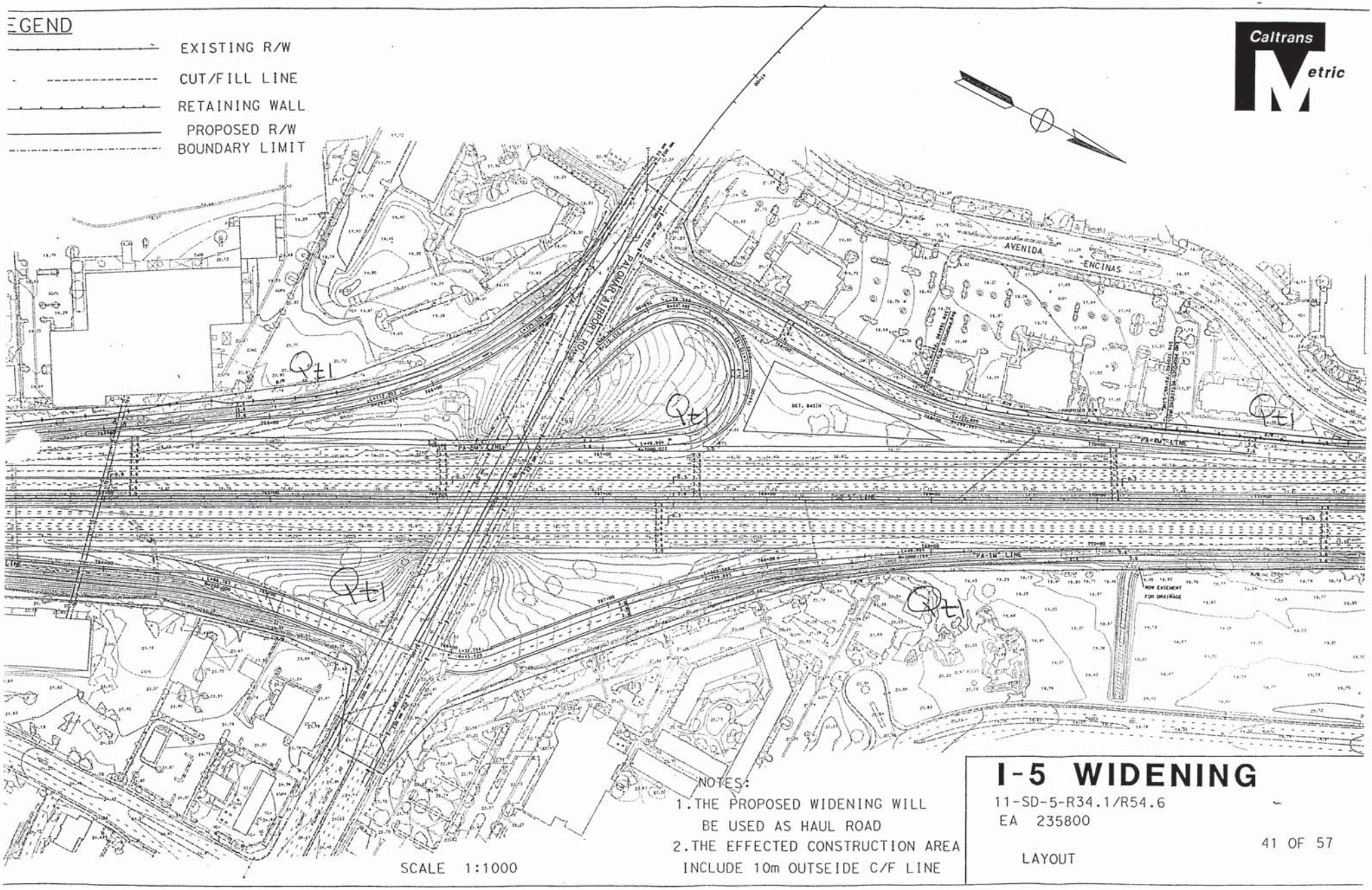
CUT/FILL LINE

RETAINING WALL

PROPOSED R/W

BOUNDARY LIMIT

Caltrans Metric



SCALE 1:1000

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I-5 WIDENING

11-SD-5-R34.1/R54.6

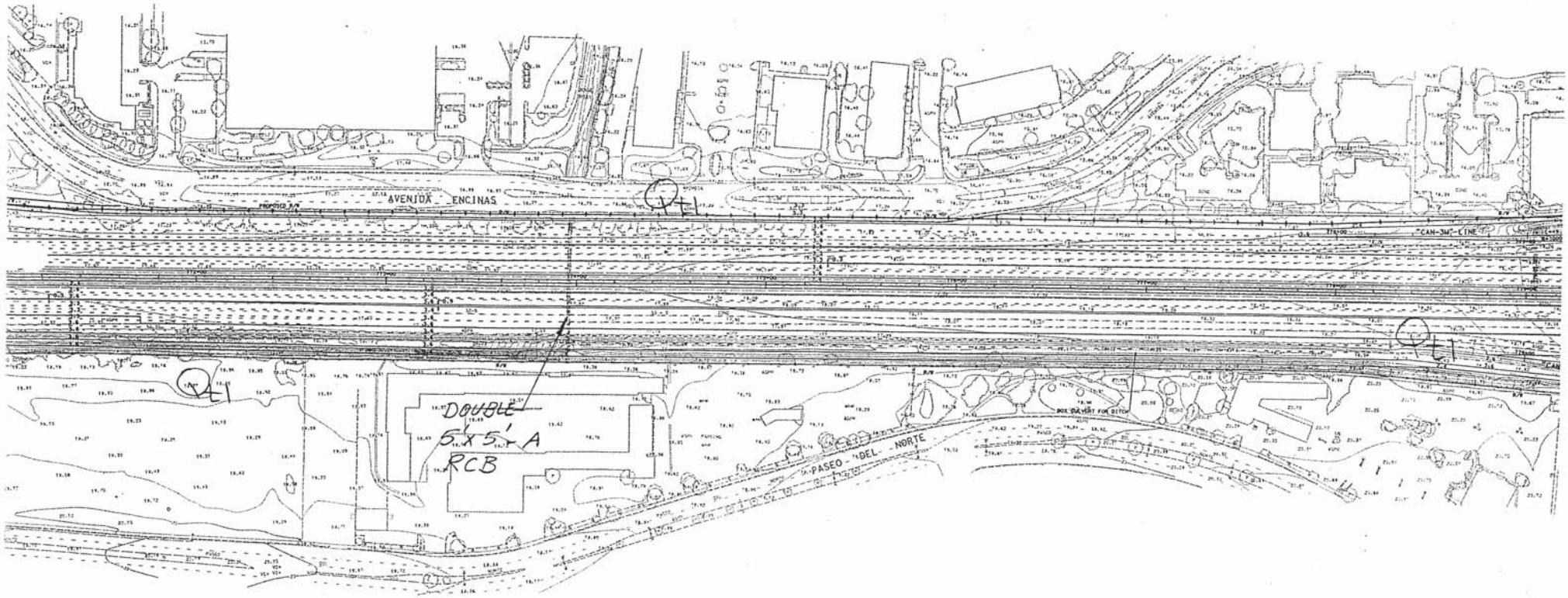
EA 235800

LAYOUT

LEGEND

- EXISTING R/W
- CUT/FILL LINE
- RETAINING WALL
- PROPOSED R/W
- BOUNDARY LIMIT

Caltrans Metric



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3. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE

SCALE 1:1000

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

I-5 WIDENING

11-SD-5

PM-R34.1/R54.6

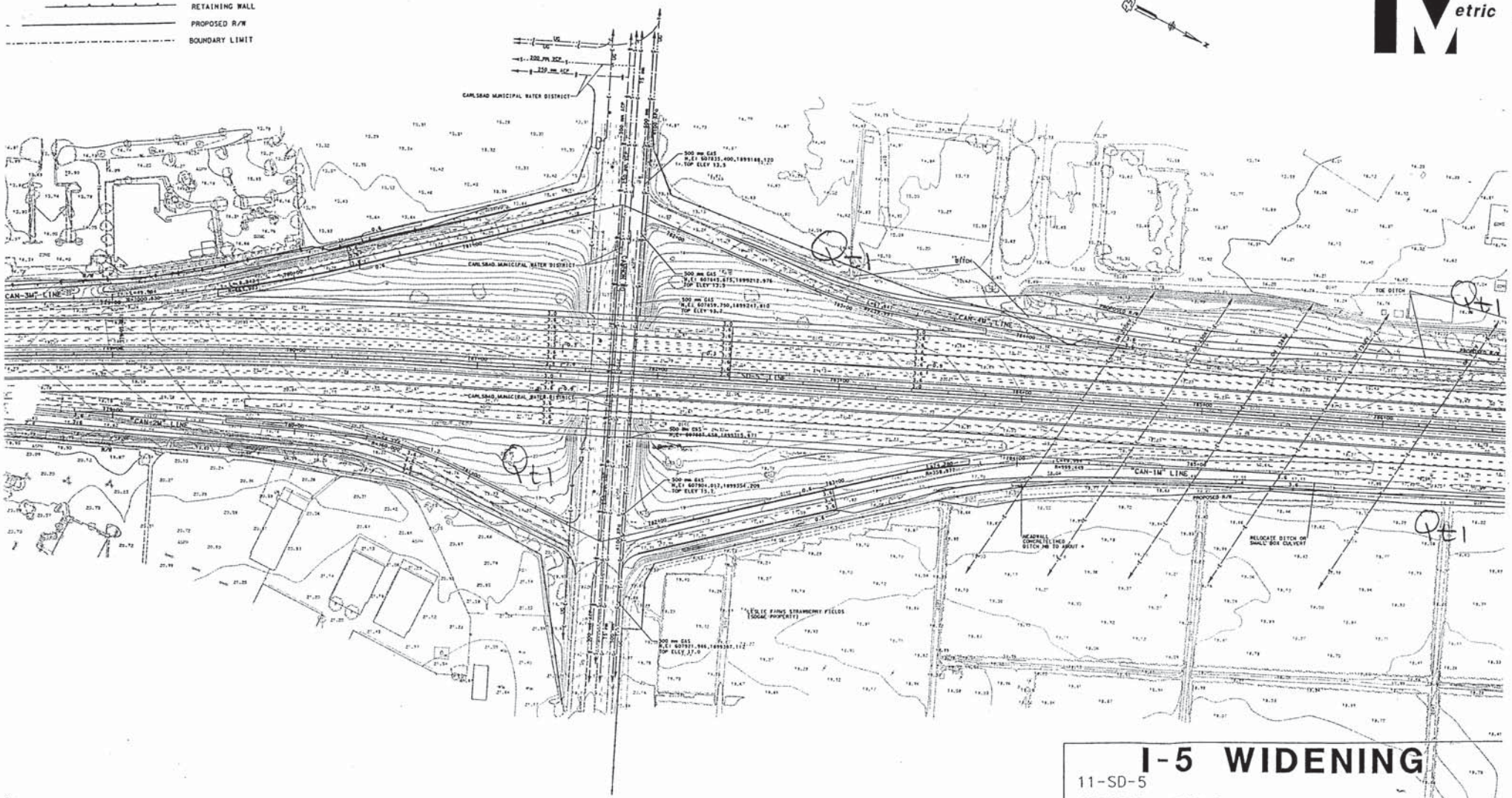
EA 235800

LAYOUT

LEGEND

- EXISTING R/W
- CUT/FILL LINE
- RETAINING WALL
- PROPOSED R/W
- BOUNDARY LIMIT

Caltrans Metric



I-5 WIDENING

11-SD-5

PM-R34.1/R54.6

EA 235800

LAYOUT

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SCALE 1:1000

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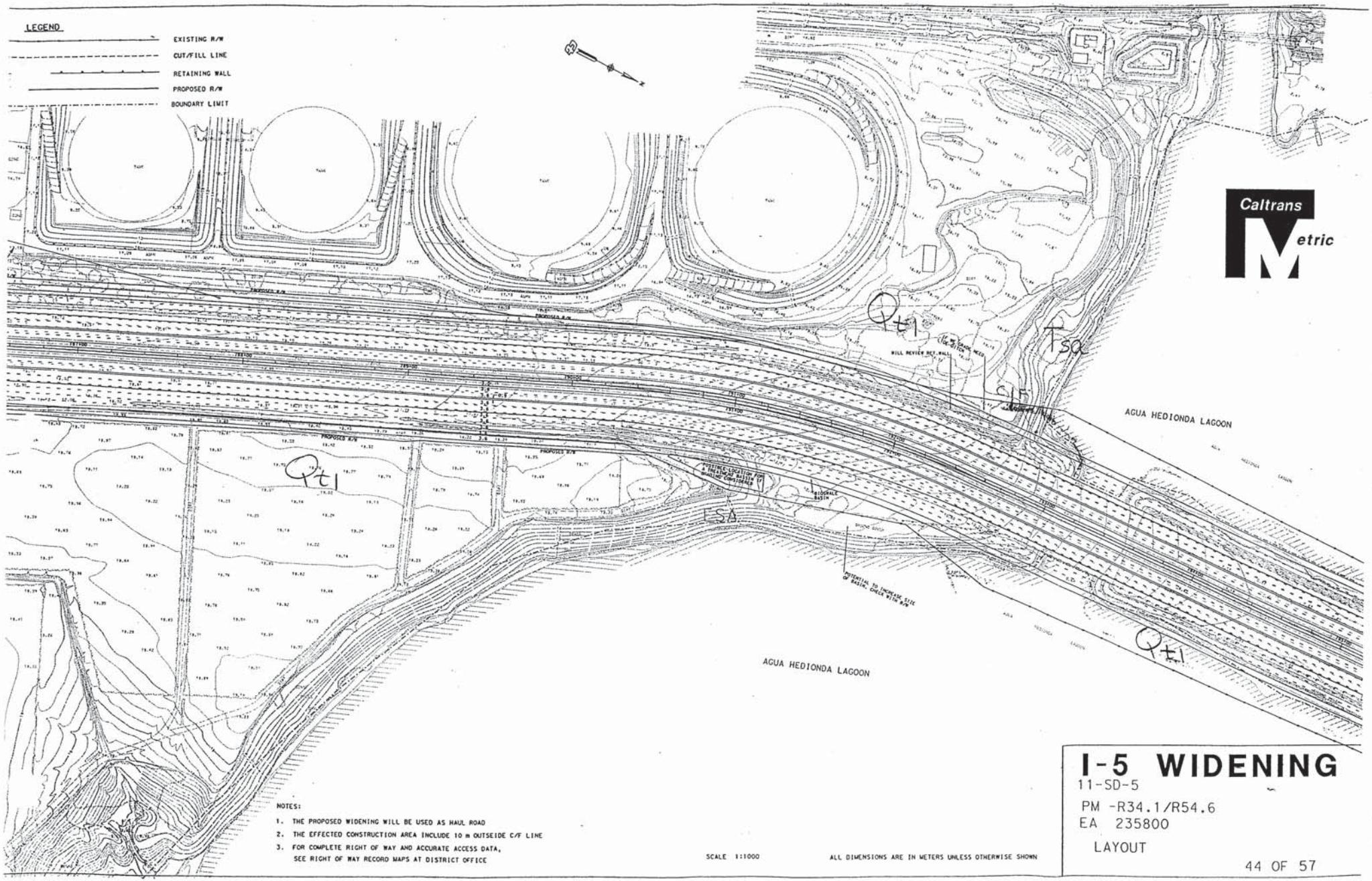

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I-5 WIDENING

11-SD-5

PM -R34.1/R54.6

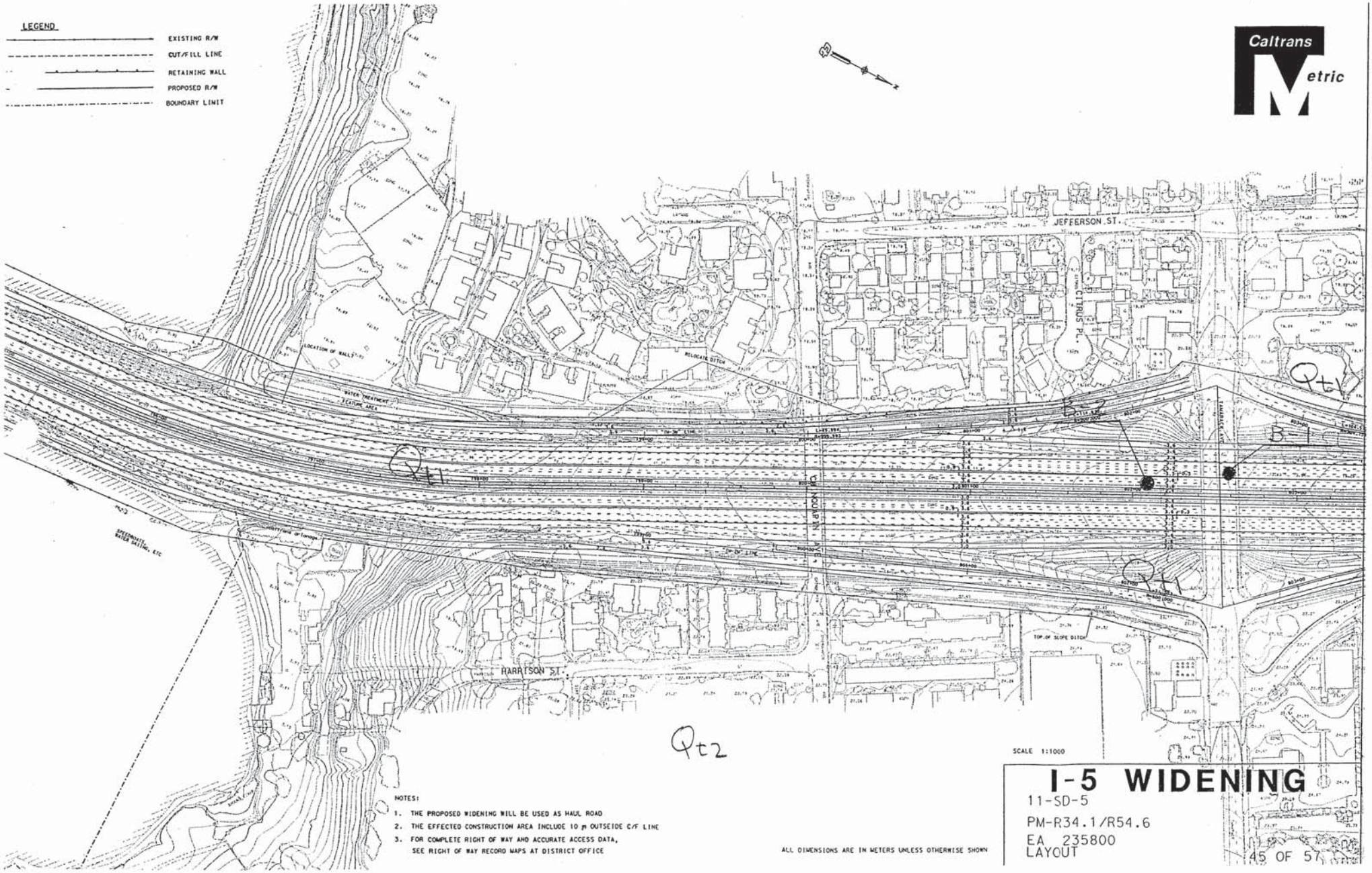
EA 235800

LAYOUT

LEGEND

- EXISTING R/W
- CUT/FILL LINE
- RETAINING WALL
- PROPOSED R/W
- BOUNDARY LIMIT

Caltrans Metric



SCALE 1:1000

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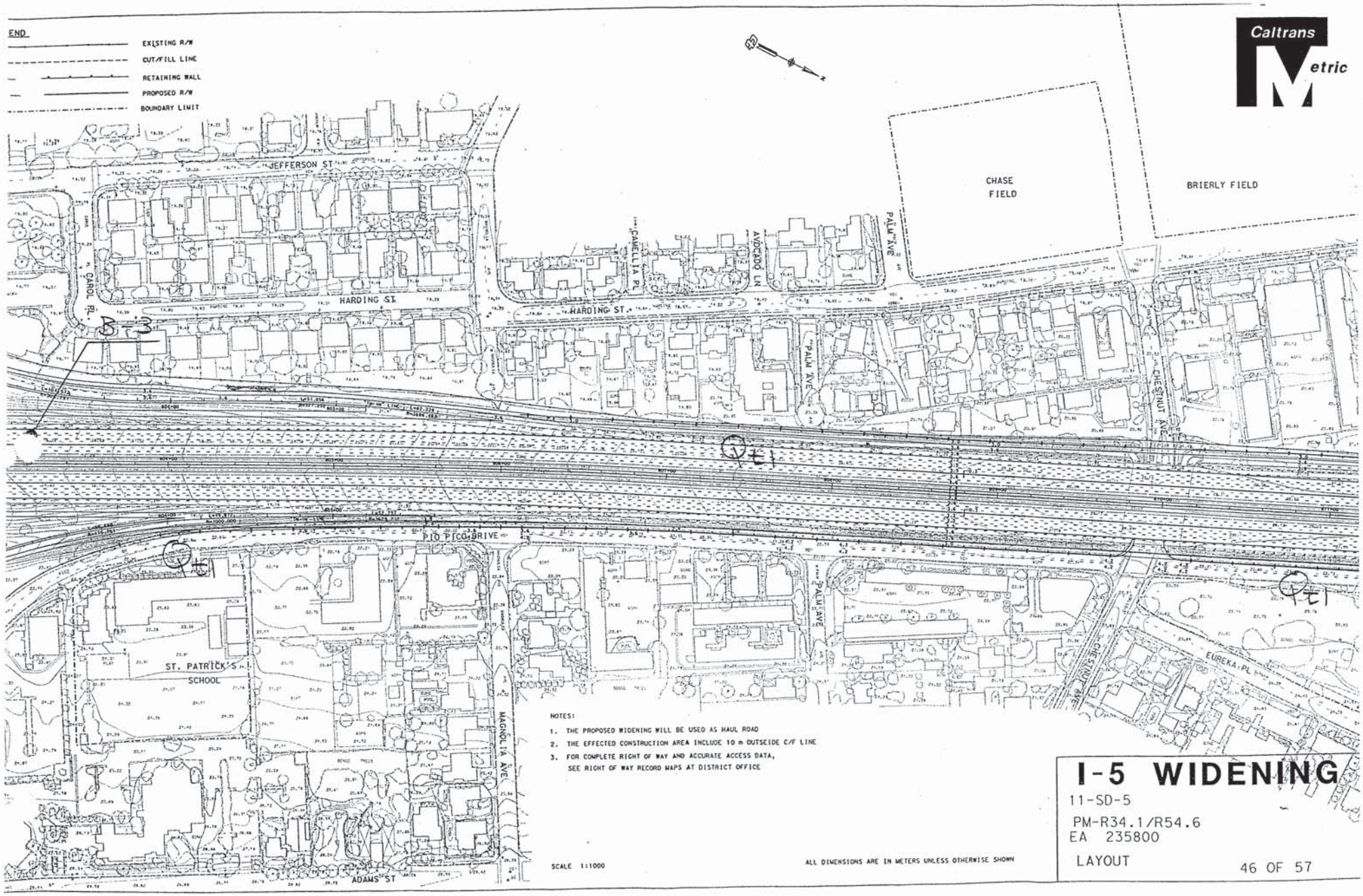
I-5 WIDENING

11-SD-5

PM-R34.1/R54.6

EA 235800

LAYOUT



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SCALE 1:1000

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I-5 WIDENING

11-SD-5

PM-R34.1/R54.6

EA 235800

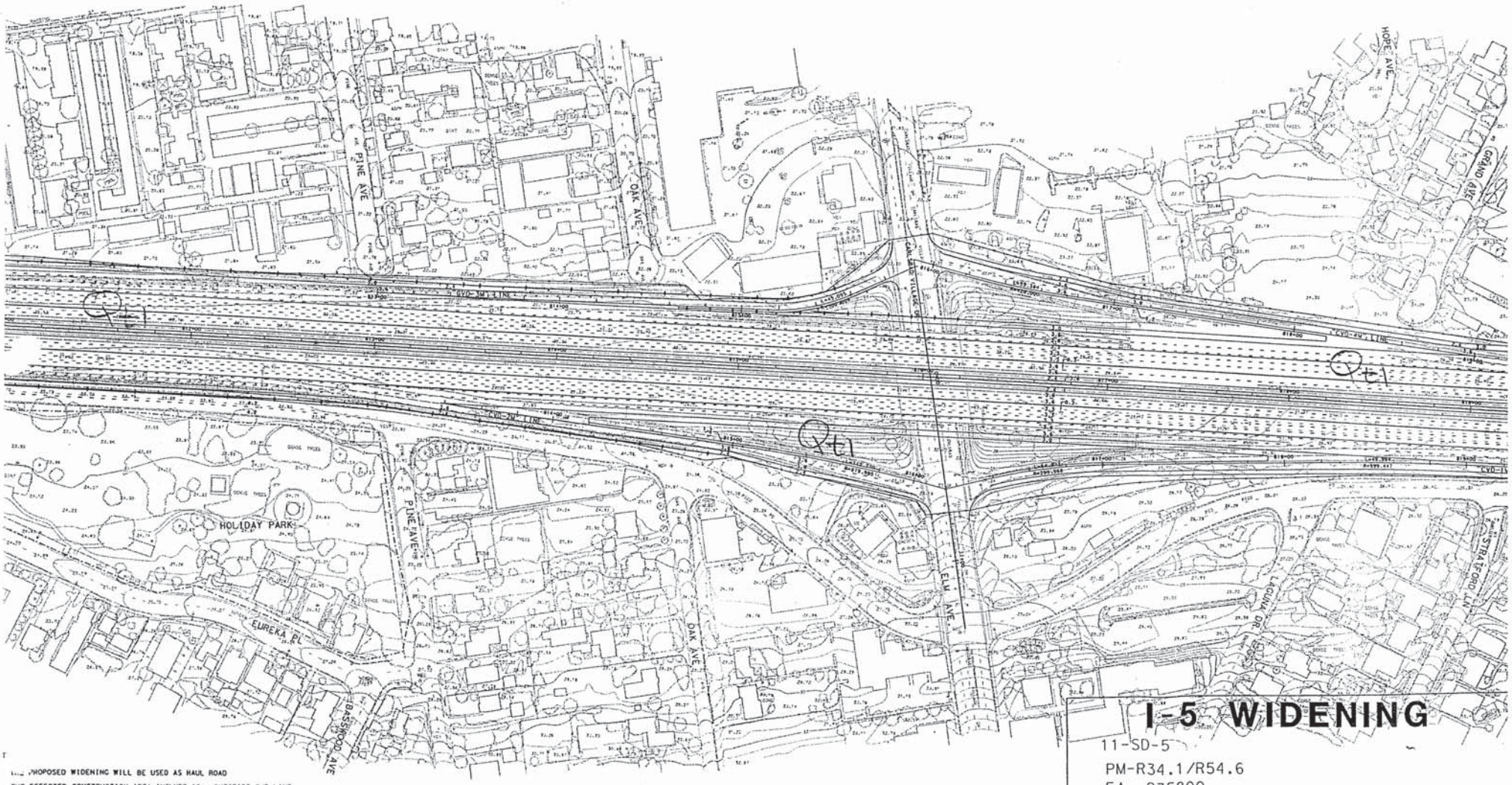
LAYOUT

BRIERLY FIELD

LEGEND

- EXISTING R/W
- CUT/FILL LINE
- RETAINING WALL
- PROPOSED R/W
- BOUNDARY LIMIT

Caltrans Metric



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FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA,
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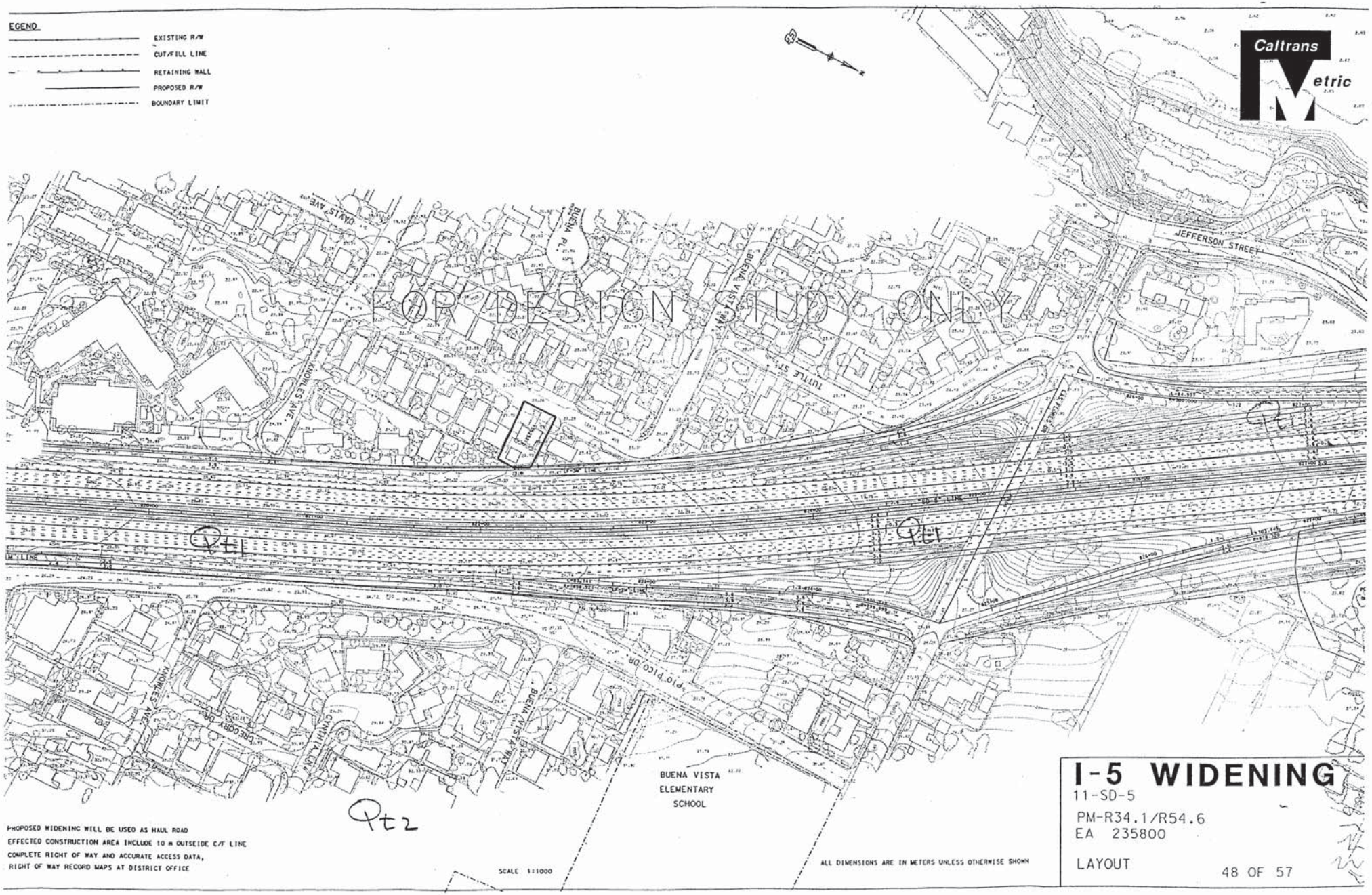
SCALE 1:1000

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

I-5 WIDENING

11-SD-5
PM-R34.1/R54.6
EA 235800
LAYOUT



I-5 WIDENING

11-SD-5

PM-R34.1/R54.6

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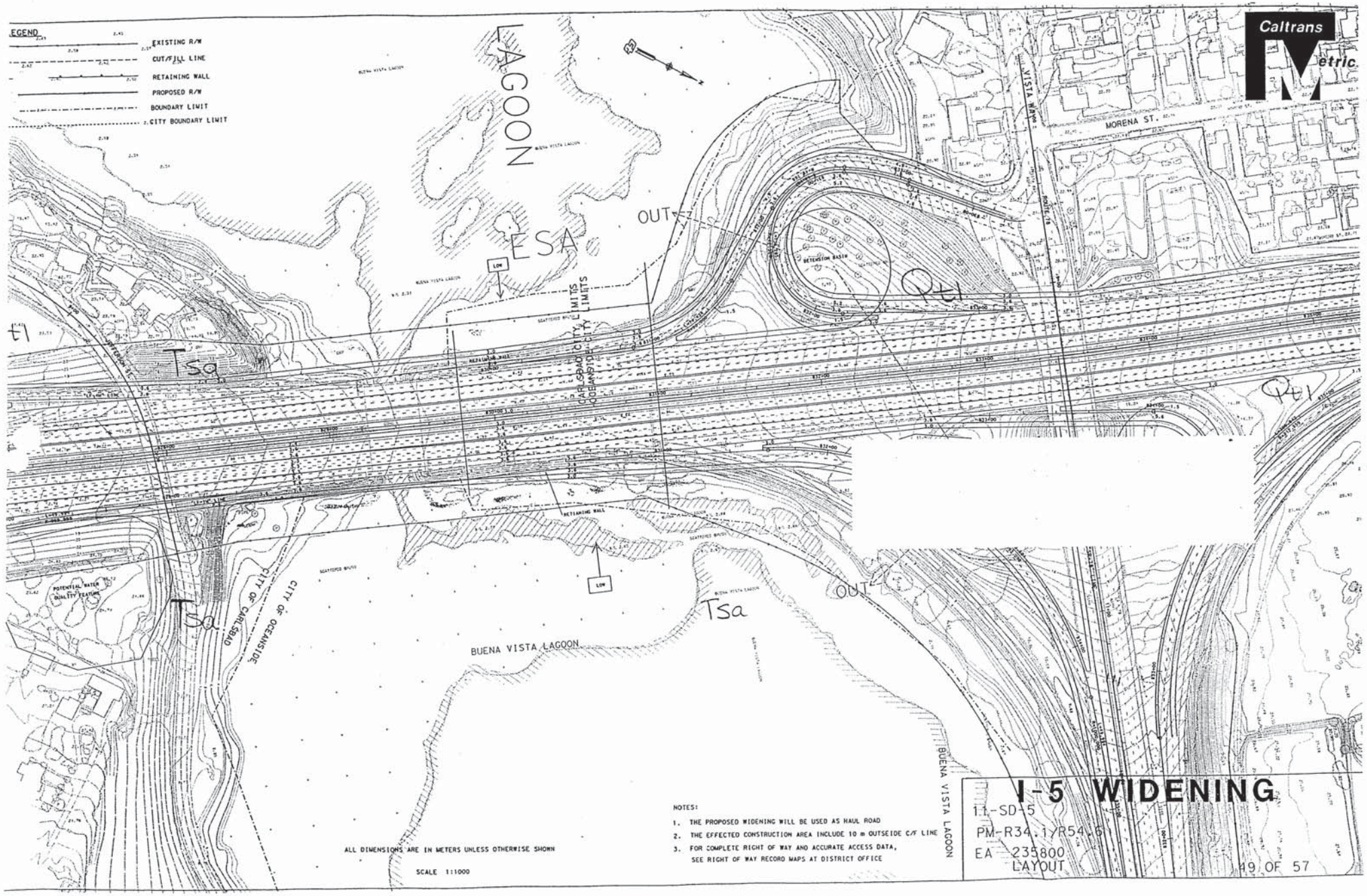
LAYOUT



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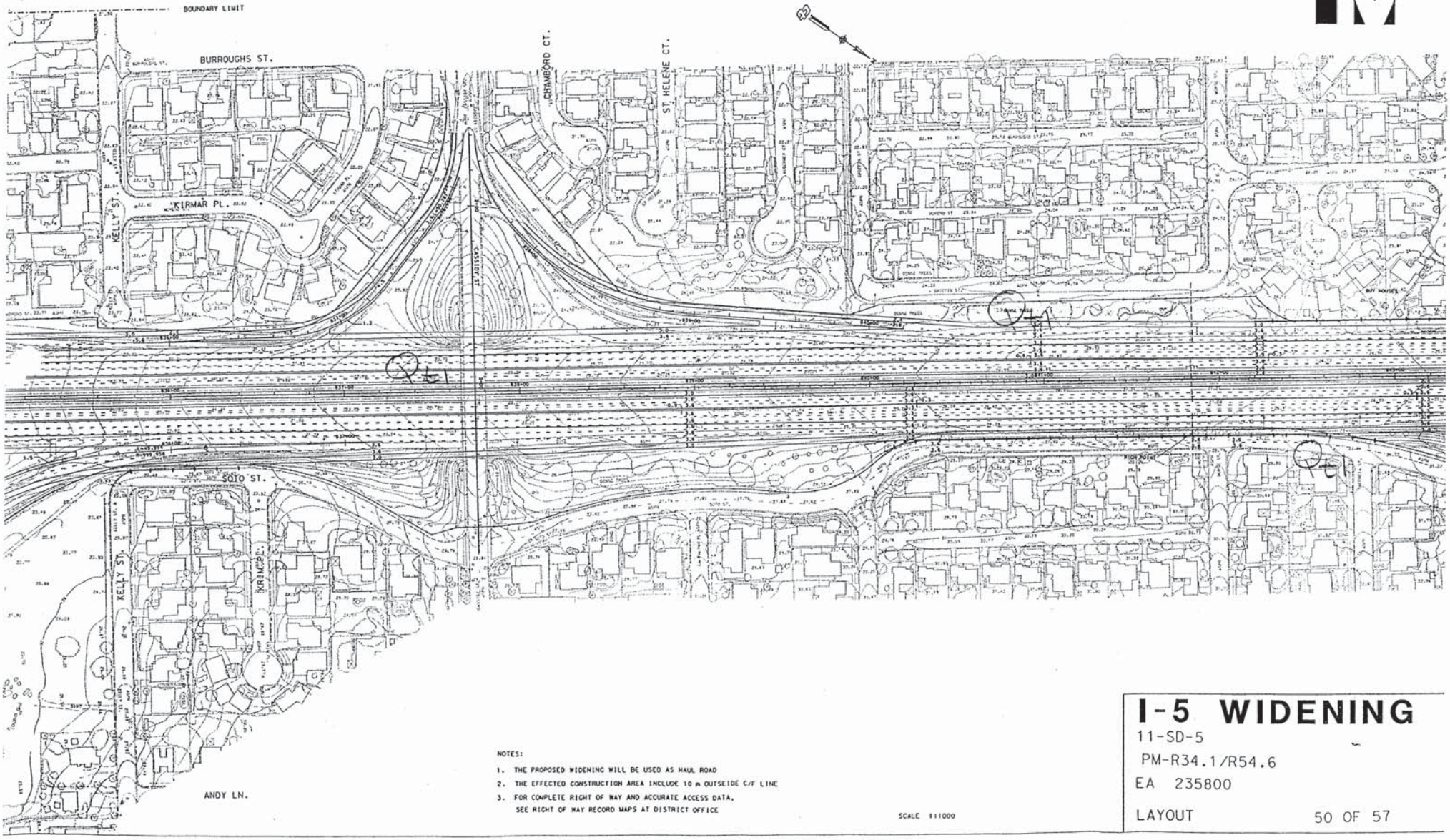
I-5 WIDENING

11-SD-5
PM-R34.1/R54.6
EA 235800
LAYOUT

LEGEND

- EXISTING R/W
- CUT/FILL LINE
- RETAINING WALL
- PROPOSED R/W
- BOUNDARY LIMIT

Caltrans Metric



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SCALE 1:1000

I-5 WIDENING

11-SD-5

PM-R34.1/R54.6

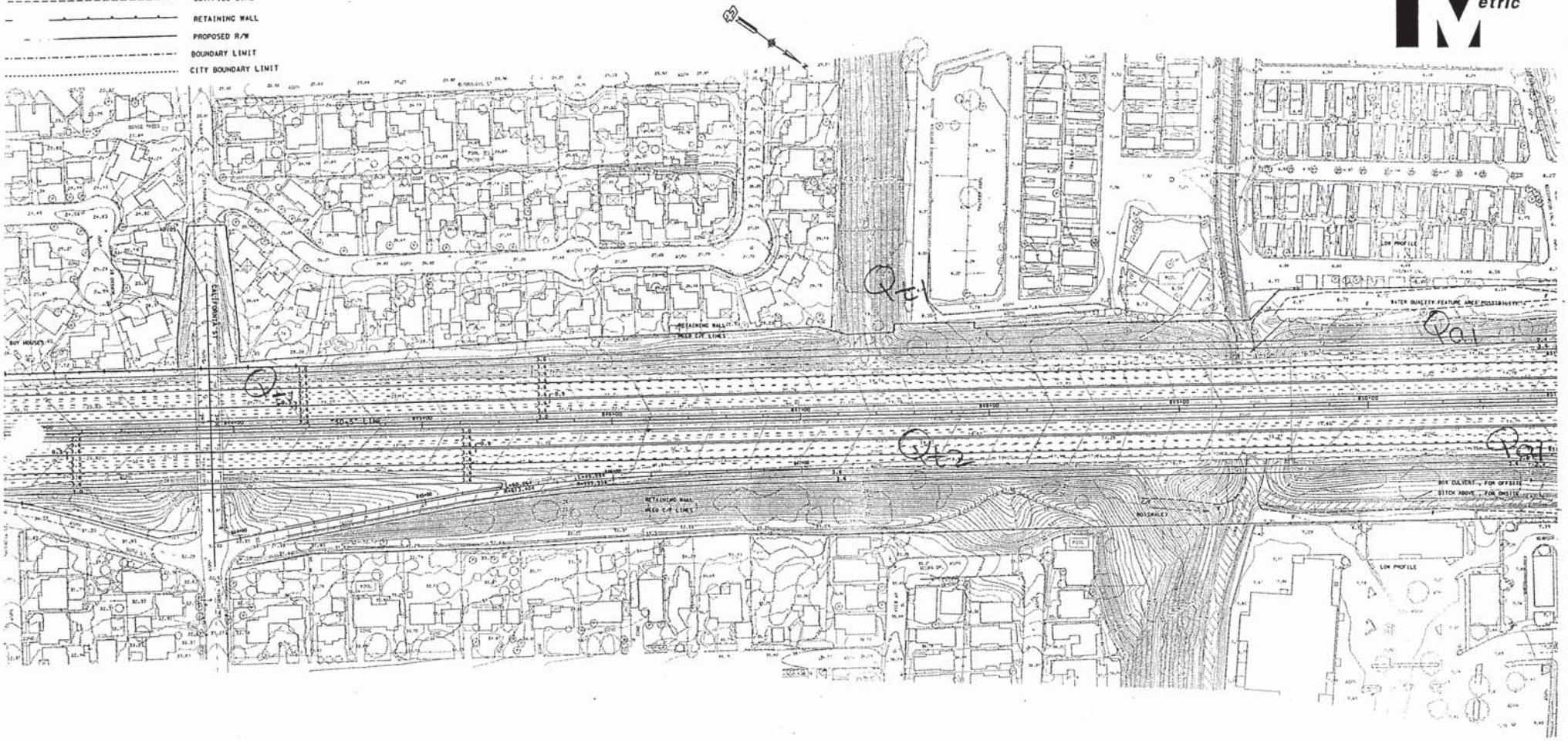
EA 235800

LAYOUT

LEGEND

- EXISTING R/W
- CUT/FILL LINE
- RETAINING WALL
- PROPOSED R/W
- BOUNDARY LIMIT
- CITY BOUNDARY LIMIT

Caltrans Metric



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SCALE 1:1000

I-5 WIDENING

11-SD-5

PM-R34.1/R54.6

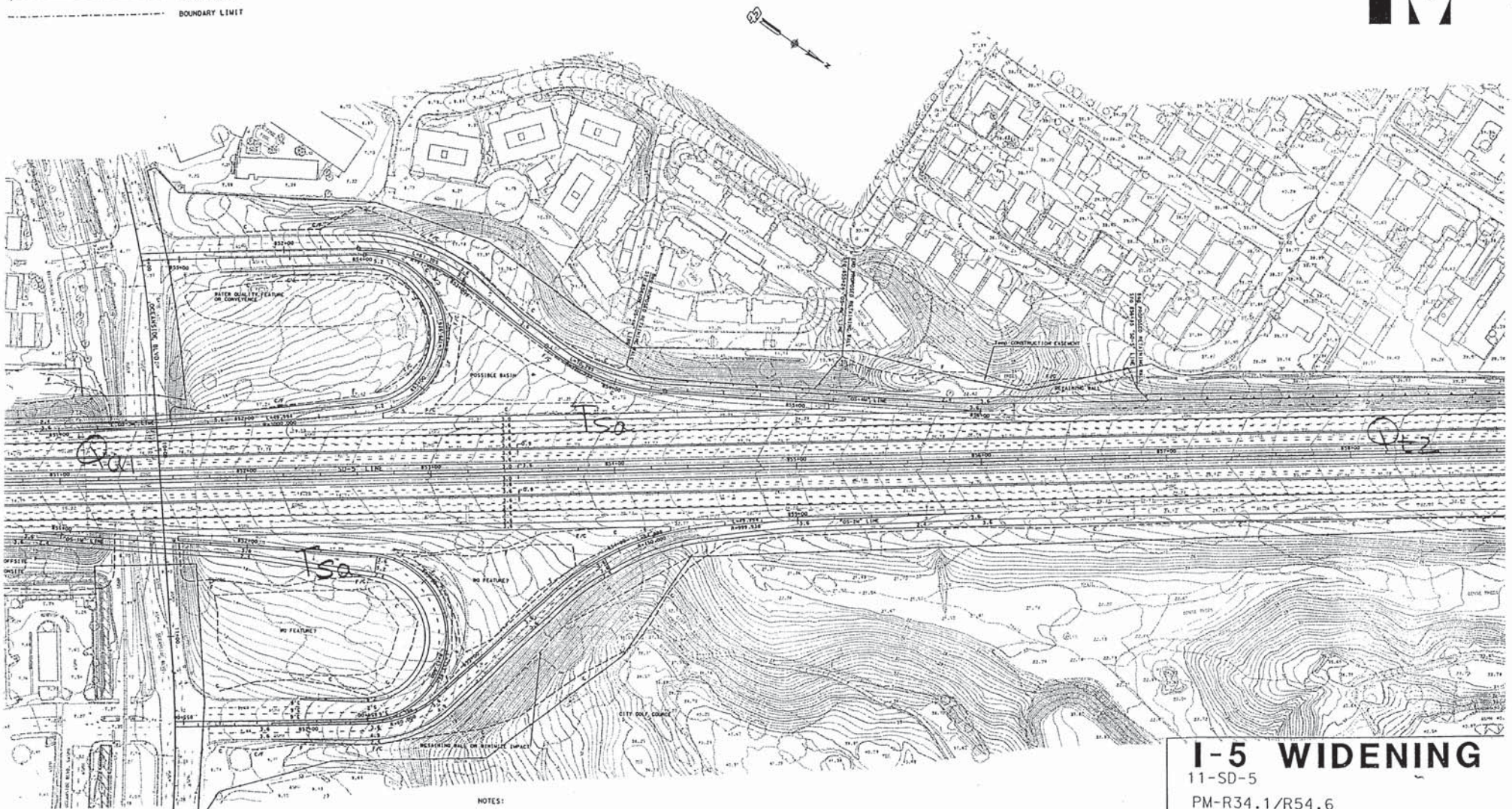
EA 235800

LAYOUT

LEGEND

- EXISTING R/W
- CUT/FILL LINE
- RETAINING WALL
- PROPOSED R/W
- BOUNDARY LIMIT

Caltrans Metric



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I-5 WIDENING

11-SD-5

PM-R34.1/R54.6

EA 235800

LAYOUT

LEGEND

- EXISTING R/W
- CUT/FILL LINE
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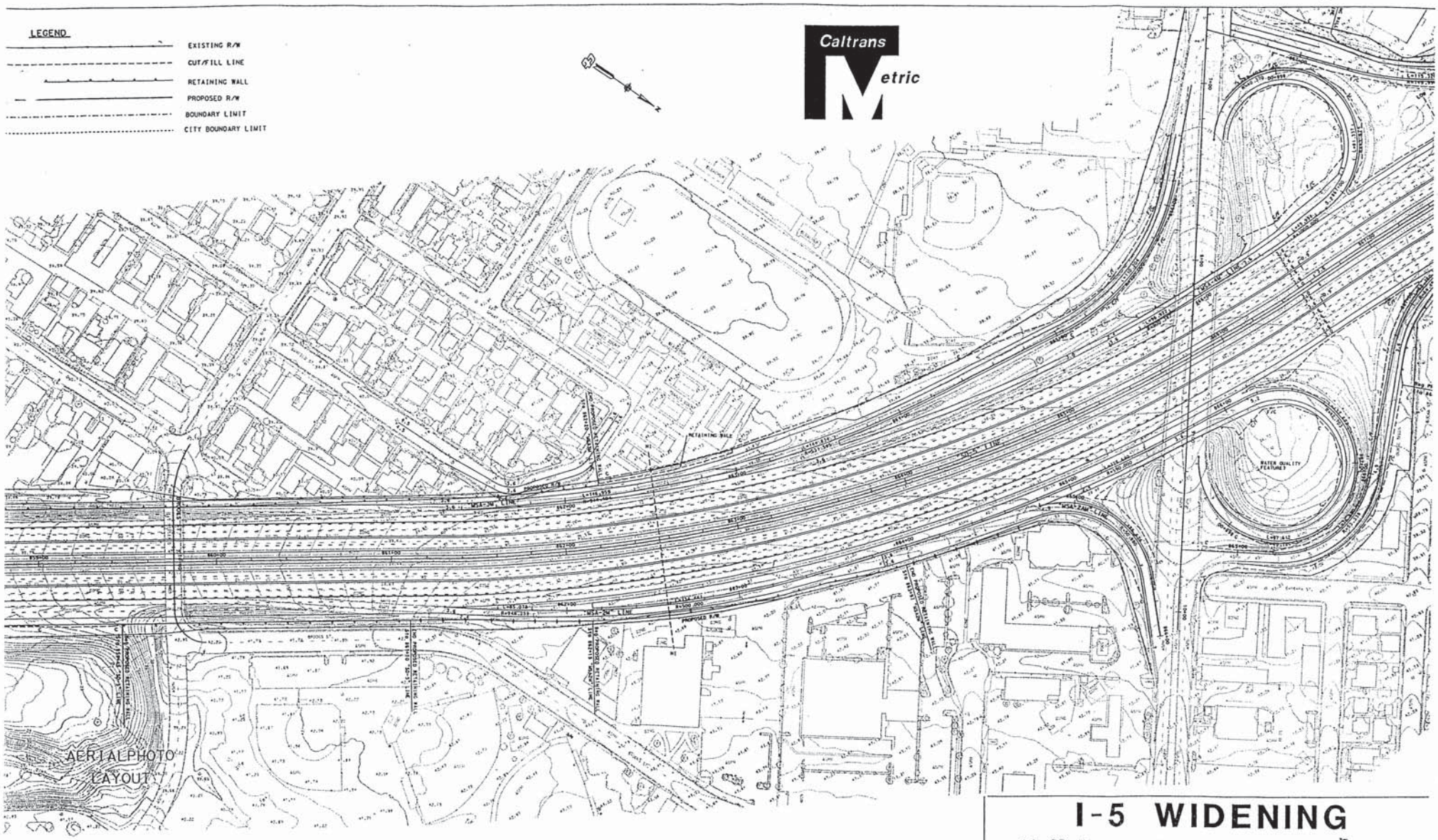
- PROPOSED R/W
- BOUNDARY LIMIT
- CITY BOUNDARY LIMIT

Caltrans Metric



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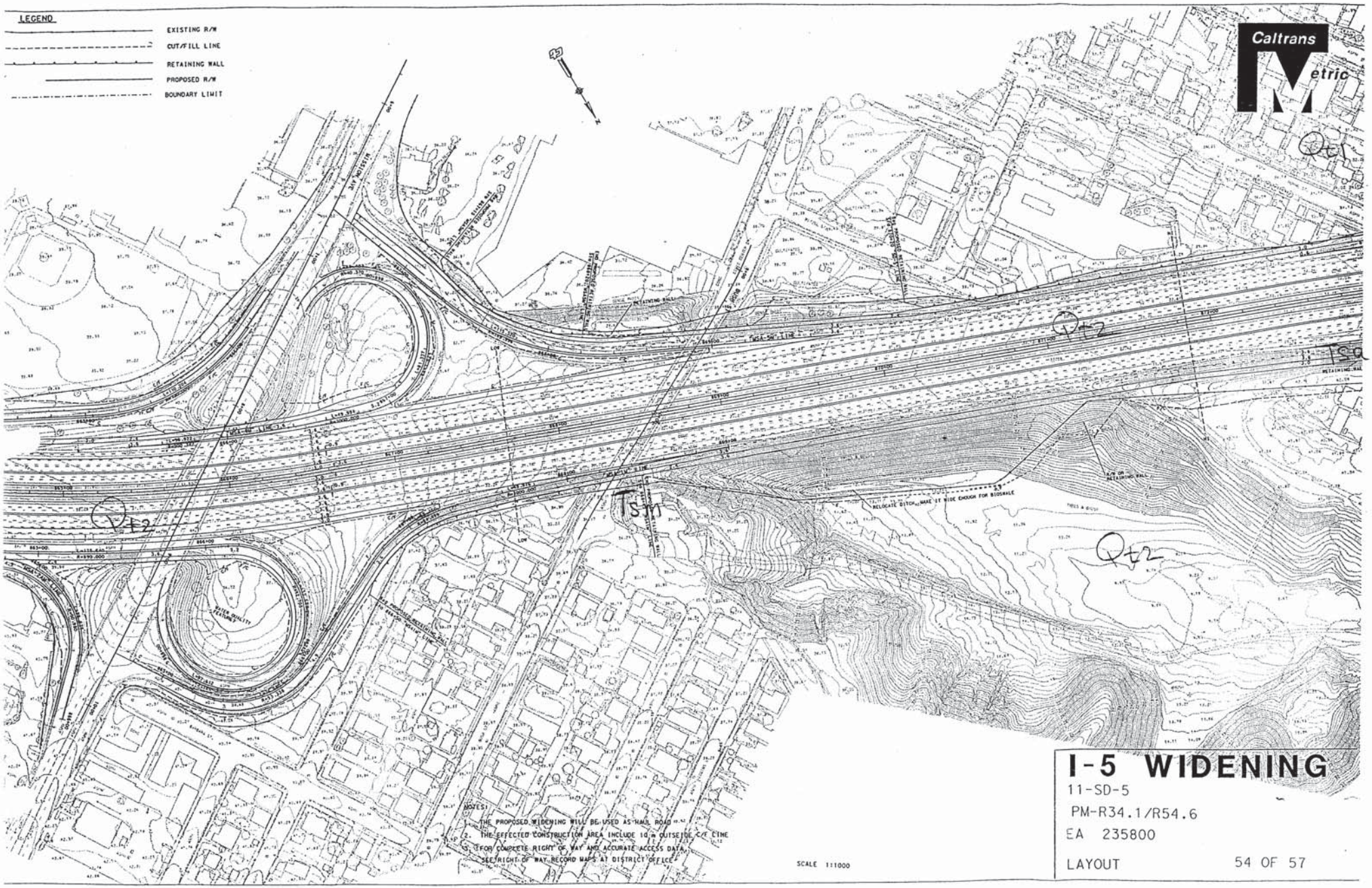
I-5 WIDENING

11-SD-5

PM-R34.1/R54.6

EA 235800

LAYOUT



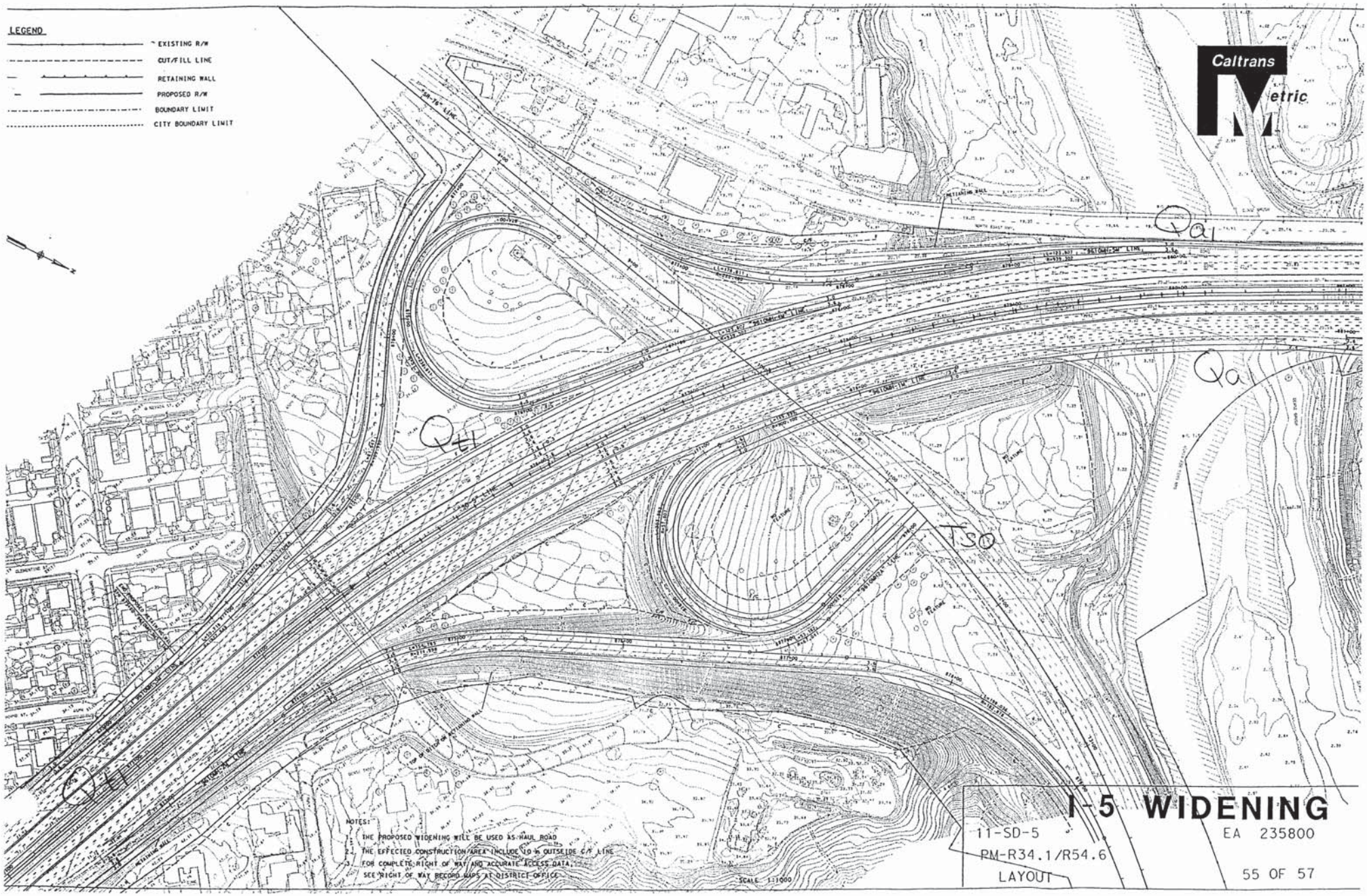
I-5 WIDENING

11-SD-5

PM-R34.1/R54.6

EA 235800

LAYOUT


LEGEND
EXISTING R/W
CUT/FILL LINE
RETAINING WALL
PROPOSED R/W
BOUNDARY LIMIT
CITY BOUNDARY LIMIT
Caltrans
Metric
Qal
Qal
Qtl
Tso
NOTES:
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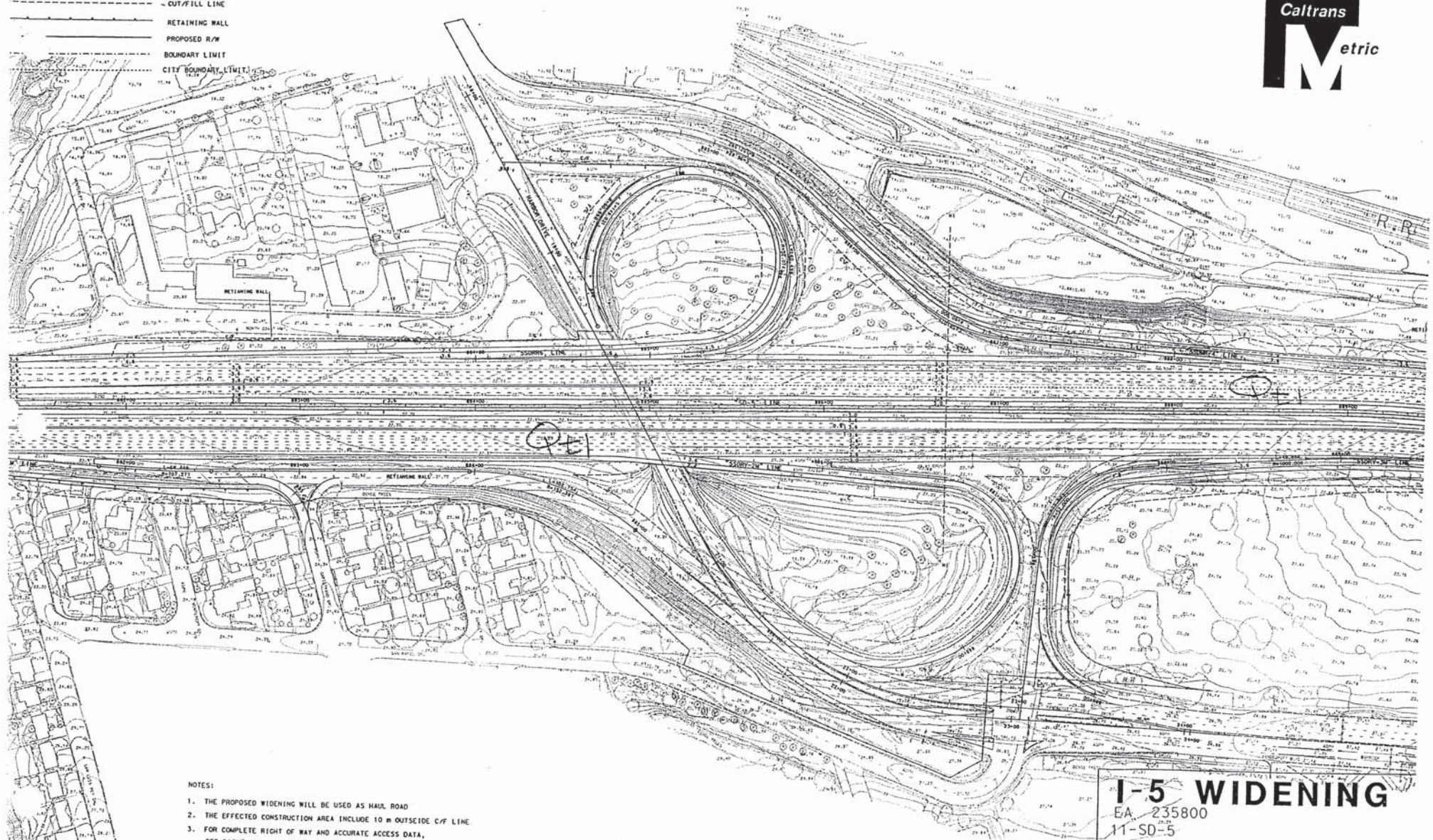
SCALE 1:1000
I-5 WIDENING
11-SD-5
EA 235800
PM-R34.1/R54.6
LAYOUT
55 OF 57

LEGEND

- EXISTING R/W
- CUT/FILL LINE
- RETAINING WALL
- PROPOSED R/W
- BOUNDARY LIMIT
- CITY BOUNDARY LIMIT

Caltrans Metric



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SCALE 1:1000

I-5 WIDENING

EA 235800

11-SD-5

PM-R34.1/R54.6

LAYOUT

END

EXISTING R/W

CUT/FILL LINE

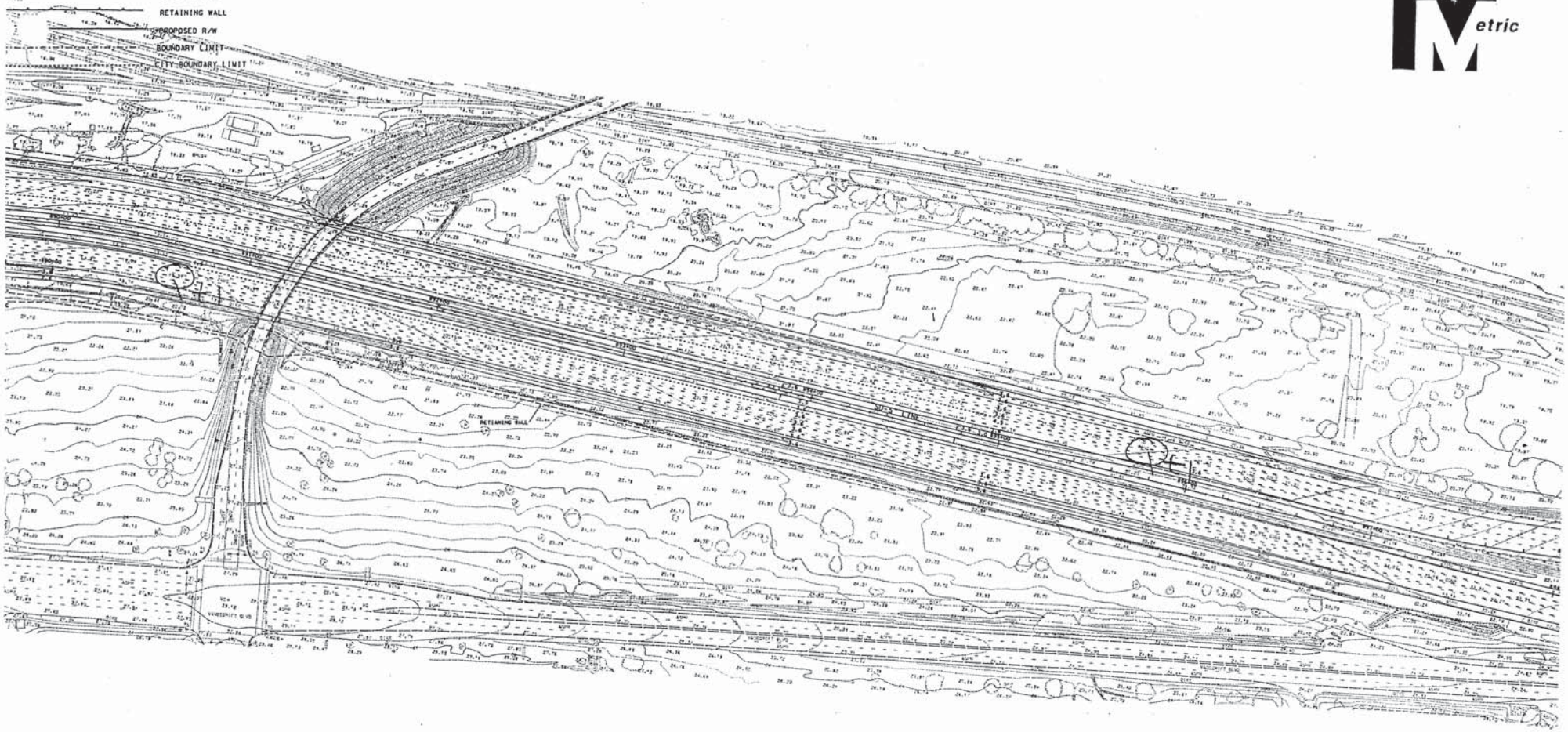
RETAINING WALL

PROPOSED R/W

BOUNDARY LIMIT

CITY BOUNDARY LIMIT

Caltrans Metric



) WIDENING WILL BE USED AS HAUL ROAD

) CONSTRUCTION AREA INCLUDE 10 m OUTSEIDE C/F LINE

COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA,

RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE

SCALE 1:1000

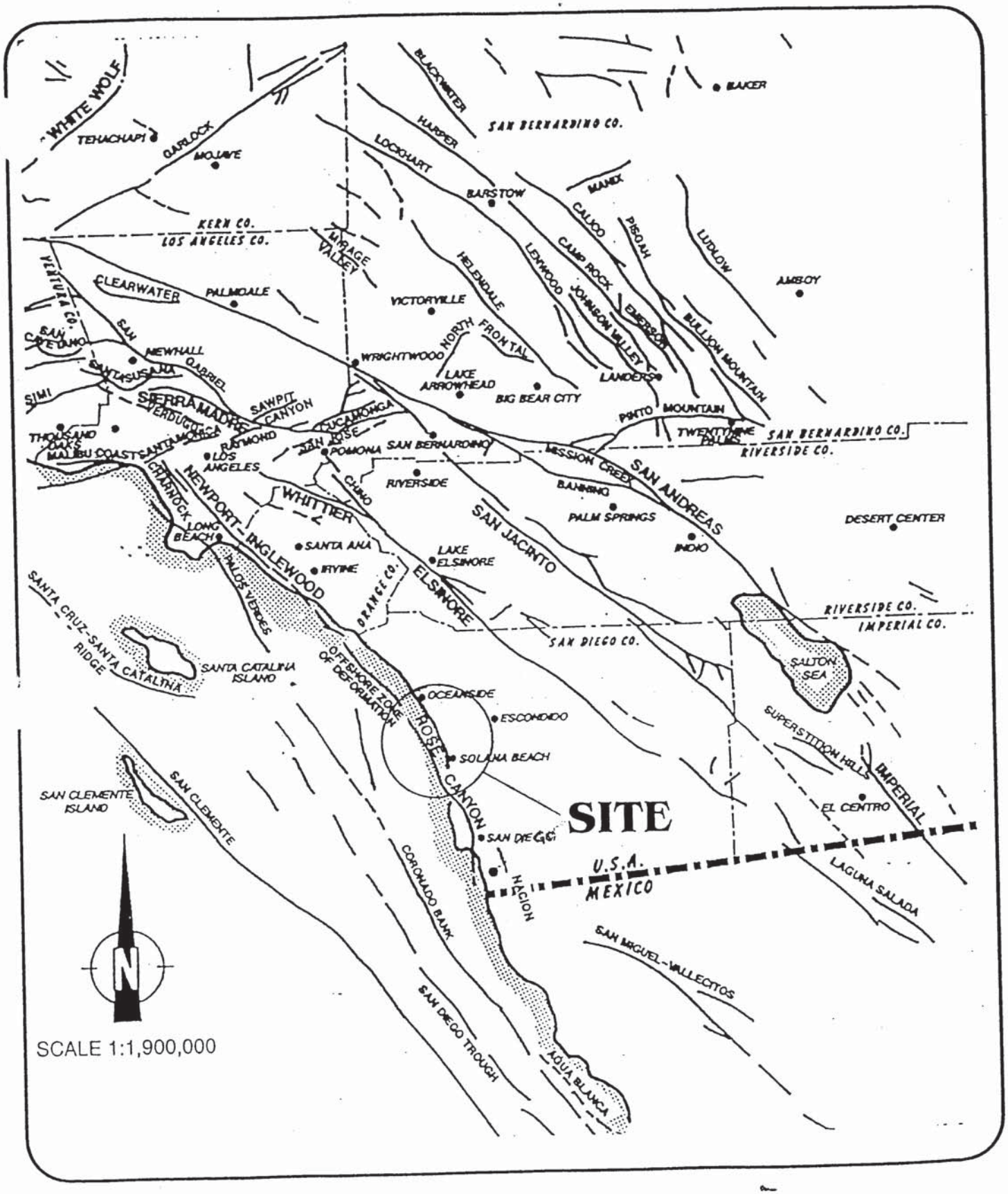
I-5 WIDENING

EA 235800

11-SD-5

PM-R34.1/R54.6

LAYOUT



From: Ninyo & Moore

FIGURE 3A

FROM: CALIFORNIA SEISMIC HAZARD MAP 1996
BY Dr. LALLIANA MUALCHIN - CALTRANS

LEGEND:

- 0.7g Peak Acceleration Contour
- 0.6g Peak Acceleration Contour
- 0.5g Peak Acceleration Contour
- 0.4g Peak Acceleration Contour
- 0.3g Peak Acceleration Contour
- 0.2g Peak Acceleration Contour
- 0.1g Peak Acceleration Contour
- Special Seismic Source (SSS)
- Faults with Fault Codes (MCE)
- State Highways
- County Boundary
- Latitude & Longitude

N
W E
S

NOTE: SEE ACCOMPANYING TECHNICAL REPORT FOR NAMES OF FAULTS CORRESPONDING TO FAULT CODES

SCALE

0 50 100 150 200 250 Kilometers

FIGURE 3B

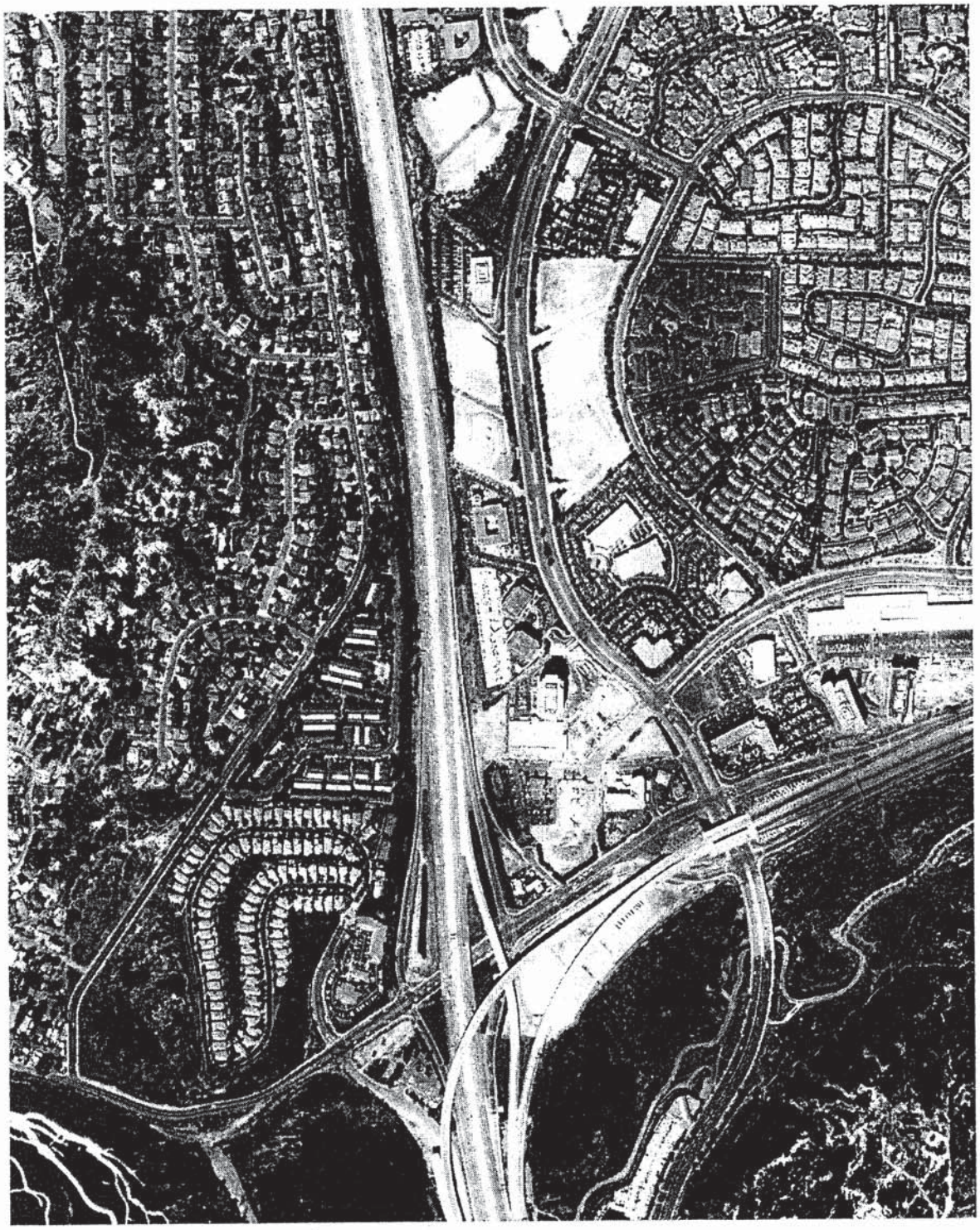
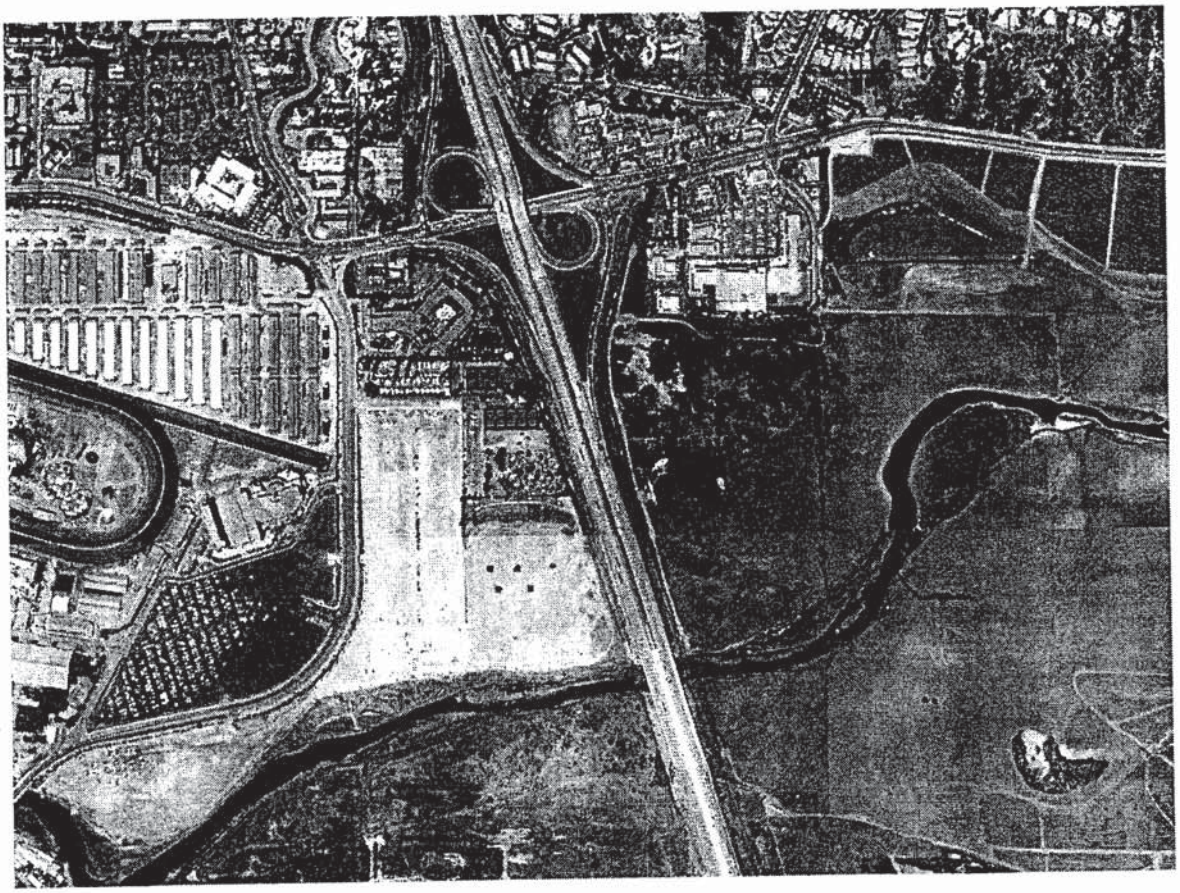


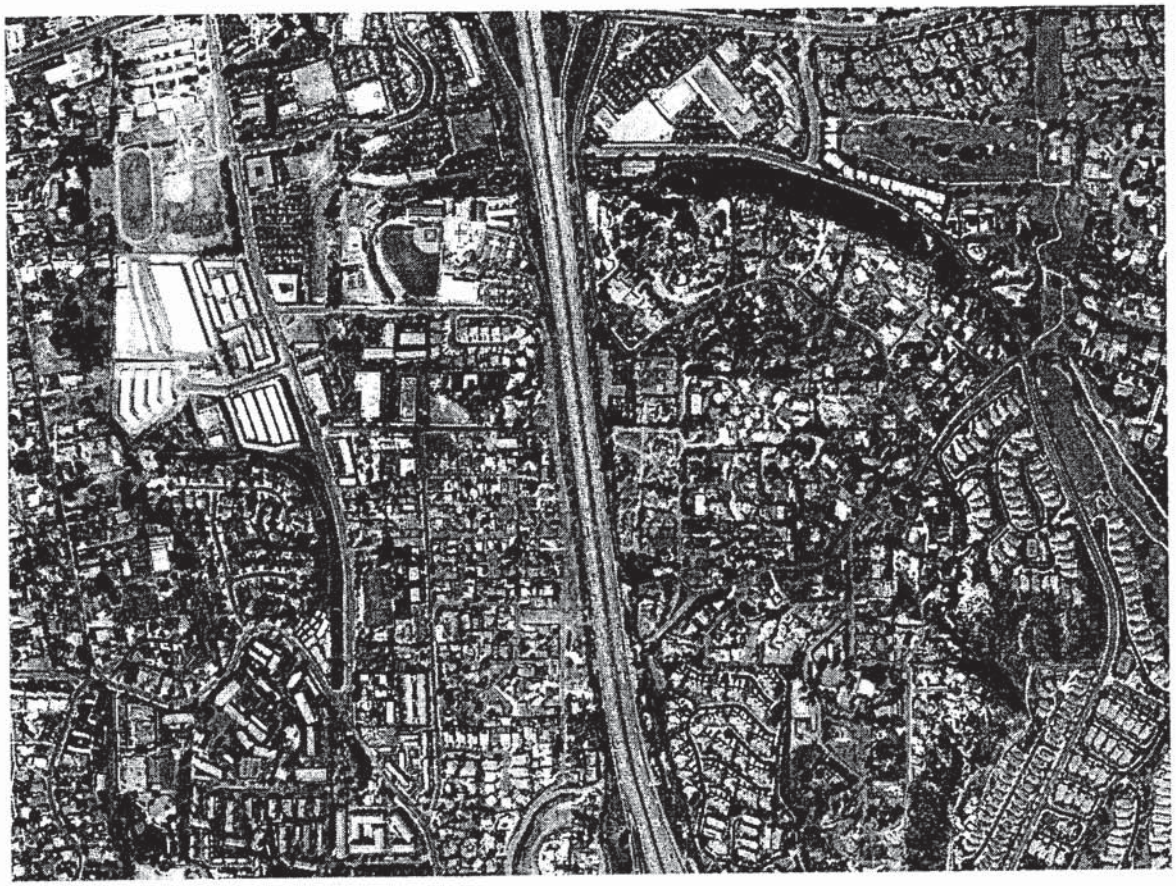
Figure 4: 5 – 56 connector

Del Mar Heights Rd

Area between Del Mar Heights Rd and Via De La Valle (farm fields on east side of I-5)



Via De La Valle

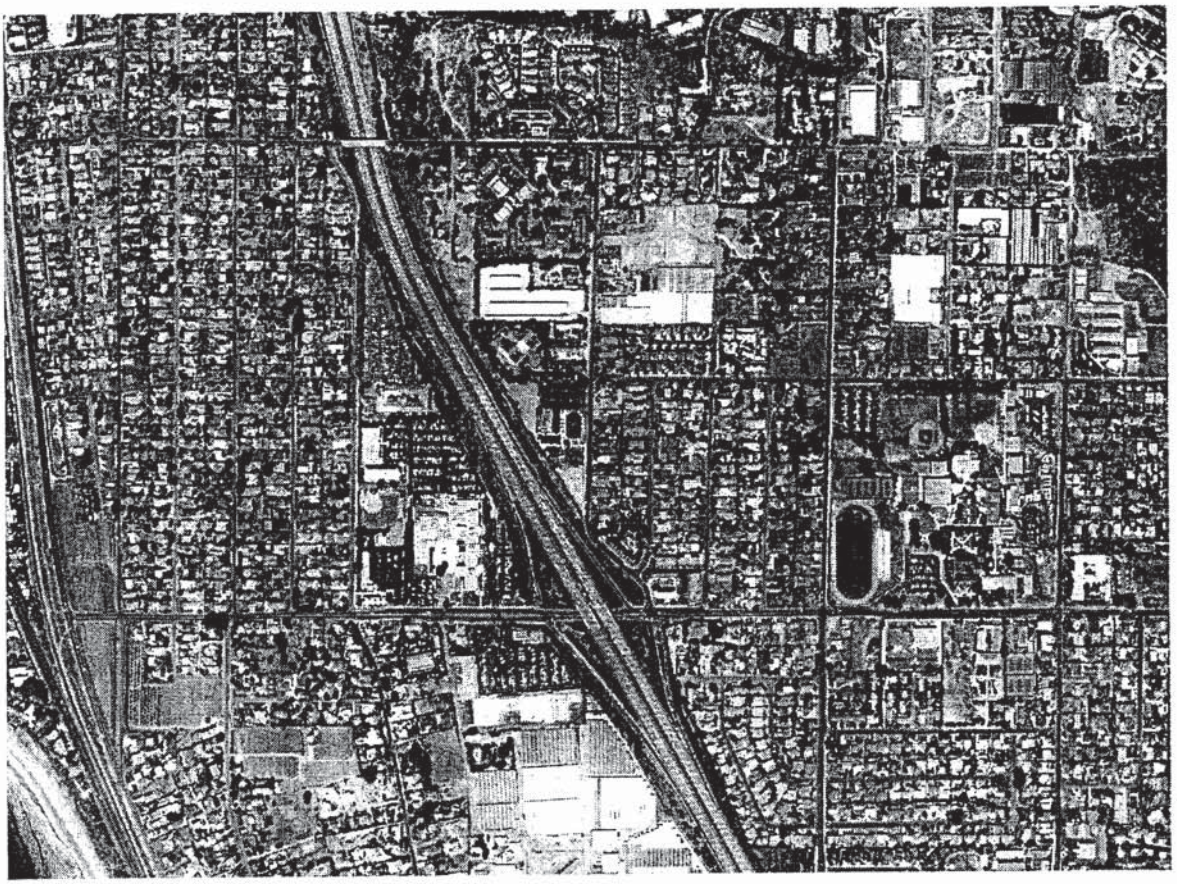


Between Via De La Valle and Lomas Santa Fe Dr

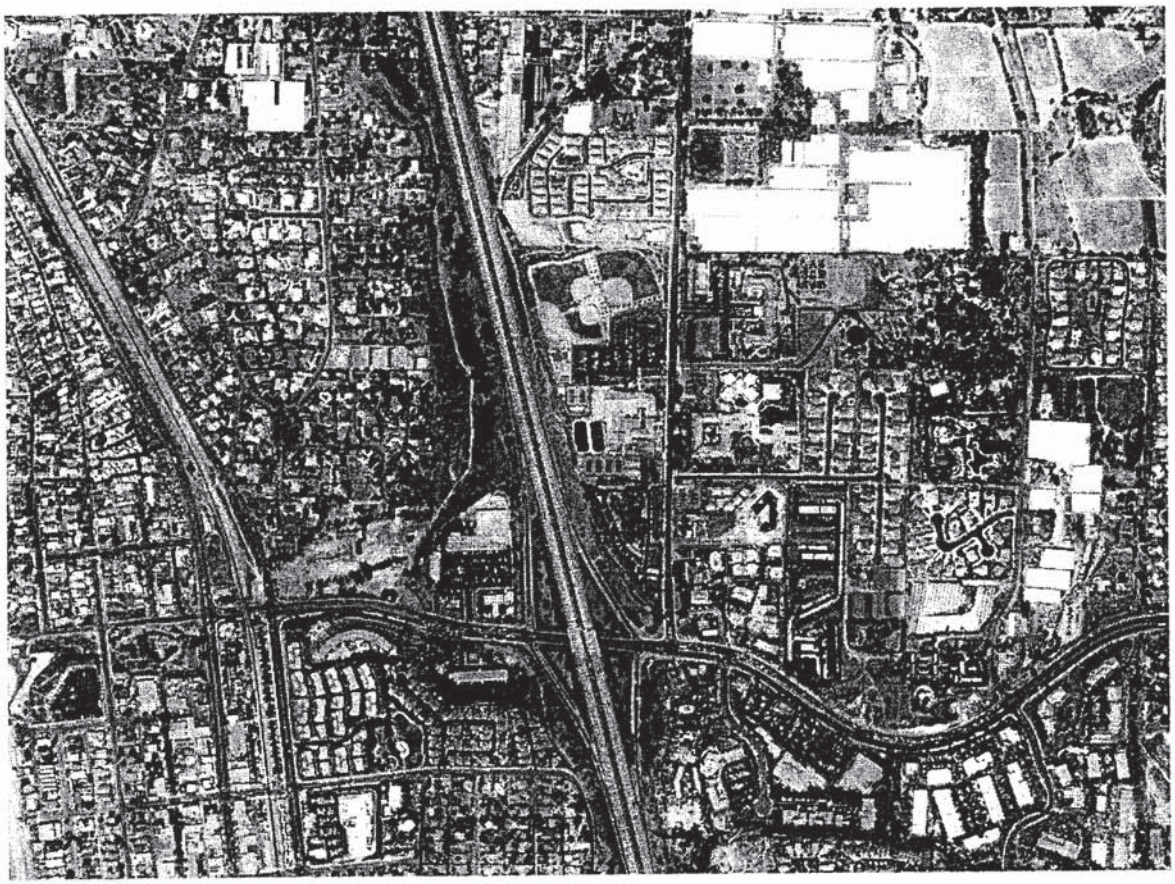
Lomas Santa Fe Dr, San Elijo Lagoon

Manchester Ave and San Elijo Lagoon

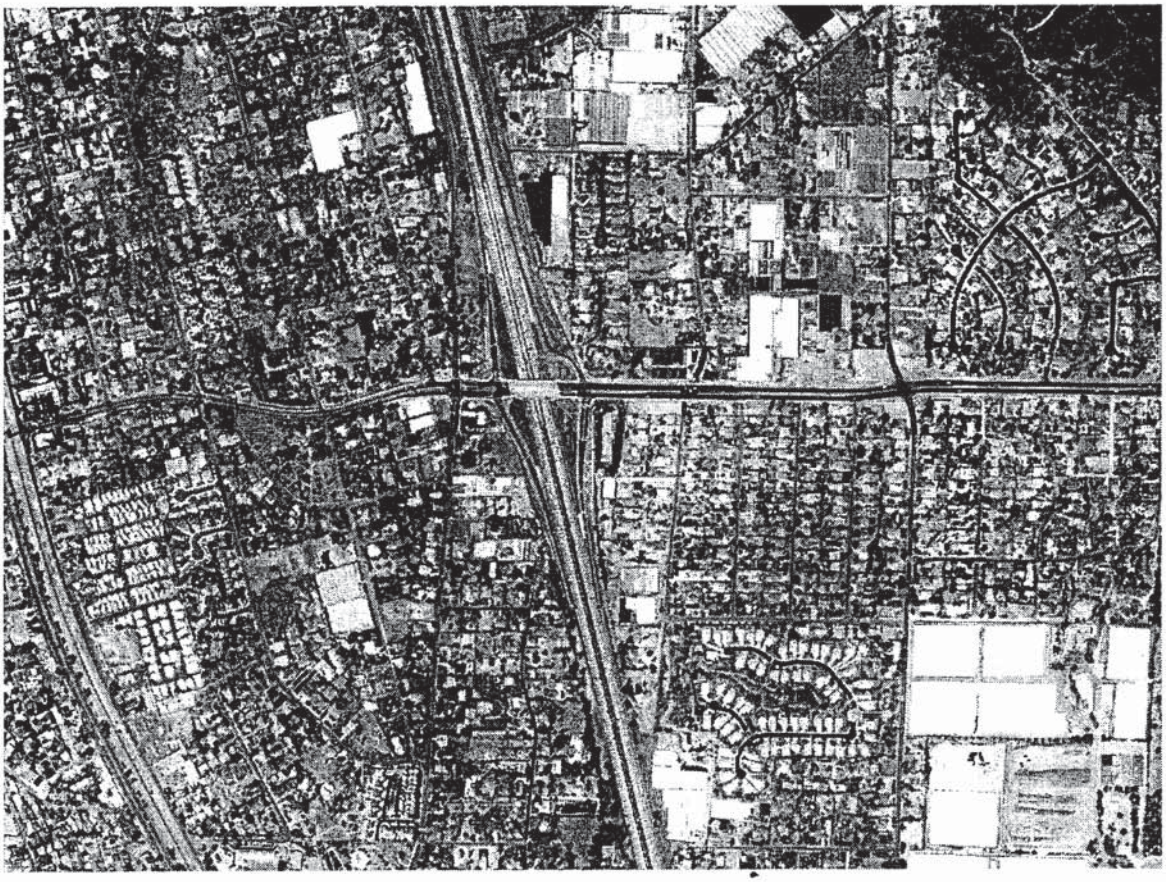
Birmingham Dr



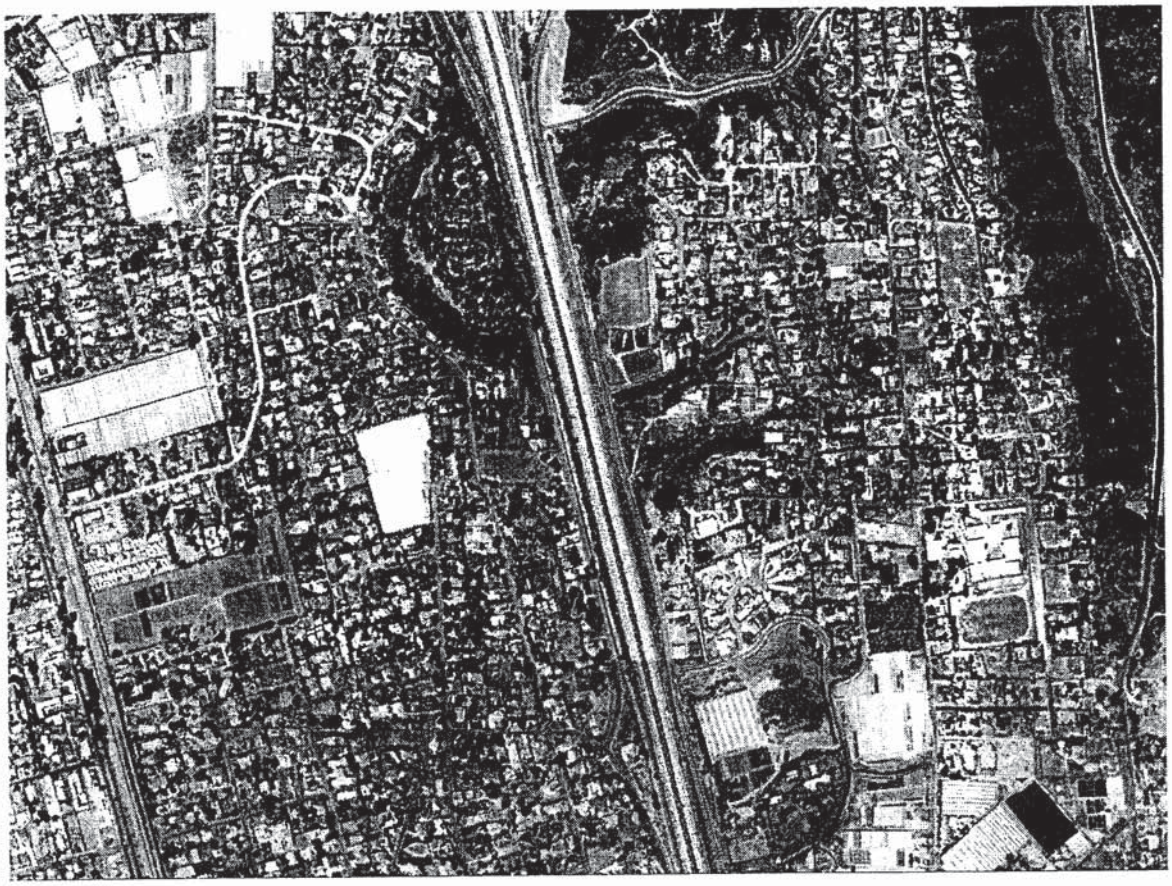
Santa Fe Dr



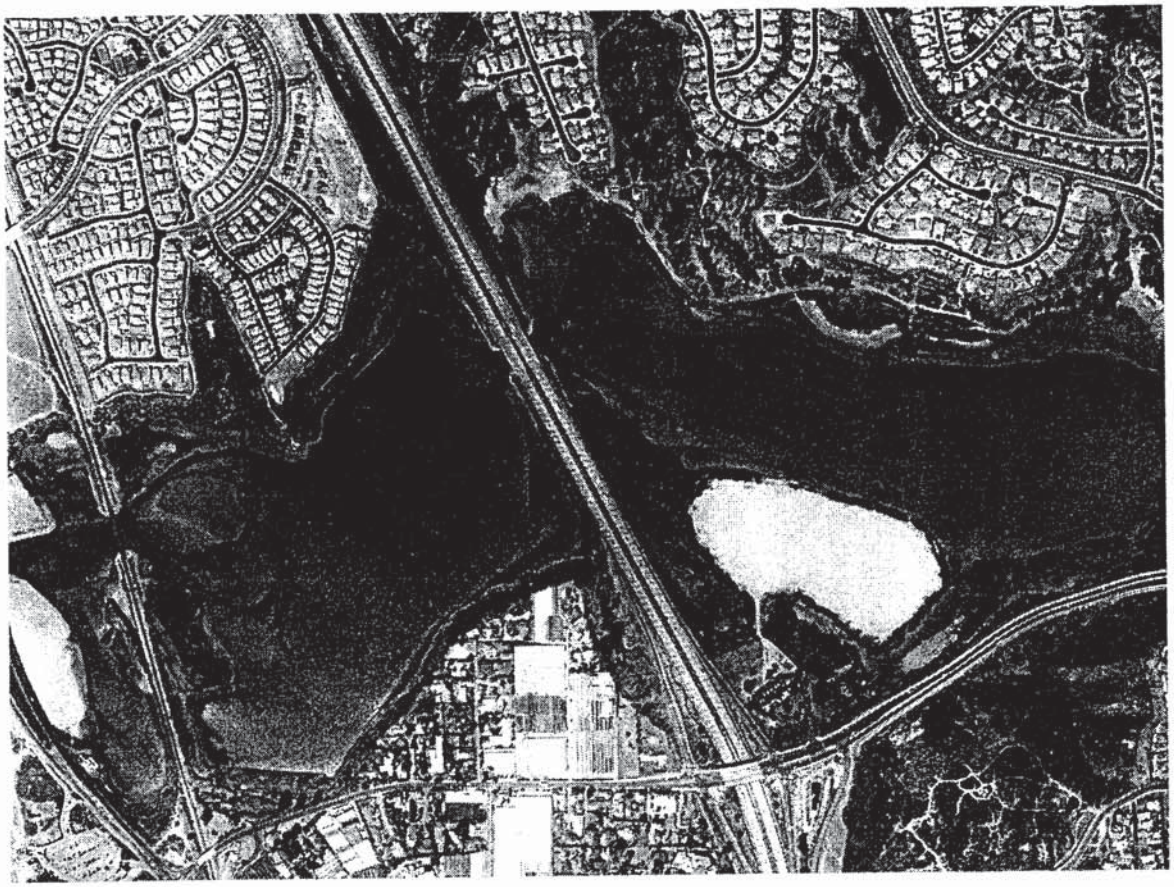
Encinitas Blvd



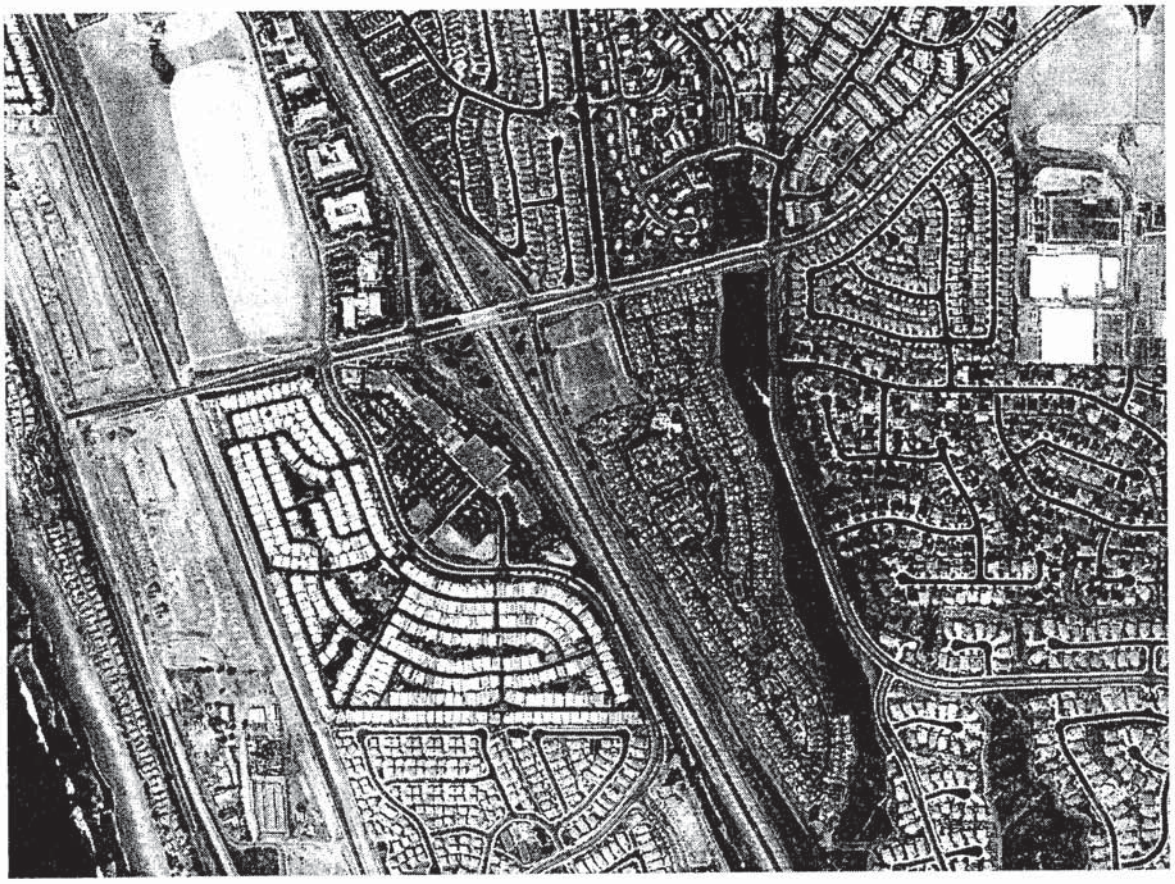
Leucadia Blvd



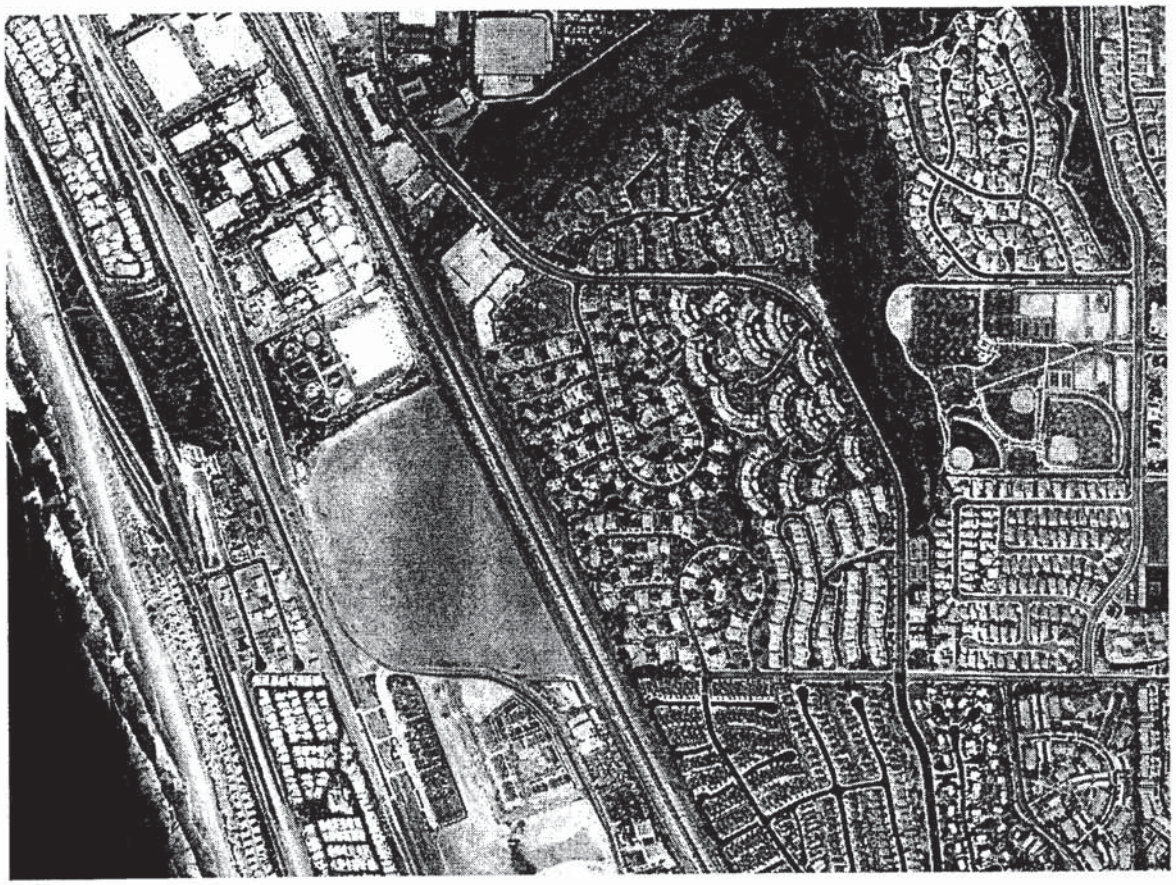
Between Leucadia Blvd and La Costa Blvd



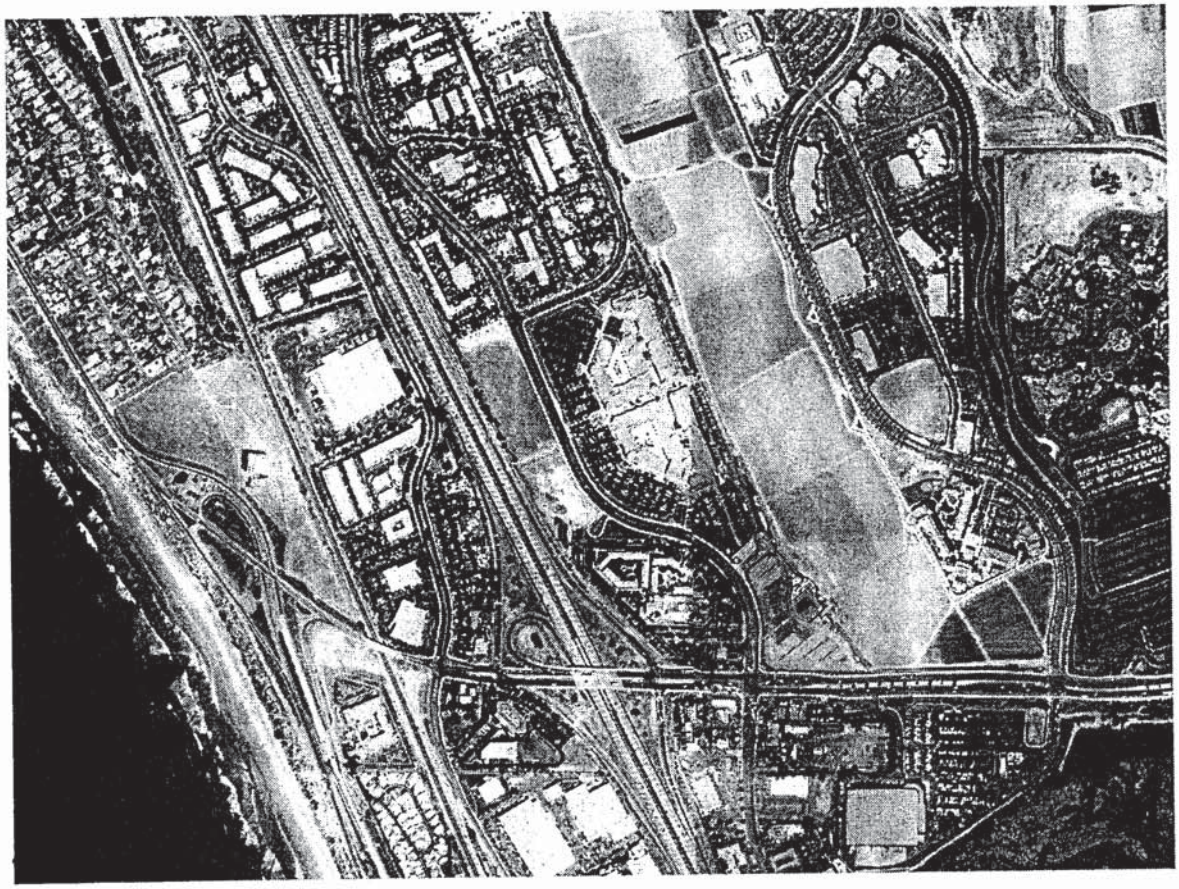
La Costa Blvd and Batiquitos Lagoon



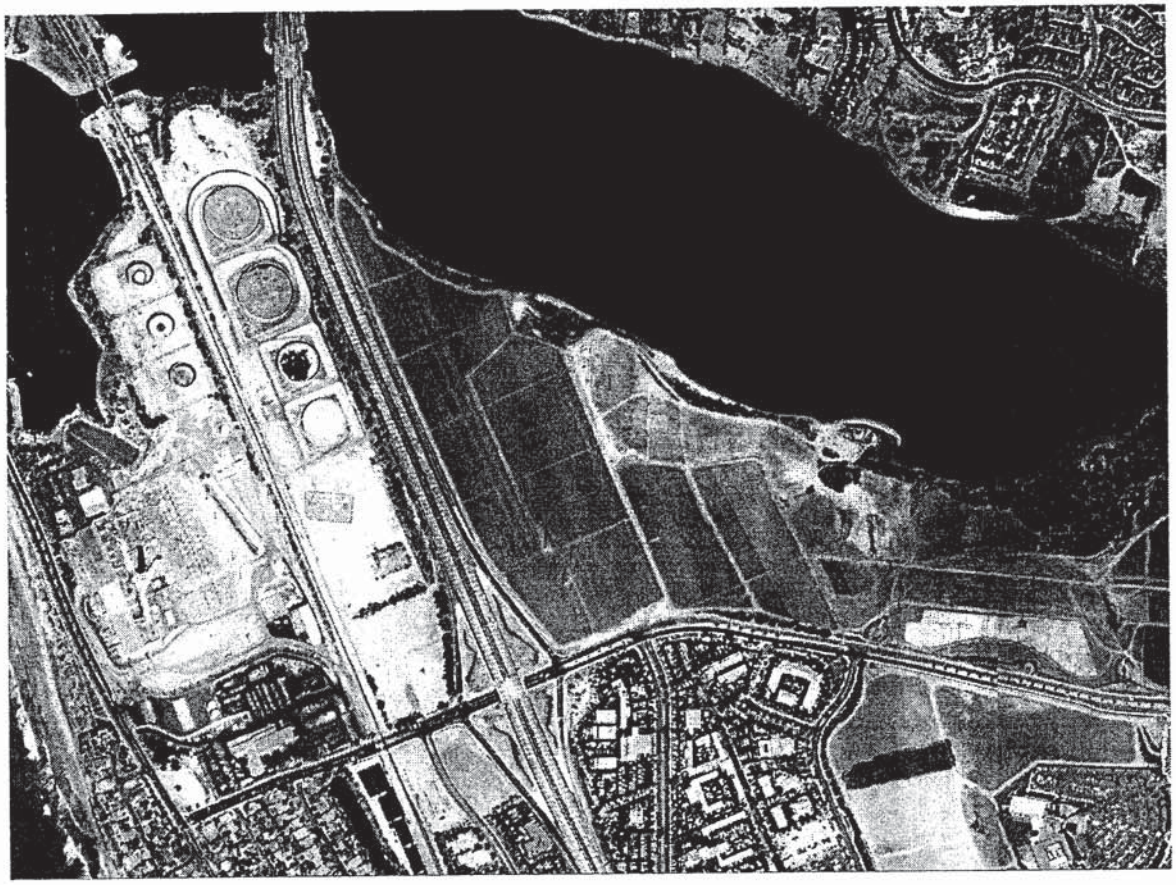
Poinsettia Ln



Between Poinsettia Ln and Palomar Airport Rd



Palomar Airport Rd



Cannon Rd and Agua Hedionda Lagoon

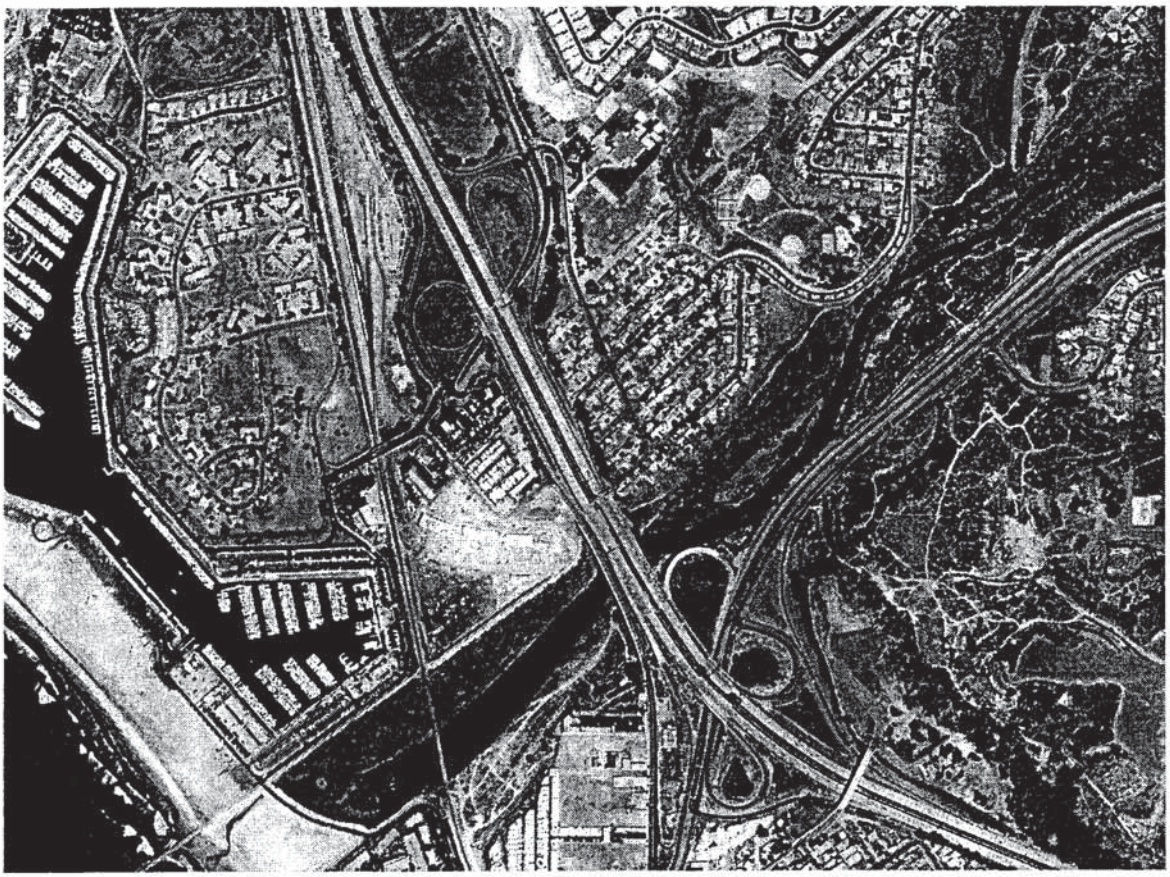
Auga Hedionda Lagoon and Tamarck Ave

Carlsbad Village Dr

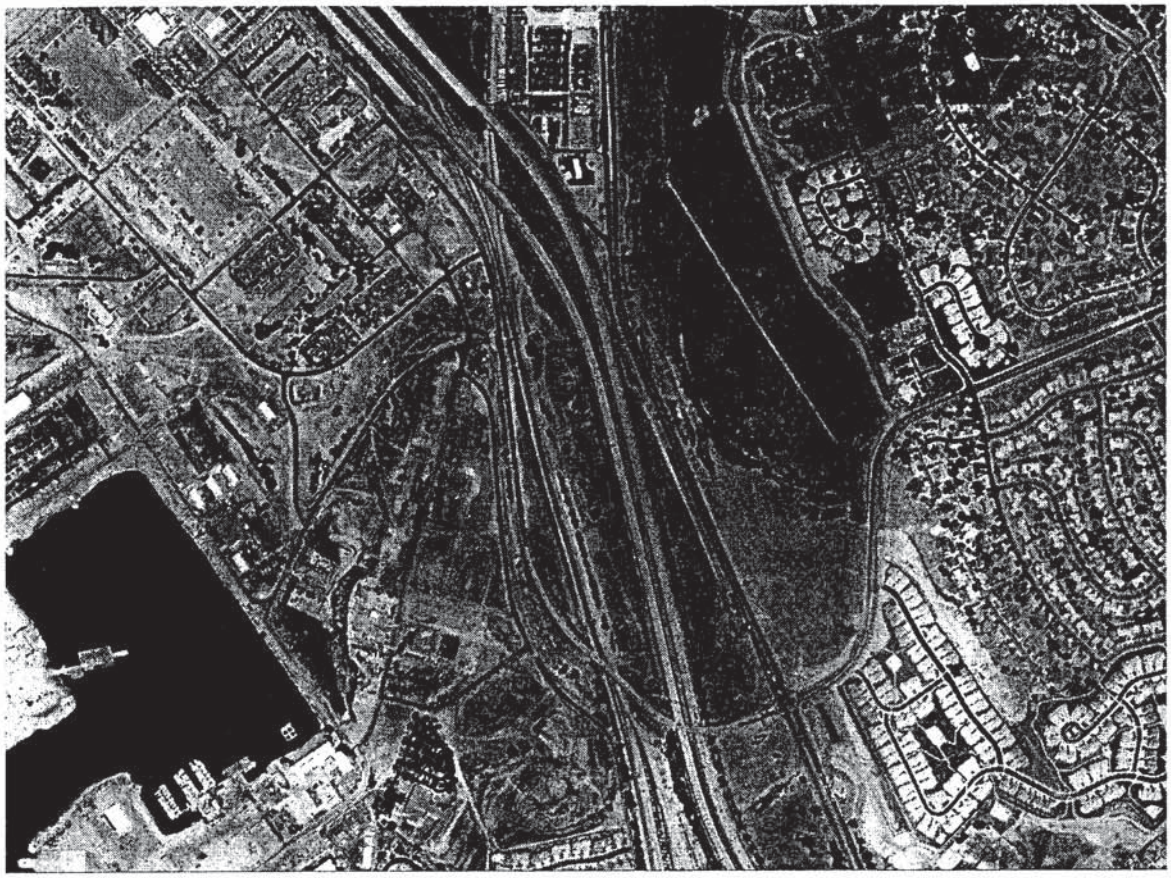
Las Flores, Buena Vista Lagoon, Vista Wy / 78 connector, and Cassidy St

Oceanside Blvd

Mission Ave and 76 connector



76 connector, San Luis Rey River and Harbor Dr



Camp Pendleton

Camp Pendleton and Santa Margarita River

Camp Pendleton and Santa Margarita River

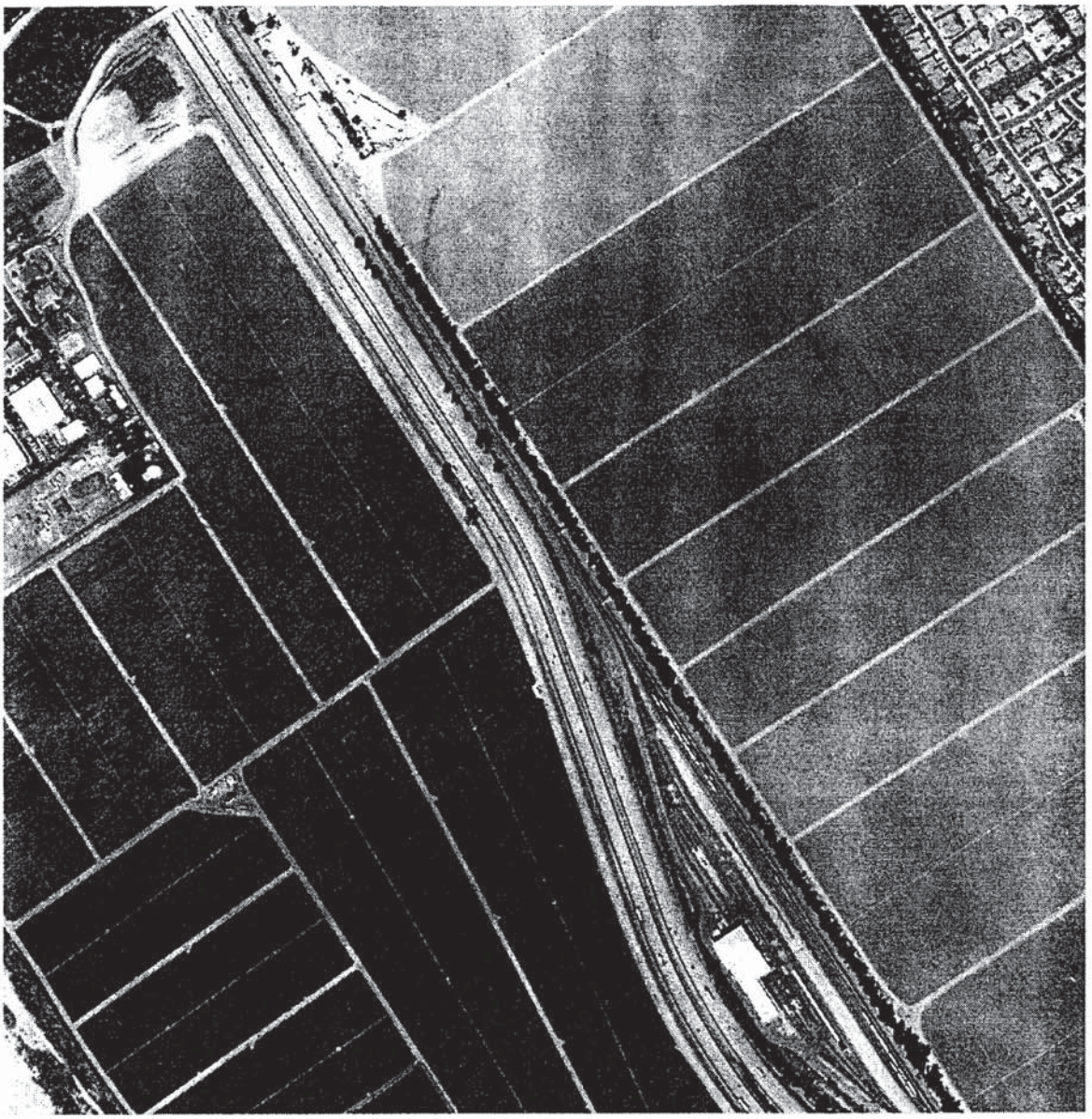
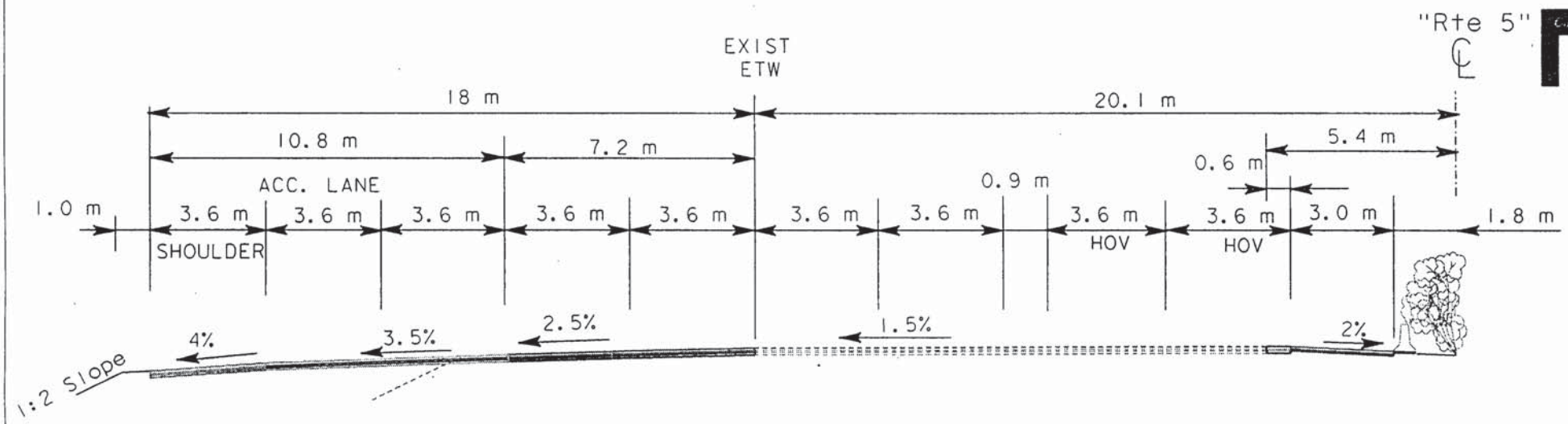


Figure 4 - Camp Pendleton



SOUTH BOUND (5 LANES+ ACC)

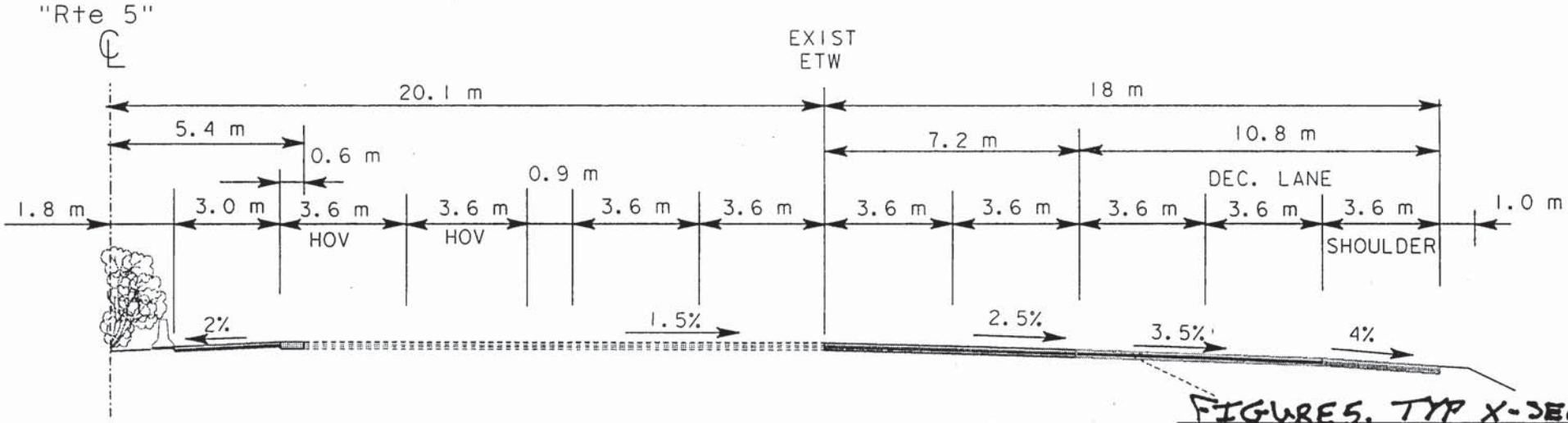


FIGURE 5. TYP X-SECTION

NORTH BOUND (5 LANES +DEC)

FROM LA COSTA AVE. TO POINSETTIA LANE

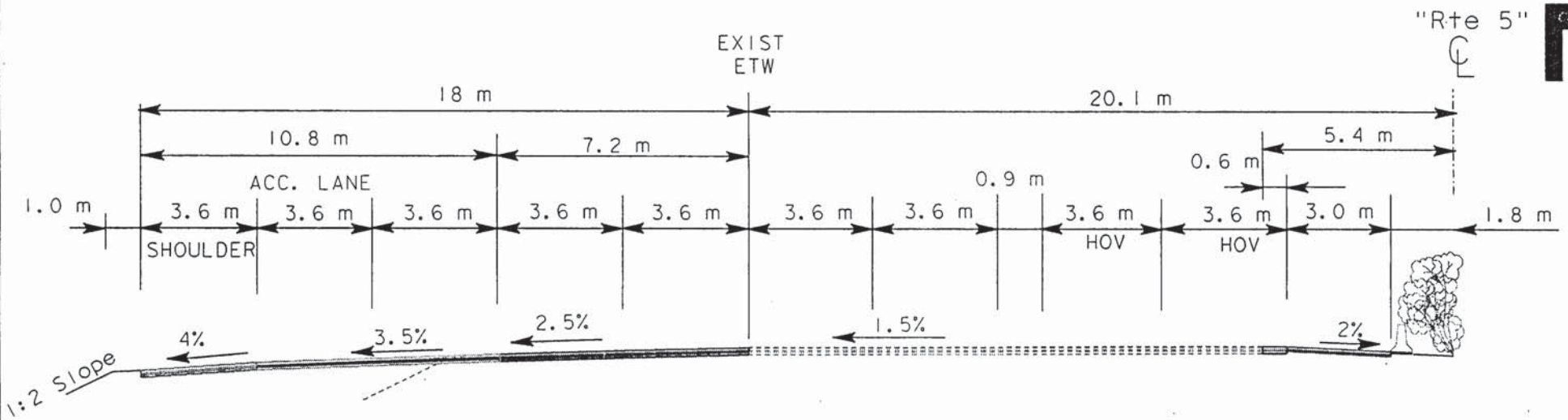
NO SCALE

11-SD-5
EA 235800

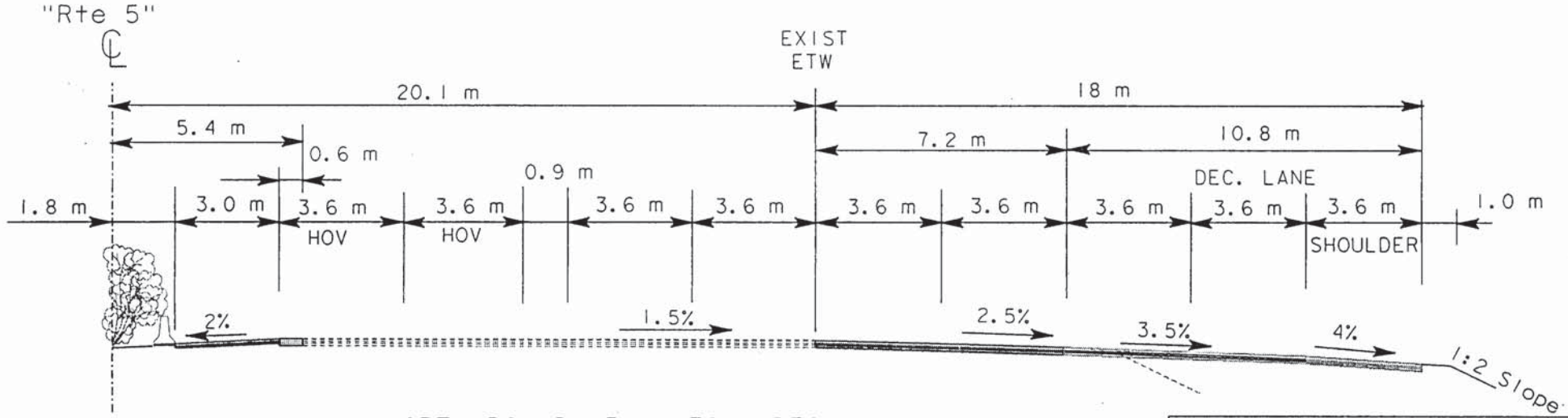
ROUTE 5/10+4 ALTERNATIVE
FROM LA COSTA AVE.
TO POINSETTIA LANE

1

...\city of carlsbad_12-08-03.dgn Aug. 08, 2005 13:36:29



SOUTH BOUND (5 LANES+ ACC)



NORTH BOUND (5 LANES + DEC)

FROM POINSETTIA LANE TO PALOMAR AIRPORT ROAD

NO SCALE

11-SD-5
EA 235800

ROUTE 5/10+4 ALTERNATIVE
FROM POINSETTIA LANE
TO PALOMAR AIRPORT ROAD ②

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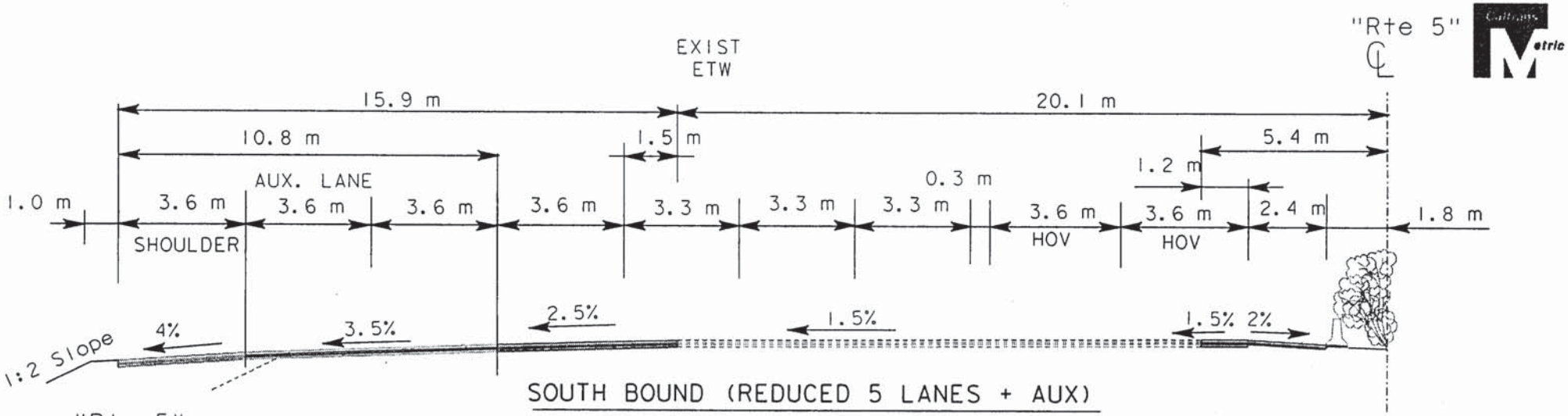
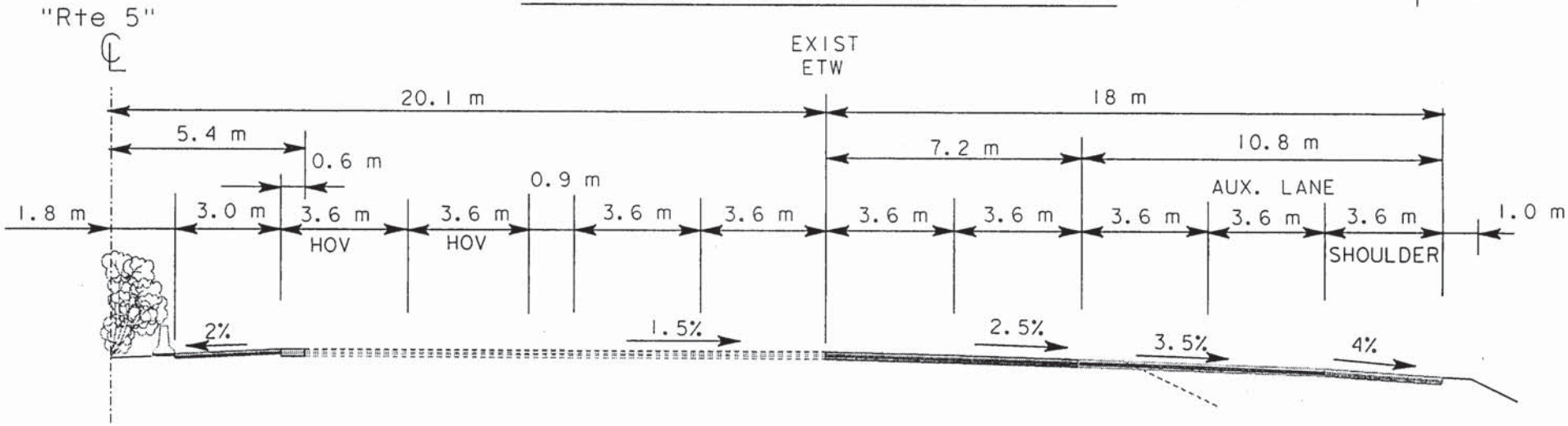


SOUTH BOUND (REDUCED 5 LANES + AUX)



NORTH BOUND (5 LANES + AUX)

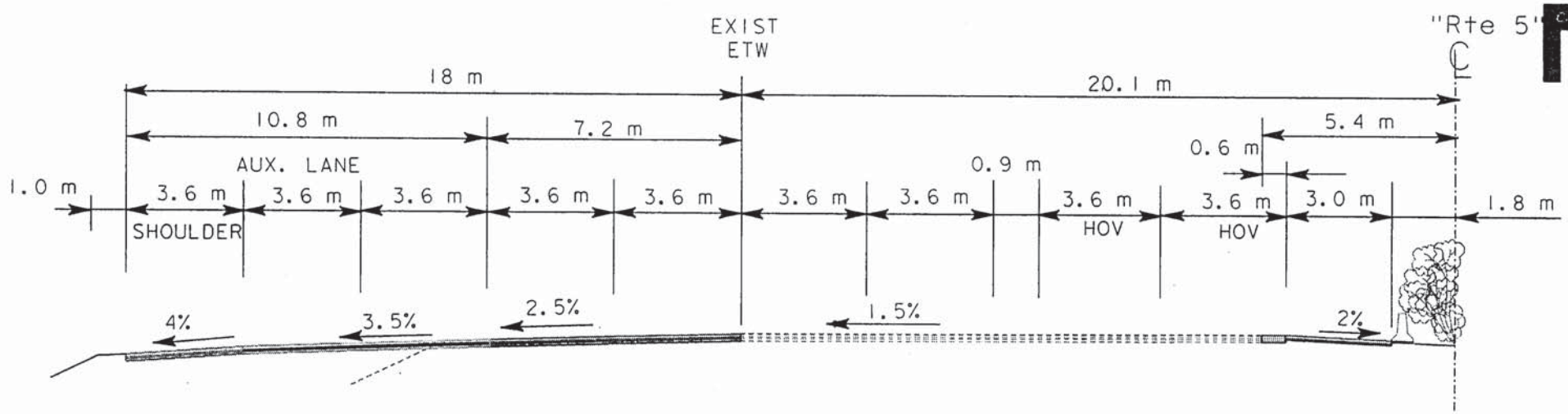
FROM PALOMAR AIRPORT ROAD TO CANNON ROAD

NO SCALE

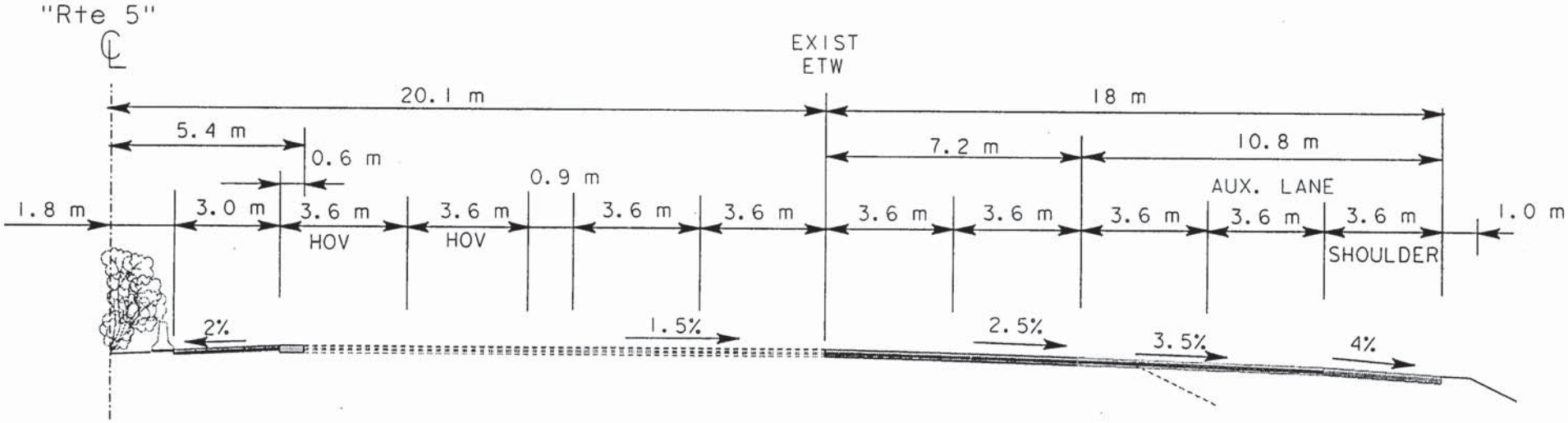
11-SD-5
EA 235800

ROUTE 5/10+4 ALTERNATIVE
FROM PALOMAR AIRPORT ROAD
TO CANNON ROAD (3)

...\city of carlsbad_12-08-03.dgn Aug. 08, 2005 13:37:13



SOUTH BOUND (5 LANES+AUX)



NORTH BOUND (5 LANES + AUX)

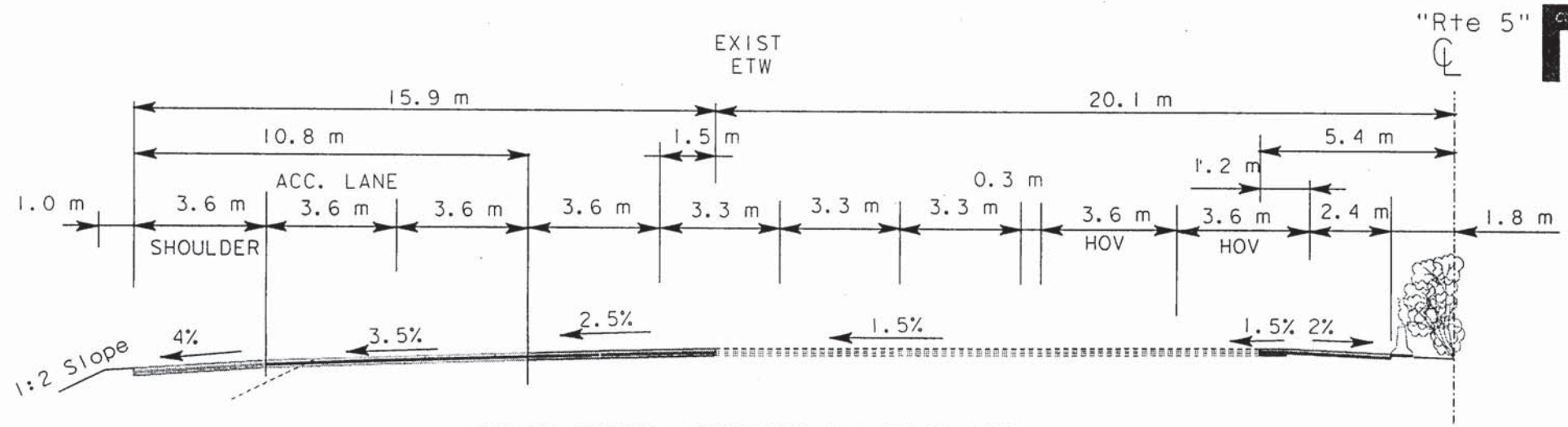
FROM CANNON ROAD TO TAMARACK AVE.

NO SCALE

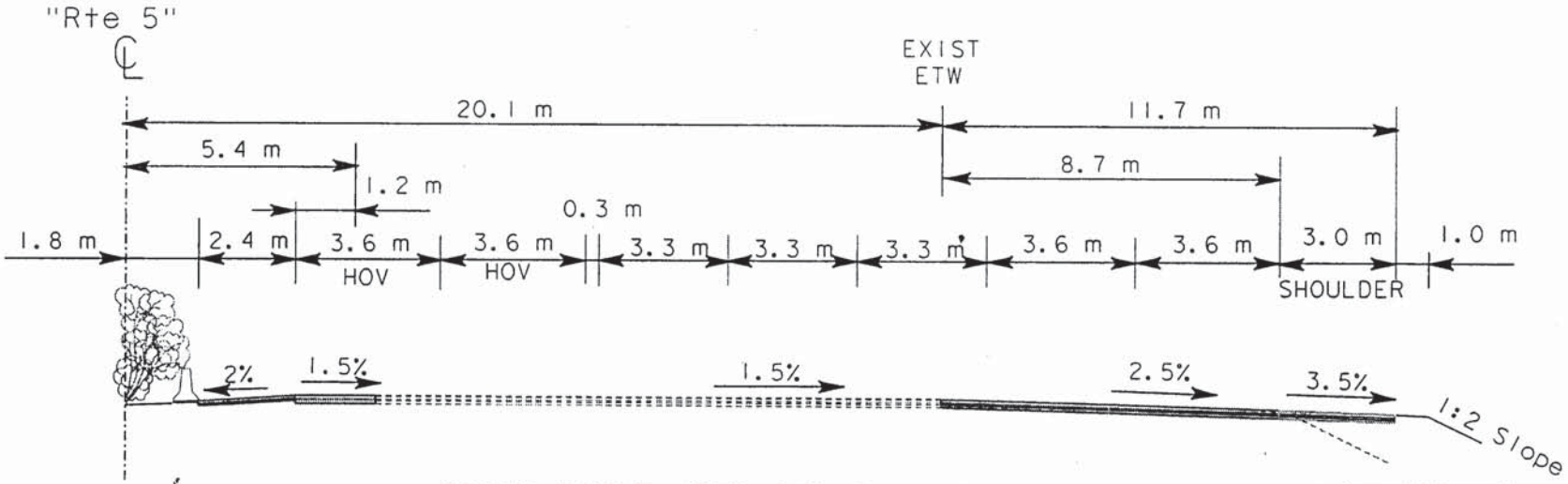
11-SD-5
EA 235800

ROUTE 5/10+4 ALTERNATIVE
FROM CANNON ROAD
TO TAMARACK AVENUE ④

...\city of carlsbad_12-08-03.dgn Aug. 08, 2005 13:37:41



SOUTH BOUND (REDUCED 5 LANES+ACC)



NORTH BOUND (REDUCED 5 LANES)

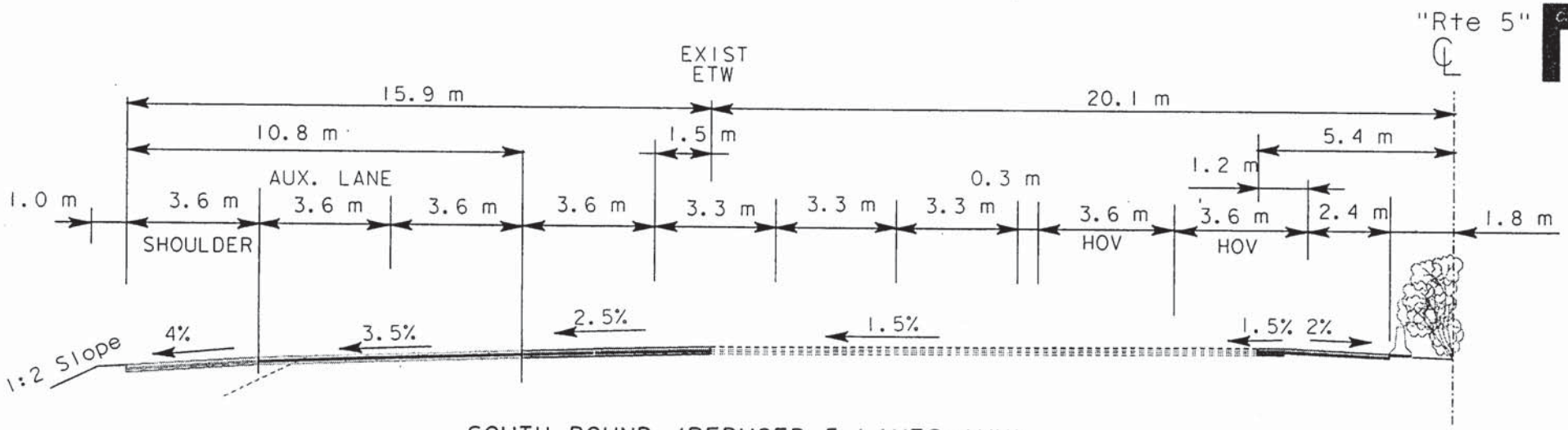
FROM TAMARACK AVENUE TO CARLSBAD VILLAGE DRIVE

NO SCALE

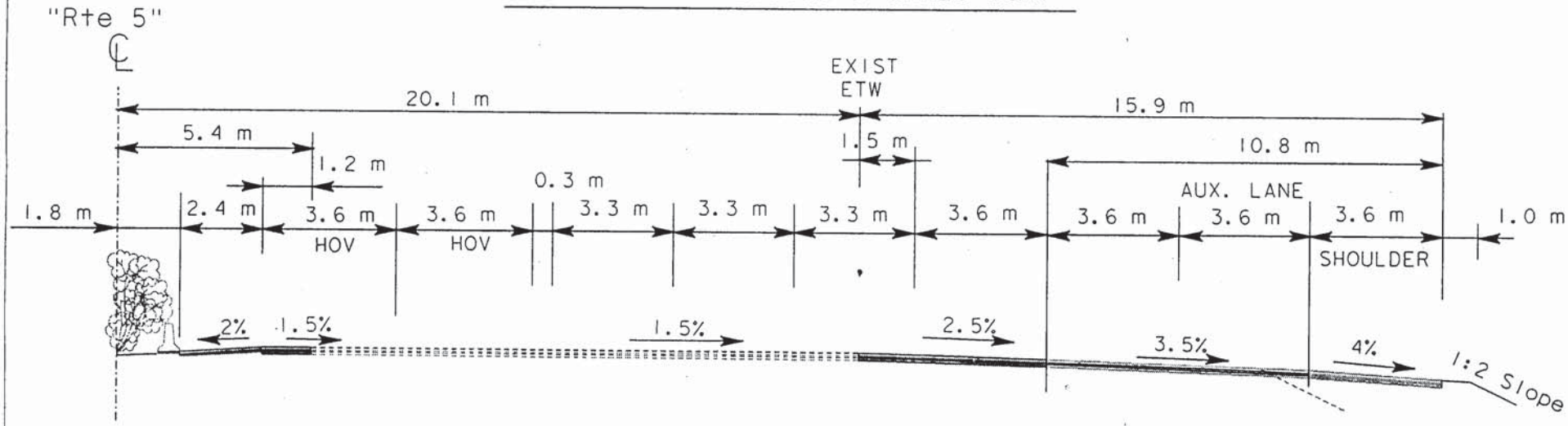
11-SD-5
EA 235800

ROUTE 5/10+4 ALTERNATIVE
FROM TAMARACK AVENUE
TO CARSBAD VILLAGE 5

...\city of carlsbad_12-08-03.dgn Aug. 08, 2005 13:37:51



SOUTH BOUND (REDUCED 5 LANES+AUX)



NORTH BOUND (REDUCED 5 LANES +AUX.)

FROM CARLSBAD VILLAGE DRIVE TO LAS FLORES DRIVE

NO SCALE

11-SD-5
EA 235800

ROUTE 5/10+4 ALTERNATIVE
FROM CARSBAD VILLAGE DRIVE
TO LAS FLORES DRIVE (6)

...\city of carlsbad_12-08-03.dgn Aug. 08, 2005 13:38:02

GEOLOGY OF THE DEL MAR QUADRANGLE
SAN DIEGO COUNTY, CALIFORNIA

by Michael P. Kennedy

SCALE 1:24 000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOWER LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 4 FEET

1975

EXPLANATION

QUATERNARY — *Holocene*

Qaf — Artificial fill

Qb — Beach sand

Qal + Qsw — Alluvium and slopewash undifferentiated

Qls — Landslide deposits

QUATERNARY — *Pleistocene*

Qt — Stream-terrace deposits

Qbp — Bay Point Formation

Qlb / Qln — Lindavista Formation

Qln, nearshore deposits; Qlb, beach deposits.

TERTIARY — *Eocene*

Tmv, Tscu, Tsc, Tf, Ta, Tt, Td, Td + Tf — Poway and La Jolla Groups

Tmv, Mission Valley Formation; Tst, Stadium Conglomerate; Tf, Friars Formation; Tscu, Scripps Formation (upper tongue); Tsc, Scripps Formation; Ta, Ardath Shale; Tf, Torrey Sandstone; Td, Delmar Formation; Td & Tf, Delmar and Friars Formation undifferentiated. Conglomerate marked by circle pattern, sandstone marker bed shown by dot pattern.

CRETACEOUS — *Upper Cretaceous*

Kl — Lusardi Formation

Kgb — Gabbro

JURASSIC

Jsp — Santiago Peak Volcanics

SYMBOLS

Contact
(dashed where approximately located; dotted where concealed)

Fault, showing dip
(dashed where approximately located; dotted where concealed; U, upthrown side; D, downthrown side; shear zone).

Anticline, showing direction of plunge.

Syncline, showing direction of plunge.

Strike and dip of bedding.

Qls

FIGURE 6 – GEOLOGIC MAP

FIGURE 6 – GEOLOGIC MAP

DIVISION OF MINES AND GEOLOGY
JAMES F. DAVIS, STATE GEOLOGIST

GEOLOGIC MAPS OF THE NORTHWESTERN PART OF SAN DIEGO COUNTY, CALIFORNIA

PLATE 2
GEOLOGIC MAP OF THE ENCINITAS AND RANCHO SANTA FE 7.5' QUADRANGLES, SAN DIEGO COUNTY, CALIFORNIA

By

Siang S. Tan and Michael P. Kennedy

1996

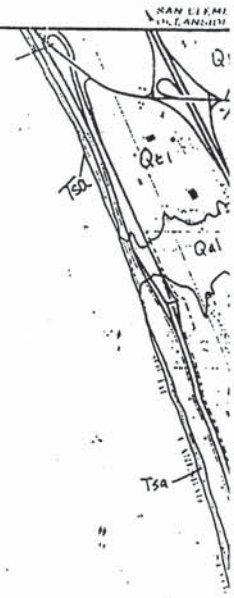
SCALE 1 : 24,000

1 1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL



AUTHORS' NOTE

This geologic mapping was conducted as part of several earlier Division of Mines and Geology investigations in northern San Diego County. The most recent and most comprehensive of these studies resulted in the release of Open-File Report 95-04 --Landslide hazards in the northern part of the San Diego metropolitan area, San Diego County, California (Tan and Giffen, 1995). Because a geologic map was not published as part of OFR 95-04 and significant geologic revisions were made to earlier mapping during the course of that investigation, we felt it important that this map be made available at this time.

An attempt has been made here to clarify the relationship of Paleogene rocks of the Santa Ana Mountains and the San Diego Embayment. Coeval nearshore marine, lagoonal, and terrestrial sedimentary rocks interfinger along the margin of the San Diego embayment with similar rocks of the southern Santa Ana Mountains in the Encinitas, Carlsbad, and Oceanside areas. Facies

MAP UNITS

QUATERNARY

Holocene

Qal	Alluvium and colluvium. Unconsolidated silt clay, sand and gravel.
Qb	Beach deposits: unconsolidated sand.
Ql	Lake, reservoir and pond deposits; partly submerged, unconsolidated clay, silt, sand and gravel.
✓✓?	Landslide deposits (includes headscarp area). See further California Division of Mines and Geology Open-File Report 95-04.

Pleistocene

Qt1-4	Terrace deposits; reddish brown, poorly bedded, poorly-to moderately-indurated sandstone, siltstone and conglomerate. Subscripts indicate relative level with 1 the lowest elevation (youngest age). The three lower levels have been correlated with the Bay Point Formation and the highest level with the Linda Vista Formation; see Kennedy (1975), Weber (1982), and Wilson (1972).

changes are rapid and lithologies extremely variable which together with low relief, compound the effort to draw clear boundaries between some of the units.

The Mid-Cretaceous batholithic rocks are labeled on the map as "Kg" with subscripts indicating the map symbols (rock types) used by Larsen (1948). We have not changed the designation of most of Larsen's rock types but have remapped most of the contacts in order to provide accurate delineations of these rock units at this much increased scale and far improved topographic base.

The earlier work by Tan, S.S. (1986 and 1987) was modified as part of this study. No new detailed geologic field work was done to revise this mapping. Most of the revised contacts are approximate and the result of reconnaissance mapping and air photo interpretation. Man-made fill material (residential, mining, waste disposal/landfill, road fill, etc.) is not shown on this map. Landslides and other geologic features have been mapped as they existed prior to development.

MAP SYMBOLS

Contact (boundary) between map units. Most boundaries are not exposed and are inferred.

Strike, and dip of inclined beds. Most bedding attitudes are estimated.

Horizontal beds.

Fault; dotted where concealed. Arrow and number indicate direction and amount of dip of exposed fault plane. U indicates upthrown side; D indicates downthrown side.

Strike, direction, and amount of dip of minor fault (shear joint) plane. Most fault displacements are less than 5 feet.

Landslide; arrows indicate general direction of movement. Both the headscarp area and debris deposit are included within the map symbol. Landslides are depicted prior to urban development. Only landslides larger than 300 feet across are shown on the map. For further information see California Division of Mines and Geology Open-File Report 95-04.

Questionable landslide.

REFERENCES

Kennedy, M.P. and Peterson, G.L., 1975, Geology of the San Diego metropolitan area, California: California Division of Mines and Geology, Bulletin 200, 56 p., 6 plates, scale 1:24,000.

Larsen, E.S., Jr., 1948, Batholith and associated rocks of Corona, Elsinore, and San Luis Rey quadrangles, southern California: The Geological Society of America Memoir 29, 182 p., 1 plate, scale 1:125,000.

Moyle, W.R., Jr., 1973, Geologic map of the eastern part of Camp Pendleton, southern California: U.S. Geological Survey Open-File Map, 1 plate, scale 1:48,000.

Tan, S.S., 1986, Landslide hazards in the Encinitas Quadrangle, San Diego County, California: California Division of Mines and Geology, Open-File Report 86-8, 3 plates, scale 1:24,000.

Tan, S.S., 1987, Landslide hazards in the Rancho Santa Fe Quadrangle, San Diego County, California: California Division of Mines and Geology Open-File Report 86-15, 3 plates, scale 1:24,000.

Tan, S.S. and Giffen, D.G., 1995, Landslide hazards in the northern part of the San Diego metropolitan area, San Diego County, California: California Division of Mines and Geology, Open-File Report 95-04, 8 plates, scale 1:24,000.

Weber, F.H., Jr., 1982, Recent slope failures, ancient landslides, and related geology of the north-central coastal area, San Diego County, California: California Division of Mines and Geology, Open-File Report 82-12, 77 p., 1 plate, scale 1:24,000.

Wilson, K.L., 1972, Eocene and related geology of a portion of the San Luis Rey and Encinitas quadrangles, San Diego County, California: University of California, Riverside, master's thesis, 135 p., 2 plates, scale 1:24,000.

Geology modified after Tan (1986 and 1987)

TERTIARY

Pliocene

Tsm — San Mateo Formation; light colored, massive to poorly bedded, poorly- to moderately-indurated, fine-grained sandstone with some conglomerate. Possibly correlative with the Niguel Formation in the Santa Ana Mountains.

Miocene

Tso — San Onofre Breccia; greenish red, poorly-to moderately-bedded, well-indurated, breccia with Catalina Schist clasts. Resistant to landsliding.

Tda — Dacite stock; small bodies of igneous rock of dacitic and basaltic composition.

Late Eocene

Tmv — Mission Valley Formation (Poway Group); light-colored, poorly-bedded, poorly-indurated, fine-to medium-grained sandstone.

Tst — Stadium Conglomerate (Poway Group); poorly-bedded, poorly-to moderately-indurated, cobble conglomerate with coarse-grained sandstone matrix.

Middle Eocene

Tsa/Tt — Santiago Formation; light-colored, poorly-bedded, poorly-indurated, fine-to medium-grained sandstone interbedded with landslide-prone siltstone and claystone. Local coarse-grained sandstone and conglomerate. Renamed from Scripps Formation in the Encinitas (Tan, 1986) and Rancho Santa Fe (Tan, 1987) quadrangles. It interfingers with Torrey Sandstone.

Torrey Sandstone (La Jolla Group); light-color massive and thick-bedded, well-indurated, me to coarse-grained arkosic sandstone. Resistan landsliding. It interfingers with Santiago For tion.

Tf — Friars Formation (La Jolla Group); poorly-bedded, poorly-indurated, landslide-prone claystone, fine- to medium-grained sandstone and some conglomerate.

Td — Del Mar Formation (La Jolla Group); poorly-bedded, poorly-indurated, landslide-prone sandy claystone interbedded with medium- to coarse-grained sandstone. A similar greenish colored claystone also occurs locally in the Santiago Formation.

LATE-CRETACEOUS

Kp — Point Loma Formation (Rosario Group); well-bedded, well-indurated siltstone and fine-grained sandstone.

Kl — Lusardi Formation (Rosario Group); poorly-bedded, moderately-indurated cobble and boulder conglomerate with thin lenses of medium-grained sandstone. Possibly correlative with the Trabuco Formation in the Santa Ana Mountains.

MID-CRETACEOUS

Kg — Undivided granitic rocks of the Southern California batholith, includes: fine-to medium-grained granodiorite, tonalite and gabbro. Subscripts indicate the map symbols used by Larsen (1948).

Kg (e) — Escondido Creek Leucogranodiorite (Larsen, 1948); light-colored, fine-grained granodiorite and tonalite, with locally abundant inclusions.

Kg (wm) — Woodson Mountain Granodiorite (Larsen, 1948); medium-to coarse-grained granodiorite. It weathers into distinctive boulders of disintegration.

Kg (b) — Bonsall Tonalite (Larsen, 1948); medium-grained tonalite, characterized by abundant inclusions.

Kg (gv) — Green Valley Tonalite (Larsen, 1948); medium-grained tonalite (similar to Bonsall Tonalite, but it lacks the abundant inclusions).

Kg(sm) — San Marcos Gabbro (Larsen, 1948); medium-grained gabbro and norite.

JURASSIC-CRETACEOUS

KJsp — Undifferentiated Santiago Peak Volcanics, mildly metamorphosed volcanic, volcaniclastic and interbedded sedimentary rocks. Volcanic rocks range from basalt to rhyolite, but are predominantly andesite. It also contains some rock types listed under KJm (mentioned below).

KJm — Metavolcanic and metasedimentary rocks, with fine-grained granodioritic and other plutonic rocks. The map unit contains schist, quartzite, argillite, slate, phyllite, amphibolite, metamorphosed tuff-breccia, gneiss and metabasalt. It also consists of some rock types listed under KJsp (mentioned above) but it generally does not contain dark-colored andesitic rocks.

Topographic Base by U.S. Geological Survey

FIGURE 6 – GEOLOGIC MAP

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
11	SD	5			

Caltrans Metric

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER CIVIL STATE OF CALIFORNIA

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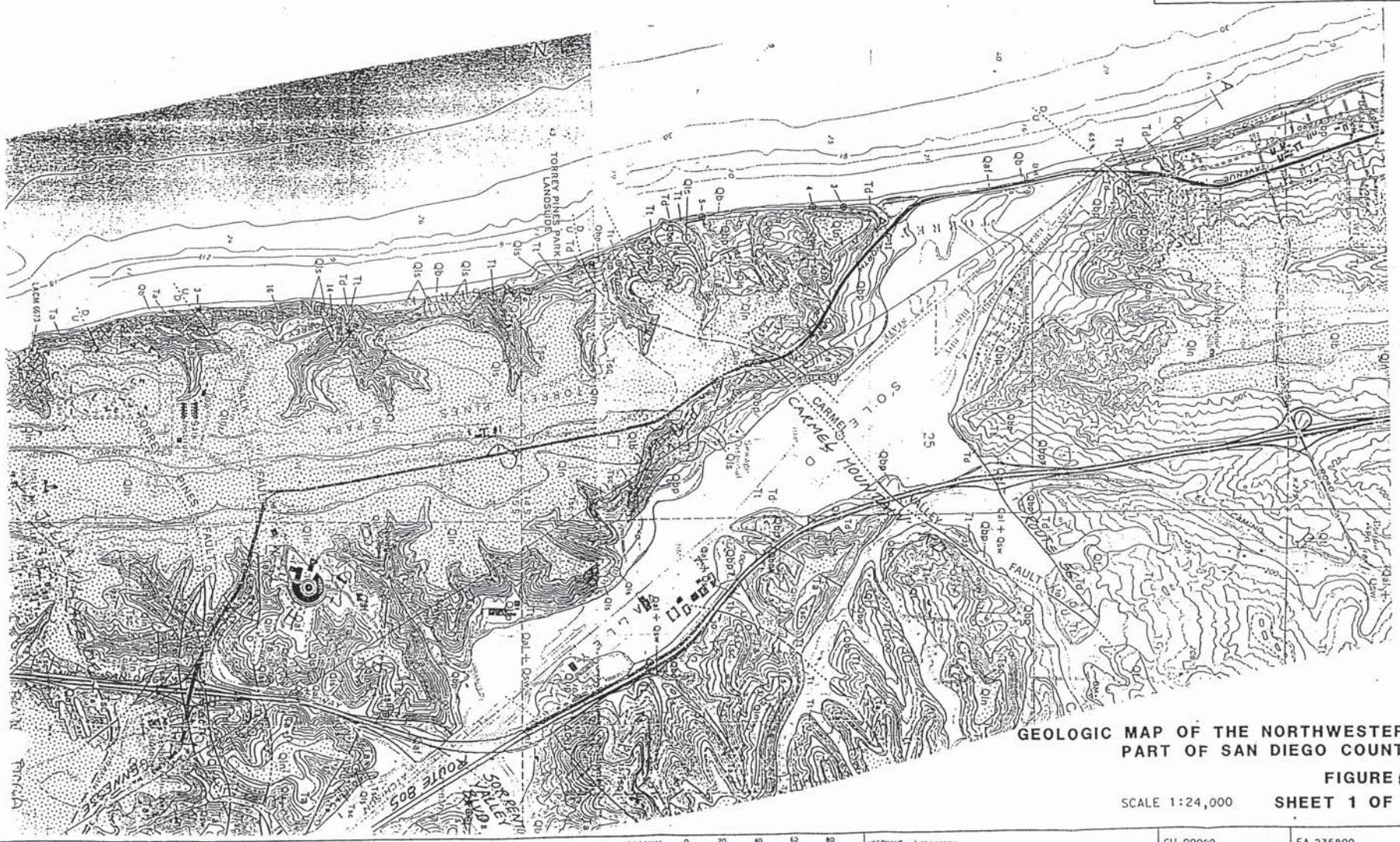
Cal-Trans now has a web site! To get to the web site, go to: http://trans.ca.gov



GEOLOGIC MAP OF THE NORTHWESTERN PART OF SAN DIEGO COUNTY

FIGURE 6

SCALE 1:24,000 SHEET 1 OF 5

LAST REVISION 03-28-05 DATE PLOTTED => 29-MAR-2005 TIME PLOTTED => 10:23

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 20 40 60 80

USERNAME => tbsromou DGN FILE => test.dgn

CU 00000

EA 235800

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
11	SD	5			

Caltrans Metric

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

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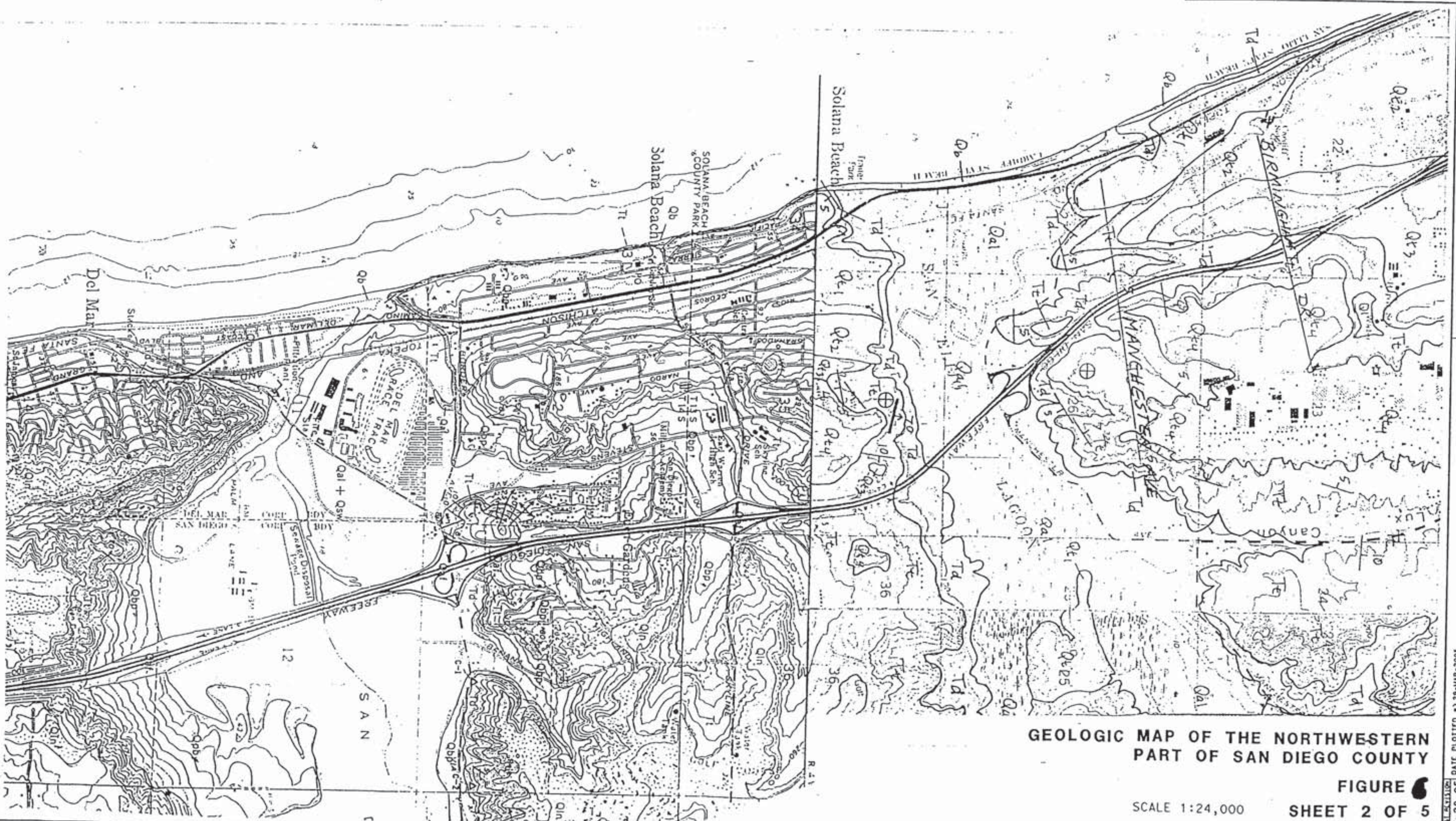

GEOLOGIC MAP OF THE NORTHWESTERN PART OF SAN DIEGO COUNTY

FIGURE 6

SCALE 1:24,000

SHEET 2 OF 5

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 20 40 60 80

USERNAME => tbsromou
DGN FILE => test.dgn

CU 00000

EA 235800

DATE PLOTTED => 29-MAR-2005
TIME PLOTTED => 10:29

03-28-05

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

PROJECT ENGINEER

I-5 WIDENING

CALCULATED/DESIGNED BY

CHECKED BY

DATE REVISED BY

DATE REVISED

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
11	SD	5			

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

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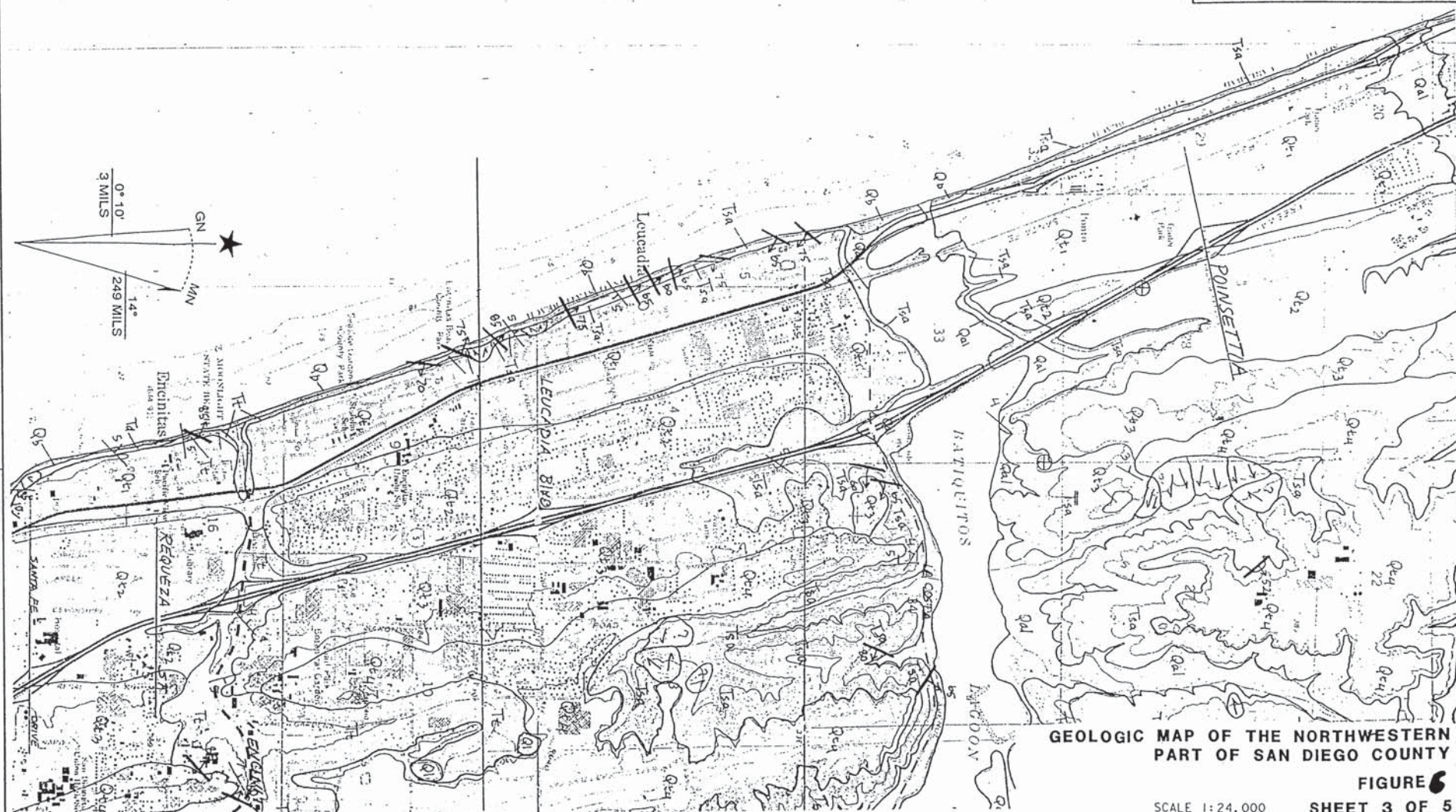

GEOLOGIC MAP OF THE NORTHWESTERN PART OF SAN DIEGO COUNTY

FIGURE 6

SCALE 1:24,000

SHEET 3 OF 5

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

PROJECT ENGINEER

I-5 WIDENING

CALCULATED/DESIGNED BY

CHECKED BY

DATE

REVISED BY

DATE REVISED

LAST REVISION 03-28-05

DATE PLOTTED => $DATE

TIME PLOTTED => $TIME

FOR REDUCED PLANS ORIGINAL 0 20 40 60 80

USERNAME => $USER

CU 00000

EA 235800

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
11	SD	5			

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — CIVIL — STATE OF CALIFORNIA

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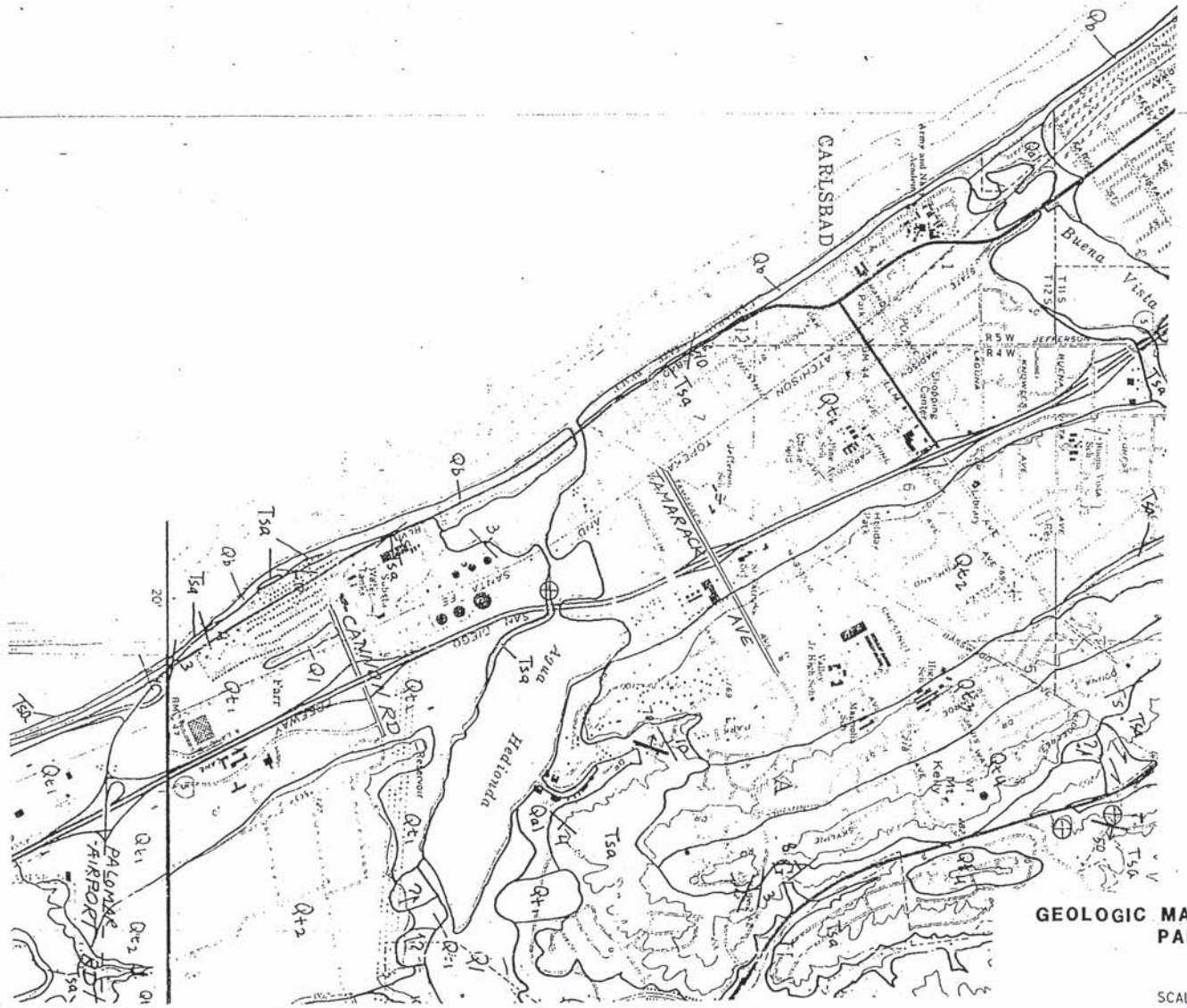
Caltrans Metric



GEOLOGIC MAP OF THE NORTHWESTERN PART OF SAN DIEGO COUNTY

FIGURE 6

SCALE 1:24,000

SHEET 4 OF 5

DATE	REVISED BY	DATE REVISED

CALCULATED/DESIGNED BY

CHECKED BY

PROJECT ENGINEER

I-5 WIDENING

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

FOR REDUCED PLANS ORIGINAL 0 20 40 60 80

USERNAME => $USER

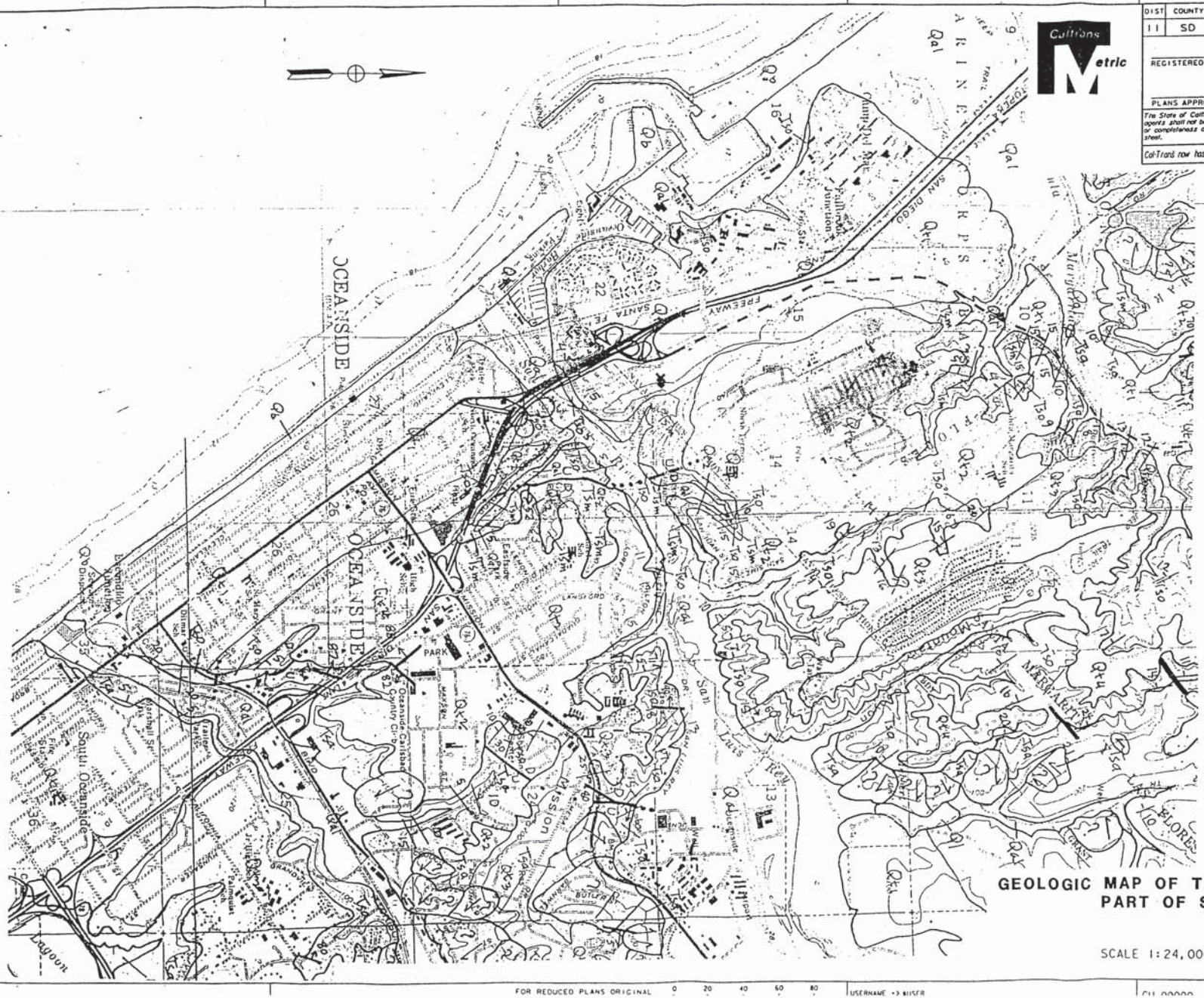
CU 00000

EA 235800

LAST REVISION 03-28-05

DATE PLOTTED => $DATE

TIME PLOTTED => $TIME



Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
11	SD	5			

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER CIVIL STATE OF CALIFORNIA

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GEOLOGIC MAP OF THE NORTHWESTERN PART OF SAN DIEGO COUNTY

FIGURE 6

SCALE 1:24,000

SHEET 5 OF 5

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

PROJECT ENGINE.

I-5 WIDENING

CALCULATED/DESIGNED BY

CHECKED BY

DATE REVISED BY

DATE REVISED

DATE PLOTTED => 03-28-05

TIME PLOTTED => TIME

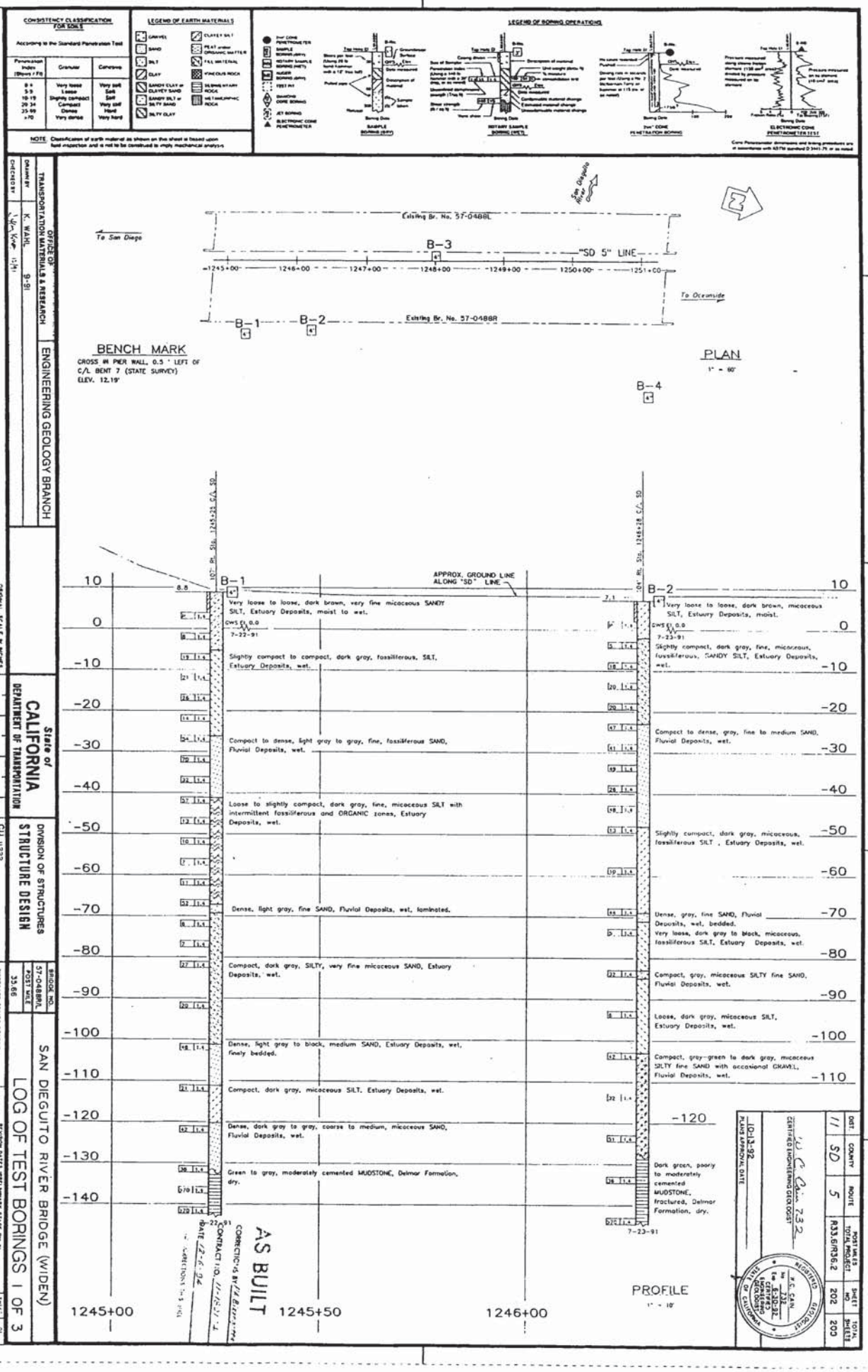
FOR REDUCED PLANS ORIGINAL 0 20 40 60 80

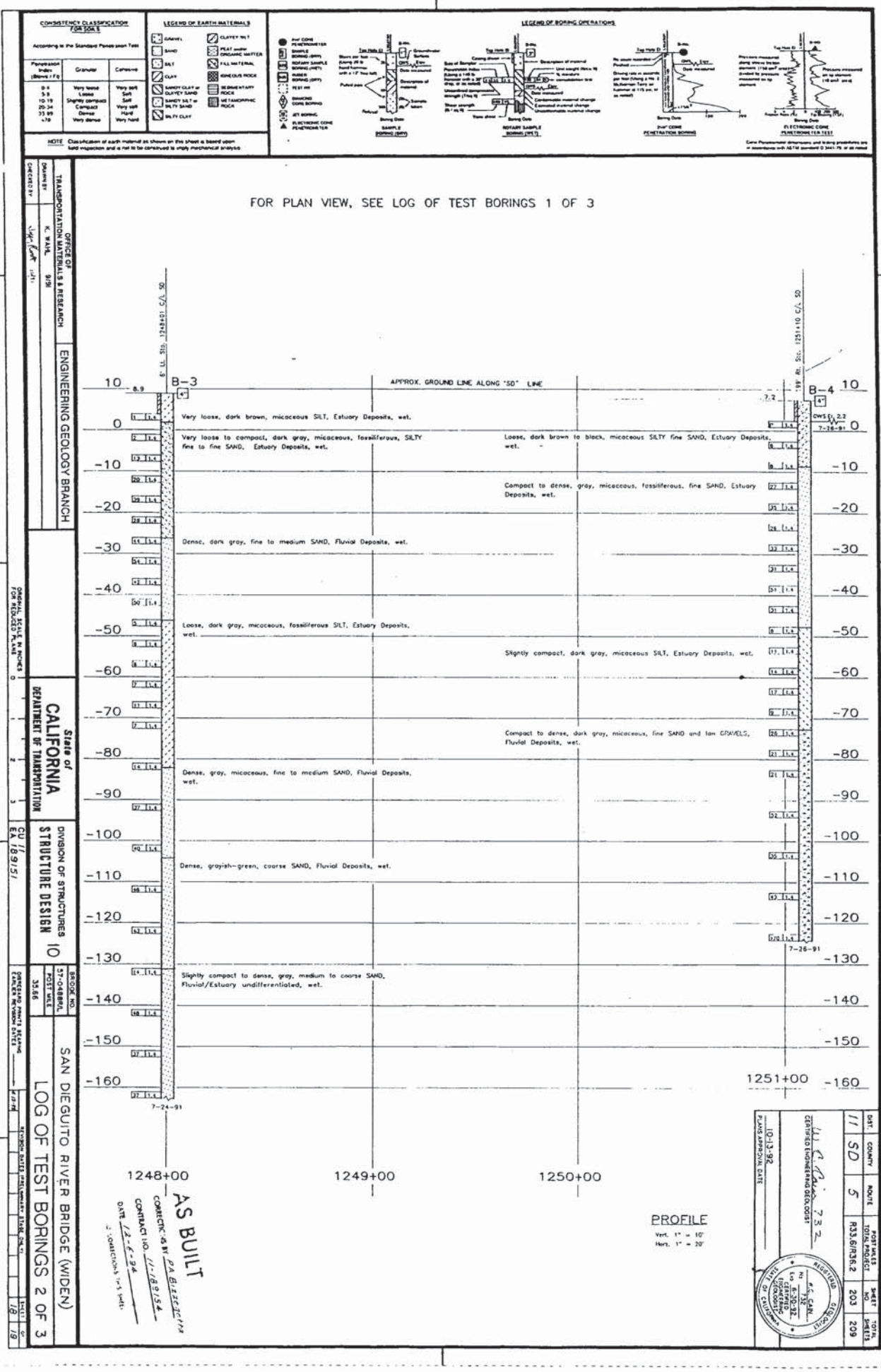
USERNAME => USER

CU 00000

EA 235800

APPENDIX A


CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test
Penetration Index (Blows / Ft)
Granular
Cohesive
0-4 Very loose Very soft
5-9 Loose Soft
10-19 Slightly compact Firm
20-34 Compact Very stiff
35-99 Dense Hard
+70 Very dense Very hard
NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis
LEGEND OF EARTH MATERIALS
GRAVEL
SAND
SILT
CLAY
SANDY CLAY or CLAYEY SAND
SANDY SILT or SILTY SAND
SILTY CLAY
CLAYEY SILT
PEAT and/or ORGANIC MATTER
FILL MATERIAL
VINCOUS ROCK
SEDIMENTARY ROCK
METAMORPHIC ROCK
LEGEND OF BORING OPERATIONS
2"or" CONE PENETROMETER
SAMPLE BORING (DRY)
ROTARY SAMPLE BORING (WET)
AUGER BORING (DRY)
TEST PIT
DRIVING CORE BORING
JET BORING
ELECTRONIC CONE PENETROMETER
SAMPLE BORING (DRY)
ROTARY SAMPLE BORING (WET)
2"or" CONE PENETRATION BORING
ELECTRONIC CONE PENETROMETER TEST
Core Penetrometer dimensions and testing procedures are in accordance with ASTM standard D 3441-79 or as noted
TRANSPORTATION MATERIALS & RESEARCH
OFFICE OF
ENGINEERING GEOLOGY BRANCH
DRAWN BY K. WAHL 9-91
CHECKED BY
State of CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF STRUCTURES
STRUCTURE DESIGN
CU 11222
EA 1B951
BRIDGE NO. 57-0488R/L
POST MILE 35.66
SAN DIEGUITO RIVER BRIDGE (WIDEN)
LOG OF TEST BORINGS 1 OF 3
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS
0 1 2 3
Existing Br. No. 57-0488L
Existing Br. No. 57-0488R
To San Diego
To Oceanside
San Dieguito River
"SD 5" LINE
1245+00 1246+00 1247+00 1248+00 1249+00 1250+00 1251+00
B-1 B-2 B-3 B-4
BENCH MARK
CROSS IN PIER WALL, 0.5' LEFT OF C/L BENT 7 (STATE SURVEY)
ELEV. 12.19'
PLAN
1" = 60'
APPROX. GROUND LINE ALONG "SD" LINE
B-1
Very loose to loose, dark brown, very fine micaceous SANDY SILT, Estuary Deposits, moist to wet.
GWS El. 0.0 7-22-91
Slightly compact to compact, dark gray, fossiliferous, SILT, Estuary Deposits, wet.
Compact to dense, light gray to gray, fine, fossiliferous SAND, Fluvial Deposits, wet.
Loose to slightly compact, dark gray, fine, micaceous SILT with intermittent fossiliferous and ORGANIC zones, Estuary Deposits, wet.
Dense, light gray, fine SAND, Fluvial Deposits, wet, laminated.
Compact, dark gray, SILTY, very fine micaceous SAND, Estuary Deposits, wet.
Dense, light gray to black, medium SAND, Estuary Deposits, wet, finely bedded.
Compact, dark gray, micaceous SILT, Estuary Deposits, wet.
Dense, dark gray to gray, coarse to medium, micaceous SAND, Fluvial Deposits, wet.
Green to gray, moderately cemented MUDSTONE, Delmar Formation, dry.
B-2
Very loose to loose, dark brown, micaceous SILT, Estuary Deposits, moist.
GWS El. 0.0 7-23-91
Slightly compact, dark gray, fine, micaceous, fossiliferous, SANDY SILT, Estuary Deposits, wet.
Compact to dense, gray, fine to medium SAND, Fluvial Deposits, wet.
Slightly compact, dark gray, micaceous, fossiliferous SILT, Estuary Deposits, wet.
Dense, gray, fine SAND, Fluvial Deposits, wet, bedded.
Very loose, dark gray to black, micaceous, fossiliferous SILT, Estuary Deposits, wet.
Compact, gray, micaceous SILTY fine SAND, Fluvial Deposits, wet.
Loose, dark gray, micaceous SILT, Estuary Deposits, wet.
Compact, gray-green to dark gray, micaceous SILTY fine SAND with occasional GRAVEL, Fluvial Deposits, wet.
Dark green, poorly to moderately cemented MUDSTONE, fractured, Delmar Formation, dry.
7-23-91
PROFILE
1" = 10'
1245+00 1245+50 1246+00
AS BUILT
CONTRACT NO. 11-1C-92-1
DATE 12-16-94
CORRECTIONS BY
PLANS APPROVAL DATE 10-13-92
CERTIFIED ENGINEERING GEOLOGIST
REGISTERED GEOLOGIST
STATE OF CALIFORNIA
DIST 11
COUNTY SD
ROUTE 5
POST MILES TOTAL PROJECT R33.6/R36.2
SHEET NO 202
TOTAL SHEETS 203


CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test
Penetration Index (Blows / ft)
Granular
Cohesive
0-4 Very loose Very soft
5-9 Loose Soft
10-19 Slightly compact Firm
20-34 Compact Stiff
35-69 Dense Very stiff
>70 Very dense Very hard
LEGEND OF EARTH MATERIALS
GRAVEL
SAND
SILT
CLAY
SANDY CLAY or CLAYEY SAND
SANDY SILT or SILTY SAND
SILTY CLAY
CLAYEY SILT
PEAT and/or ORGANIC MATTER
FILL MATERIAL
IGNEOUS ROCK
SEDIMENTARY ROCK
METAMORPHIC ROCK
NOTE Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.
LEGEND OF BORING OPERATIONS
2-1/2" CONE PENETROMETER
SAMPLE BORING (SPT)
ROTARY SAMPLE BORING (WET)
RUBBER BORING (DRY)
TEST PIT
DIAMOND CORE BORING
JET BORING
ELECTRONIC CONE PENETROMETER
Top Hole El.
Bore Date
Sample Interval
Rotary Sample Boring (Wet)
Cone Penetrometer determinations and borings predominately are in accordance with ASTM standard D 3441-79 or as noted
FOR PLAN VIEW, SEE LOG OF TEST BORINGS 1 OF 3
8' Lt. Sta. 1248+01 C/L SD
B-3
APPROX. GROUND LINE ALONG "SD" LINE
Very loose, dark brown, micaceous SILT, Estuary Deposits, wet.
Very loose to compact, dark gray, micaceous, fossiliferous, SILTY fine to fine SAND, Estuary Deposits, wet.
Dense, dark gray, fine to medium SAND, Fluvial Deposits, wet.
Loose, dark gray, micaceous, fossiliferous SILT, Estuary Deposits, wet.
Dense, gray, micaceous, fine to medium SAND, Fluvial Deposits, wet.
Dense, grayish-green, coarse SAND, Fluvial Deposits, wet.
Slightly compact to dense, gray, medium to coarse SAND, Fluvial/Estuary undifferentiated, wet.
7-24-91
1248+00
1249+00
1250+00
1251+00
B-4
Loose, dark brown to black, micaceous SILTY fine SAND, Estuary Deposits, wet.
Compact to dense, gray, micaceous, fossiliferous, fine SAND, Estuary Deposits, wet.
Slightly compact, dark gray, micaceous SILT, Estuary Deposits, wet.
Compact to dense, dark gray, micaceous, fine SAND and fan GRAVELS, Fluvial Deposits, wet.
7-26-91
1' Rt. Sta. 1251+10 C/L SD
PROFILE
Vert. 1" = 10'
Horz. 1" = 20'
AS BUILT
CORRECTIONS BY
CONTRACT NO.
DATE
OFFICE OF TRANSPORTATION MATERIALS & RESEARCH
ENGINEERING GEOLOGY BRANCH
DRAWN BY K. WAHL 9/91
CHECKED BY
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS
State of CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF STRUCTURES
STRUCTURE DESIGN 10
CU 16 EA 189151
BRIDGE NO. 57-0488L
POST MILE 33.66
SAN DIEGUITO RIVER BRIDGE (WIDEN)
LOG OF TEST BORINGS 2 OF 3
DIST. 11
COUNTY SD
ROUTE 5
POST MILES TOTAL PROJECT R33.6/R36.2
SHEET NO. 203
TOTAL SHEETS 209
10-13-92
PLANS APPROVAL DATE
CERTIFIED ENGINEERING GEOLOGIST
REGISTERED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

Dist	County	Route	POST MILE TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
11	SD	5	R33.6/R36.2	204	209

AS BUILT PLANS
Contract No. 11-022484
Date Completed
Document No. A0000131

"SD" LINE

Indicates existing footing

Approximate existing ground line along "SD" Line

Pile data
Type of pile - Raymond Step Taper Type
Hammer data - Raymond G5C Hammer
Pile dia. Tip - 8" Butt - 11-5" min
Pile design load - 45 Ton
For the Structure:
Number of piles - 86
Est. length of piling - [illegible] LF
Actual - [illegible] LF

Pile data
Type of pile - Raymond Step Taper Type
Hammer data - Raymond G5C Hammer
Pile dia. Tip - 8" Butt - 12" min
Pile design load - 45 Ton
For the Structure:
Number of piles - 494
Est. length of piling - 12,460 LF
Actual - [illegible] LF

AS BUILT
CORRECTED BY R.A. BIZZACCHI
CONTRACT NO. 11-129154
DATE 12-6-94
(CORRECTIONS THIS LINE)

Classification of Material Based on Standard Grade Size Limits

Diagram showing the basis for estimates of grade size distribution used in determination of class names. If gravel is present in appreciable amounts the term "gravelly" may be added to the class name, viz. "gravelly sand". The terms "coarse", "medium" and "fine" when used to describe sand, silt and gravel refer to standard grade size limits.

Legend of Earth Materials

- Gravel
- Sand
- Silt
- Clay
- Sandy Clay or Clayey Sand
- Sandy Silt or Silty Sand
- Silty Clay or Clayey Silt
- Peat and/or Organic Matter
- Fill Material
- Igneous Rock
- Sedimentary Rock
- Metamorphic Rock

Legend

- Penetrometer
- 2½" Cone Penetrometer
- Sampler Boring (Dry)
- Rotary Boring (Wet)
- Auger Boring (Dry)
- Jet Boring
- Core Boring
- Test Pit

1" Soil Tube — Rotary Boring — Penetration Boring

OFFICE OF ENGINEERING GEOLOGY - DIV. OF NEW TECH., MATLS. & RESEARCH
W. C. Cain 753 10-13-92
CERTIFIED ENGINEERING GEOLOGIST — PLANS APPROVAL DATE
SAN DIEGUITO RIVER (WIDEN)
LOG OF TEST BORINGS 3 OF 3
NOTE: THIS LOG OF TEST BORINGS IS AVAILABLE ON MICROFILM AT OFFICE OF STRUCTURES DESIGN SACRAMENTO, CALIFORNIA
CU: 2155.2 EA: 189151 — BRIDGE No. 57-488 R/L

REGISTERED GEOLOGIST W. C. CAIN No. 753 Exp. 3-30-93 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

NOTE

Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

SAN DIEGUITO RIVER BRIDGE (WIDEN)

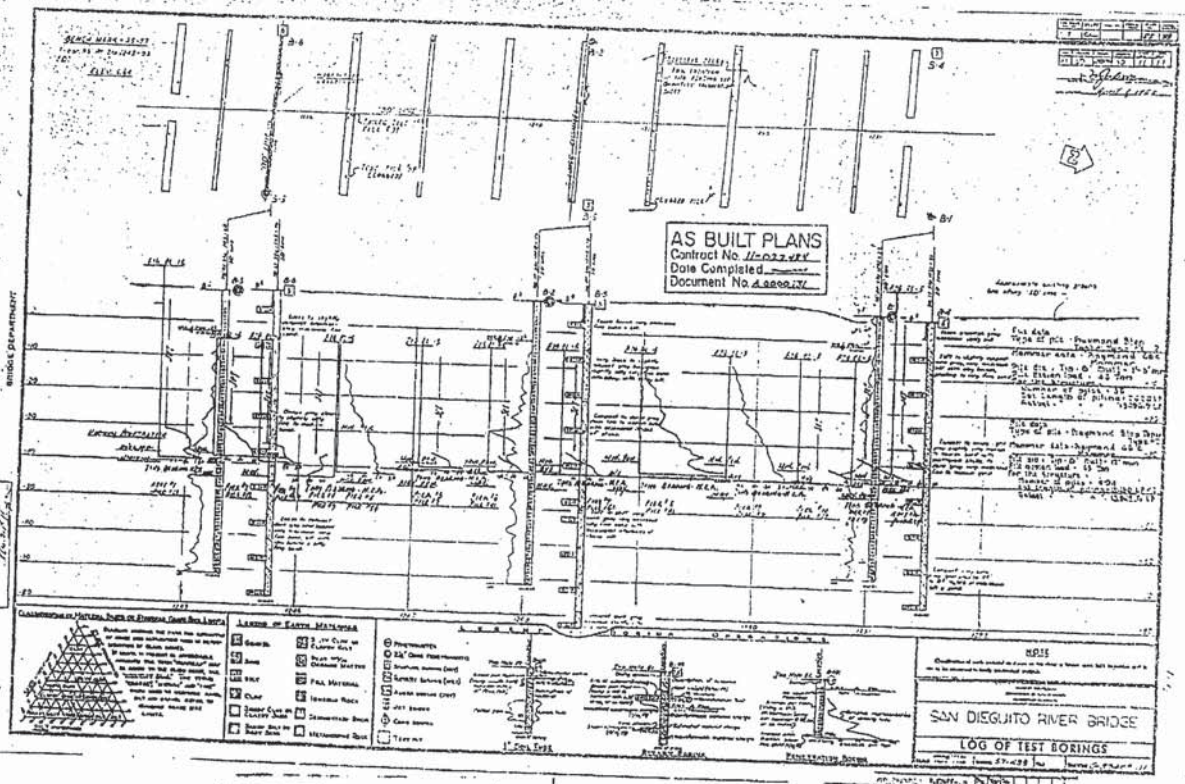
LOG OF TEST BORINGS 3 OF 3

SCALE Vert. 1:100 Horiz. 1:100 — BRIDGE 57-488 — FILE — DRAWING L-57488-11 — SHEET 19 OF 19

BRIDGE DEPARTMENT

11	SD	5	R25.7/R36.0	26	26

Robert W. Reynolds #165
November 25 1985



AS BUILT PLANS
Contract No. 11-196074
Date Completed 5-29-87
Document No.

AS BUILT
CORRECTIONS BY
CONTRACT NO. 11-196074
DATE 5-29-87

GEOTECHNICAL BRANCH - TRANSPORTATION LABORATORY

DRAWN BY 2/85
CHECKED BY

State of CALIFORNIA
DEPARTMENT OF TRANSPORTATION

STRUCTURES - DESIGN 6

BRIDGE NO. 57-488
POST MILE 35.66

SAN DIEGUITO RIVER BRIDGE (WIDEN)
LOG OF TEST BORINGS

CU 11
WO 196071

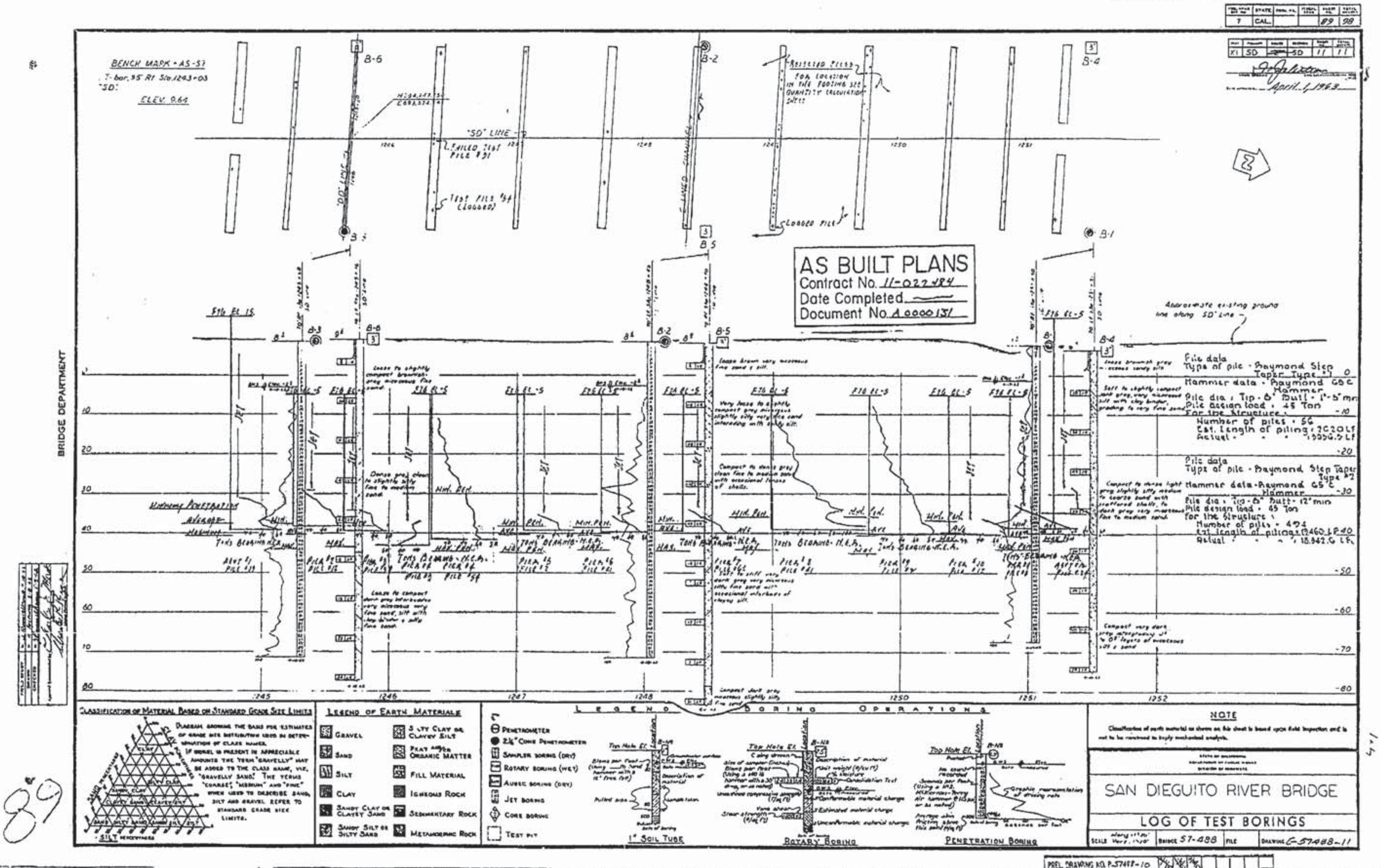
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

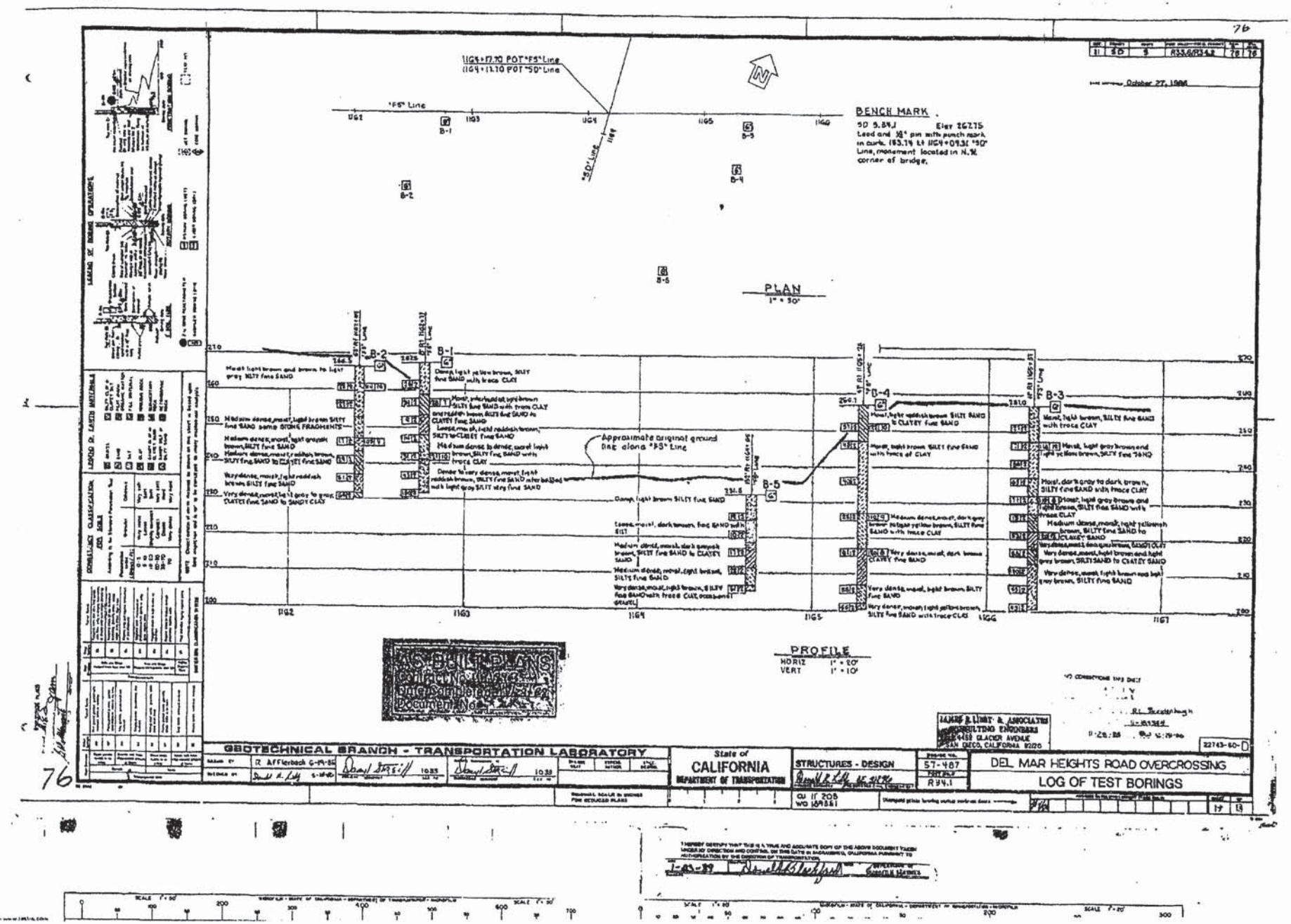
11 11

26

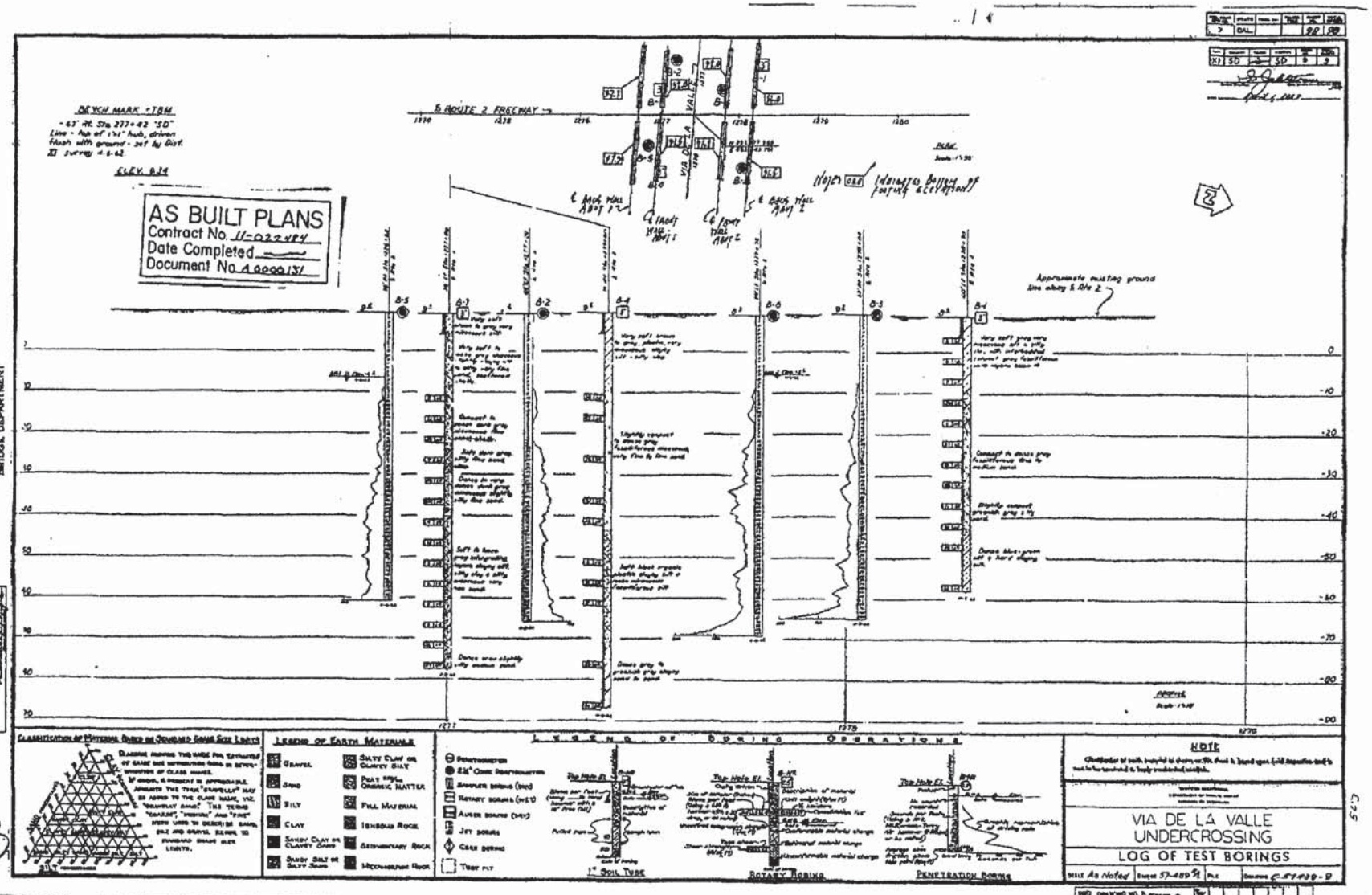
I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

1-19-88 Donald Blackford SUPERVISOR OF MICROFILM SERVICES


AS BUILT PLANS
Contract No. 11-022484
Date Completed
Document No. A0000131
BENCH MARK - AS-57
ELEV. 9.64
"SD" LINE
B-1
B-2
B-3
B-4
B-5
B-6
Pile data
Type of pile - Raymond Step Taper Type "J"
Hammer data - Raymond 65C Hammer
Pile design load - 45 Ton
For the Structure:
Number of piles - 56
Pile data
Type of pile - Raymond Step Taper Type "J"
Hammer data - Raymond 65C Hammer
Pile design load - 45 Ton
For the Structure:
Number of piles - 474
BRIDGE DEPARTMENT
CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS
LEGEND OF EARTH MATERIALS
Gravel
Sand
Silt
Clay
Sandy Clay or Clayey Sand
Sandy Silt or Silty Sand
Silty Clay or Clayey Silt
Peat and/or Organic Matter
Fill Material
Igneous Rock
Sedimentary Rock
Metamorphic Rock
Penetrometer
2¼" Cone Penetrometer
Sampler Boring (Dry)
Rotary Boring (Wet)
Auger Boring (Dry)
Jet Boring
Core Boring
Test Pit
LEGEND OF BORING OPERATIONS
1" Soil Tube
Rotary Boring
Penetration Boring
NOTE
SAN DIEGUITO RIVER BRIDGE
LOG OF TEST BORINGS
Bridge 57-488
Drawing G-57488-11
PREL. DRAWING NO. P-57488-10
April 1, 1963
CAL.
89
98



76
BENCH MARK
PLAN
1" = 50'
PROFILE
HORIZ 1" = 20'
VERT 1" = 10'
Approximate original ground line along "F5" Line
B-1
B-2
B-3
B-4
B-5
AS BUILT PLANS
GEOTECHNICAL BRANCH - TRANSPORTATION LABORATORY
State of CALIFORNIA
DEPARTMENT OF TRANSPORTATION
STRUCTURES - DESIGN
57-487
R94.1
DEL MAR HEIGHTS ROAD OVERCROSSING
LOG OF TEST BORINGS
22743-60-D
October 27, 1988


AS BUILT PLANS
Contract No. 11-022484
Date Completed
Document No. A0000131
BENCH MARK - TBM
ELEV. 0.34
S ROUTE 2 FREEWAY
VIA DE LA VALLE
Approximate existing ground line along S Rte 2
BRIDGE DEPARTMENT
CLASSIFICATION OF MATERIAL BASED ON SOUNDARD GRAIN SIZE LIMITS
LEGEND OF EARTH MATERIALS
GRAVEL
SAND
SILT
CLAY
SANDY CLAY OR CLAYEY SAND
SANDY SILT OR SILTY SAND
SILTY CLAY OR CLAYEY SILT
PEAT OR ORGANIC MATTER
FILL MATERIAL
IGNEOUS ROCK
SEDIMENTARY ROCK
METAMORPHIC ROCK
LEGEND OF BORING OPERATIONS
PENETROMETER
2½" CONE PENETROMETER
SAMPLER BORING (SMB)
ROTARY BORING (RB)
AUGER BORING (SMB)
JET BORING
CORE BORING
TEST PIT
1" SOIL TUBE
ROTARY BORING
PENETRATION BORING
NOTE
VIA DE LA VALLE
UNDERCROSSING
LOG OF TEST BORINGS
SCALE As Noted
DRAWING C-57489-9
98

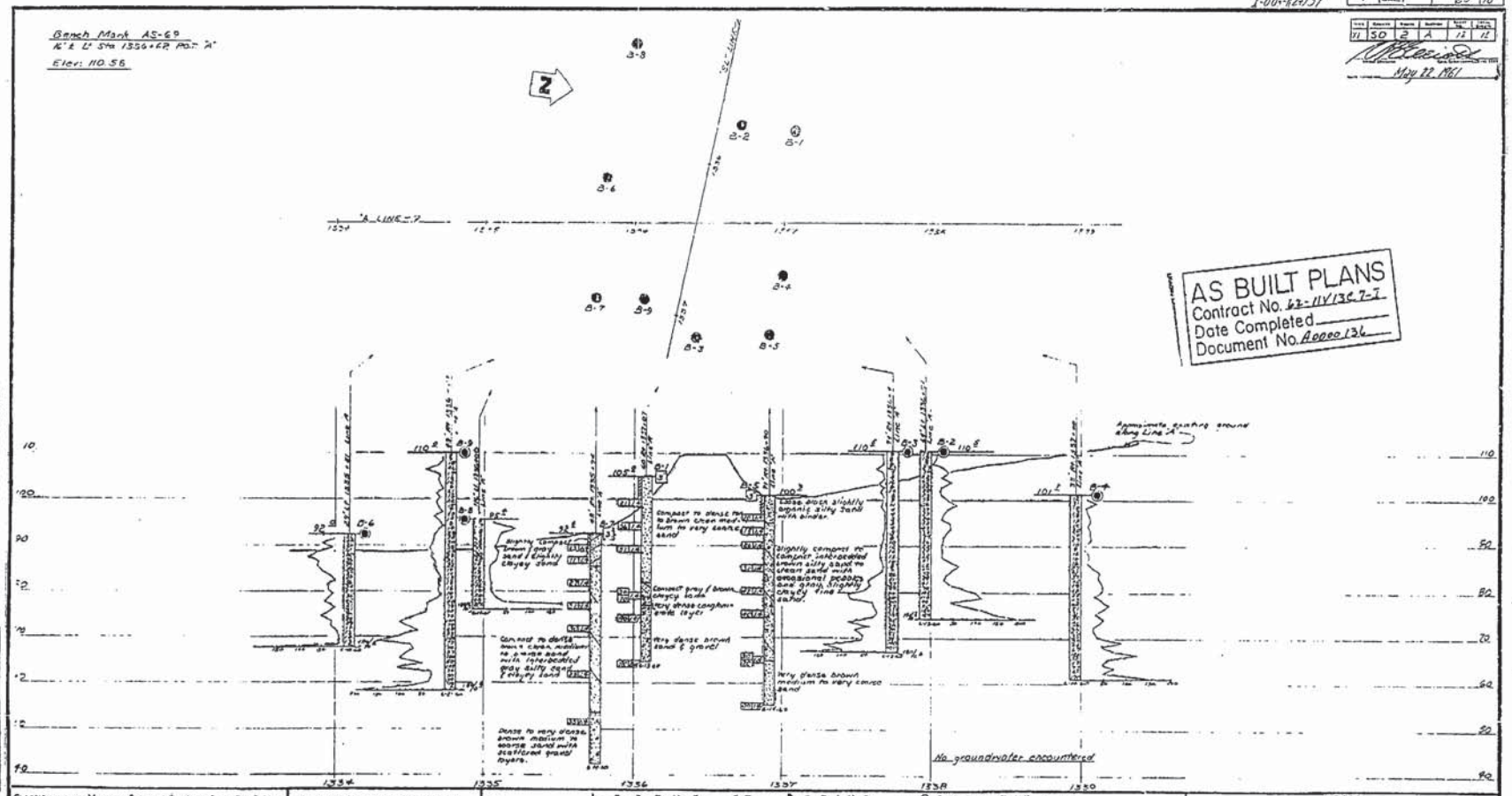
I-005-(24)37

FED. ROAD DIST.	STATE	FISCAL NO.	PROJECT	SHEET	TOTAL SHEETS
7	CAL.		60	78	

DIST.	COUNTY	ROUTE	SUBMITTED	DATE	SHEET
11	SD	2	A	12	11

May 22 1961

Bench Mark AS-69
16" E. L. Sta 1356+62 Ptr. "A"
Elev: 110.56



AS BUILT PLANS
Contract No. 62-11V136.7-2
Date Completed
Document No. A0000136

BRIDGE DEPARTMENT

CLASSIFICATION OF MATERIALS BASED ON STANDARD GRADE SIZE LIMITS

DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTIONS USED IN DETERMINATION OF CLASS NAMES.
IF GRAVEL IS PRESENT IN APPRECIABLE AMOUNTS THE TERM "GRAVELLY" MAY BE ADDED TO THE CLASS NAME, VIZ. "GRAVELLY SAND". THE TERMS "COARSE", "MEDIUM" AND "FINE" WHEN USED TO DESCRIBE SAND, SILT AND GRAVEL REFER TO STANDARD GRADE SIZE LIMITS.

SILT PERCENTAGES

LEGEND OF EARTH MATERIALS

- GRAVEL
- SAND
- SILT
- CLAY
- SANDY CLAY OR CLAYEY SAND
- SANDY SILT OR SILTY SAND
- SILTY CLAY OR CLAYEY SILT
- PEAT AND ORGANIC MATTER
- FILL MATERIAL
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

LEGEND OF BORING OPERATIONS

- PLAN OF ANY BORING
- PENETROMETER
- 2¼" CONE PENETROMETER
- SAMPLER BORING (DRY)
- ROTARY BORING (WET)
- AUGER BORING (DRY)
- JET BORING
- CORE BORING
- TEST PIT

1" SOIL TUBE — ROTARY BORING — PENETRATION BORING

NOTES

The contractor's attention is directed to Section 2, Article (b) of the Standard Specifications and to the Special Provisions accompanying this set of plans.
Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

SKYLINE DRIVE UNDERCROSSING

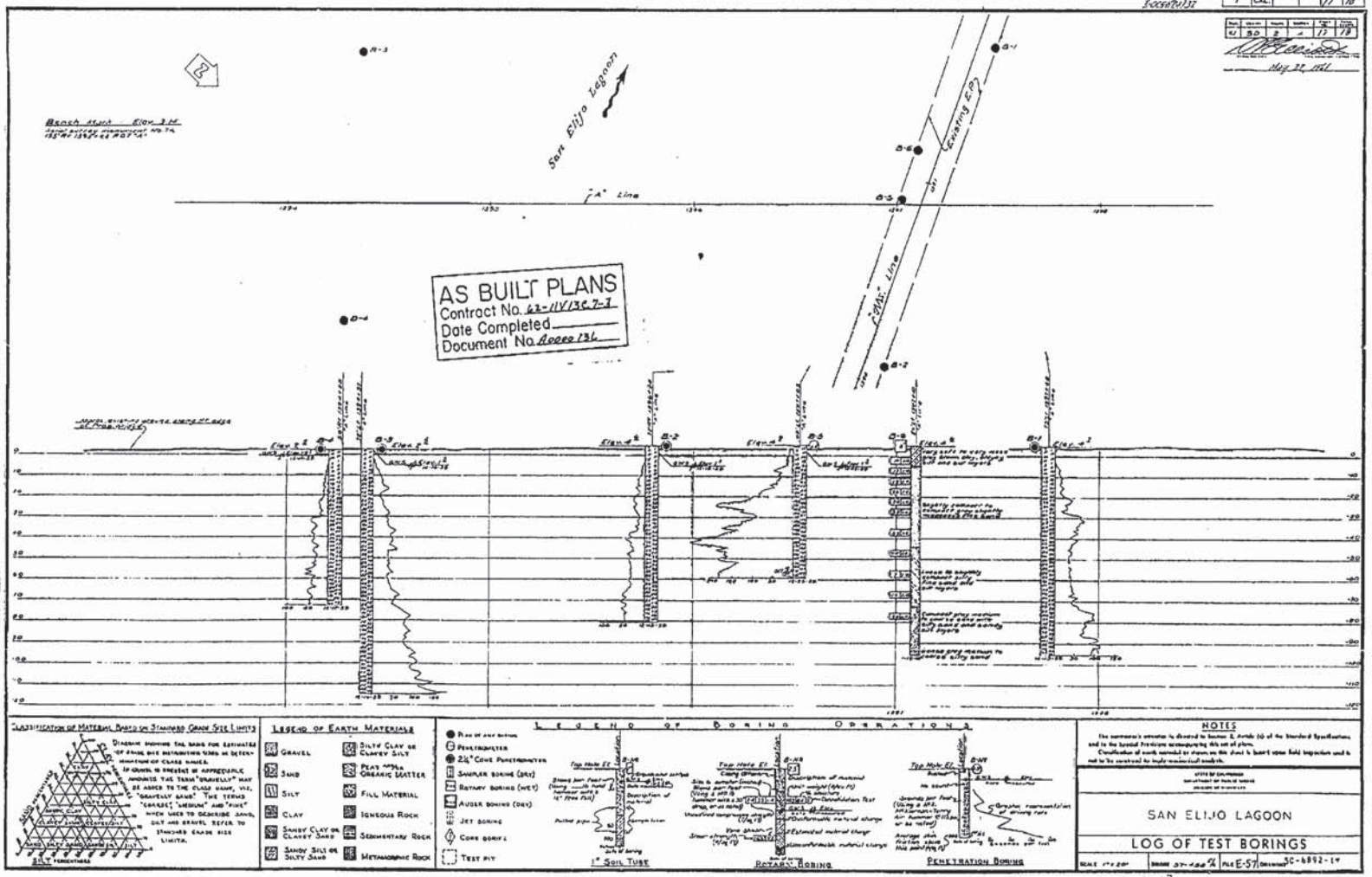
LOG OF TEST BORINGS

SCALE VERT. 1" = 10' HOR. 1" = 10' | BRIDGE 57-C 794L | FILE | DRAWING C-7141-12

PRIL DRAWING NO. P-7141

160

LOMAS SANTA FE DRIVE UC



BRIDGE DEPARTMENT
AS BUILT PLANS
Contract No. 62-11V13C7-3
Date Completed
Document No. A0000136
San Elijo Lagoon
"A" Line
"MAS" Line
Existing E.P.
Bench Mark Elev. 3.4
CLASSIFICATION OF MATERIAL BASED ON STANDARD GRAIN SIZE LIMITS
SILT PERCENTAGES
LEGEND OF EARTH MATERIALS
GRAVEL
SAND
SILT
CLAY
SANDY CLAY OR CLAYEY SAND
SANDY SILT OR SILTY SAND
SILTY CLAY OR CLAYEY SILT
PEAT OR ORGANIC MATTER
FILL MATERIAL
IGNEOUS ROCK
SEDIMENTARY ROCK
METAMORPHIC ROCK
LEGEND OF BORING OPERATIONS
PLAN OF ANY BORING
PENETROMETER
2½" CONE PENETROMETER
SAMPLER BORING (DRY)
ROTARY BORING (WET)
AUGER BORING (DRY)
JET BORING
CORE BORING
TEST PIT
1" SOIL TUBE
ROTARY BORING
PENETRATION BORING
NOTES
SAN ELIJO LAGOON
LOG OF TEST BORINGS
SCALE 1" = 20'
FILE E-57
DRAWING 3C-6892-14
FWEL DRAWING NO. P-6892

AS BUILT PLANS
Contract No. 11-022414
Date Completed
Document No. A00000133

BRIDGE DEPARTMENT

October 14, 1943

PLAN
Scale: 1" = 50'

"BD" LINE

Logged Pile

Abut. 1 Bent 2 Bent 4 Abut. 5

B-1 B-2 B-3 B-4 B-5

Design Pile Loading: 45 Ton
Type Pile: 10B42 H Pile
Total Number Piles: 4
Lineal Feet Piles As-Built: 4224
Lineal Feet Piles Called For on Plans: 340
Hammer: Vulcan 50C

Design Pile Loading: 45 Ton
Type Pile: 10" C.I.P.M.
Total Number of Piles: 48
Lineal Feet Piles As-Built: 1708.7
Lineal Feet Piles Called for on Plans: 1890

Min. Penet.
Aver. Penet.
Max. Penet.

Torq. Reading Ent.

PROFILE
Scale - Horiz: 1" = 20'
Vert: 1" = 10'

NO GROUND WATER ENCOUNTERED DURING THIS INVESTIGATION BY BRIDGE DEPT. GEOLOGY SECTION

SHEET 13 OF 13

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION USED IN DETERMINATION OF CLASS NAMES.
IF GRAVEL IS PRESENT IN APPRECIABLE AMOUNTS THE TERM "GRAVELLY" MAY BE ADDED TO THE CLASS NAME, VIZ. "GRAVELLY SAND." THE TERMS "COARSE," "MEDIUM" AND "FINE" WHEN USED TO DESCRIBE SAND, SILT AND GRAVEL REFER TO STANDARD GRADE SIZE LIMITS.

LEGEND OF EARTH MATERIALS

- Gravel
- Sand
- Silt
- Clay
- Sandy Clay or Clayey Sand
- Sandy Silt or Silty Sand
- Silty Clay or Clayey Silt
- Peat or Organic Matter
- Fill Material
- Igneous Rock
- Sedimentary Rock
- Metamorphic Rock

LEGEND OF BORING OPERATIONS

- Penetrometer
- 2½" Cone Penetrometer
- Sampler Boring (Dry)
- Rotary Boring (Wet)
- Auger Boring (Dry)
- Jet Boring
- Core Boring
- Test Pit

1" Soil Tube — Rotary Boring — Penetration Boring

NOTE
Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

BIRMINGHAM DRIVE OVERCROSSING

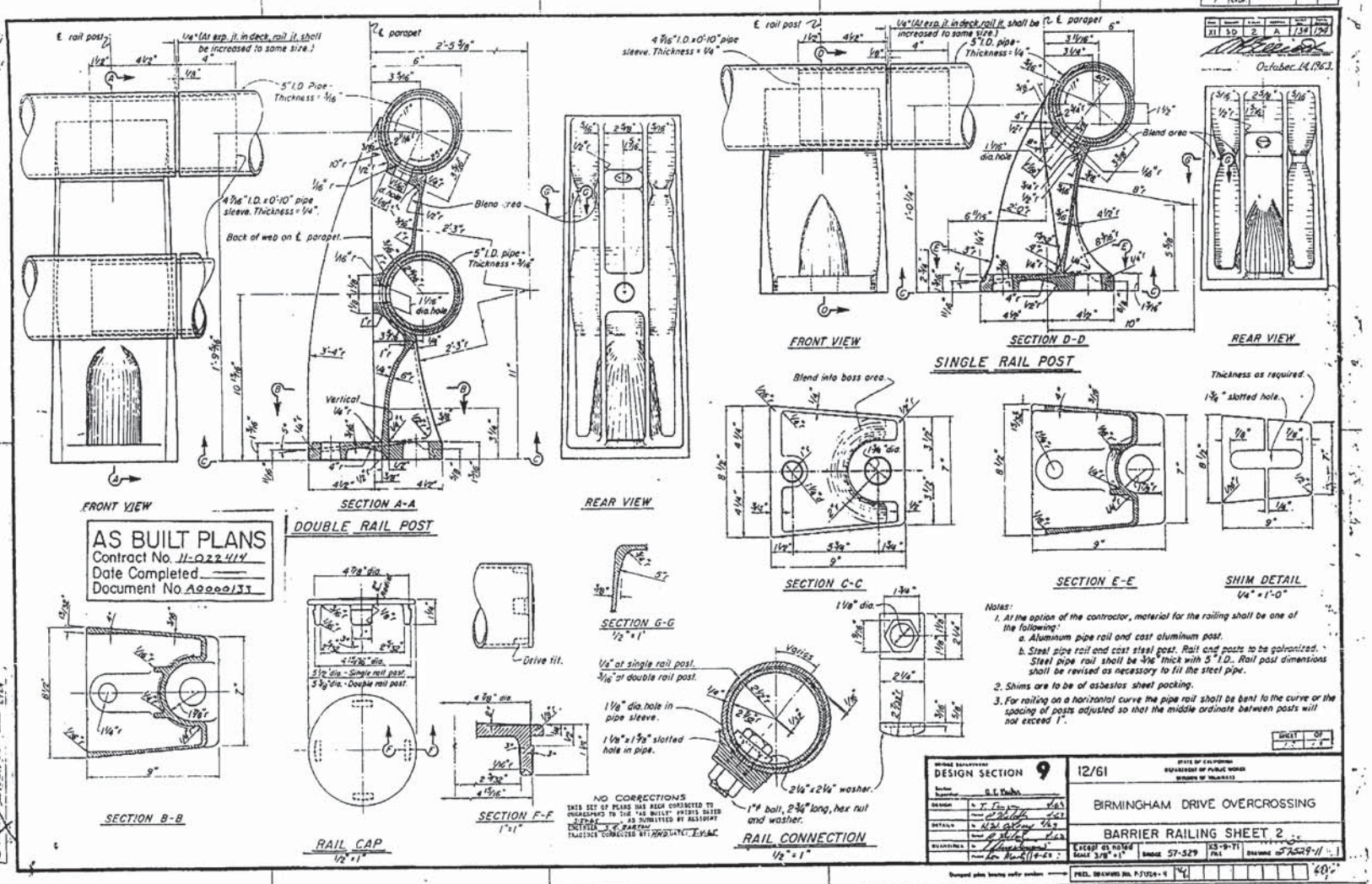
LOG OF TEST BORINGS

Scale As Noted | Bridge 57-529 | File | Drawing 57229-13

PROJ. DRAWING NO. 57-529-13

135

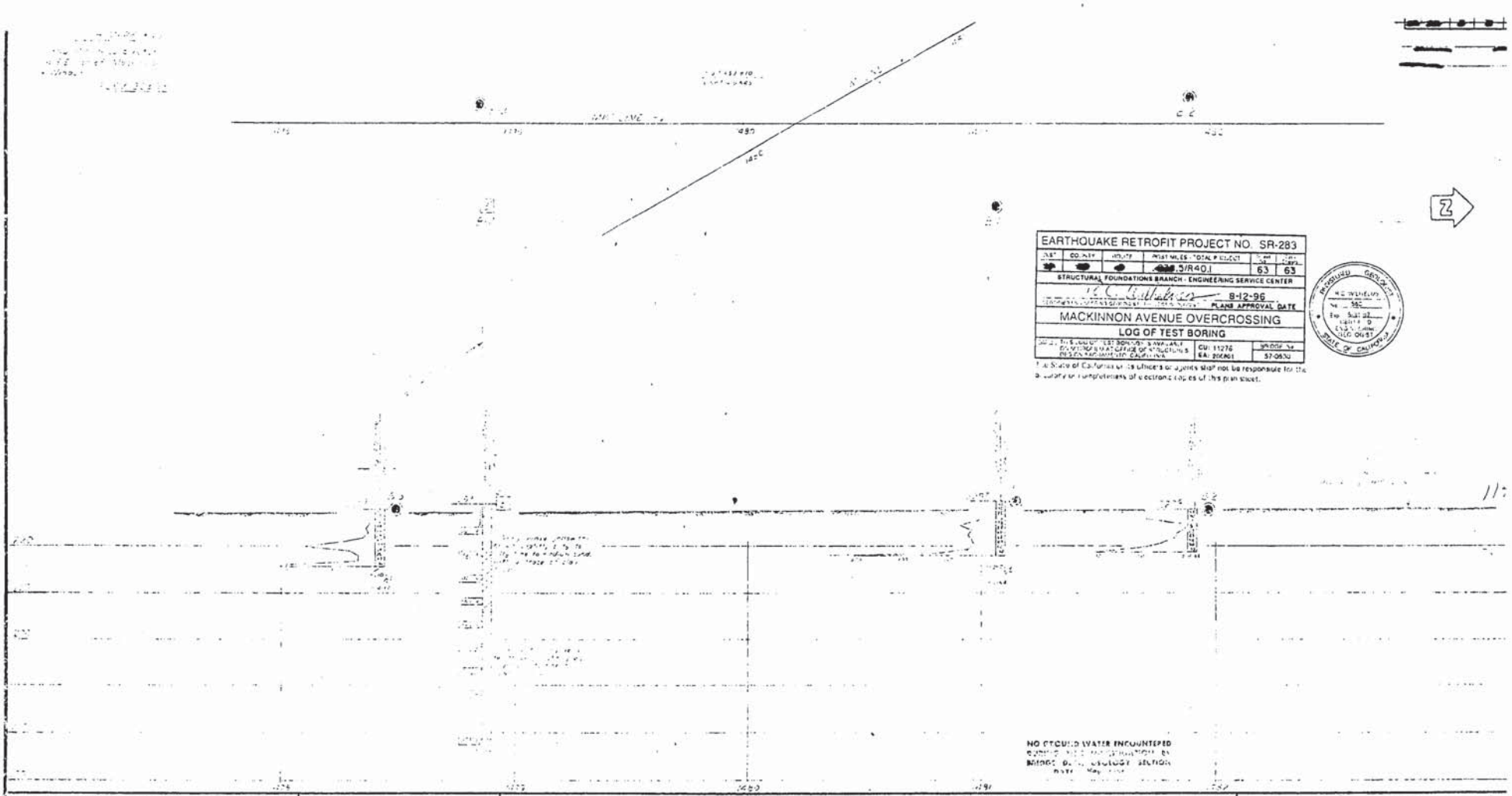
691



Notes:

1. At the option of the contractor, material for the railing shall be one of the following:
   a. Aluminum pipe rail and cast aluminum post.
   b. Steel pipe rail and cast steel post. Rail and posts to be galvanized. Steel pipe rail shall be 3/16" thick with 5" I.D.. Rail post dimensions shall be revised as necessary to fit the steel pipe.
2. Shims are to be of asbestos sheet packing.
3. For railing on a horizontal curve the pipe rail shall be bent to the curve or the spacing of posts adjusted so that the middle ordinate between posts will not exceed 1".

BRIDGE DEPARTMENT



Classification of Material Based on Standard Grade Size Limits

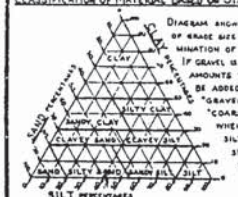


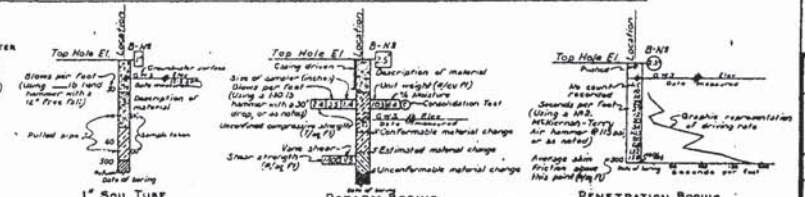
Diagram showing the basis for estimates of grade size distribution used in determination of class names.
If gravel is present in appreciable amounts the term "gravelly" may be added to the class name, viz. "gravelly sand". The terms "coarse", "medium" and "fine" when used to describe sand, silt and gravel refer to standard grade size limits.

Legend of Earth Materials

- Gravel
- Sand
- Silt
- Clay
- Sandy Clay or Clayey Sand
- Sandy Silt or Silty Sand
- Silty Clay or Clayey Silt
- Peat and/or Organic Matter
- Fill Material
- Igneous Rock
- Sedimentary Rock
- Metamorphic Rock

Legend of Boring Operations

- Penetrometer
- 2¼" Cone Penetrometer
- Sampler boring (dry)
- Rotary boring (wet)
- Auger boring (dry)
- Jet boring
- Core boring
- Test pit



Note

Classification of earth material as shown on this sheet is based upon field insp
not to be construed to imply mechanical analysis.

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

MACKINNON AVE. OVERCROSSING

LOG OF TEST BORINGS

SCALE	BRIDGE	FILE	DRAWING
Horiz. 1:120' Vert. 1:20'	57-530		

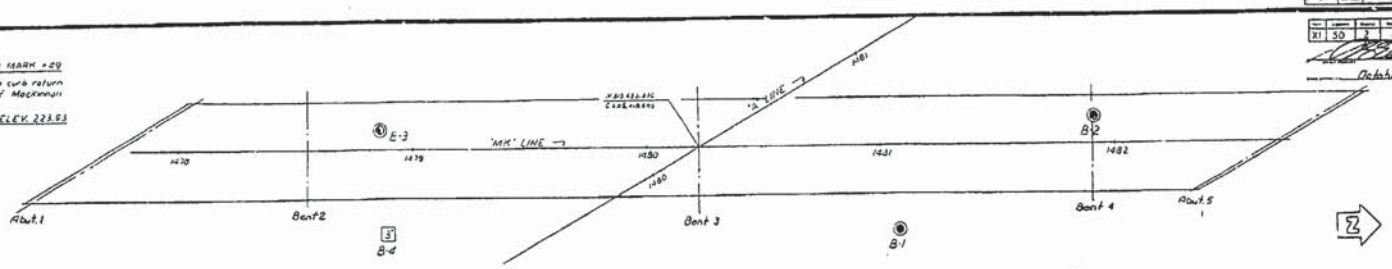
SHEET 11

FED. ROAD DIV. NO.	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
7	CAL.			

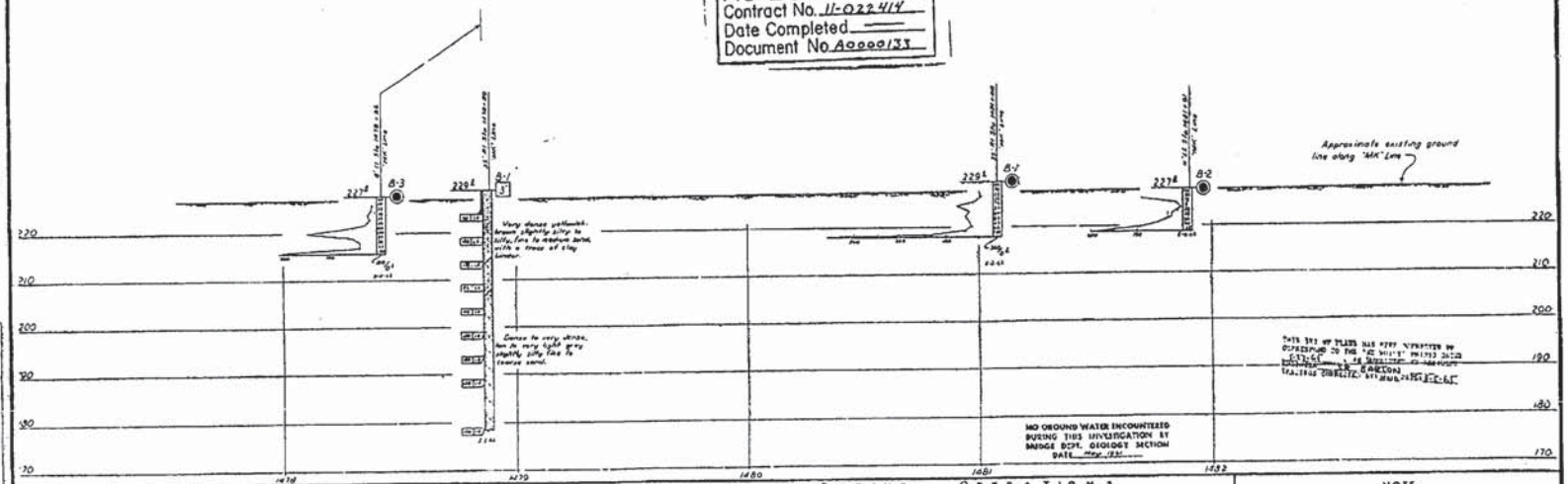
ROUTE	SUBROUTE	PROJECT	SECTION	SHEET	TOTAL SHEETS
XI	30	2	A	13	14

October 14 1963

BENCH MARK #29
Fnd. P.K. in curb return at S.E. cor. of Mackinnon & Windsor.
ELEV. 223.93



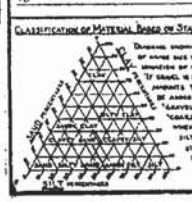
AS BUILT PLANS
Contract No. 11-022414
Date Completed
Document No. A00000133



BRIDGE DEPARTMENT

1-2-64	Approximate existing ground line added
9-9-63	Bridge Dept. Geology Section
8-8-63	Bridge Dept. Geology Section

Classification of Material Based on Standard Grain Size Limits



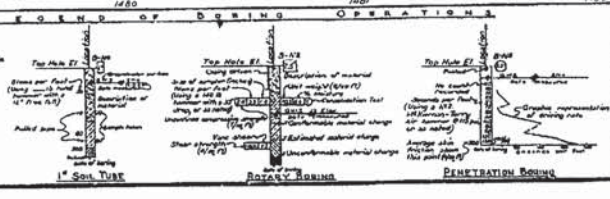
Dividing lines shown the same for estimates of grain size distribution used in interpretation of close names.
If gravel is present in appreciable amounts the term "gravelly" may be added to the close name, inf. "gravelly sand". The terms "coarse", "medium" and "fine" when used to describe sand, silt and gravel, refer to standard grain size limits.

Legend of Earth Materials

- Gravel
- Sand
- Silt
- Clay
- Sandy Clay or Clayey Sand
- Sandy Silt or Silty Sand
- Silty Clay or Clayey Silt
- Peat, Muck, Organic Matter
- Fill Material
- Igneous Rock
- Sedimentary Rock
- Metamorphic Rock

Legend of Boring Operations

- Penetrometer
- 2½" Core Penetrometer
- Sampler boring (SBX)
- Rotary boring (RBX)
- Auger boring (ABX)
- Jet boring
- Core boring
- Test pit



Note

Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

STATE OF CALIFORNIA DEPARTMENT OF PUBLIC WORKS DIVISION OF HIGHWAYS	SHEET	OF
	13	14

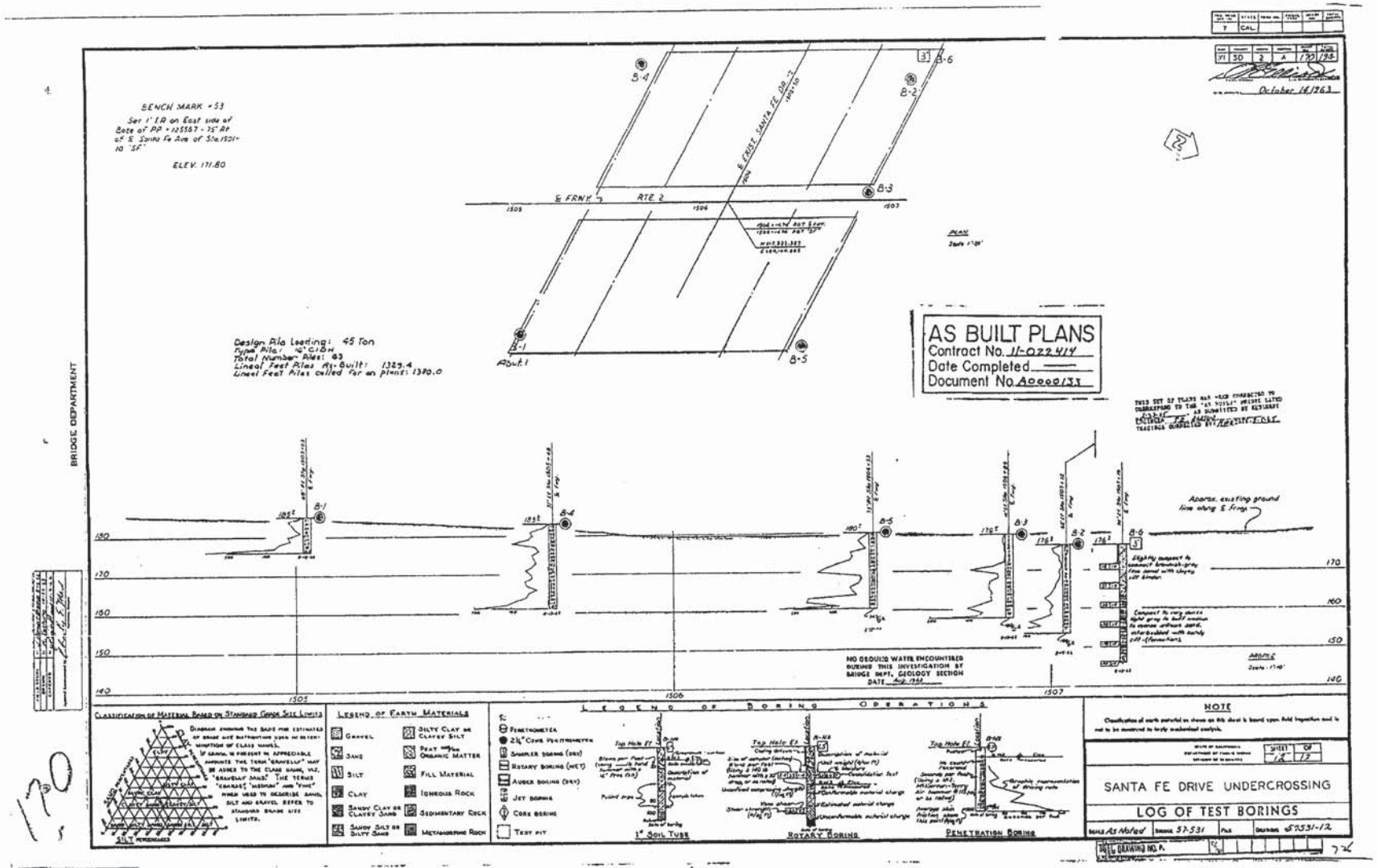
MACKINNON AVENUE OVERCROSSING

LOG OF TEST BORINGS

SCALE Horiz. 1"=10' Vert. 1"=10'	BRIDGE 57-530	FILE	DRAWING 57530-22

PREL. DRAWING NO. 714

158



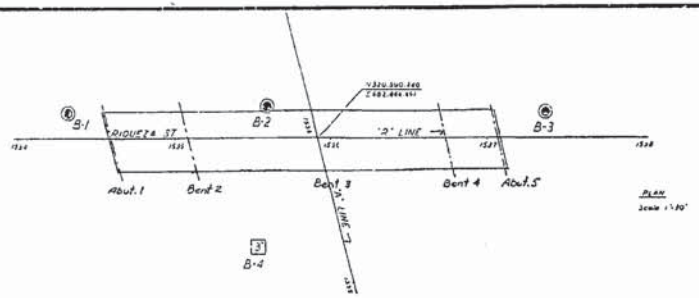
BENCH MARK #53
Set 1" I.R. on East side of Base of PP #125567 - 75' Rt of ℄ Santa Fe Ave of Sta. 1501+10 "SF"
ELEV. 171.80
Design Pile Loading: 45 Ton
Type Pile: 16" CIDH
Total Number Piles: 63
Lineal Feet Piles As-Built: 1329.4
Lineal Feet Piles called for on plans: 1370.0
℄ FRWY
RTE 2
℄ EXIST. SANTA FE DR.
Abut. 1
B-1
B-2
B-3
B-4
B-5
B-6
PLAN
AS BUILT PLANS
Contract No. 11-022414
Date Completed
Document No. A0000133
October 14, 1963
BRIDGE DEPARTMENT
Approx. existing ground line along ℄ Frwy.
NO GROUND WATER ENCOUNTERED DURING THIS INVESTIGATION BY BRIDGE DEPT. GEOLOGY SECTION
DATE Aug. 1962
CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS
LEGEND OF EARTH MATERIALS
GRAVEL
SAND
SILT
CLAY
SANDY CLAY OR CLAYEY SAND
SANDY SILT OR SILTY SAND
SILTY CLAY OR CLAYEY SILT
PEAT OR ORGANIC MATTER
FILL MATERIAL
IGNEOUS ROCK
SEDIMENTARY ROCK
METAMORPHIC ROCK
LEGEND OF BORING OPERATIONS
PENETROMETER
2½" CONE PENETROMETER
SAMPLER BORING (DRY)
ROTARY BORING (WET)
AUGER BORING (DRY)
JET BORING
CORE BORING
TEST PIT
1" SOIL TUBE
ROTARY BORING
PENETRATION BORING
NOTE
SANTA FE DRIVE UNDERCROSSING
LOG OF TEST BORINGS
SCALE As Noted
DRAWING 57-531
DRAWING 57531-12
SHEET 12 OF 12

FED. ROAD DIST. NO.	STATE	FISCAL YEAR	ROUTE NO.	PROJECT NO.	TOTAL SHEETS
7	CAL.				

DIST.	SECTION	SHEET	SUBSECT.	FORM NO.	TOTAL SHEETS
XI	50	2	A	13	198

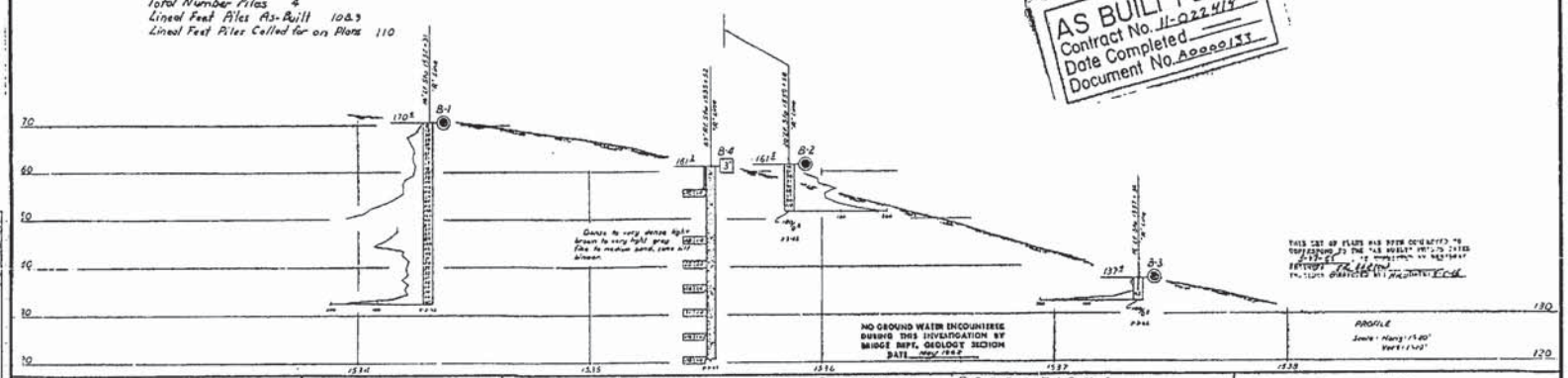
October 16, 1963

BENCH MARK - AS-66
RR Spike w/c -5' Lt. Sta 1535+
39' 50 ft' Line
N 326,901.061 E 1,482,413.890
ELEV 183.29



Design Pile Loading 45 ton
Type Pile 16" CIDH
Total Number Piles 4
Lineal Feet Piles As-Built 108.3
Lineal Feet Piles Called for on Plans 110

AS BUILT PLANS
Contract No. 11-022414
Date Completed
Document No. A0000137



BRIDGE DEPARTMENT

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRAIN SIZE LIMITS

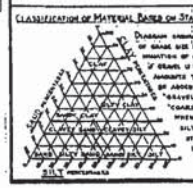


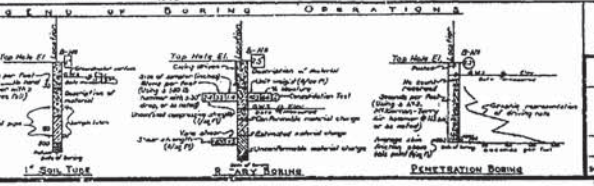
DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRAIN SIZE DISTRIBUTION USED IN DETERMINATION OF CLASS NAMES.
IF GRAVEL IS PRESENT IN APPRECIABLE AMOUNTS THE TERM "GRAVELLY" MAY BE ADDED TO THE CLASS NAME, VIZ. "GRAVELLY SAND." THE TERMS "COARSE," "MEDIUM" AND "FINE" WHEN USED TO DESCRIBE SAND, SILT AND GRAVEL REFER TO STANDARD GRAIN SIZE LIMITS.

LEGEND OF EARTH MATERIALS

- Gravel
- Sand
- Silt
- Clay
- Sandy Clay or Clayey Sand
- Sandy Silt or Silty Sand
- Silty Clay or Clayey Silt
- Peat or Organic Matter
- Fill Material
- Igneous Rock
- Sedimentary Rock
- Metamorphic Rock

LEGEND OF BORING OPERATIONS

- Penetrometer
- 2½" Cone Penetrometer
- Sampler Boring (DRY)
- Rotary Boring (WET)
- Auger Boring (DRY)
- Jet Boring
- Core Boring
- Test Pit



NOTE

Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

STATE OF CALIFORNIA DEPARTMENT OF PUBLIC WORKS DIVISION OF HIGHWAYS	SHEET	OF
	13	13

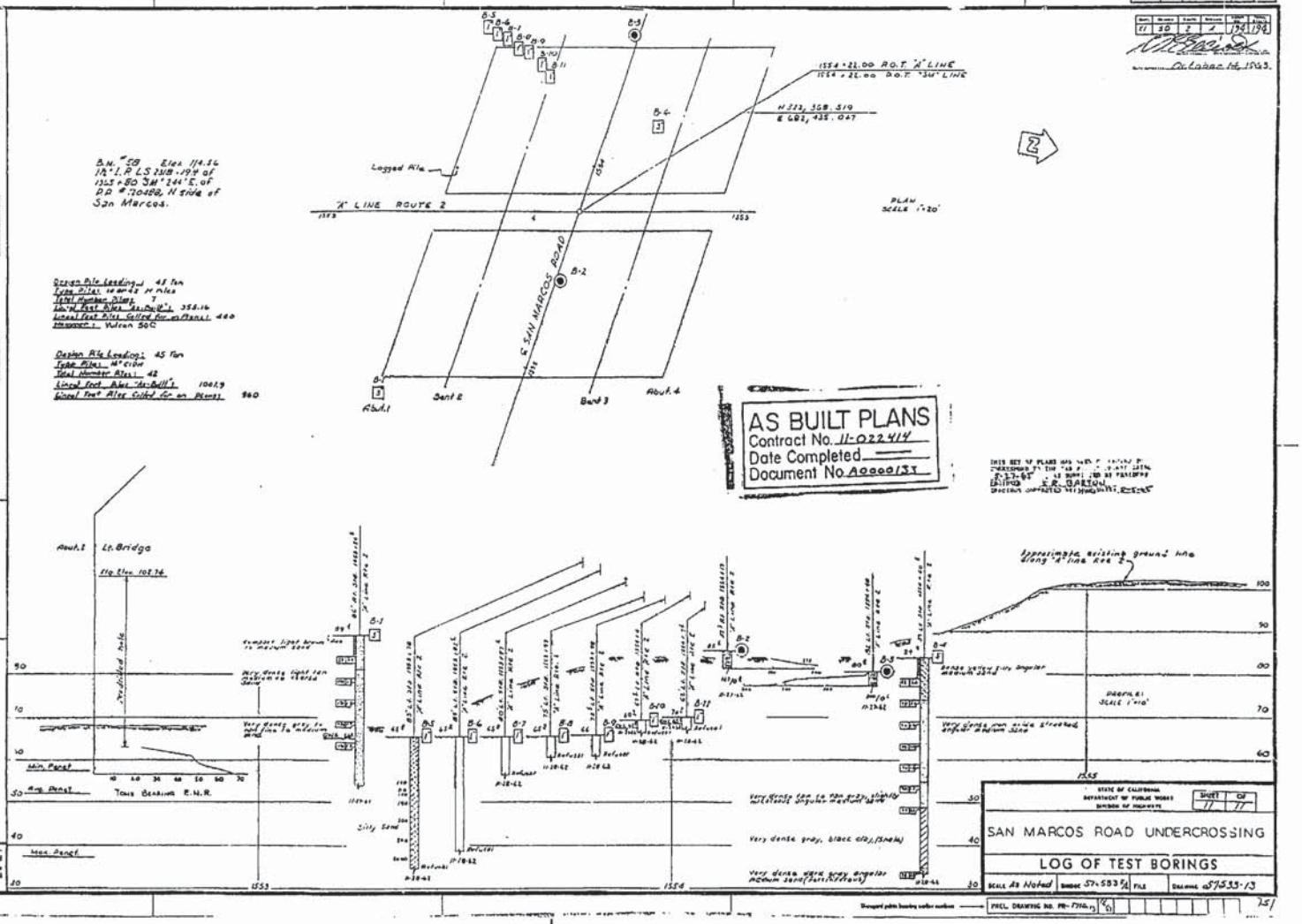
RIQUEZA STREET OVERCROSSING

LOG OF TEST BORINGS

SCALE As Noted	BRIDGE 57-532	FILE	DRAWING 57532-8

FWEL DRAWING NO. P- 57532 R

740



ENCINITAS BLVD UC

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
11	SD	5	R67.9/R69.5	192	193

REGISTERED PROFESSIONAL ENGINEER

04/06/98
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER JAMES J. STEW No. GE 808 Exp. 12/31/01 STATE OF CALIFORNIA

AGRA
Earth & Environmental, Inc.
16760 W. Bernardo Drive San Diego, Ca 92127

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF ELECTRONIC COPIES OF THIS PLAN SHEET.

NOTES:

1.) ELEVATIONS BASED ON TOPOGRAPHIC MAP BY COUNTY OF SAN DIEGO, DATED 9-17-75, SCALE 1:2400

2.) BORINGS LOGGED BY TED W. PRIMAS, PROJECT GEOLOGIST

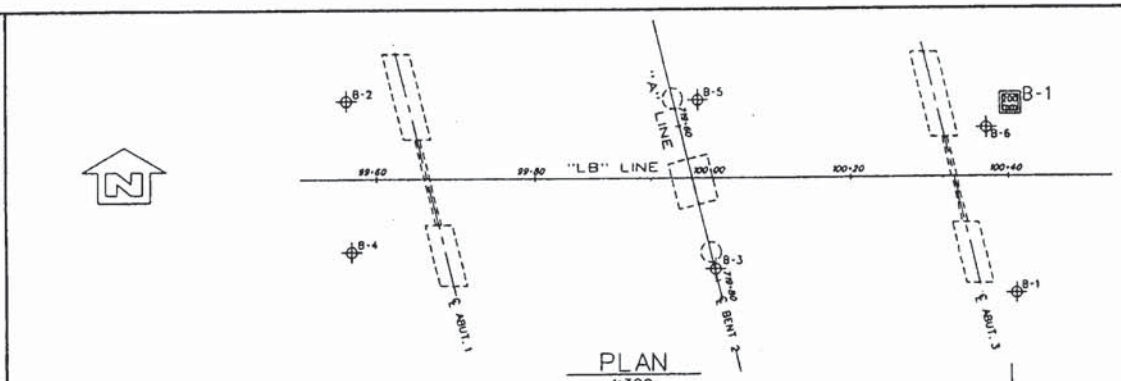
3.) BENCHMARK - SD CO STD DISC IN S/W STMPD OC 173 1968 SE CORNER OF I-5/LEUCADIA BRIDGE, RECORDED FROM S.D. CO. VERT CONTROL PG 127 ELEV.: 53.210 DATUM: M.S.L.

4.) 84mm SAMPLER DRIVEN WITH 63.5 kg HAMMER FALLING 762mm SAMPLER: 84mm ID 70mm OD

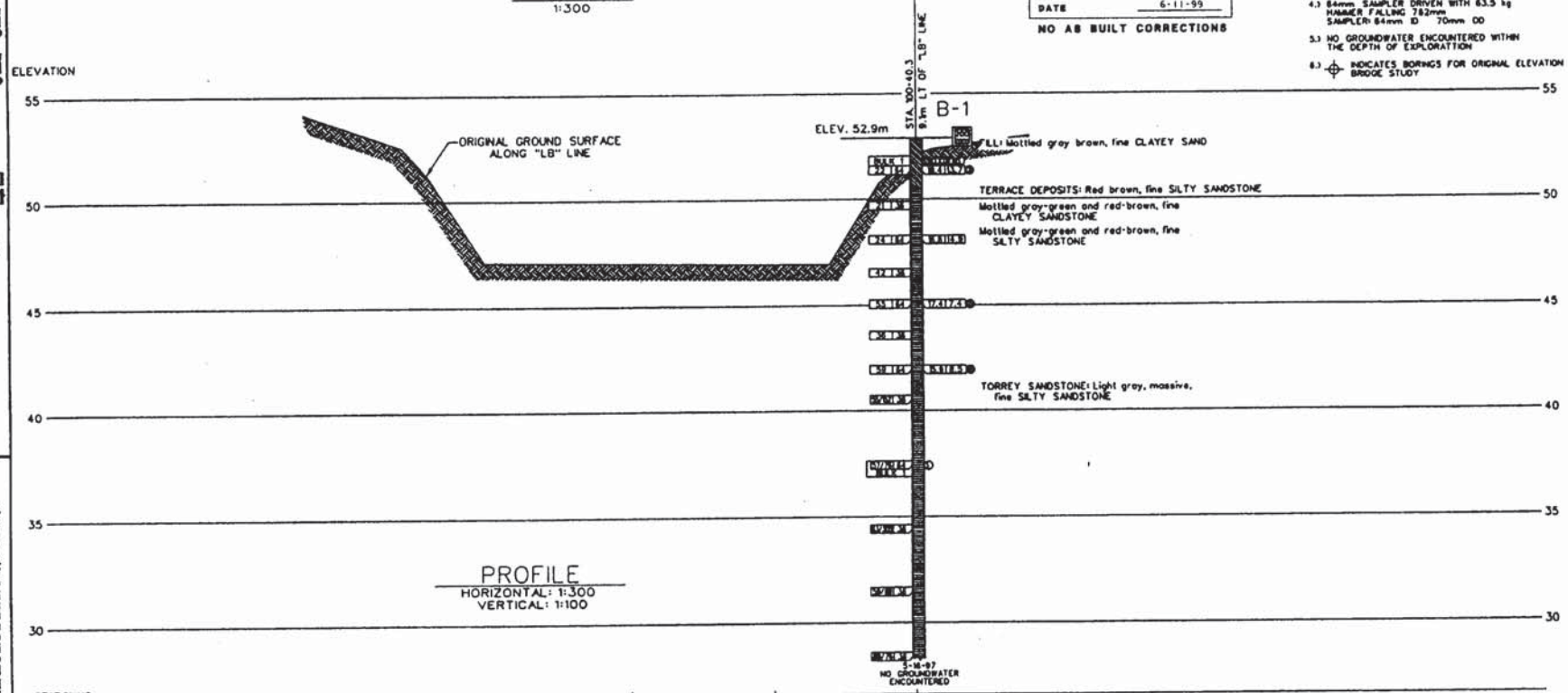
5.) NO GROUNDWATER ENCOUNTERED WITHIN THE DEPTH OF EXPLORATION

6.) ⊕ INDICATES BORINGS FOR ORIGINAL ELEVATION BRIDGE STUDY

AS BUILT
CORRECTIONS BY Gabriel Acero
CONTRACT NO. 11-166644
DATE 6-11-99
NO AS BUILT CORRECTIONS



PLAN
1:300



PROFILE
HORIZONTAL: 1:300
VERTICAL: 1:100

JOB No. 7-252-1016

LEGEND OF BORING OPERATIONS

LEGEND OF EARTH MATERIALS

CONSISTENCY CLASSIFICATION FOR SOILS

NOTE: Classification of earth materials shown on this plan is based upon visual inspection and not to be construed as being a soil classification.

DESIGN OVERSIGHT	DRAWN BY J.B. DePOORTER	T.M. PRIMAS FIELD INVESTIGATOR	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
SIGN OFF DATE	CHECK BY J.J. VETTEL	DATE MAY 16, 1997	

JOHN BISHOP
PROJECT ENGINEER

BRIDGE NO. 57-554
KILOMETER POST 42.7/68.7

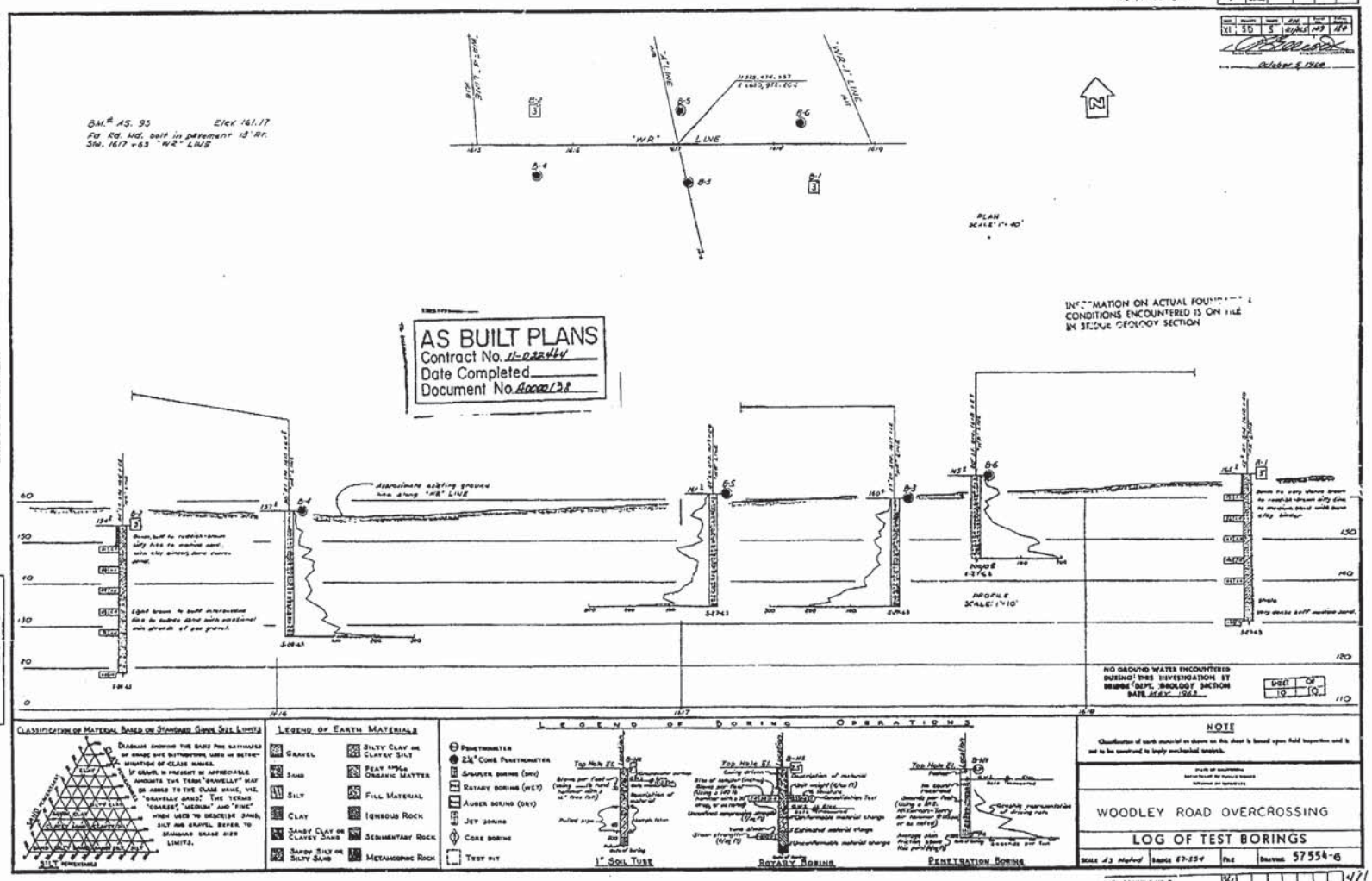
LEUCADIA BOULEVARD O.C. (WIDEN)
LOG OF TEST BORINGS

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 20 40 60 80 100

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 23 OF 24



BM.# AS. 95 Elev. 161.17
Fd. Rd. Hd. bolt in pavement 13' Rt.
Sta. 1617+63 "WR" LINE
"WR" LINE
PLAN
SCALE: 1"=40'
INFORMATION ON ACTUAL FOUNDATION CONDITIONS ENCOUNTERED IS ON FILE IN BRIDGE GEOLOGY SECTION
AS BUILT PLANS
Contract No. 11-032464
Date Completed
Document No. A0000138
Approximate existing ground line along "WR" LINE
PROFILE
SCALE: 1"=10'
NO GROUND WATER ENCOUNTERED DURING THIS INVESTIGATION BY BRIDGE DEPT. GEOLOGY SECTION
DATE MAY 1963
CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS
LEGEND OF EARTH MATERIALS
GRAVEL
SAND
SILT
CLAY
SANDY CLAY OR CLAYEY SAND
SANDY SILT OR SILTY SAND
SILTY CLAY OR CLAYEY SILT
PEAT AND/OR ORGANIC MATTER
FILL MATERIAL
IGNEOUS ROCK
SEDIMENTARY ROCK
METAMORPHIC ROCK
LEGEND OF BORING OPERATIONS
PENETROMETER
2½" CORE PENETROMETER
SAMPLER BORING (DRY)
ROTARY BORING (WET)
AUGER BORING (DRY)
JET BORING
CORE BORING
TEST PIT
1" SOIL TUBE
ROTARY BORING
PENETRATION BORING
NOTE
WOODLEY ROAD OVERCROSSING
LOG OF TEST BORINGS
57554-6
PREL. DRAWING NO. F-
471
BRIDGE DEPARTMENT

Revisions made to this log of Test Borings from the original 1964 Log of Test Borings are:

1. "LOL" Line - Metric was added.
2. The bearing for the "WR" line from Sta 1615+00 to Sta 1619+00 was added.
3. The metric Northing and Easting in NAD83 are shown below for the two stations on "LOL" Line and one station on the "WR" Line.

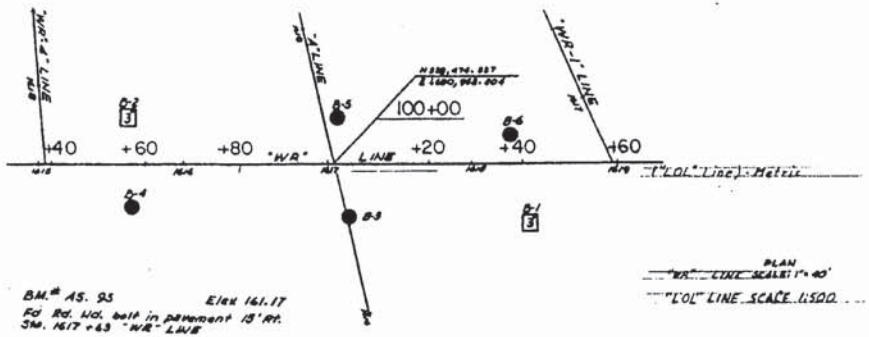
("LOL" Line) - Metric (100+00)	N 600120.7239	E 1902675.7950
("LOL" Line) - Metric (100+60)	N 600120.1878	E 1902736.7926
("WR" Line) - Metric (1617+000)	N 600120.7389	E 1902675.1217

4. "LOL" Line - Metric stations and offsets:

Boring	Station	Offset from "LOL"
B-1	100+41.0	12.8M Rt
B-2	99+56.3	9.8M Lt
B-3	100+02.9	11.3M Rt
B-4	99+57.0	9.1M Rt
B-5	100+00.8	9.8M Lt
B-6	100+37.0	6.1M Lt

Note:

100+00 "LOL" Line = 1617+05.49 "WR" Line



AS BUILT PLANS
Contract No. 11-166644
Date Completed
Document No. 6000132

AS BUILT
CORRECTIONS BY Gabriel Acero
CONTRACT NO. 11-166644
DATE 6-11-99
NO AS BUILT CORRECTIONS

October 8, 1964

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date will not be required. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
11	SD	5	R67.9/R69.5	193	193

LEUCADIA BLVD OC (WIDEN)

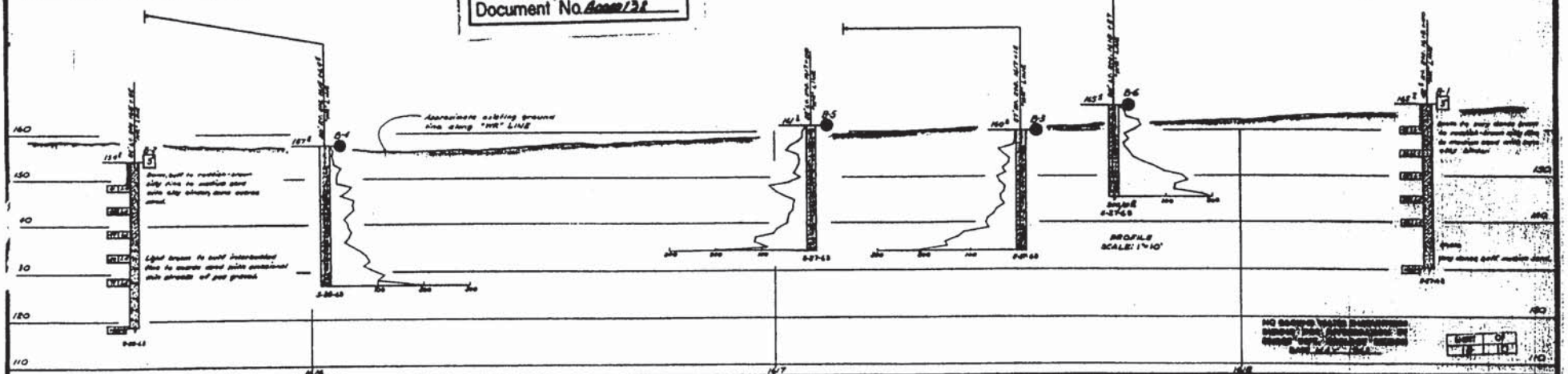
AS-BUILT LOG OF TEST BORINGS

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

CU 11275
EA 166641

BRIDGE NO. 57-0554

INFORMATION ON ACTUAL FOUNDATION CONDITIONS ENCOUNTERED IS ON FILE IN BRIDGE GEOLOGY SECTION



Classification of Material Based on Standard Soil Limits

Legend of Earth Materials

- Gravel
- Sand
- Silt
- Clay
- Sandy Clay or Clayey Sand
- Sandy Silt or Silty Sand
- Silty Clay or Clayey Silt
- Peat and Organic Matter
- Fill Material
- Igneous Rock
- Sedimentary Rock
- Metamorphic Rock

Legend of Boring Operations

- Penetrometer
- 2½" Core Penetrometer
- Sampler Boring (SB)
- Rotary Boring (WET)
- Auger Boring (DRY)
- Jet Boring
- Core Boring
- Test Pit

1" Soil Tube — Rotary Boring — Penetration Boring

NOTE

Classification of earth material as shown by the data is based upon field inspection and is not to be construed to imply representation of other than that encountered.

WOODLEY ROAD OVERCROSSING

LOG OF TEST BORINGS

FHEL DRAWING NO. K

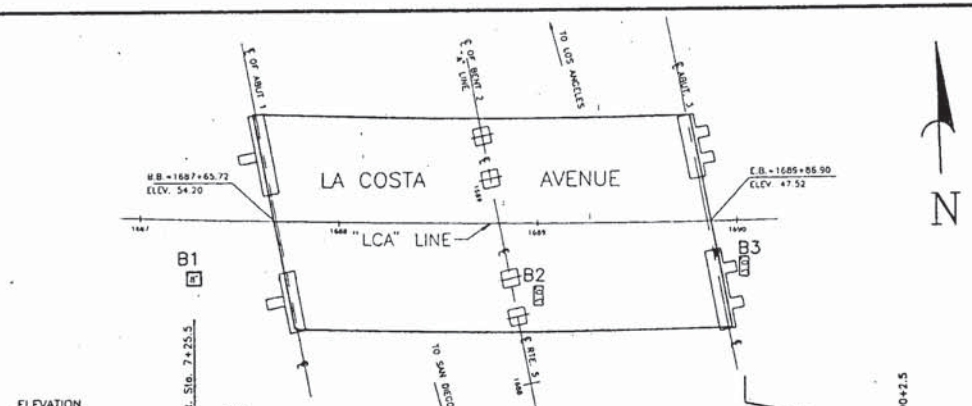
DIST.	COUNTY	ROUTE	POST MILES TOTAL MILES	SHEET No.	TOTAL SHEETS
11	SD	5	R43.8/R44.4	140	142

Rick E. Larson
REGISTERED CIVIL ENGINEER

2-19-96
PLANS APPROVED DATE

REGISTERED PROFESSIONAL ENGINEER Rick E. Larson No. 39226 Exp. 12-31-97 STATE OF CALIFORNIA

KLEINFELDER
9555 CHESAPEAKE DRIVE #101
SAN DIEGO, CALIFORNIA 92123



PLAN

SCALE : 1" = 30'

NOTES :

1.) BORINGS LOGGED BY JIM S. HOYLE, STAFF GEOLOGIST

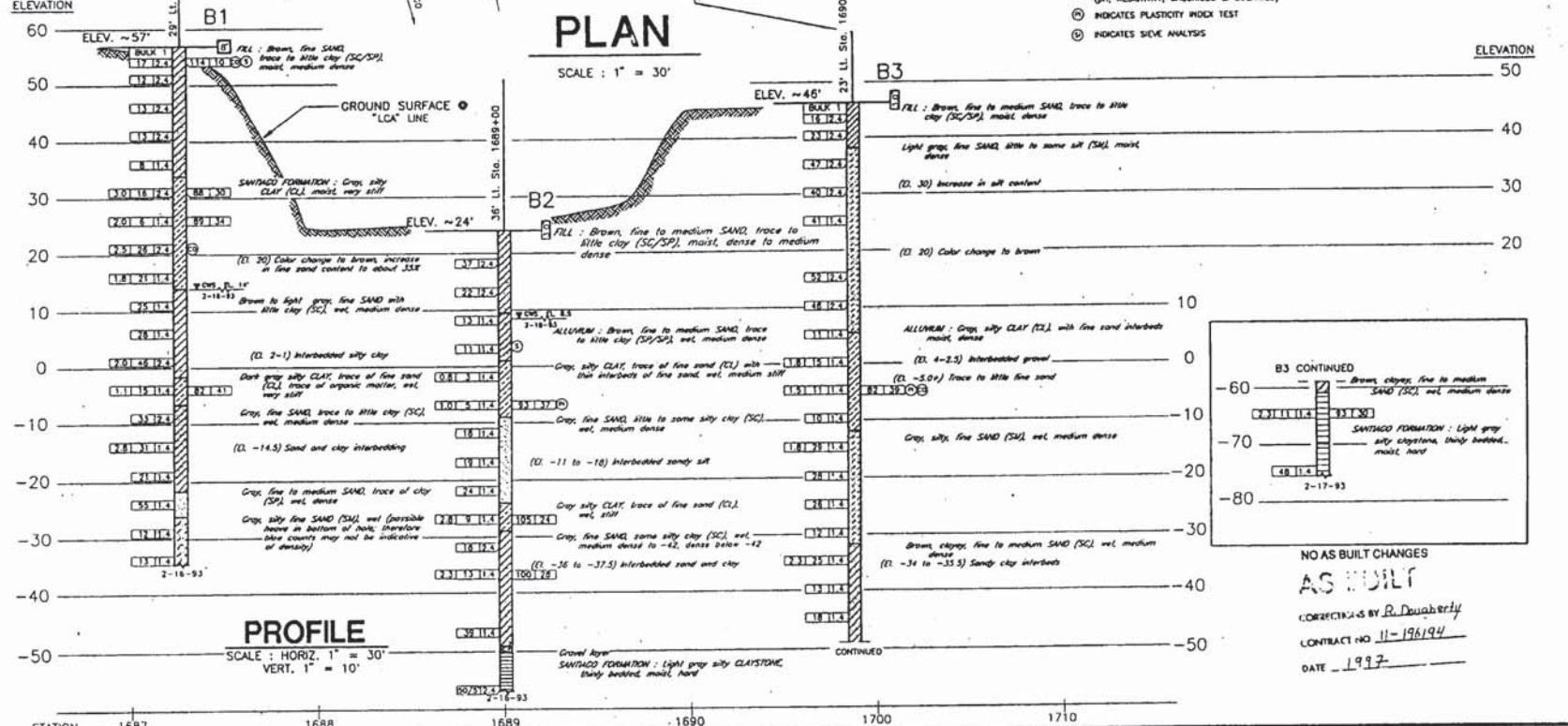
2.) BENCHMARK- CALTRANS MONUMENT No.5-44.1A 136.06 RT STA 1688+82.73 P.O.C. "A", ELEVATION 45.20.

3.) IN-SITU SOIL SAMPLES WERE OBTAINED BY USING A 2.4-INCH I.D., 3.0-INCH O.D. CALIFORNIA SAMPLER. SEE GEOTECHNICAL REPORT FOR TEST RESULTS.

4.) ALL SAMPLERS WERE DRIVEN WITH A CME AUTOMATIC HAMMER, 140 lb. HAMMER, 30-INCH DROP.

5.) (CR) INDICATES CORROSIVITY TEST SERIES (pH, RESISTIVITY, CHLORIDES & SULFATES)
(PI) INDICATES PLASTICITY INDEX TEST
(SV) INDICATES SIEVE ANALYSIS

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF ELECTRONIC COPIES OF THIS PLAN SHEET.



PROFILE

SCALE : HORIZ. 1" = 30'
VERT. 1" = 10'

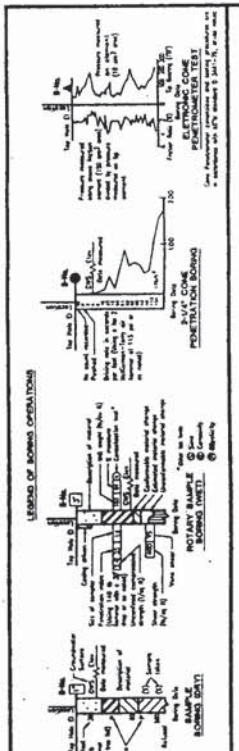
NO AS BUILT CHANGES

AS BUILT

CORRECTIONS BY R. Dougherty

CONTRACT NO 11-196194

DATE 1997



DESIGN OVERSIGHT / SIGN OFF DATE	DRAWN BY: EMBER C. DELANNOY	JIM S. HOYLE, FIELD INVESTIGATOR	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
	CHECK BY: RICK E. LARSON	DATE 2/16-18/93	R. HUEMAC TRIGUEROS, PROJECT ENGINEER

BRIDGE NO. 57-460
POST MILE R43.3

LA COSTA AVENUE OC (WIDEN)
LOG OF TEST BORINGS

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

DISREGARD PRINTS BEARING EARLIER REVISION DATES (FOR LOCATION STATE OFFICE) SHEET OF

The As-Built Log of Test Boring sheet was used to prepare the Geotechnical Report

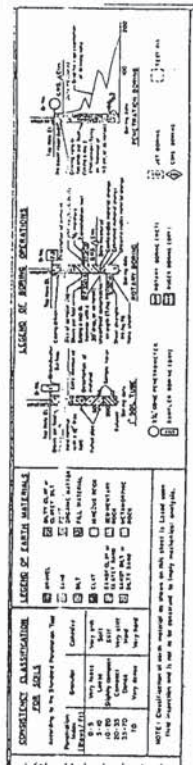
2-19-96

DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
11	SD	5	R43.8/R44.4	141	142

The State Of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

DIST.	COUNTY	ROUTE	POST MILES	SHEET NO.	TOTAL SHEETS
11	S.D	5	R44.1	4	4

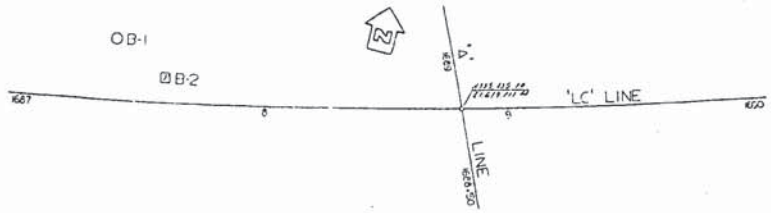
On Contract of 221
March 31, 1975



BENCH MARKS

TOB #1604
3ft curvature of shoul. 1, near end of general rail, red painted end of bolt (most end of ring wall, elevation painted on concrete).
Elev. 37.66

BM #112
90'±/- property corner +160, 26' lt. of Sta. 1022 +80 to Costa Ave.
Elev. 38.03

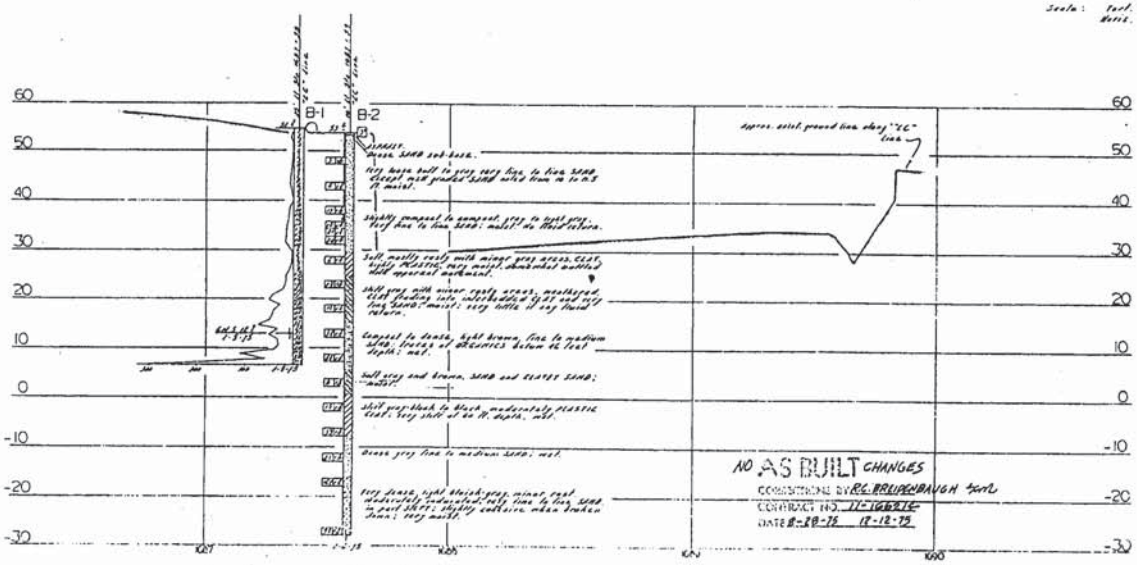


PLAN

Scale: 1" = 20'

PROFILE

Scale: Vert. 1" = 10'
Horiz. 1" = 20'



NO AS BUILT CHANGES
CORRECTIONS BY R.C. BRUGENBAUGH Corp.
CONTRACT NO. 11-166216
DATE 8-28-75 12-12-75

JAN 6 1976

AS BUILT PLANS
Contract No. 11-166214
Date Completed ____
Document No. A0006901

ENGINEERING GEOLOGY SECTION
FIELD STUDY — 1-2-1-4 — 1-8-75
BOARD — 1-8-75
CHECKED — Sr. Engr. 2-28-75 — Charles E. Smith

State of CALIFORNIA DEPARTMENT OF TRANSPORTATION
OFFICE OF STRUCTURES DESIGN GROUP 9
PROJECT ENGINEER Lt. H. Klein 1/15
BRIDGE NO. 57-0460
POST MILE R 44.

LA COSTA AVENUE O.C. (REPAIRS)
LOG OF TEST BORINGS

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 11101
WO 166211

Disregard plan bearing earlier revision dates ____

SHEET 4 OF 4

NO AS BUILT CHANGES
AS BUILT
CORRECTIONS BY R. Dougherty
CONTRACT NO. 11-196194
DATE 1997

Design Oversight — Date
Sign Off Date

NOTE:
Additional As-Built data may be available at the Division of New Technologies, Material and Research 5900 Folsom Boulevard, Sacramento, California 95819

DESIGN	R. Triqueros	H. Wells
DETAILS	C. Palglase	H. Wells
QUANTITIES		

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Mark A. Imbriani
PROJECT ENGINEER

CU 11276
EA 196191

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

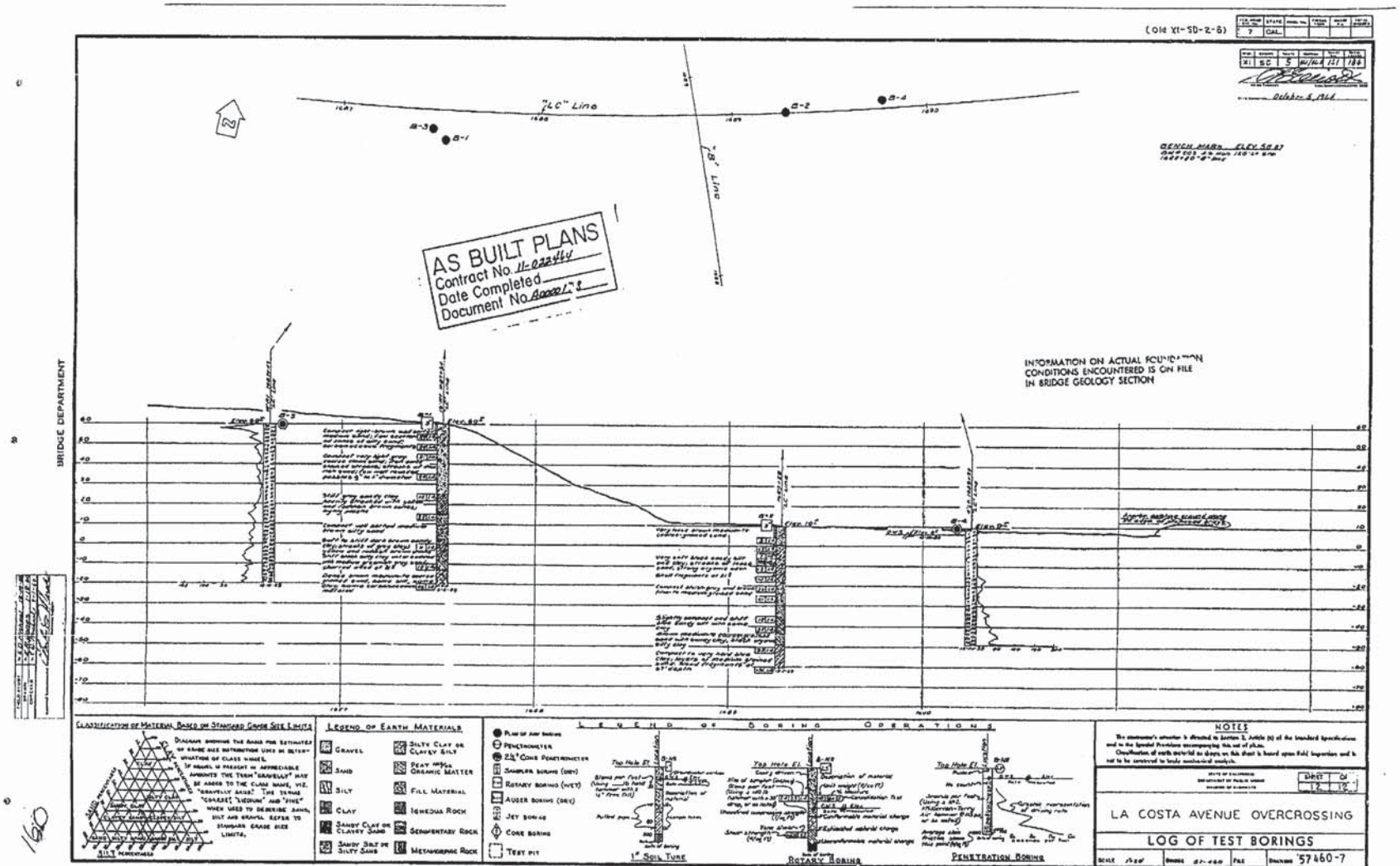
BRIDGE NO. 57-460
POST MILE R 44.07

LA COSTA AVENUE O.C. (WIDEN)
AS-BUILT LOG OF TEST BORINGS

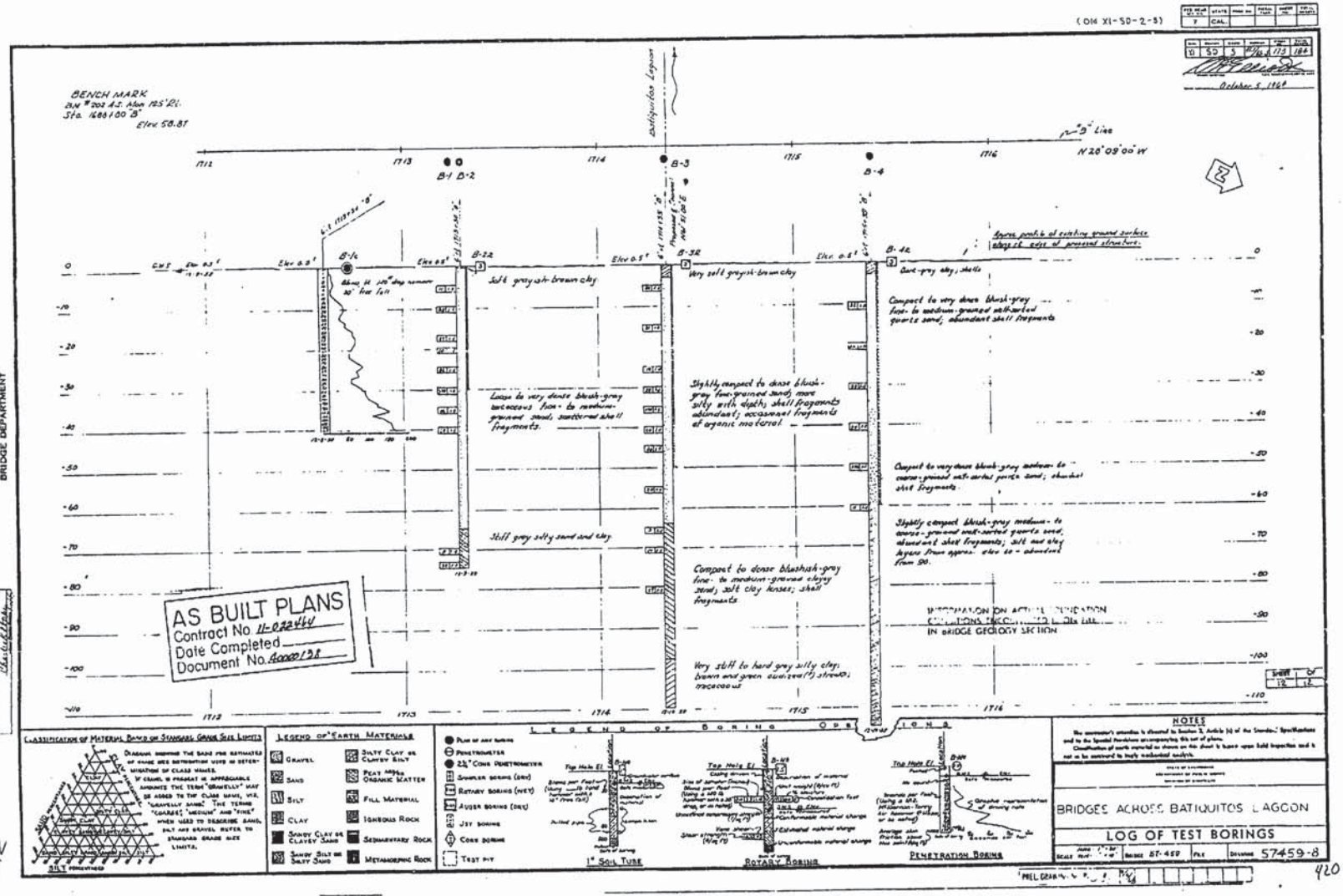
DISREGARD PRINTS BEARING EARLIER REVISION DATES ____
REVISIONS DATES (PRELIMINARY STAGE ONLY)

SHEET 20 OF 21

CO3-LOG.DVG 09/13/94 1:1



BRIDGE DEPARTMENT
"LC" Line
"B" Line
B-1
B-2
B-3
B-4
AS BUILT PLANS
Contract No. 11-022464
Date Completed
Document No. A0000178
INFORMATION ON ACTUAL FOUNDATION CONDITIONS ENCOUNTERED IS ON FILE IN BRIDGE GEOLOGY SECTION
CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS
LEGEND OF EARTH MATERIALS
GRAVEL
SAND
SILT
CLAY
SANDY CLAY OR CLAYEY SAND
SANDY SILT OR SILTY SAND
SILTY CLAY OR CLAYEY SILT
PEAT AND/OR ORGANIC MATTER
FILL MATERIAL
IGNEOUS ROCK
SEDIMENTARY ROCK
METAMORPHIC ROCK
LEGEND OF BORING OPERATIONS
PENETROMETER
CORE BORING
TEST PIT
1" SOIL TUBE
ROTARY BORING
PENETRATION BORING
NOTES
LA COSTA AVENUE OVERCROSSING
LOG OF TEST BORINGS
57460-7



(DIM XI-SD-2-3)
BENCH MARK
B.N. #202 A.S. Mon 125' Rt.
Sta. 1688+00 "B"
Elev. 58.87
Batiquitos Lagoon
N 28° 09' 00" W
B-1 B-2
B-3
B-4
B-1c
B-2c
B-3c
B-4c
Soft grayish-brown clay
Very soft grayish-brown clay
Dark-gray clay; shells
Compact to very dense bluish-gray fine- to medium-grained well-sorted quartz sand; abundant shell fragments
Loose to very dense bluish-gray micaceous fine- to medium-grained sand; scattered shell fragments.
Slightly compact to dense bluish-gray fine-grained sand; more silty with depth; shell fragments abundant; occasional fragments of organic material.
Compact to very dense bluish-gray medium- to coarse-grained well-sorted quartz sand; abundant shell fragments.
Stiff gray silty sand and clay
Compact to dense bluishish-gray fine- to medium-grained clayey sand; soft clay lenses; shell fragments
Very stiff to hard gray silty clay; brown and green oxidized(?) streaks; micaceous
INFORMATION ON ACTUAL FOUNDATION CONDITIONS INCORPORATED IN BRIDGE GEOLOGY SECTION
AS BUILT PLANS
Contract No. 11-022464
Date Completed
Document No. 40000138
BRIDGE DEPARTMENT
CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS
LEGEND OF EARTH MATERIALS
GRAVEL
SAND
SILT
CLAY
SANDY CLAY OR CLAYEY SAND
SANDY SILT OR SILTY SAND
SILTY CLAY OR CLAYEY SILT
PEAT MOSS ORGANIC MATTER
FILL MATERIAL
IGNEOUS ROCK
SEDIMENTARY ROCK
METAMORPHIC ROCK
LEGEND OF BORING OPERATIONS
PENETROMETER
2½" CONE PENETROMETER
SAMPLER BORING (DRY)
ROTARY BORING (WET)
AUGER BORING (DRY)
JET BORING
CORE BORING
TEST PIT
1" SOIL TUBE
ROTARY BORING
PENETRATION BORING
NOTES
BRIDGES ACROSS BATIQUITOS LAGOON
LOG OF TEST BORINGS
57459-8

420

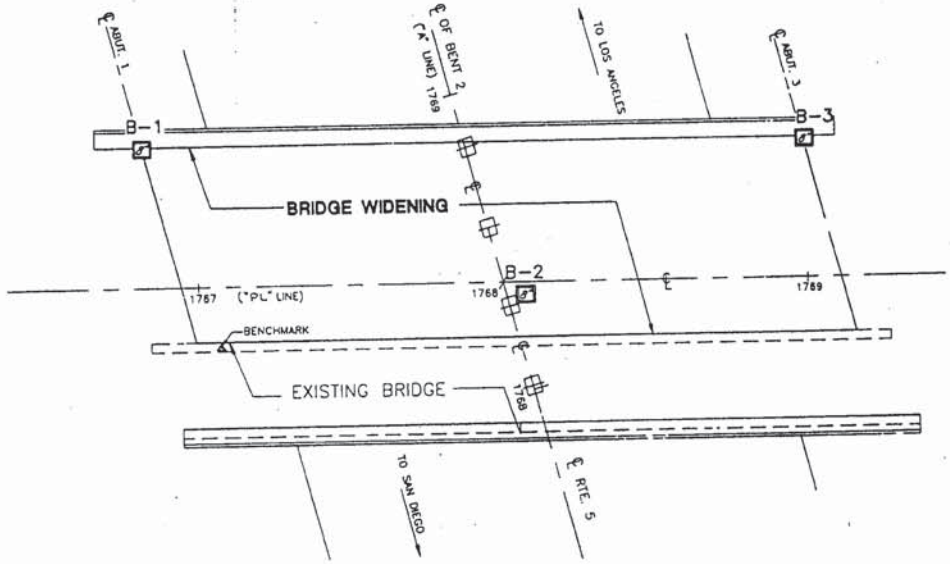
DIST.	COUNTY	ROUTE	POST MILE TOTAL PROJ.	SHEET No.	TOTAL SHEETS
11	SD	5	R44.9/R45.9	166	167

George P. Hettinger 3-16-94
REGISTERED CIVIL ENGINEER

6-6-94
PLANS APPROVED DATE

REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

KLEINFELDER
9555 CHESAPEAKE DRIVE #101
SAN DIEGO, CALIFORNIA 92123



PLAN

SCALE : 1" = 20'

AS BUILT
CORRECTIONS BY J P H RWE
CONTRACT NO. 11-167844
DATE 2/28/96 11/22/96

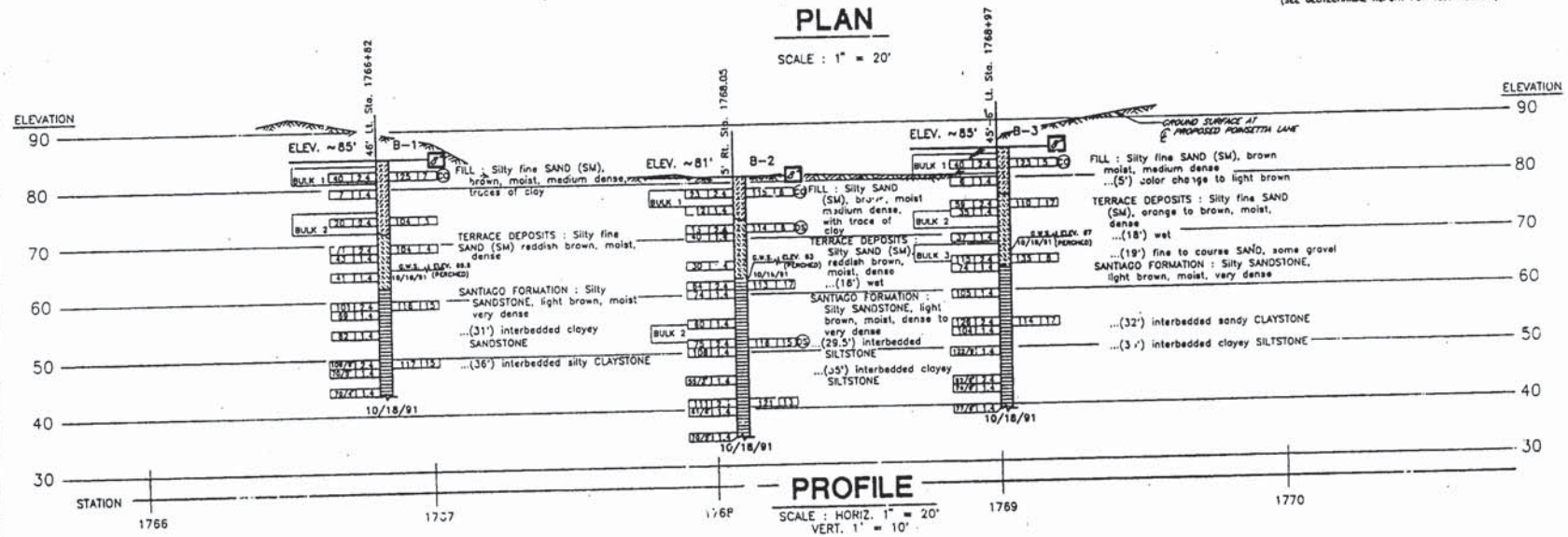
NOTES :

1.) BORINGS LOGGED BY JIM S. HOYLE, STAFF GEOLOGIST.

2.) BENCHMARK- CALTRANS MONUMENT 3-43.8A L & T W/CDH TAG 97.01' LT. STA. 1766+41.48 P.O.T. "A" LINE, ELEVATION 103.80.

3.) IN-SITU SOIL SAMPLES WERE OBTAINED USING A 2.4-INCH I.D., 3.0-INCH O.D., CALIFORNIA SAMPLER.

4.) CC INDICATES CORROSIVITY TEST (pH, RESISTIVITY, CHLORIDES, & SULFATES)
DS INDICATES 3-POINT DIRECT SHEAR TEST (SEE GEOTECHNICAL REPORT FOR TEST RESULTS)



PROFILE

SCALE : HORIZ. 1" = 20'
VERT. 1" = 10'

LEGEND OF EQUIPMENT OPERATIONS

LEGEND OF EARTH MATERIALS

CONSISTENCY DESCRIPTION FOR SOILS

NOTE: CLASSIFICATION OF SOIL MATERIAL AS SHOWN IS THE VISUAL & TACTILE JUDGMENT OF THE ENGINEER OR GEOLOGIST.

DESIGN ENGINEER 4/18/94	DRAWN BY E. G. DELANNOY	FIELD INVESTIGATION Jim S. Hoyle 3/16/94
SIGN OFF DATE	CHECKED BY George P. Hettinger	DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 11276
EA 167841

BRIDGE NO. 57-555
POST MILE R45.57

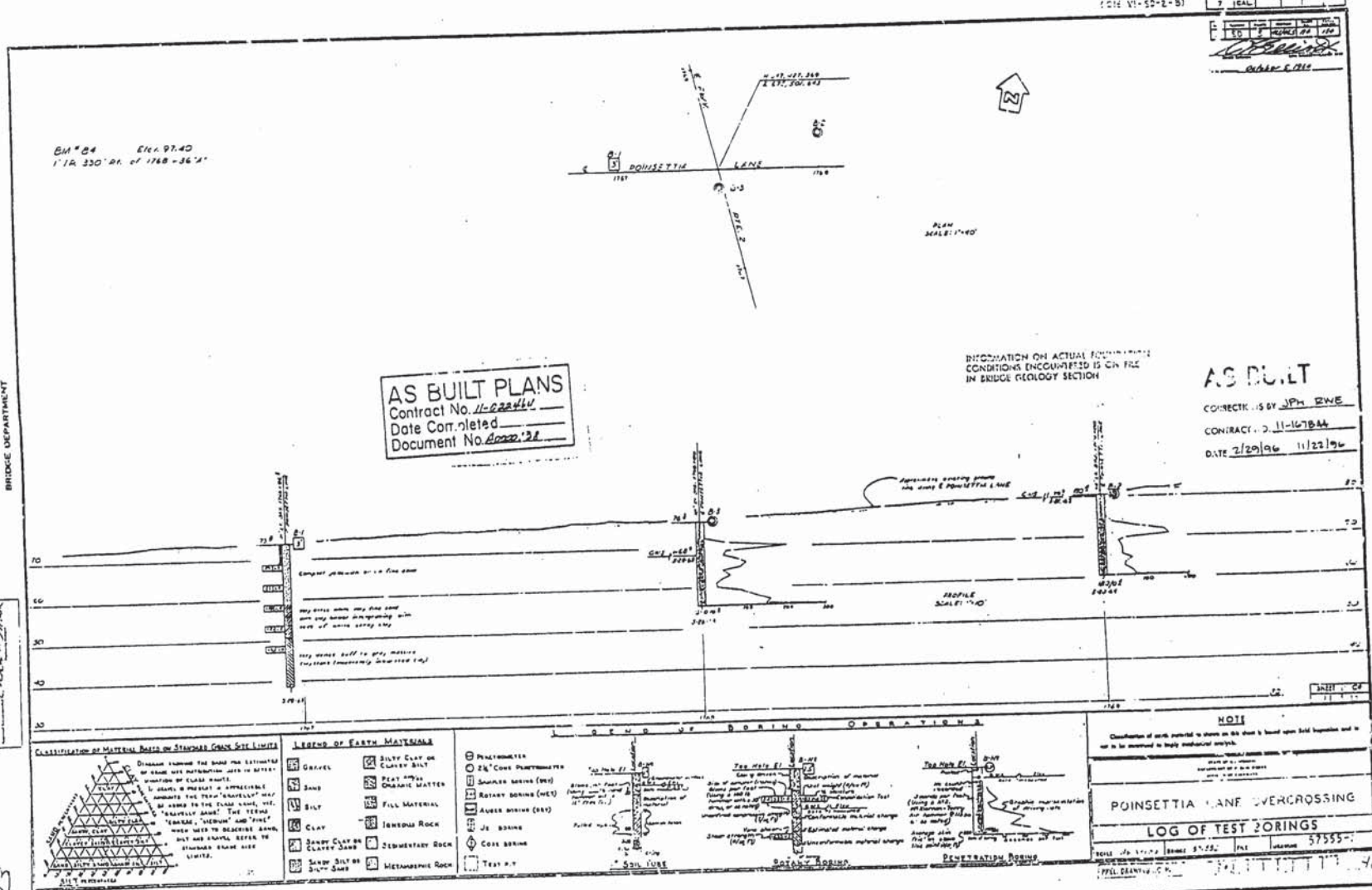
POINSETTIA LANE O.C. (WIDEN)
LOG OF TEST BORINGS

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 17 OF 18

6-6-94 TO ACCOMPANY PLANS DATED	DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
	11	SD	5	R44.9/R45.9	167	167



183

F. M. Jensen DESIGN SUPERVISOR 4/18/94 SIGN OFF DATE	NOTE: ADDITIONAL AS-BUILT FOUNDATION DATA MAY BE AVAILABLE AT THE DIVISION OF NEW TECHNOLOGY, MATERIALS AND RESEARCH 5900 FOLSOM BOULEVARD, SACRAMENTO, CALIFORNIA 95819	DESIGN BY Ruben Trigueros 7/92 DETAILS BY Engineering Drafting Service QUANTITIES BY Ruben Trigueros 10/92	CHECKED Noel Swan 10/92 CHECKED Noel Swan 10/92 CHECKED Engineering Drafting Service	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION ORIGINAL SCALE IN INCHES FOR REDUCED PLANS	Mark A. Imbriani PROJECT ENGINEER CU 11276 EA 167841

BRIDGE NO. 57-555
POST MILE R45.57

POINSETTIA LANE OC (WIDEN)

AS-BUILT LOG OF TEST BORINGS

REVISION DATES (PRELIMINARY STAGE ONLY)

DISREGARD PRINTS BEARING EARLIER REVISION DATES 11/6/92

SHEET 18 OF 18

DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
11	SD	5	R46.6/R47.9	160	161

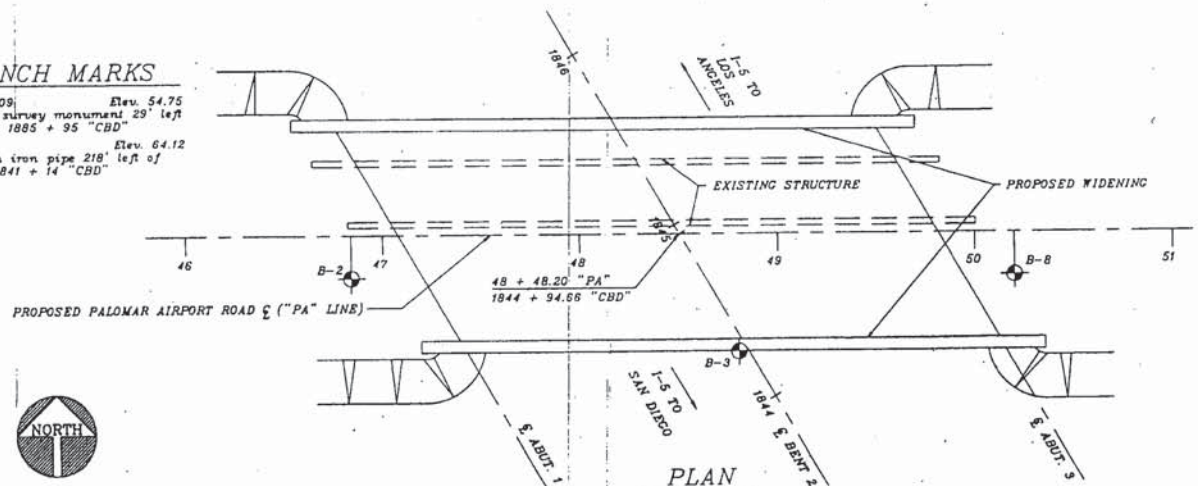
George P. Hattrup
REGISTERED ENGINEER CIVIL
KLEINFELDER INC.
9555 CHESAPEAKE DR. SUITE 101
SAN DIEGO, CALIFORNIA 92123
4-20-92
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER GEORGE P. HATTRUP No. C43979 Exp. 3-31-93 CIVIL STATE OF CALIFORNIA

BENCH MARKS

B. M. #AS 209 Elev. 54.75
Aerial survey monument 29' left of Sta. 1885 + 95 "CBD"

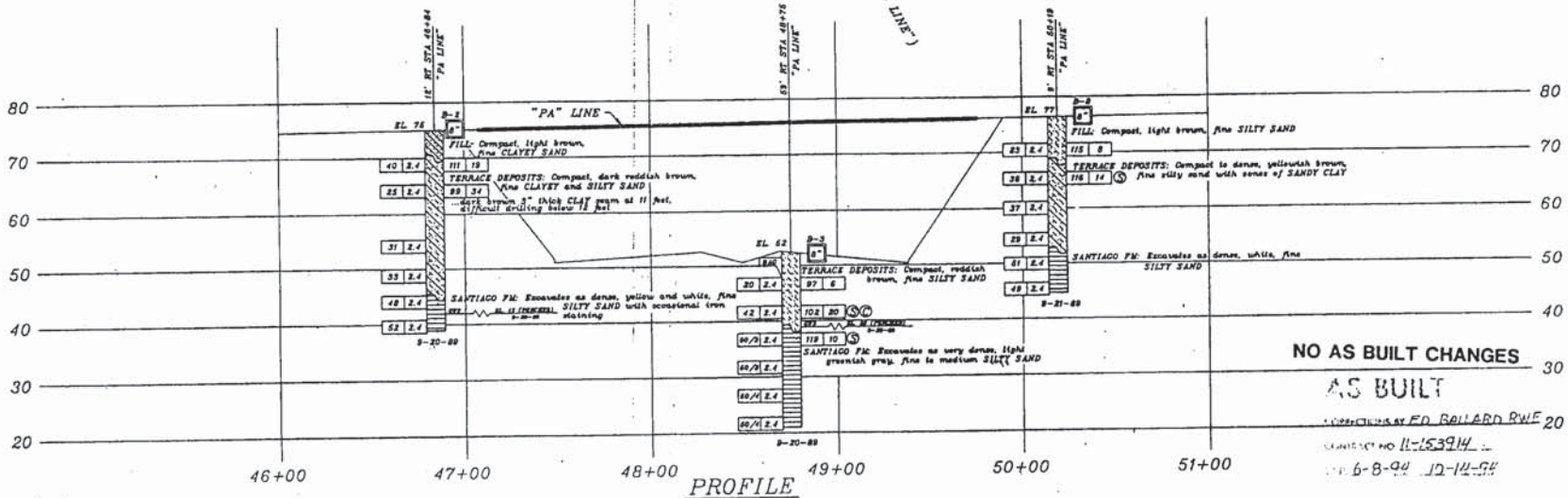
B. M. #92 Elev. 64.12
1 Inch iron pipe 218' left of Sta. 1841 + 14 "CBD"



PLAN
1" = 30'

NOTES:

1) In-situ soil samples were obtained using a 2.4-inch I.D., 3.0-inch O.D. CALIFORNIA SAMPLER with brass rings.
2) (S) indicates 3-point shear test
(C) indicates consolidation test
(see geotechnical report for test results)
3) Locations and logs of other test borings within the vicinity of the interchange are given in the Kleinfelder "Final Report of Geotechnical Investigation" dated March 12, 1991, revised May 29, 1991 (Proj. No. 61-1417-03)
4) Field study performed by Debbie A. Carroll, Staff Geologist.



PROFILE
HORIZ: 1" = 30'
VERT: 1" = 10'

NO AS BUILT CHANGES

AS BUILT
CORRECTIONS BY ED BALLARD RWE
CONTRACT NO 11-153914
6-8-94 10-11-94

Bridge Designer 11/6/91 Date

DIVISION OF: NEW TECHNOLOGY, MATERIALS AND RESEARCH	ENGINEERING GEOLOGY BRANCH
DRAWN BY	Jeff Rhine
CHECKED BY	George P. Hattrup

BRIDGE NO.	PALOMAR AIRPORT ROAD O.C. (WIDEN)
57-556	
POST MILE R47.0	LOG OF TEST BORINGS

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU = 11203
EA = 153911

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 17 OF 18

LEGEND OF BORING OPERATIONS

LEGEND OF EARTH MATERIALS

CONSISTENCY CLASSIFICATION

NOTE: Classification of soils required as shown on the sheet is based upon the modified Unified Classification system.

TL 0062 REV 8/89

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
11	SD	5	R46.6/R47.9	161	161

REGISTERED CIVIL ENGINEER

4-20-92
PLANS APPROVAL DATE

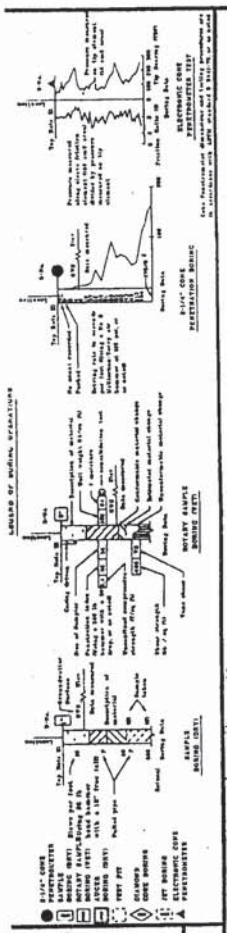
REGISTERED PROFESSIONAL ENGINEER — M.A. Imbrian — No. C36634 — Exp. 6-30-92 — CIVIL — STATE OF CALIFORNIA

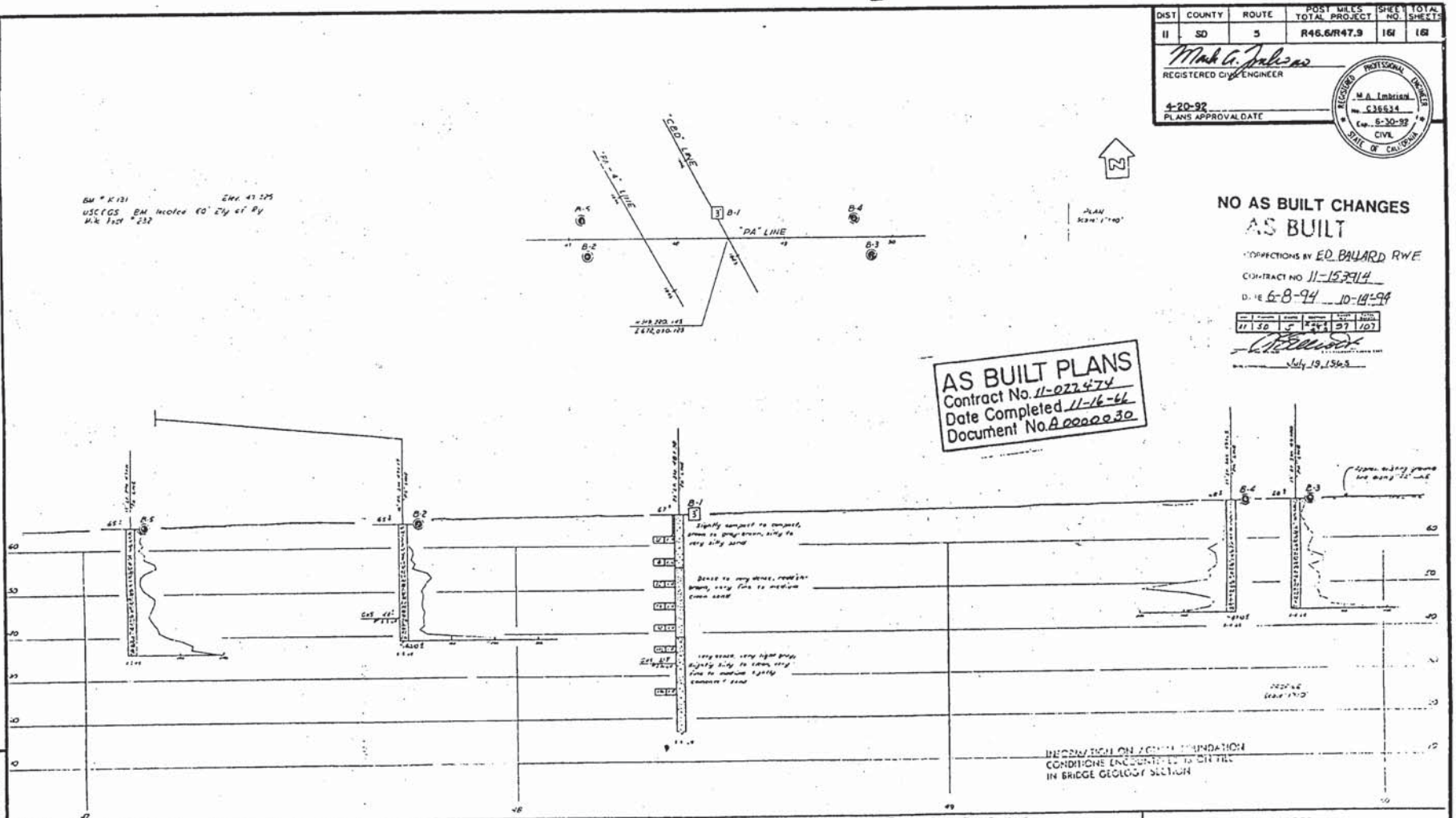
NO AS BUILT CHANGES
AS BUILT
CORRECTIONS BY ED BALLARD RWE
CONTRACT NO 11-157914
DATE 6-8-94 10-14-94

11	SD	5	R46.6 R47.9	97	107

July 19, 1968

AS BUILT PLANS
Contract No. 11-022474
Date Completed 11-16-66
Document No. 8000030





CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTIONS USED IN DETERMINATION OF CLASS NAMES. IF GRAVEL IS PRESENT IN APPRECIABLE AMOUNTS THE TERM "GRAVELLY" MAY BE ADDED TO THE CLASS NAME, VIZ. "GRAVELLY SAND." THE TERMS "COARSE", "MEDIUM" AND "FINE" WHEN USED TO DESCRIBE SAND, SILT AND GRAVEL REFER TO STANDARD GRADE SIZE LIMITS.

LEGEND OF EARTH MATERIALS

- GRAVEL
- SAND
- SILT
- CLAY
- SANDY CLAY OR CLAYEY SAND
- SANDY SILT OR SILTY SAND
- SILTY CLAY OR CLAYEY SILT
- PEAT AND ORGANIC MATTER
- FILL MATERIAL
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

LEGEND OF BORING OPERATIONS

- PENETROMETER
- 2½" CONE PENETROMETER
- SAMPLER BORING (DRY)
- ROTARY BORING (WET)
- AUGER BORING (DRY)
- JET BORING
- CORE BORING
- TEST PIT

1" SOIL TUBE — ROTARY BORING — PENETRATION BORING

NOTE

Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

PALOMAR AIRPORT ROAD OVERCROSSING

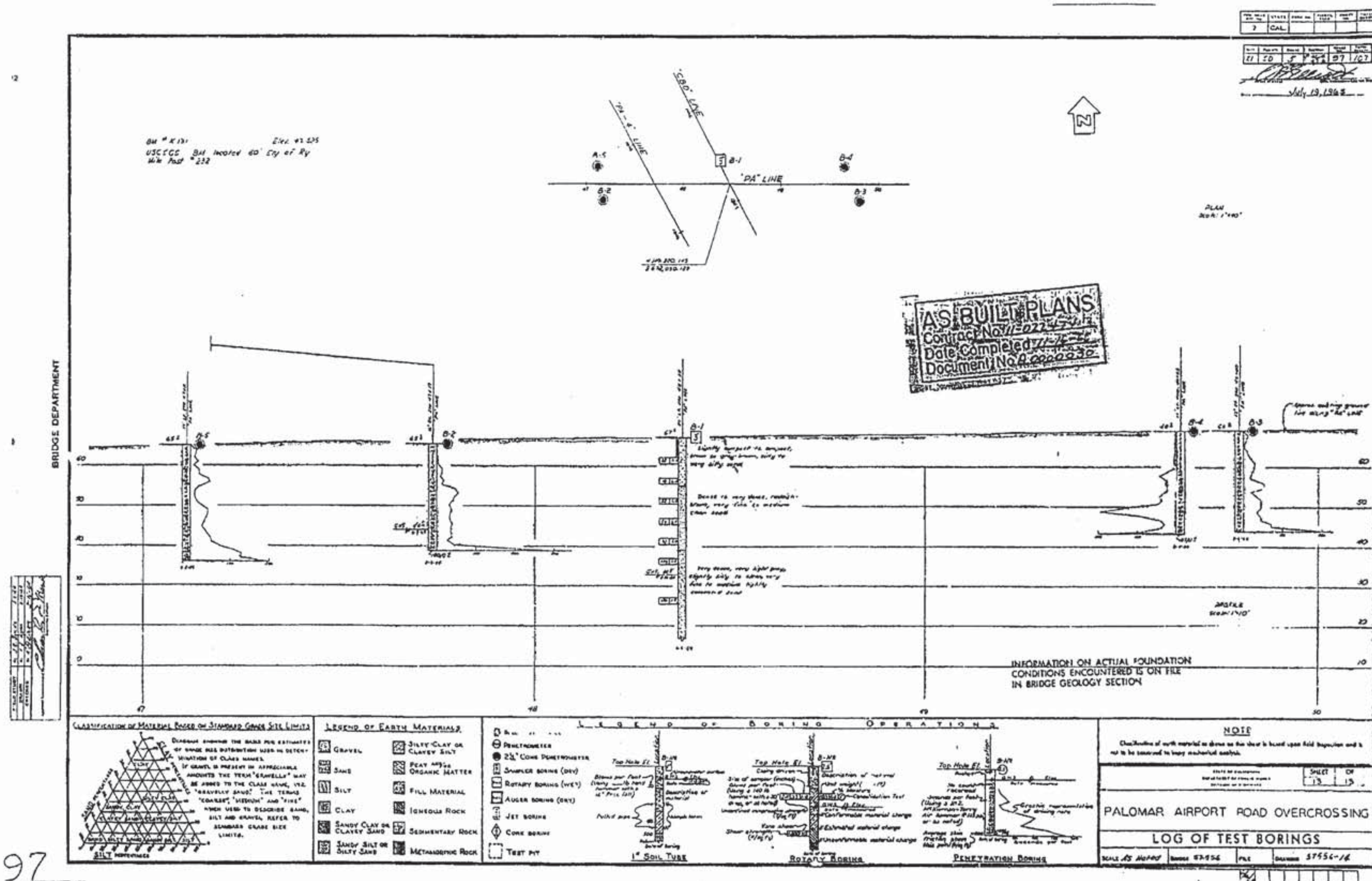
LOG OF TEST BORINGS

DRAWN BY		FIELD INVESTIGATOR	
CHECKED BY		DATE	

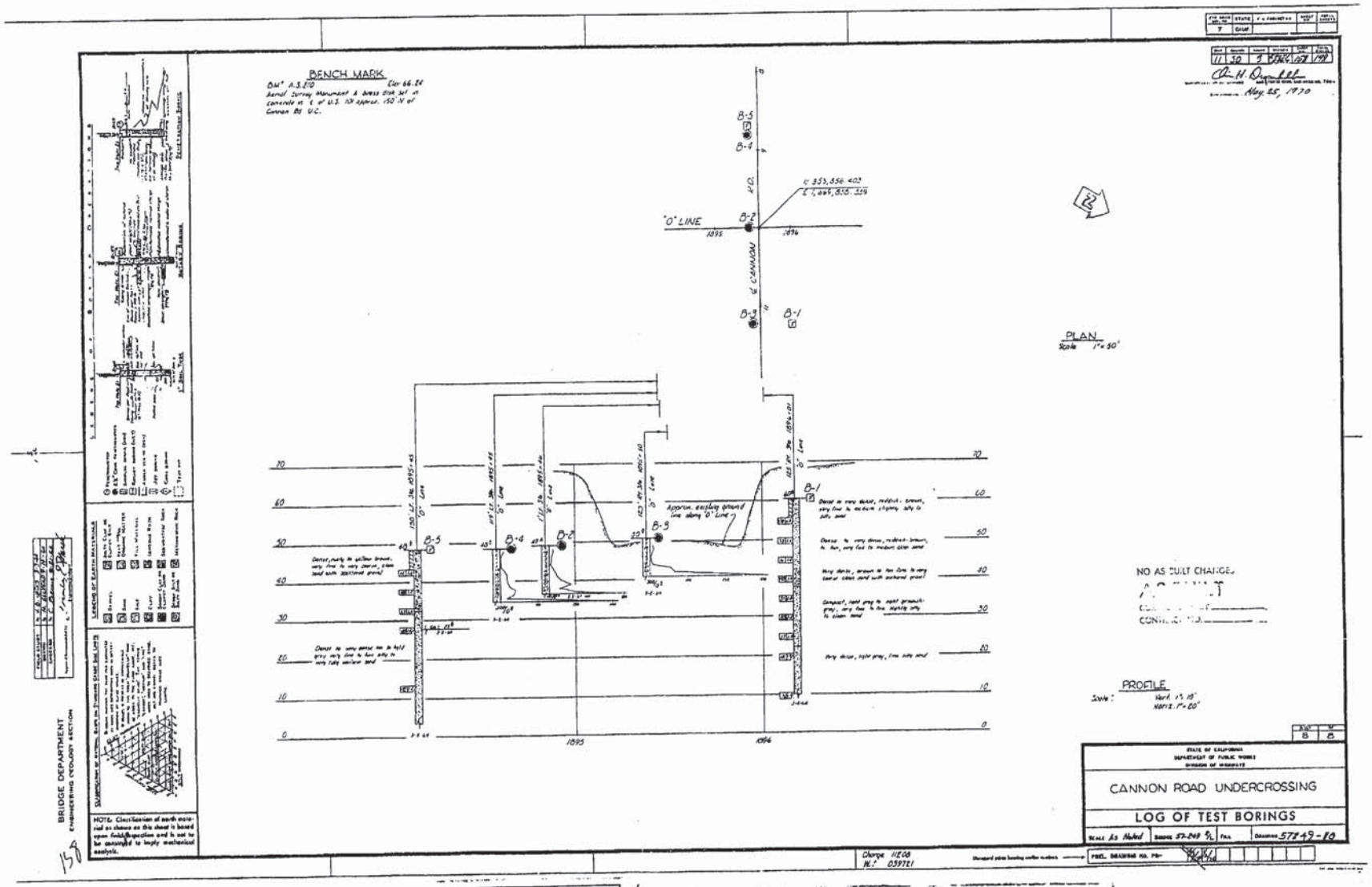
ORIGINAL SCALE IN INCHES — CU 11203

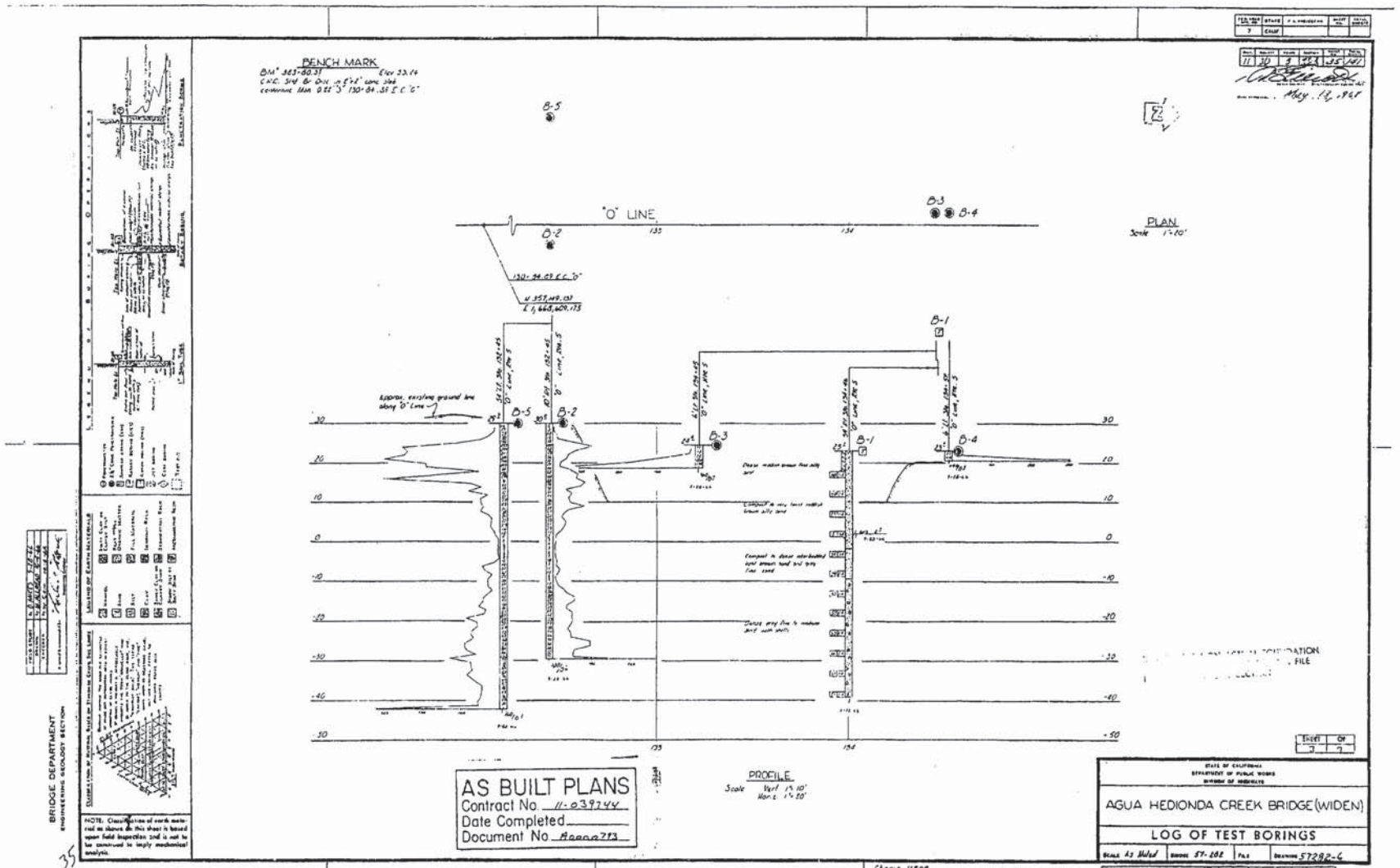
BRIDGE NO.	PALOMAR AIRPORT ROAD O.C. (WIDEN)
57-556	
POST MILE R47.0	LOG OF TEST BORINGS

DISREGARD PRINTS BEARING — REVISION DATES (PRELIMINARY STAGE ONLY) — SHEET OF



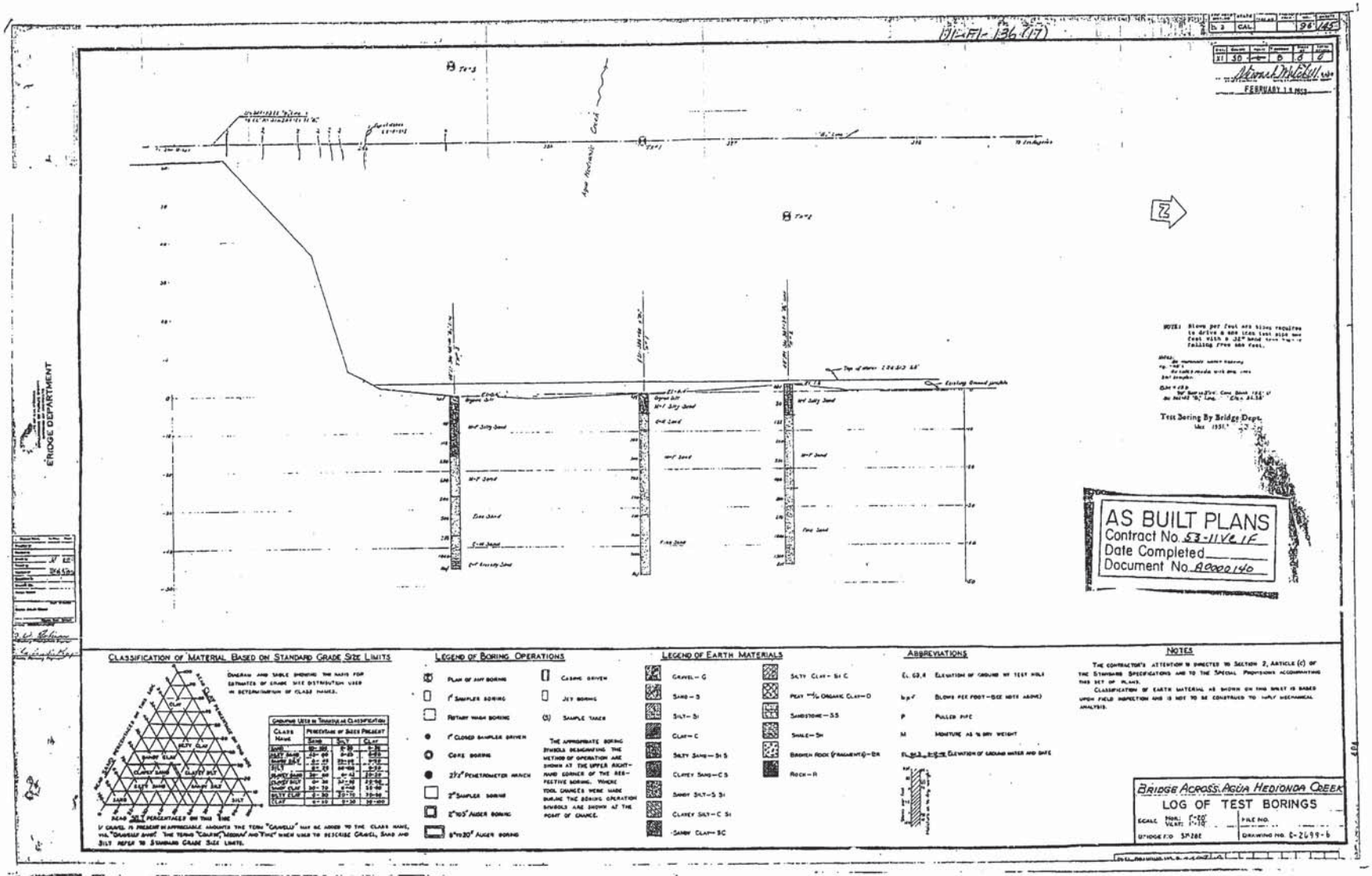
'CBD' LINE
'PA-4' LINE
'PA' LINE
B-1
B-2
B-3
B-4
A-5
PLAN
PROFILE
AS BUILT PLANS
Contract No.
Date Completed
Document No.
INFORMATION ON ACTUAL FOUNDATION CONDITIONS ENCOUNTERED IS ON FILE IN BRIDGE GEOLOGY SECTION
BRIDGE DEPARTMENT
CLASSIFICATION OF MATERIALS BASED ON STANDARD GRADE SIZE LIMITS
LEGEND OF EARTH MATERIALS
GRAVEL
SAND
SILT
CLAY
SANDY CLAY OR CLAYEY SAND
SANDY SILT OR SILTY SAND
SILTY CLAY OR CLAYEY SILT
PEAT AND/OR ORGANIC MATTER
FILL MATERIAL
IGNEOUS ROCK
SEDIMENTARY ROCK
METAMORPHIC ROCK
LEGEND OF BORING OPERATIONS
PENETROMETER
2½" CONE PENETROMETER
SAMPLER BORING (DRY)
ROTARY BORING (WET)
AUGER BORING (DRY)
JET BORING
CONE BORING
TEST PIT
1" SOIL TUBE
ROTARY BORING
PENETRATION BORING
NOTE
SHEET 13 OF 13
PALOMAR AIRPORT ROAD OVERCROSSING
LOG OF TEST BORINGS
57-556
57556-16
July 19, 1968
CAL.
97


BENCH MARK
BM# A.S.210
Elev 66.24
Aerial Survey Monument A brass disk set in concrete at ℄ of U.S. 101 approx. 150' N of Cannon Rd U.C.
"O" LINE
℄ CANNON RD.
B-1
B-2
B-3
B-4
B-5
PLAN
Scale 1" = 50'
PROFILE
Scale: Vert. 1" = 10'
Horiz. 1" = 20'
NO AS BUILT CHANGES
BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
CANNON ROAD UNDERCROSSING
LOG OF TEST BORINGS
Scale As Noted
Drawing 57249-10
Charge 11208
W.I. 039721
Date 4/24/73
Title Sr. Mech.
AS BUILT PLANS
Contract No. 11.039724
Date Completed
Document No. A0002483



I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE March 26, 1971 SIGNATURE [signature] TITLE Highway Mineralogist



FEBRUARY 1 9 1963
Test Boring By Bridge Dept.
AS BUILT PLANS
Contract No. 53-11VC1F
Date Completed
Document No. A0000140
BRIDGE DEPARTMENT
CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS
LEGEND OF BORING OPERATIONS
LEGEND OF EARTH MATERIALS
ABBREVIATIONS
NOTES
BRIDGE ACROSS AGUA HEDIONDA CREEK
LOG OF TEST BORINGS

DIST	COUNTY	ROUTE	TOTAL PROJECT	NO	SHEETS
11	SD	5	R49.1/R54.0	93	137

REGISTERED ENGINEER – CIVIL

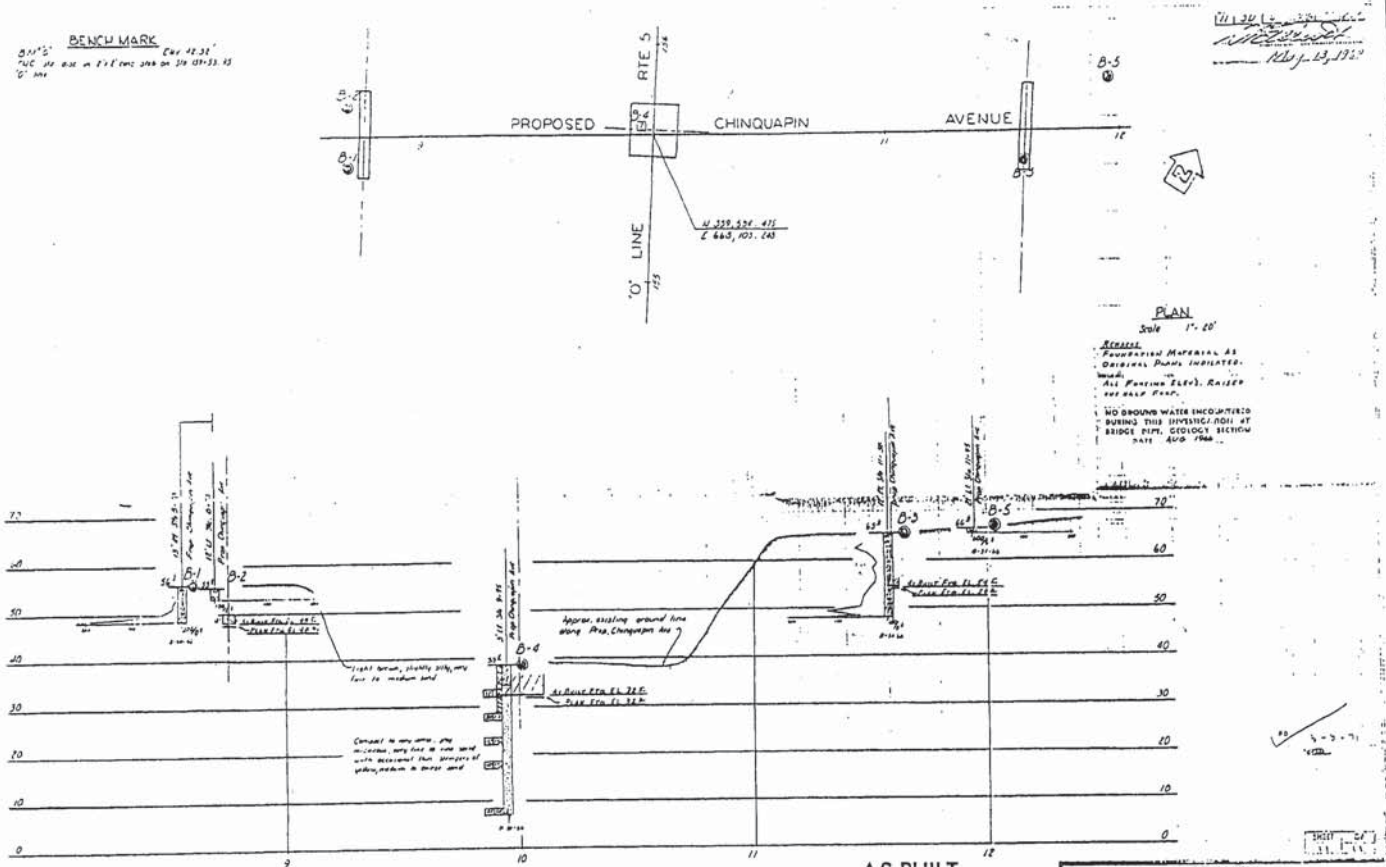
9-9-96
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER JAMES J. STOW No. C25081 Exp. 12/31/97 CIVIL STATE OF CALIFORNIA

ROBERT BEIN, WILLIAM FROST AND ASSOCIATES
14725 ALTON PARKWAY
IRVINE, CA. 92718

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF ELECTRONIC COPIES OF THIS PLAN SHEET

NOTE:
THE AS-BUILT LOG OF TEST BORING SHEETS WERE USED TO PREPARE THE GEOTECHNICAL REPORT.



AS BUILT
CORRECTIONS BY
CONTRACT NO. 11-059744 (302)
DATE 3/21/96

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

CHINQUAPIN AVENUE OVERCROSSING

LOG OF TEST BORINGS

Scale As Noted | Bridge 57-0672 | Unit | Drawing 57-0672-4

Charge 11208
W.B. 039721

AS BUILT
CORRECTIONS BY CHRISTIAN JENSEN DOKKEN ENGR.
CONTRACT NO. 11-206904
DATE 9-2-97
NO AS BUILT CHANGES

EARTHQUAKE RETROFIT PROJECT NO. 284

CHINQUAPIN AVE OVERCROSSING

AS-BUILT LOG OF TEST BORINGS

DESIGN OVERSIGHT R.BRENT LEMON
SIGNOFF DATE 8-21-96

NOTE:
ADDITIONAL AS-BUILT FOUNDATION DATA MAY BE AVAILABLE AT THE OFFICE OF TRANSPORTATION MATERIALS AND RESEARCH 5900 FOLSOM BOULEVARD, SACRAMENTO, CALIFORNIA 95819

DESIGN	BY M.PALASKAS	CHECKED E.D.HENDERSON	
DETAILS	BY J.SALDANA	CHECKED H.MONTOYA	
QUANTITIES	BY J.SALDANA	CHECKED J.LING	

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

P. YOUNG
PROJECT ENGINEER

CU 11273
EA 206901

BRIDGE NO. 57-0672
POST MILE 49.12

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGES ONLY) | SHEET 5 OF 5

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

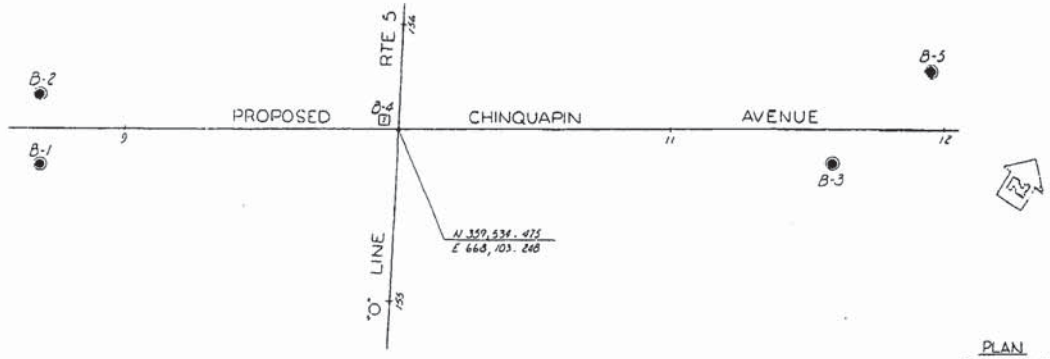
32235d05.dwg

DIST.	COUNTY	ROUTE	POSTMILE	SHEET NO.	TOTAL SHEETS
11	SD	5	19.2	46	141

May 13, 1968

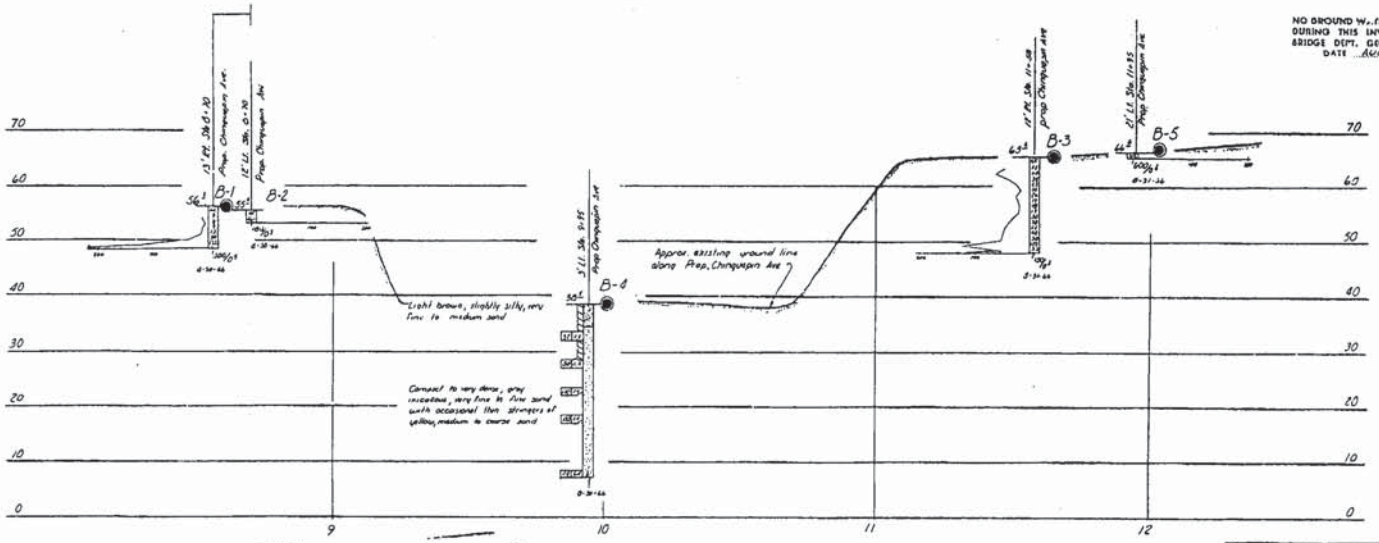
BENCH MARK

B.M. "O" Elev. 42.32'
CHC 3½" disc in 2'x2' conc slab on Sta. 139+53.95 "O" line



PLAN
Scale 1" = 20'

NO GROUND WATER ENCOUNTERED DURING THIS INVESTIGATION BY BRIDGE DEPT. GEOLOGY SECTION
DATE AUG. 1966



PROFILE
Scale Vert. 1" = 10'
Horiz. 1" = 20'

AS BUILT PLANS
Contract No. 11-039744
Date Completed
Document No. A0000773

DEVIATIONS ON ACTUAL FOUNDATION
[illegible] ON FILE

SHEET	OF
11	11

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

CHINQUAPIN AVENUE OVERCROSSING

LOG OF TEST BORINGS

SCALE As Noted	BRIDGE 57-672	FILE	DRAWING 57672-7

Charge 11208
W.A. 039721

Underground plan boring center numbers

PREL. DRAWING No. PR-

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE March 21, 1972 SIGNATURE [illegible] TITLE Highway Reproduction Officer

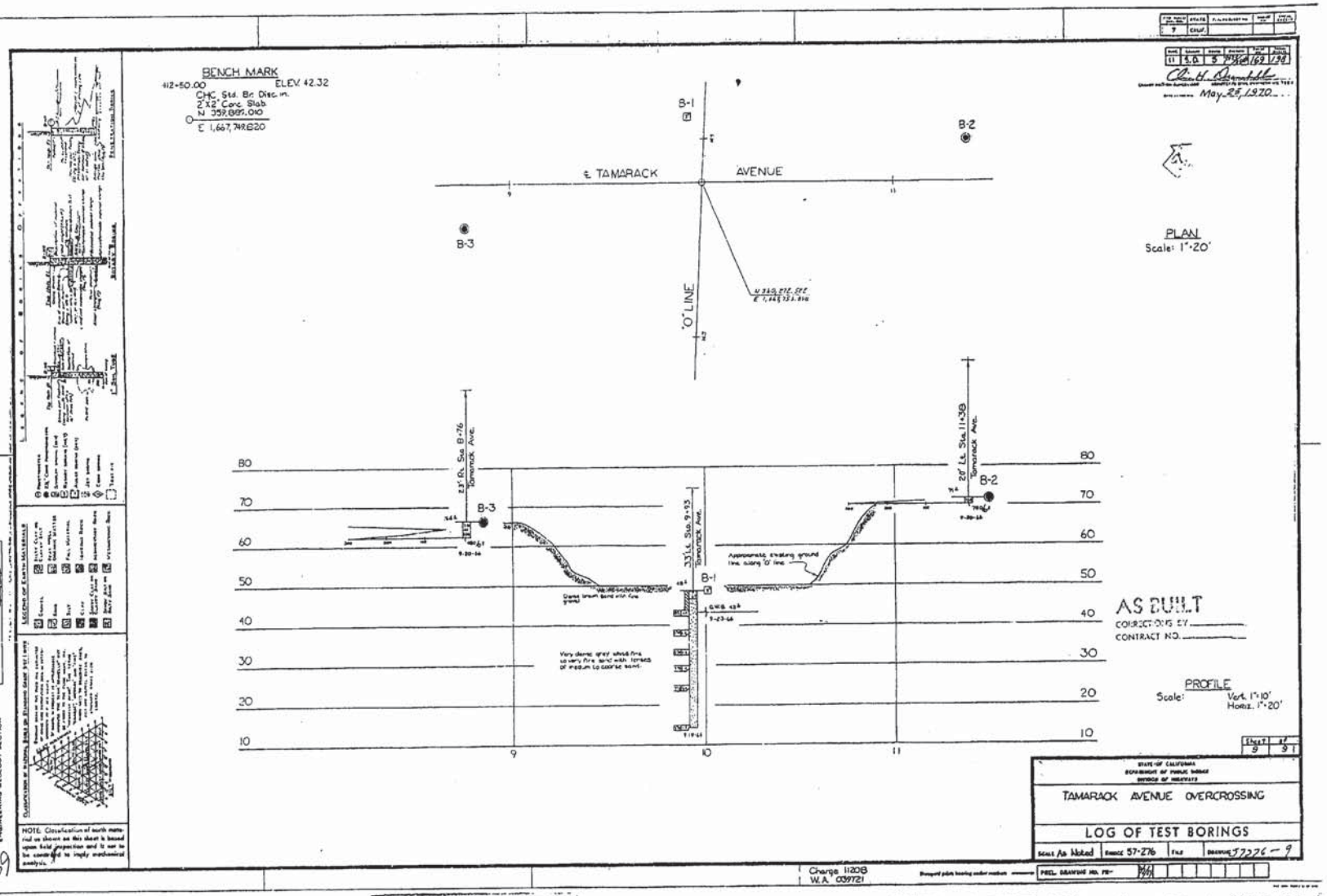
LEGEND OF EARTH MATERIALS

CLASSIFICATION OF MATERIAL BASED ON STANDARD CLASS SIZE LIMITS

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

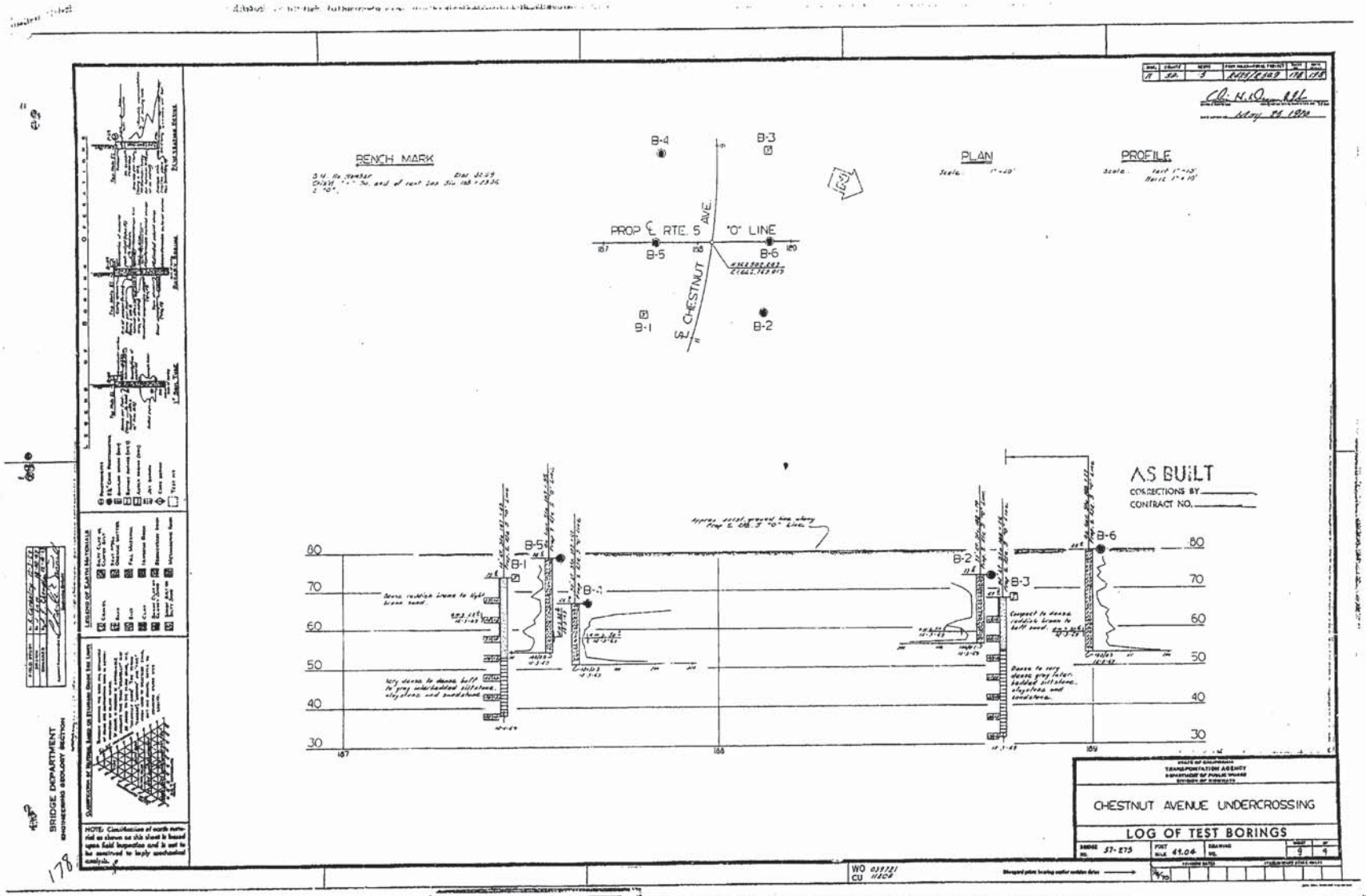
BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

46



AS BUILT PLANS
Contract No. 11-039724
Date Completed
Document No. A0002483

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.
DATE 4/24/73 SIGNATURE [signature] TITLE Sr. Mech.

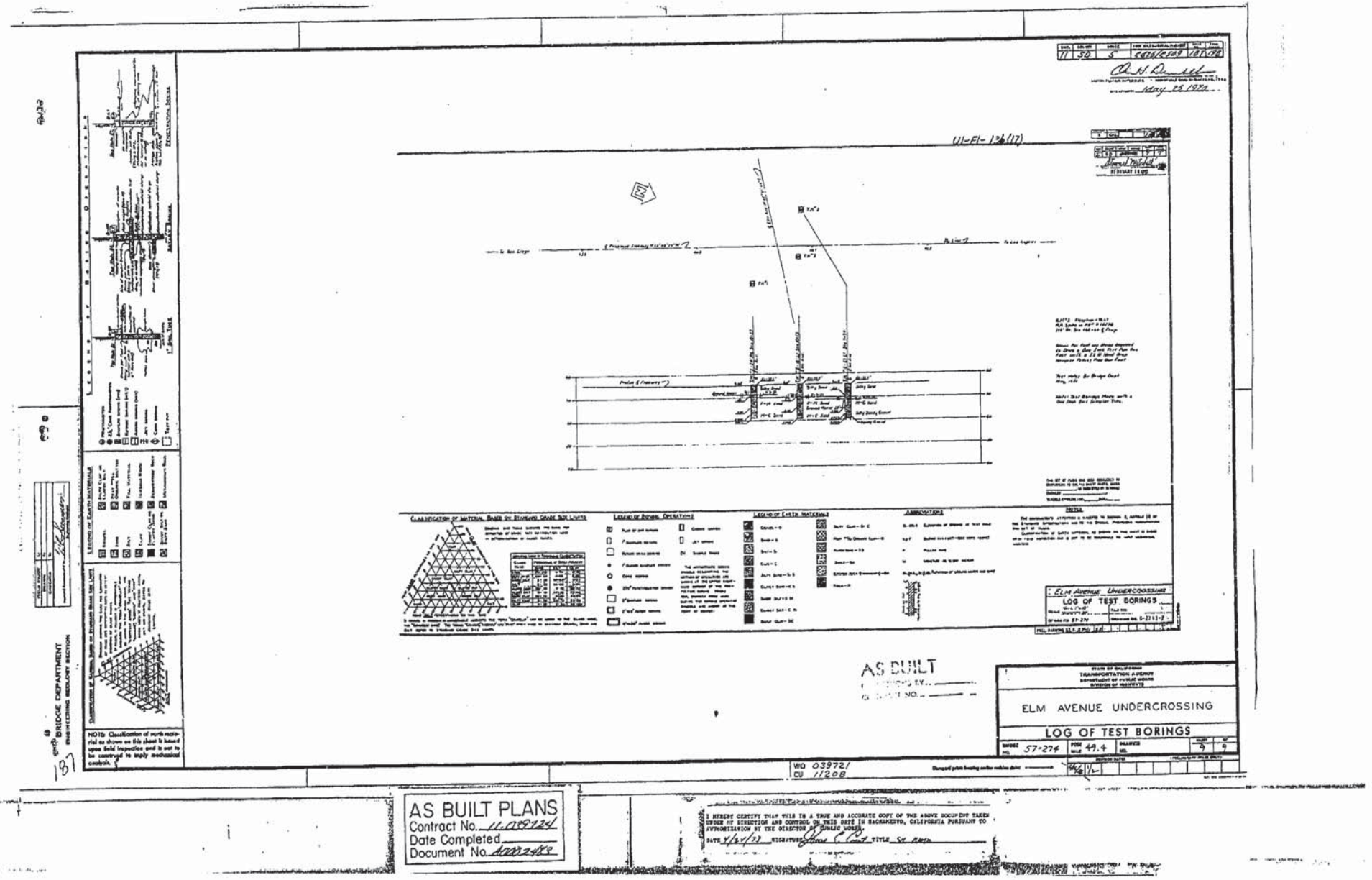


178

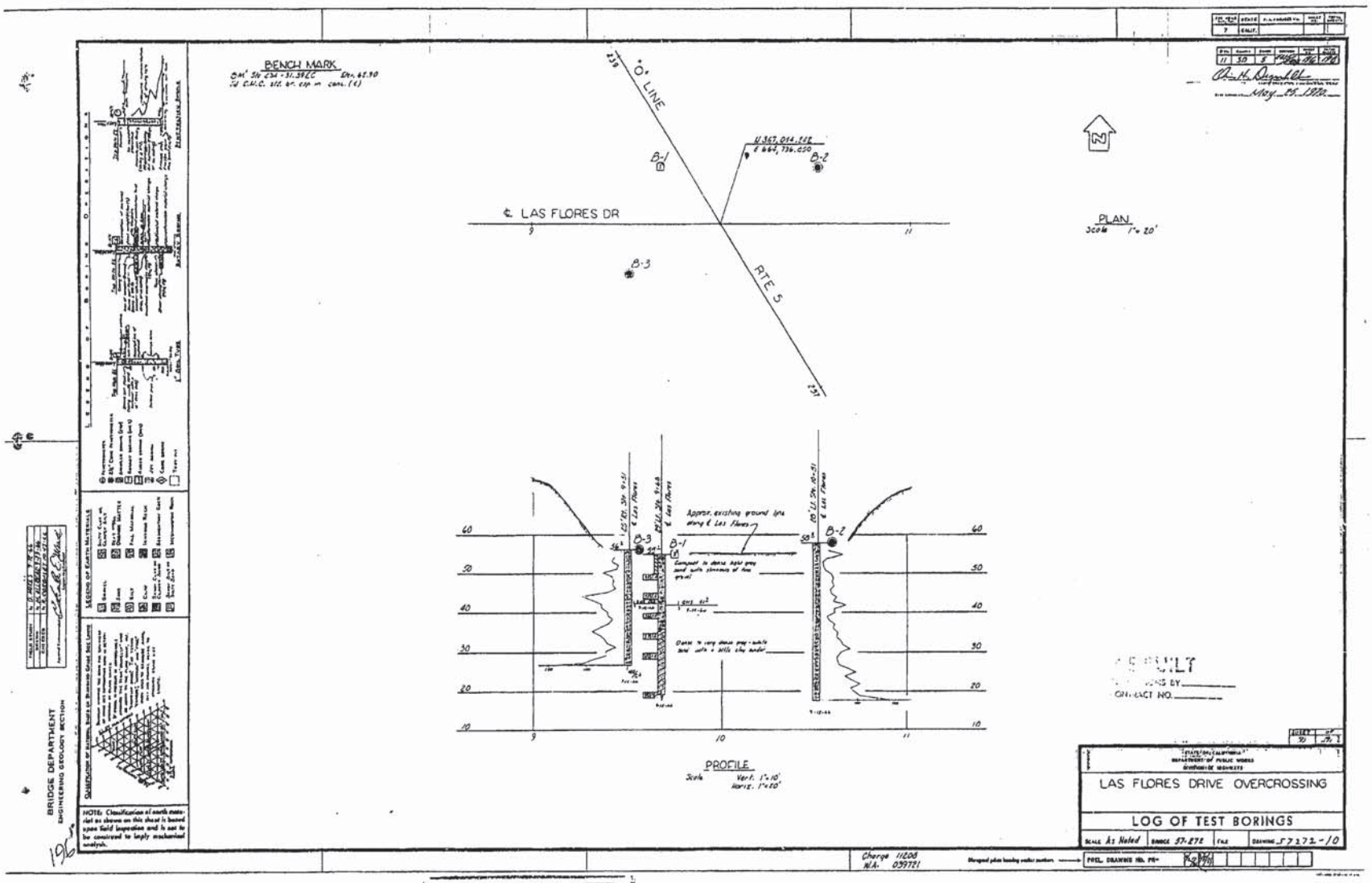
AS BUILT PLANS
Contract No. 11.039724
Date Completed
Document No. [illegible]

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE 4/24/77 SIGNATURE [signature] TITLE [illegible]

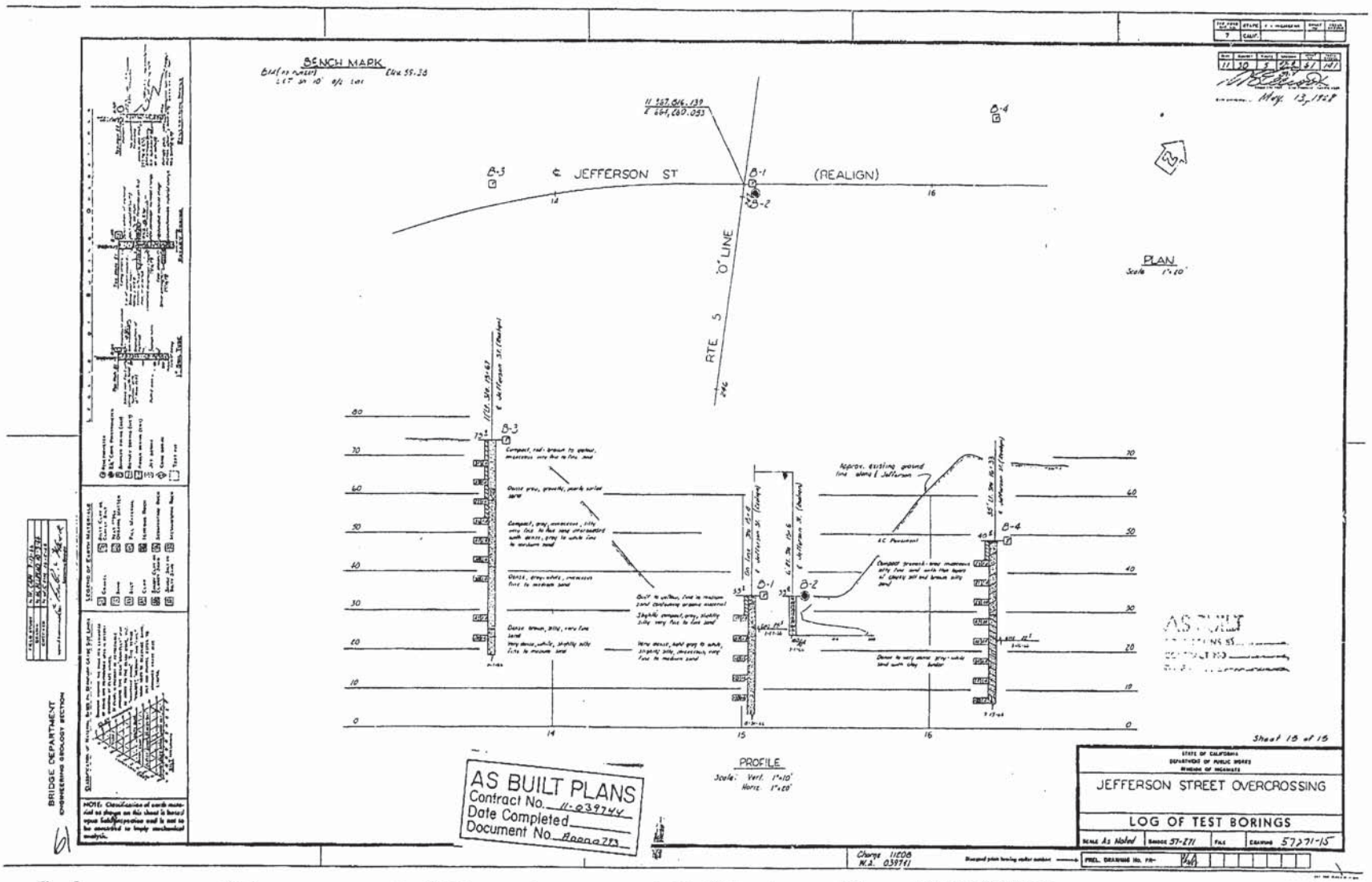


Carlsbad Village Dr. UC



AS BUILT PLANS
Contract No. 11.039724
Date Completed
Document No. A0002483

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.
DATE 4/24/73 SIGNATURE [signature] TITLE Sr. Mech.



I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE [illegible] SIGNATURE [illegible] TITLE [illegible]

DIST	COUNTY	ROUTE	TOTAL PROJECT	NO	SHEETS
11	SD	5	R49.1/R54.0	88	137

REGISTERED ENGINEER - CIVIL

9-9-96

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER JAMES J. STONE No. C25081 Exp. 12/31/97 CIVIL STATE OF CALIFORNIA

ROBERT BEIN, WILLIAM FROST AND ASSOCIATES
14725 ALTON PARKWAY
IRVINE, CA. 92718

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NOTE:
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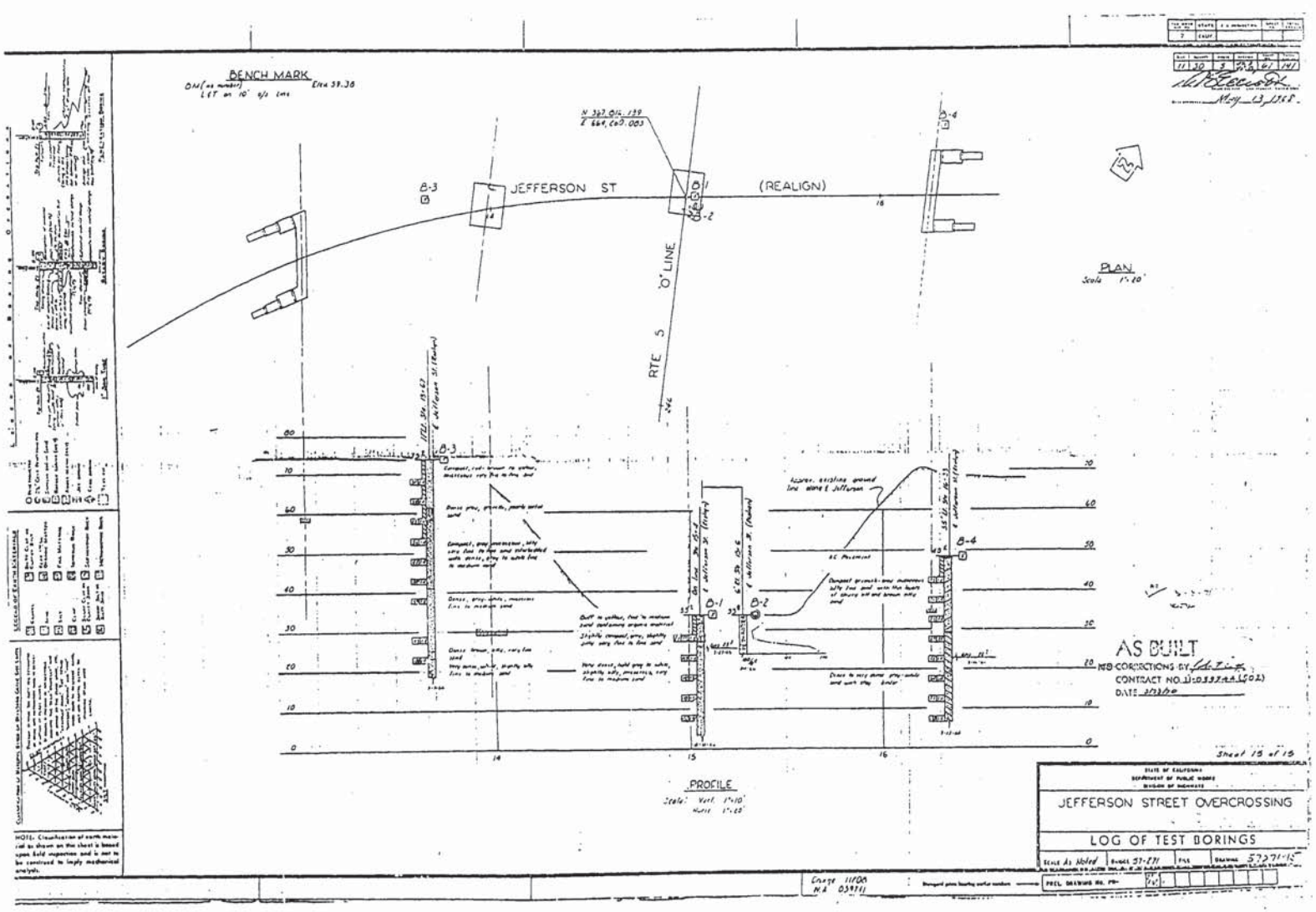


AS BUILT
CORRECTIONS BY CHRISTIAN JENSEN DOKKEN ENGR.
CONTRACT NO. 11-206904
DATE 9-2-97
NO AS BUILT CHANGES

EARTHQUAKE RETROFIT PROJECT NO. 284

JEFFERSON ST OVERCROSSING

AS-BUILT LOG OF TEST BORINGS

DESIGN	A.KAMRANY/H.MONTOYA	CHECKED	N.AGBAYANI
DETAILS	J.SALDANA	CHECKED	H.MONTOYA
QUANTITIES	J.LING	CHECKED	R.ROLLINS

NOTE:
ADDITIONAL AS-BUILT FOUNDATION DATA MAY BE AVAILABLE AT THE OFFICE OF TRANSPORTATION MATERIALS AND RESEARCH 5900 FOLSOM BOULEVARD, SACRAMENTO, CALIFORNIA 95819

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

P. YOUNG
PROJECT ENGINEER

CU 11273
EA 206901
XXXXXX

BRIDGE NO. 57-0271
POST MILE 50.86

DISREGARD PRINTS BEARING EARLIER REVISION DATES

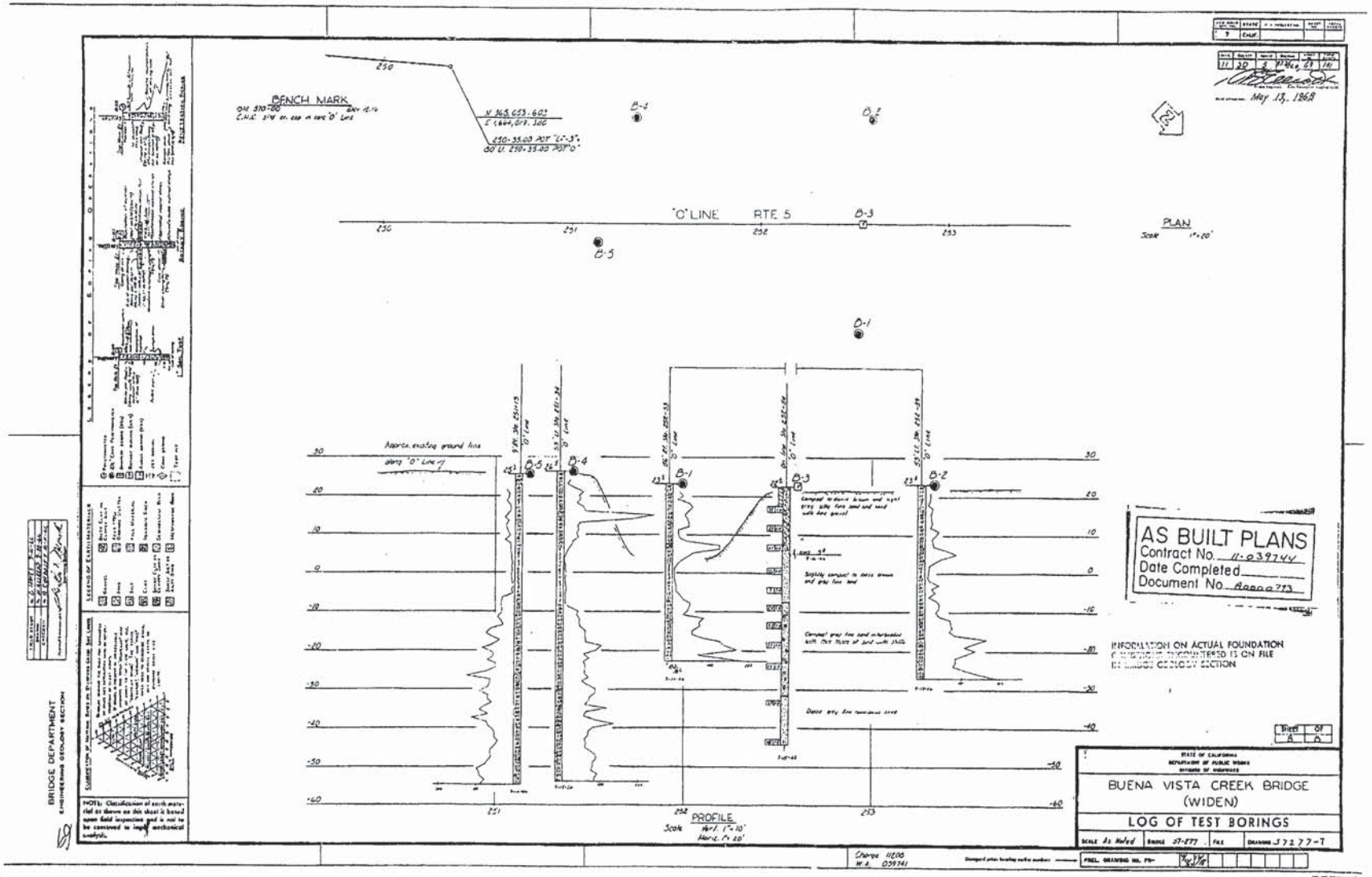
REVISION DATES (PRELIMINARY STAGES ONLY)

SHEET 7 OF 7

32235c06.dwg

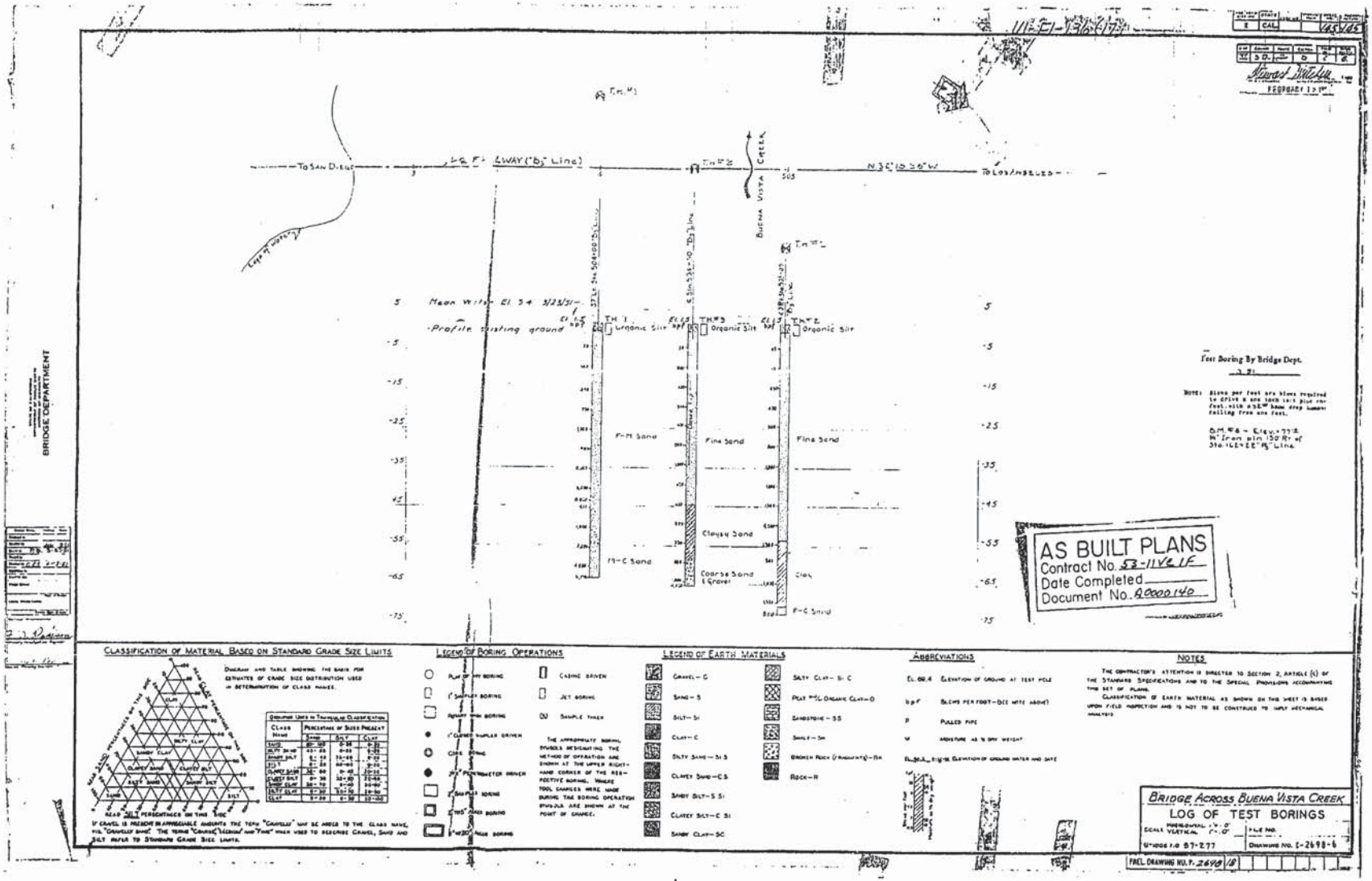
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

IGN OVERSIGHT
RENT LEMON
OFF DATE
8-21-96

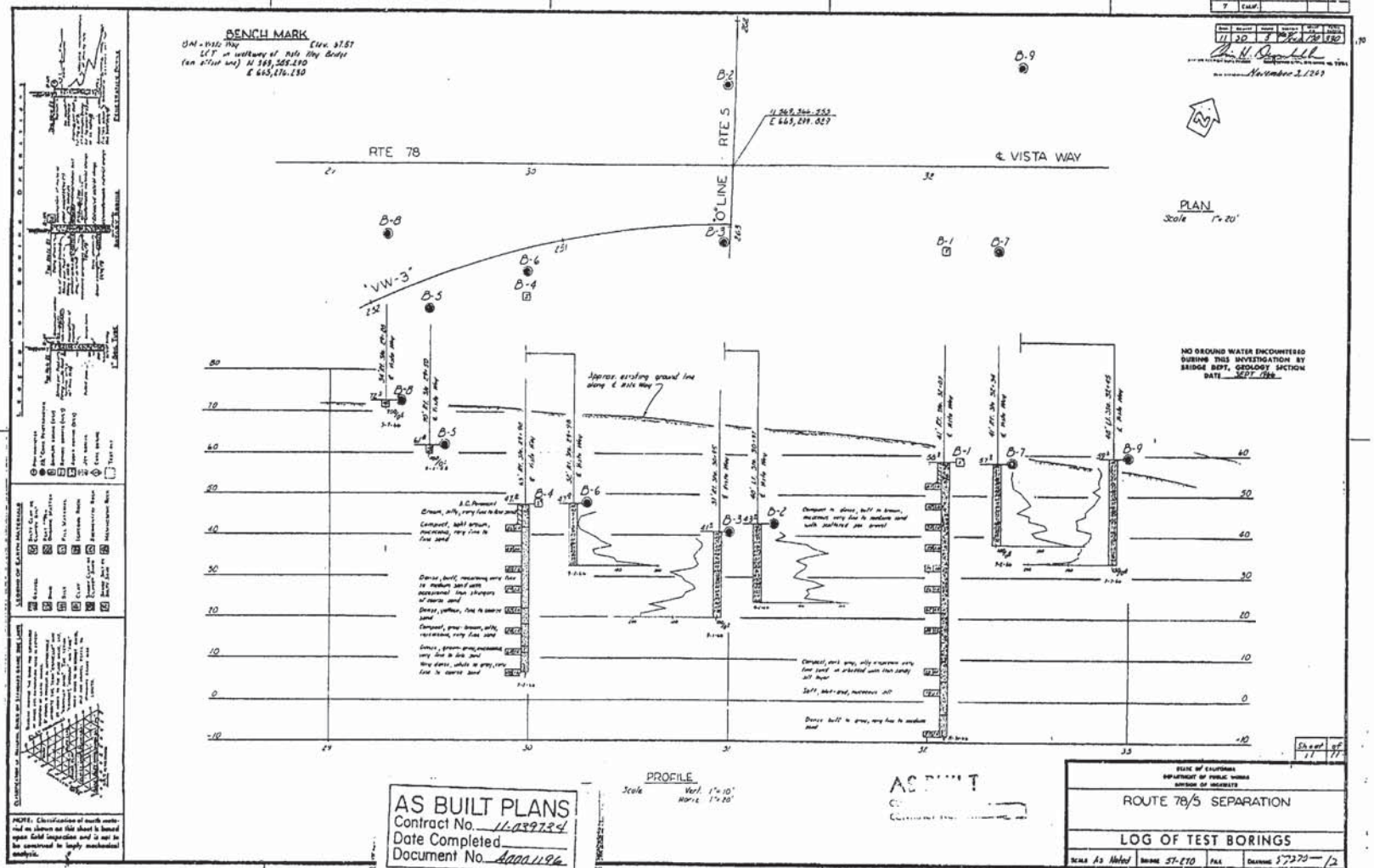


I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE [illegible] SIGNATURE [illegible] TITLE [illegible]

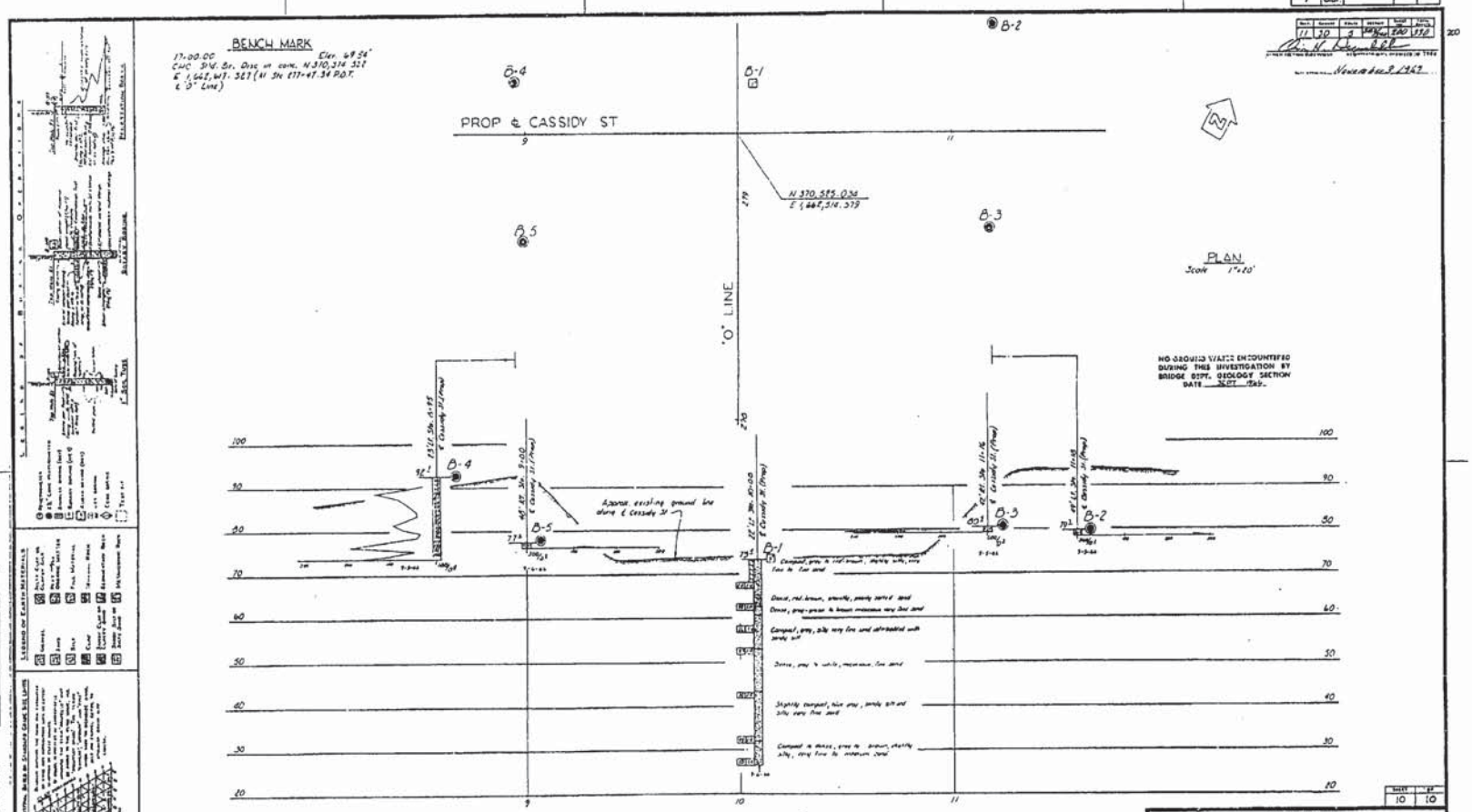


BRIDGE DEPARTMENT
To San Diego
To Los Angeles
Buena Vista Creek
Mean Water El. 3.4 3/23/51
Profile existing ground
Organic Silt
Fine Sand
Clayey Sand
Coarse Sand & Gravel
Clay
F-C Sand
M-C Sand
Foot Boring By Bridge Dept.
AS BUILT PLANS
Contract No. 53-11VE1F
Date Completed
Document No. A0000140
Classification of Material Based on Standard Grade Size Limits
Legend of Boring Operations
Legend of Earth Materials
Abbreviations
Notes
Bridge Across Buena Vista Creek
LOG OF TEST BORINGS
Scale Horizontal 1" = 0' Vertical 1" = 0'
File No.
Drawing No. S-2698-6
Fuel Drawing No. F-2698 18



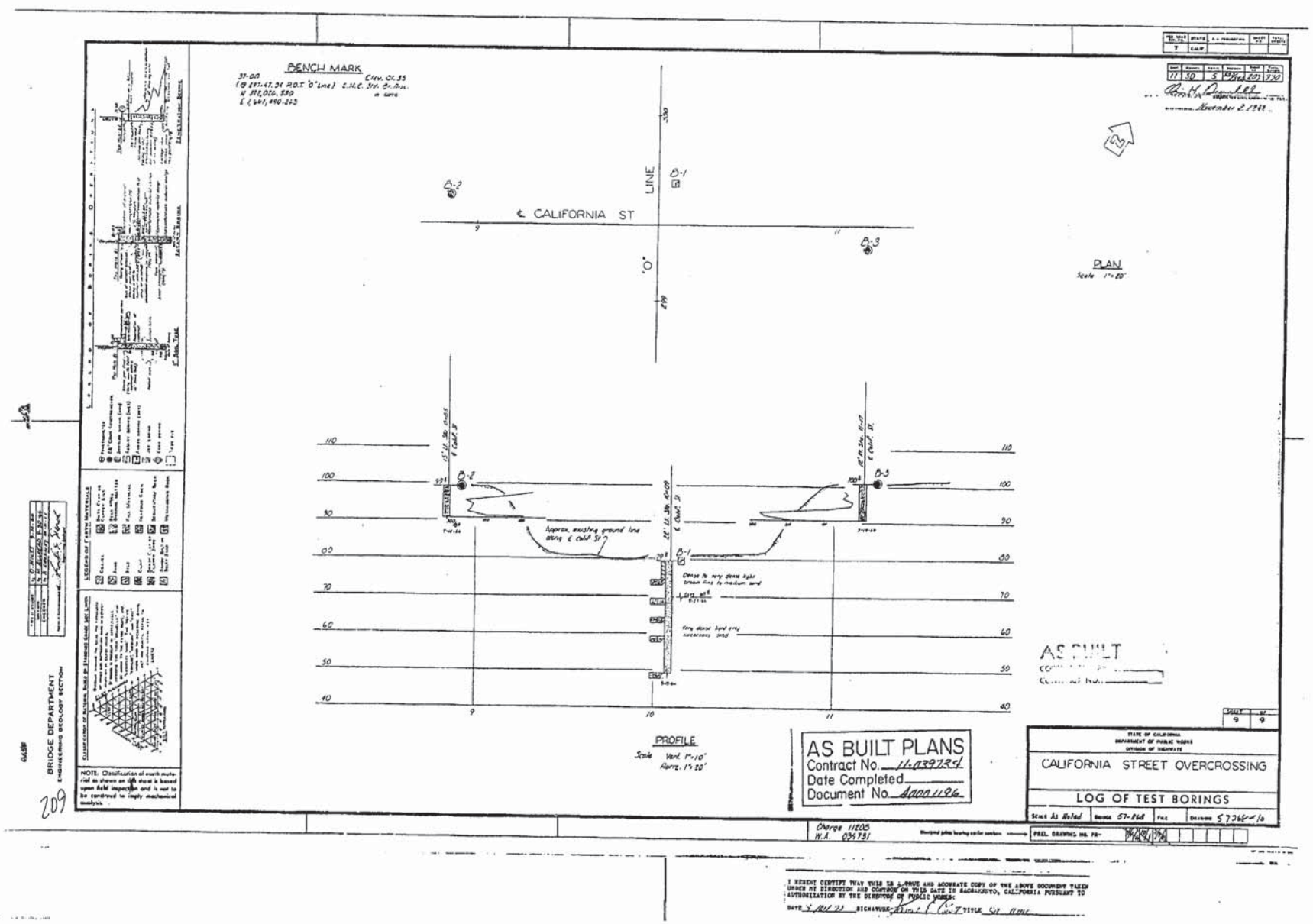
I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE 8/11/72 SIGNATURE [signature] TITLE SA. OMI.



I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE 8/10/72 SIGNATURE [signature] TITLE SR AMO



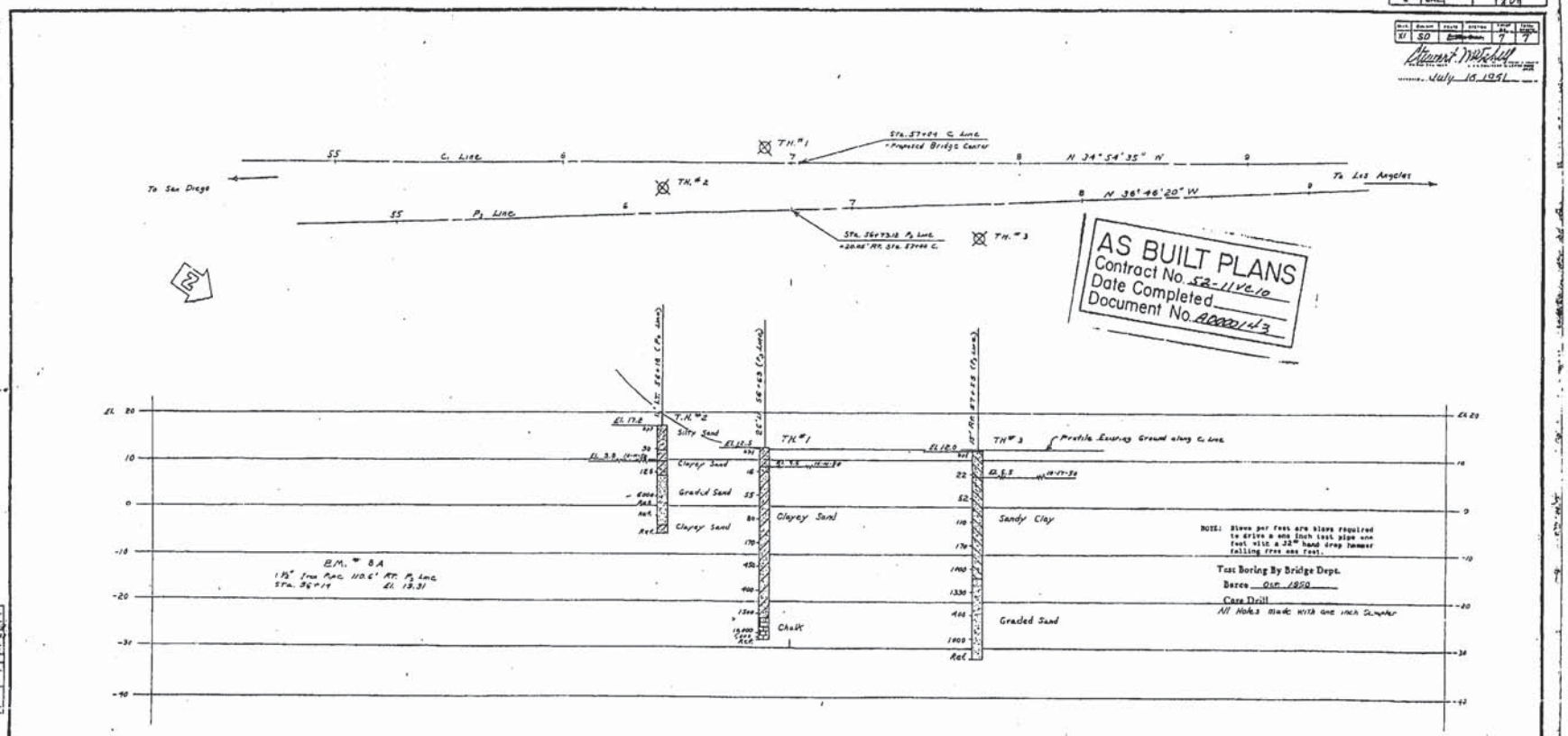
I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE 5 Nov 77 SIGNATURE [signature] TITLE Sr. Mgr.

2	CAL			20	

XI	SD			7	7

Clement Mitchell
July 16 1951



Classification of Material Based on Standard Grade Size Limits

Diagram and table showing the basis for estimates of grade size distribution used in determination of class names.

Class Name	Percentage of Sizes Present: Sand	Silt	Clay
Sand	80-100	0-20	0-20
Silty Sand	45-80	0-35	0-20
Sandy Silt	0-45	35-80	0-20
Silt	0-20	80-100	0-20
Clayey Sand	30-60	0-42	20-30
Clayey Silt	0-30	32-60	20-30
Sandy Clay	30-70	0-40	30-50
Silty Clay	0-30	20-70	30-50
Clay	0-30	0-30	50-100

Grading Used in Triangular Classification

If gravel is present in appreciable amounts the term "Gravelly" may be added to the class name, viz. "Gravelly Sand". The terms "Coarse", "Medium" and "Fine" which used to describe Gravel, Sand and Silt refer to Standard Grade Size Limits.

Legend of Boring Operations

- Plan of any boring
- 1" Sampler boring
- Rotary wash boring
- 1" Closed sampler driven
- Core boring
- 2½" Penetrometer driven
- 2" Sampler boring
- 2"×15" Auger boring
- 8"×20" Auger boring
- Casing driven
- Jet boring
- (S) Sample taken

The appropriate boring symbols designating the method of operation are shown at the upper right-hand corner of the respective boring. Where tool changes were made during the boring operation symbols are shown at the point of change.

Legend of Earth Materials

- Gravel – G
- Sand – S
- Silt – Si
- Clay – C
- Silty Sand – Si S
- Clayey Sand – C S
- Sandy Silt – S Si
- Clayey Silt – C Si
- Sandy Clay – SC
- Silty Clay – Si C
- Peat and/or Organic Clay – O
- Sandstone – SS
- Shale – Sh
- Broken Rock (fragments) – BR
- Rock – R

Abbreviations

El. 69.4	Elevation of ground at test hole
bpf	Blows per foot – (see note above)
P	Pulled pipe
M	Moisture as % dry weight
El. 64.3	Elevation of ground water and date

Notes

The contractor's attention is directed to Section 2, Article (c) of the Standard Specifications and to the Special Provisions accompanying this set of plans.

Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

This set of plans has been checked to correspond to the "as built" profile, datum as submitted by resident engineer

Tracings corrected by: _____ Date: _____

Loma Alta Creek

Log of Test Borings

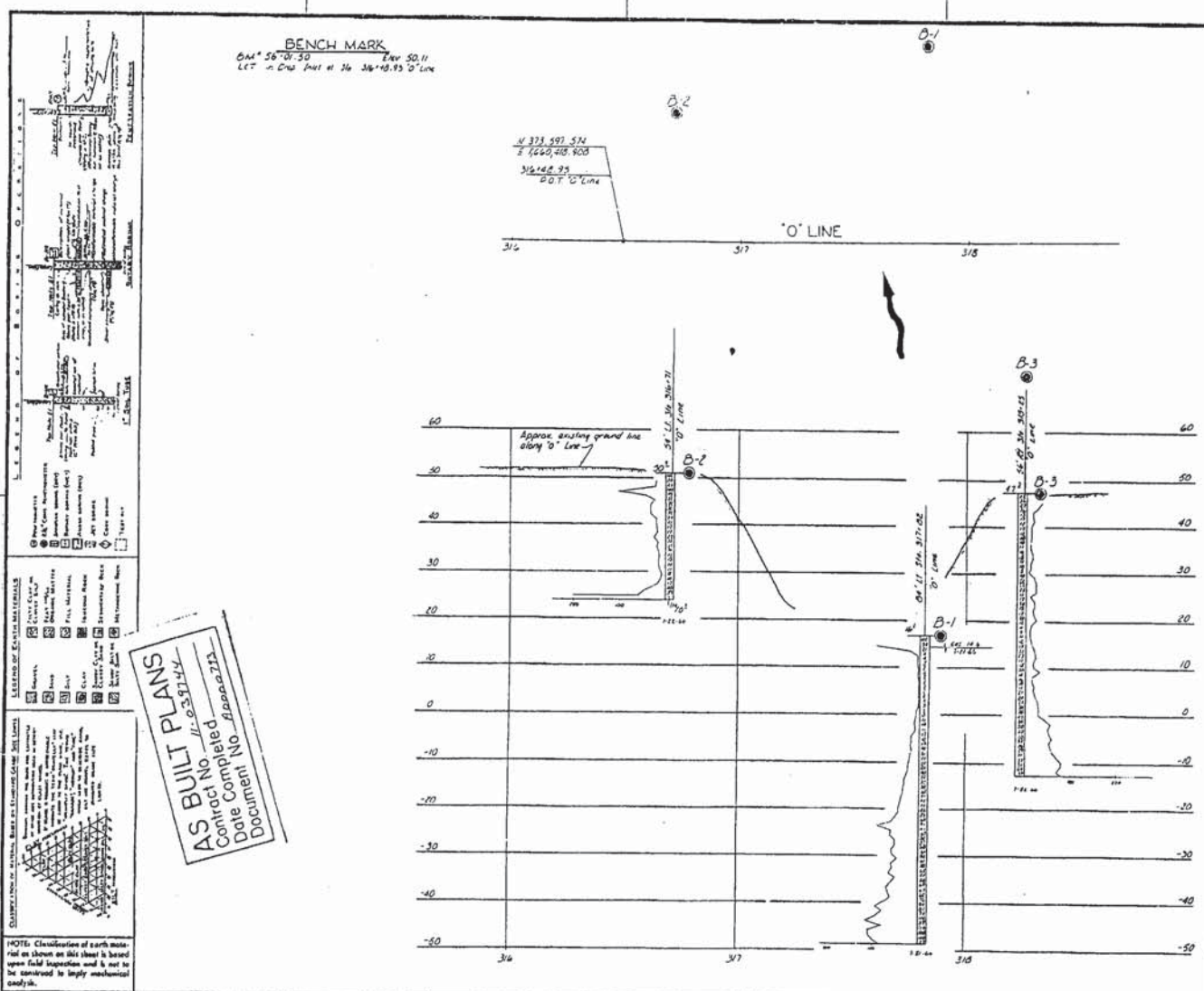
Scale: Horiz. 1" = 20'; Vert. 1" = 10'

File No.

Bridge No. 57-125

Drawing No. C-2507-7

BRIDGE DEPARTMENT



AS BUILT PLANS
Contract No. 11-039744
Date Completed
Document No. A0000773

LEGEND OF BORING OPERATIONS

LEGEND OF EARTH MATERIALS

CLASSIFICATION OF MATERIAL BASED ON STANDARD CASE SITE LIMITS

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

INFORMATION ON ACTUAL FOUNDATION
[illegible] ENCOUNTERED IS ON FILE
[illegible] GEOLOGY SECTION

SHEET	OF
12	12

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

LOMA ALTA CREEK BRIDGE
WIDEN

LOG OF TEST BORINGS

SCALE As Noted | DRAWN 57-125 | FILE | DRAWING 57125-15

Charge 11205
W.A. 039721

Disregard plan boring number ——— PREL. DRAWING No. PR-

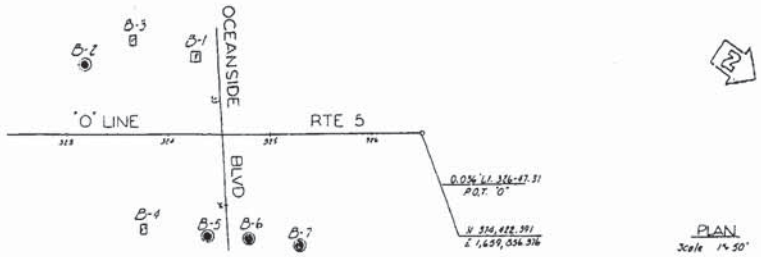
May 13, 1968

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

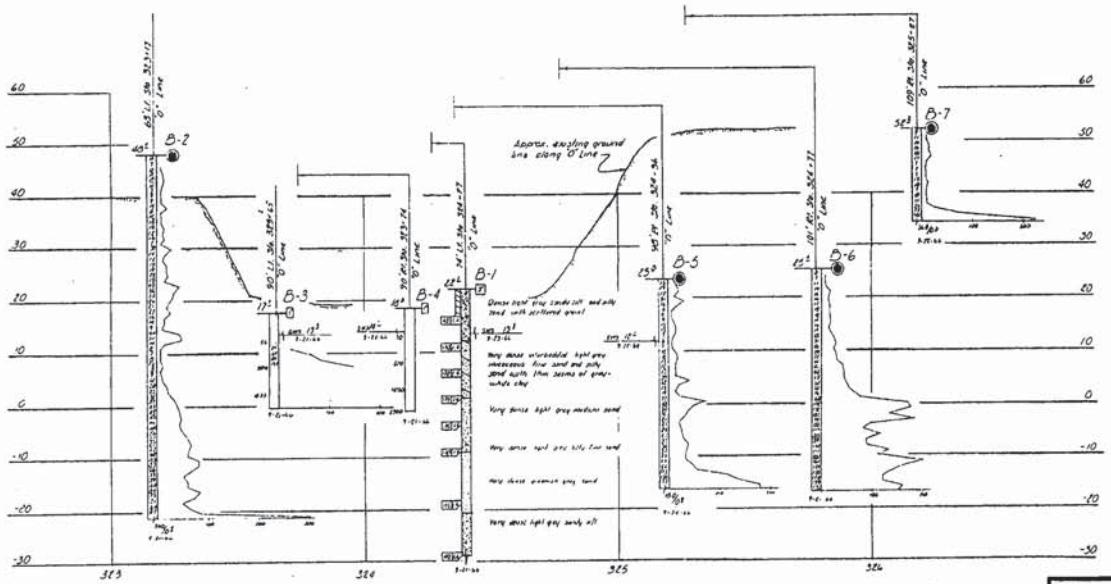
DATE March 7, 1970 SIGNATURE [illegible] TITLE [illegible]

BENCH MARK

Site BLVD
Cross Dill in curb (N 374,482.391 E 1,659,554.376)



PLAN
Scale 1"=50'



PROFILE
Scale Vert. 1"=10'. Horiz. 1"=20'

AS BUILT
COPY
CONTRACT NO.

AS BUILT PLANS
Contract No. 11-039724
Date Completed
Document No. A0001196

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

OCEANSIDE BOULEVARD OVERHEAD
(WIDEN)

LOG OF TEST BORINGS

SCALE As Noted	BRIDGE 57-124	FILE	57/24-16 DRAWING	SHEET 13 OF 13

Change 11205
H.A. 0597.11

Changed plan bearing center numbers

FREL. DRAWING No. PR-

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

223

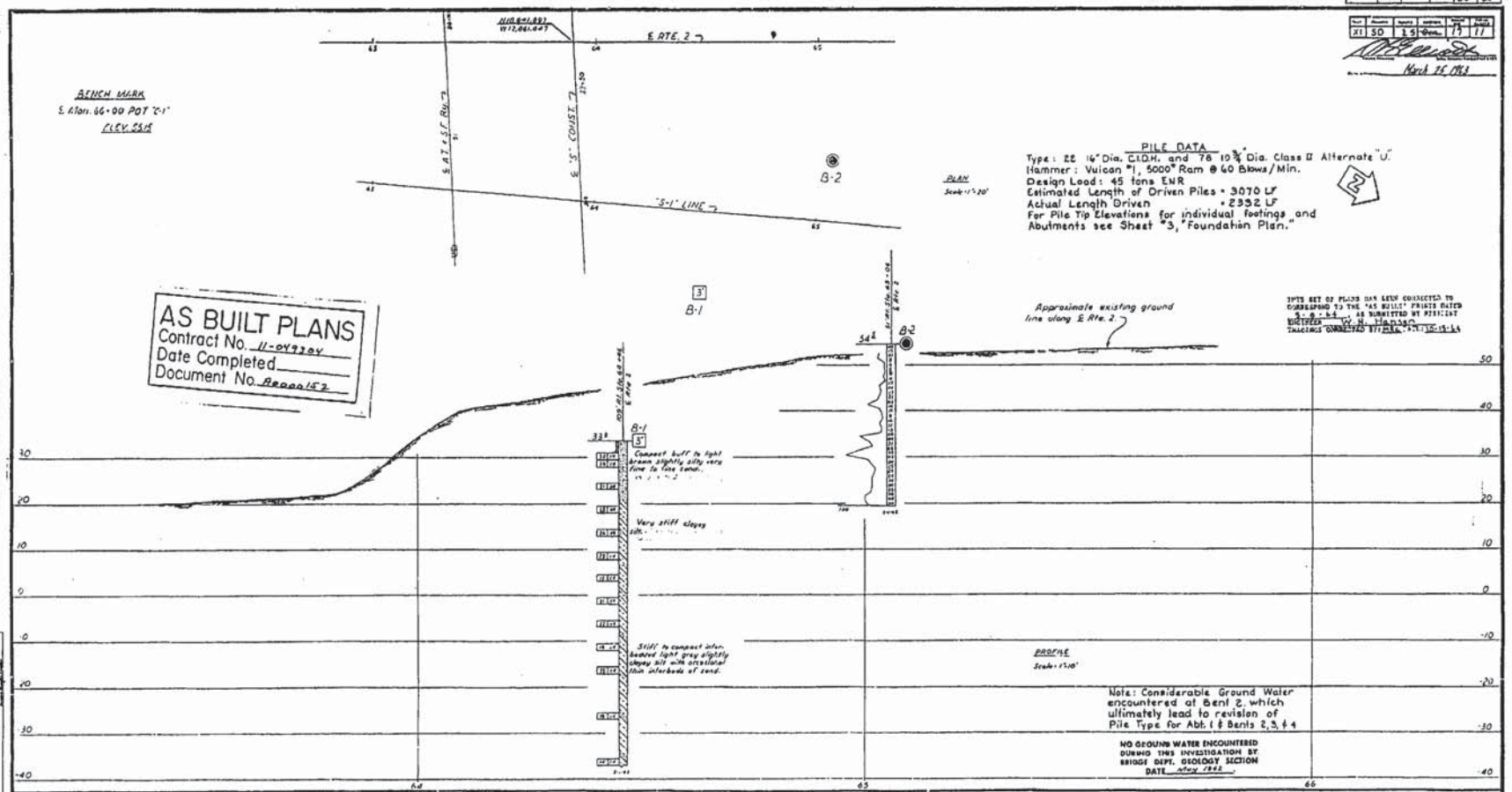
I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL OF THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

TOTAL FOLDS OR SHEETS	STATE	FEDERAL AID NO.	FEDERAL PROJ.	SHEET NO.	TOTAL SHEETS
7	CAL.			60	60

SHEET	DISTRICT	COUNTY	ROUTE	SHEET NO.	TOTAL SHEETS
XI	50	SD		19	11

March 25 1963

BRIDGE DEPARTMENT



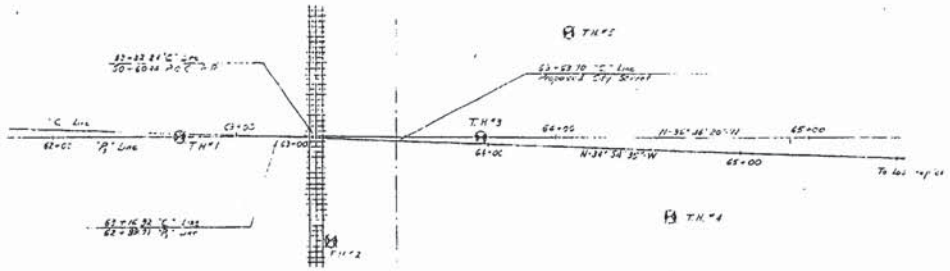
60

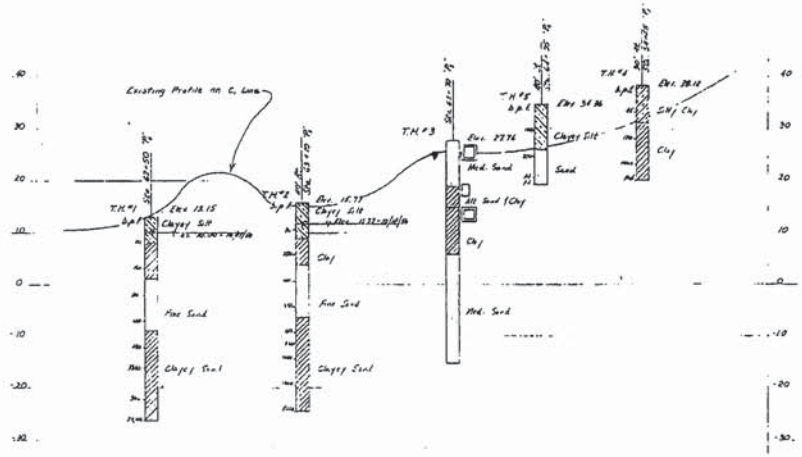
437

OCEANSIDE BLVD OH

DIST	COUNTY	ROUTE	POSTMILE	PROJECT NO.	SHEET NO.
12	SD	5	14.6/R17.7	7	7

BRIDGE DEPARTMENT





B.M. #9A

1½" Iron pipe 160' Lt. 62+19.80 "A" Line
Elev 16.33

Test Boring By Bridge Dept.

Barco October 12 and 13, 1950

Core Drill September 12, 1950

Test Holes #1, 2, 4 & 5 made with one inch Soil Sampler
Test Hole #3 made with 3" Auger Bit & one inch Soil Sampler

NOTE: Blows per foot are blows required to drive a one inch test pipe one foot with a 30" hand drop hammer falling free one foot.

AS BUILT PLANS
Contract No. 52-114610
Date Completed
Document No. A000 1098

Classification of Material Based on Standard Grade Size Limits

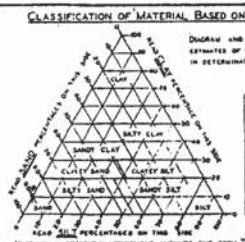


Diagram and table showing the basis for estimates of grade size distribution used in determination of class names.

Class Name	Percentage of Sizes Present: Sand	Silt	Clay
SAND	80-100	0-20	0-20
SILTY SAND	40-80	0-40	0-20
SANDY SILT	0-40	20-80	0-20
SILT	0-20	80-100	0-20
CLAYEY SAND	20-80	0-40	20-30
CLAYEY SILT	0-20	30-80	20-30
SANDY CLAY	30-70	0-40	30-60
SILTY CLAY	0-30	30-70	30-60
CLAY	0-30	0-30	30-100

If gravel is present in appreciable amounts the term "Gravelly" may be added to the class name, viz. "Gravelly sand". The terms "Coarse," "Medium" and "Fine" when used to describe Gravel, Sand, and Silt refer to Standard Grade Size Limits.

Legend of Boring Operations

- Plan of any boring
- 1" Sampler boring
- Rotary wash boring
- 1" Closed sampler driven
- Core boring
- 2½" Penetrometer driven
- 2" Sampler boring
- 2"-10.5" Auger boring
- 6"-10.20" Auger boring
- Casing driven
- Jet boring
- (S) Sample taken

The appropriate boring symbols demonstrating the method of operation are shown at the upper right-hand corner of the respective boring. Where tool changes were made during the boring operation symbols are shown at the point of change.

Legend of Earth Materials

- Gravel – G
- Sand – S
- Silt – Si
- Clay – C
- Silty Sand – Si S
- Clayey Sand – C S
- Sandy Silt – S Si
- Clayey Silt – C Si
- Sandy Clay – SC
- Silty Clay – Si C
- Peat Mfg. Inorganic Clay – O
- Sandstone – SS
- Shale – Sh
- Broken Rock (Fragments) – Br
- Rock – R

Abbreviations

El. 89.4	Elevation of ground at test hole
b.p.f.	Blows per foot – (See note above)
P	Pulled pipe
M	Moisture as % dry weight
El. 9.3	Elevation of ground water and site

Notes

The contractor's attention is directed to Section 2, Article (c) of the Standard Specifications and to the Special Provisions accompanying this set of plans.

Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

I - set in plans has been corrected to conform to the "As Built" plans, dated ... as submitted by resident engineer

"Records corrected" by: ____ Date: ____

LAGUNA-PARK OVERHEAD

LOG OF TEST BORINGS

Scale: Horizontal 1" = 20'; Vertical 1" = 10'

File No.

3-1006 No. 57-124 K.V.

Drawing No. C-2574-7

I hereby certify that this is a true and accurate copy of the above document taken under my direction and control on this date in Sacramento, California pursuant to authorization by the Director of Public Works.

Date ____ Signature ____ Title ____

OCEANSIDE BLVD OH

DIST	COUNTY	ROUTE	TOTAL PROJECT	NO	SHEETS
11	SD	5	R49.1/R54.0	98	137

REGISTERED ENGINEER - CIVIL

9-9-96
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER JAMES J. STOE No. C25081 Exp. 12/31/97 CIVIL STATE OF CALIFORNIA

ROBERT BEIN, WILLIAM FROST AND ASSOCIATES
14725 ALTON PARKWAY
IRVINE, CA. 92718

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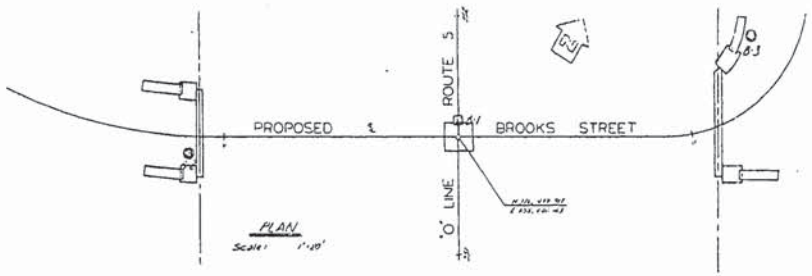
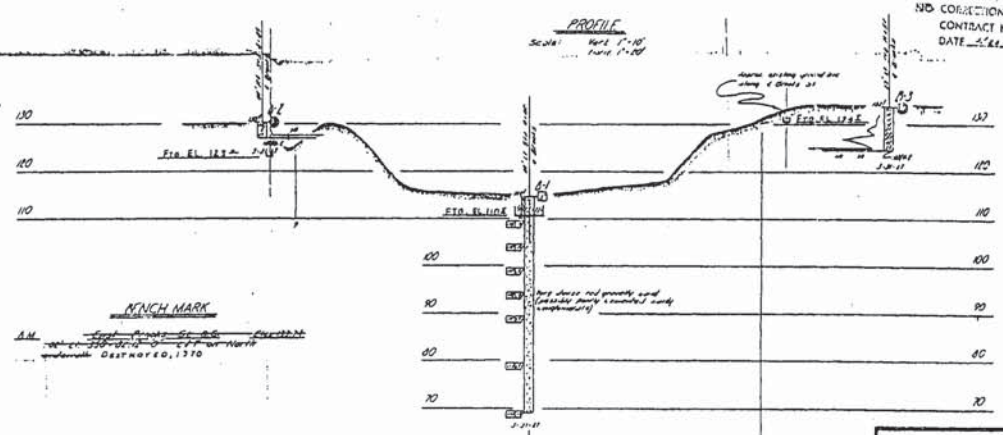




AS BUILT
NO CORRECTIONS BY
CONTRACT NO.
DATE

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

BROOKS STREET OVERCROSSING

LOG OF TEST BORINGS

AS BUILT
CORRECTIONS BY CHRISTIAN JENSEN DOKKEN ENGR
CONTRACT NO. 11-206906
DATE 9-2-97
NO AS BUILT CHANGES

EARTHQUAKE RETROFIT PROJECT NO. 284

BROOKS STREET OVERCROSSING

AS-BUILT LOG OF TEST BORINGS

DESIGN OVERSIGHT R. BRENT LEMON
SIGNOFF DATE 8-21-96

NOTE:
ADDITIONAL AS-BUILT FOUNDATION DATA MAY BE AVAILABLE AT THE OFFICE OF TRANSPORTATION MATERIALS AND RESEARCH 5900 FOLSOM BOULEVARD, SACRAMENTO, CALIFORNIA 95819

DESIGN	BY M. PALASKAS	CHECKED E.D. HENDERSON	
DETAILS	BY J. SALDANA	CHECKED H. MONTOYA	
QUANTITIES	BY J. LING	CHECKED R. SMITTIPATANA	

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

P. YOUNG
PROJECT ENGINEER

CU 11273
EA 206901

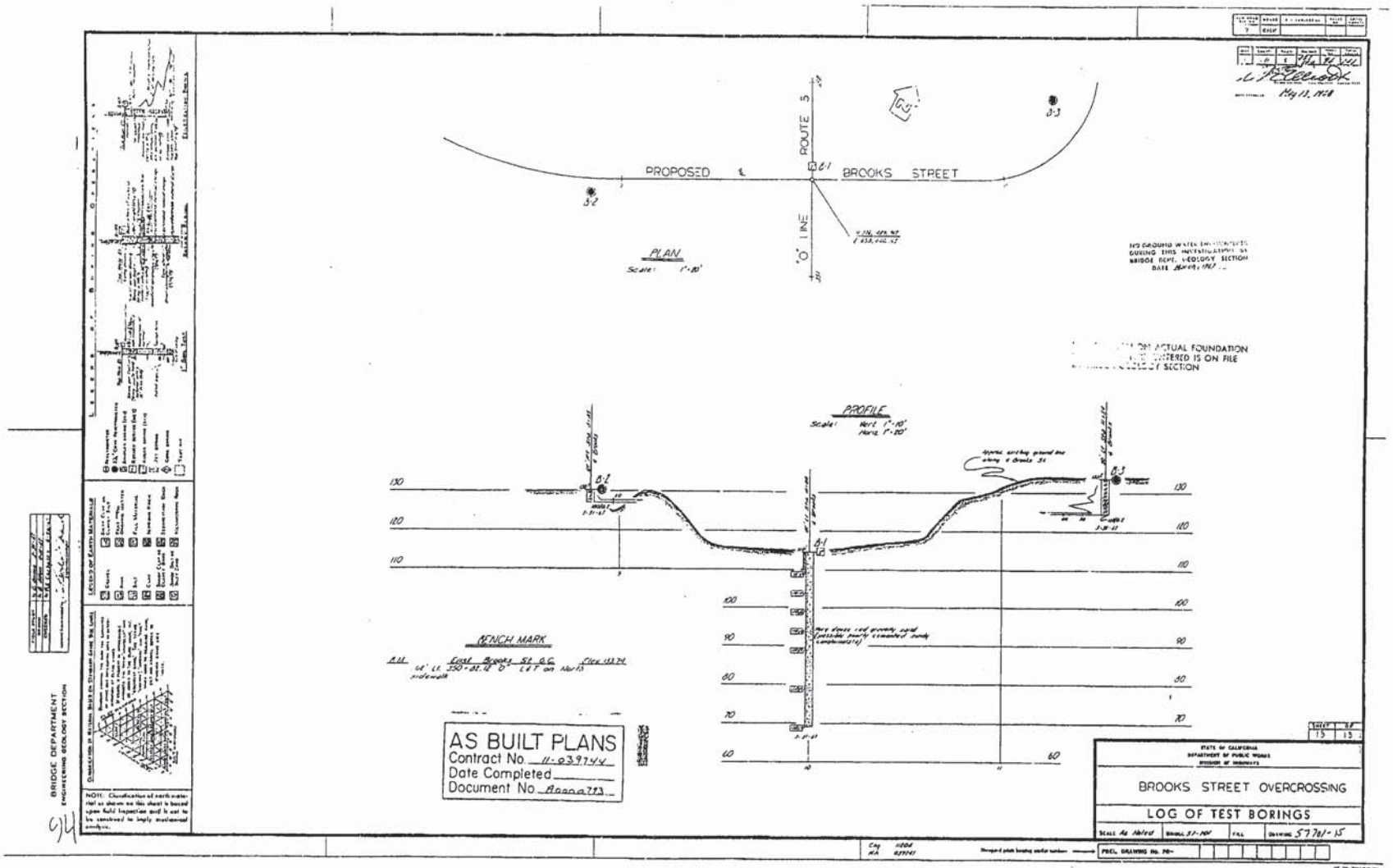
BRIDGE NO. 57-0701
POST MILE 52.13

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGES ONLY) | SHEET 5 OF 5

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

32235E05.dwg


PROPOSED ℄ BROOKS STREET
ROUTE 5
'O' LINE
PLAN
Scale: 1"=20'
PROFILE
Scale: Vert 1"=10' Horiz 1"=20'
BENCH MARK
AS BUILT PLANS
Contract No. 11-039744
Date Completed
Document No. 8000a793
BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
BROOKS STREET OVERCROSSING
LOG OF TEST BORINGS
Scale As Noted
Drawing 57701-15
PREL. DRAWING No. PR-
I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.
DATE
SIGNATURE
TITLE

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
11	SD	5	R49.1/R54.0	76	137

REGISTERED ENGINEER - CIVIL

9-9-96
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER JAMES J. STONE No. C25081 Exp. 12/31/97 CIVIL STATE OF CALIFORNIA

ROBERT BEIN, WILLIAM FROST AND ASSOCIATES
14725 ALTON PARKWAY
IRVINE, CA. 92718

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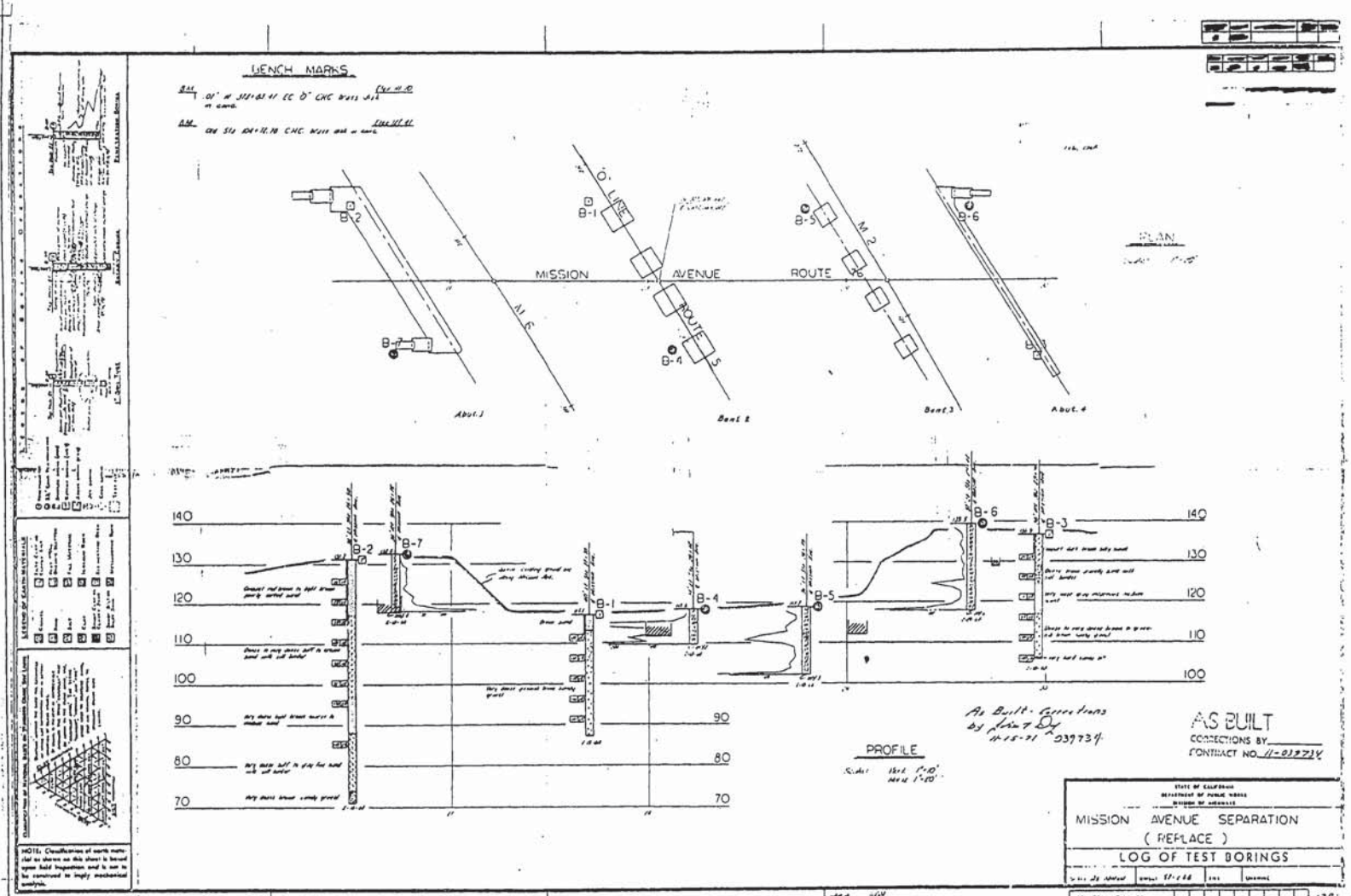
NOTE:
THE AS-BUILT LOG OF TEST BORING SHEETS WERE USED TO PREPARE THE GEOTECHNICAL REPORT.



AS BUILT
CORRECTIONS BY CHRISTIAN JENSEN DOKKEN ENGR.
CONTRACT NO. 11-206908
DATE 9-2-97
NO AS BUILT CHANGES

EARTHQUAKE RETROFIT PROJECT NO. 284

MISSION AVENUE OVERCROSSING

AS-BUILT LOG OF TEST BORINGS

DESIGN OVERSIGHT R.BRENT LEMON
SIGNOFF DATE 8-21-96

NOTE:
ADDITIONAL AS-BUILT FOUNDATION DATA MAY BE AVAILABLE AT THE OFFICE OF TRANSPORTATION MATERIALS AND RESEARCH 5900 FOLSOM BOULEVARD, SACRAMENTO, CALIFORNIA 95819

DESIGN	BY E.D.HENDERSON	CHECKED K.KOO	
DETAILS	BY J.SALDANA	CHECKED H.MONTOYA	
QUANTITIES	BY R.SMITTIPATANA	CHECKED R.ROLLINS	

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

P. YOUNG
PROJECT ENGINEER

CU 11273
EA 206901

BRIDGE NO. 57-0266
POST MILE 53.21

DISREGARD PRINTS BEARING EARLIER REVISION DATES

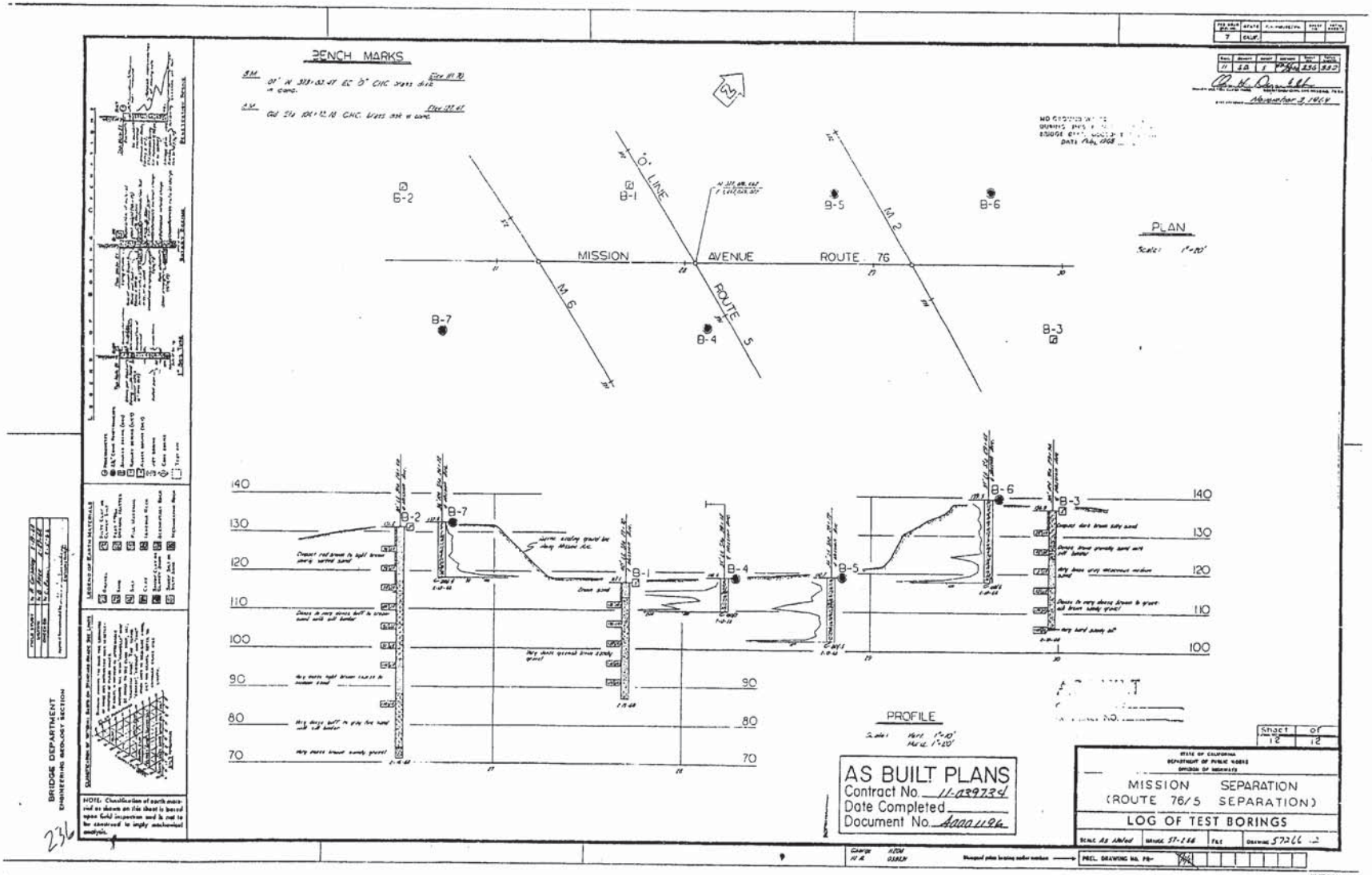
REVISION DATES (PRELIMINARY STAGES ONLY)

SHEET 8 OF 8

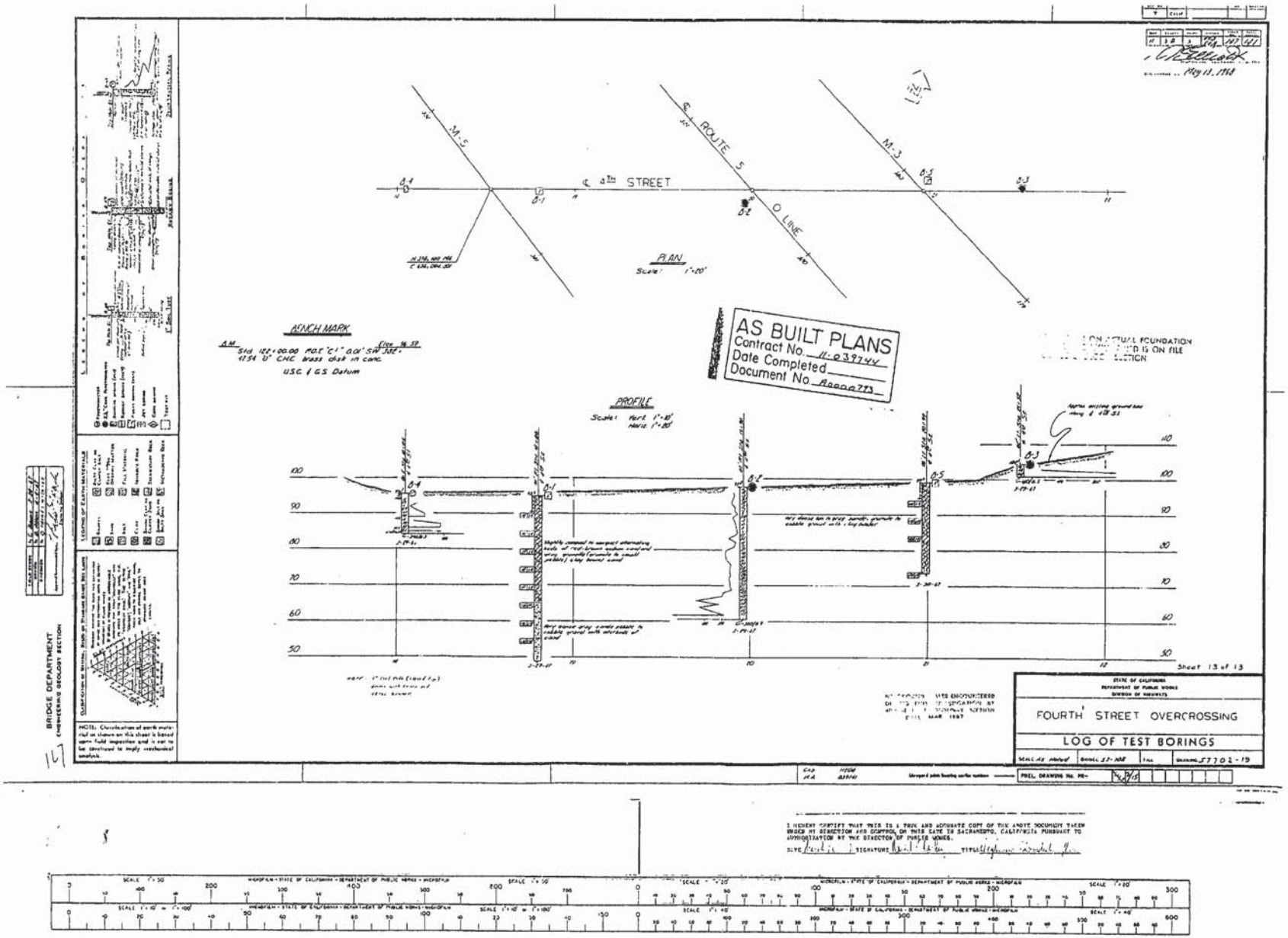
32235A08.DWG

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

ROUTE 76/5 SEPARATION


BENCH MARKS
PLAN
Scale: 1"=20'
MISSION AVENUE ROUTE 76
"O" LINE
ROUTE 5
M 6
M 2
B-1
B-2
B-3
B-4
B-5
B-6
B-7
PROFILE
Scale: Vert. 1"=10'
Horiz. 1"=20'
140
130
120
110
100
90
80
70
LEGEND OF EARTH MATERIALS
BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION
NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.
AS BUILT PLANS
Contract No. 11-039734
Date Completed
Document No. A0001196
Sheet 12 of 12
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
MISSION SEPARATION
(ROUTE 76/5 SEPARATION)
LOG OF TEST BORINGS
Scale As Noted
Drawing 57266
PREL. DRAWING NO. PR-
I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.
DATE
SIGNATURE
TITLE

236



M-5
ROUTE 5
M-3
℄ 4th STREET
O LINE
PLAN
Scale: 1"=20'
BENCH MARK
USC & GS Datum
AS BUILT PLANS
Contract No. 11-039744
Date Completed
Document No. A0000773
PROFILE
Scale: Vert. 1"=10'
Horiz. 1"=20'
Sheet 13 of 13
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
FOURTH STREET OVERCROSSING
LOG OF TEST BORINGS
DRAWING 57702-19
BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

DIST	COUNTY	ROUTE	TOTAL PROJECT	NO	SHEETS
07	SD	5	R49.1/R54.0	108	137

REGISTERED ENGINEER - CIVIL

9-9-96
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER JAMES T. STOCK No. C25081 Exp. 12/31/97 CIVIL STATE OF CALIFORNIA

ROBERT BEIN, WILLIAM FROST AND ASSOCIATES
14725 ALTON PARKWAY
IRVINE, CA. 92718

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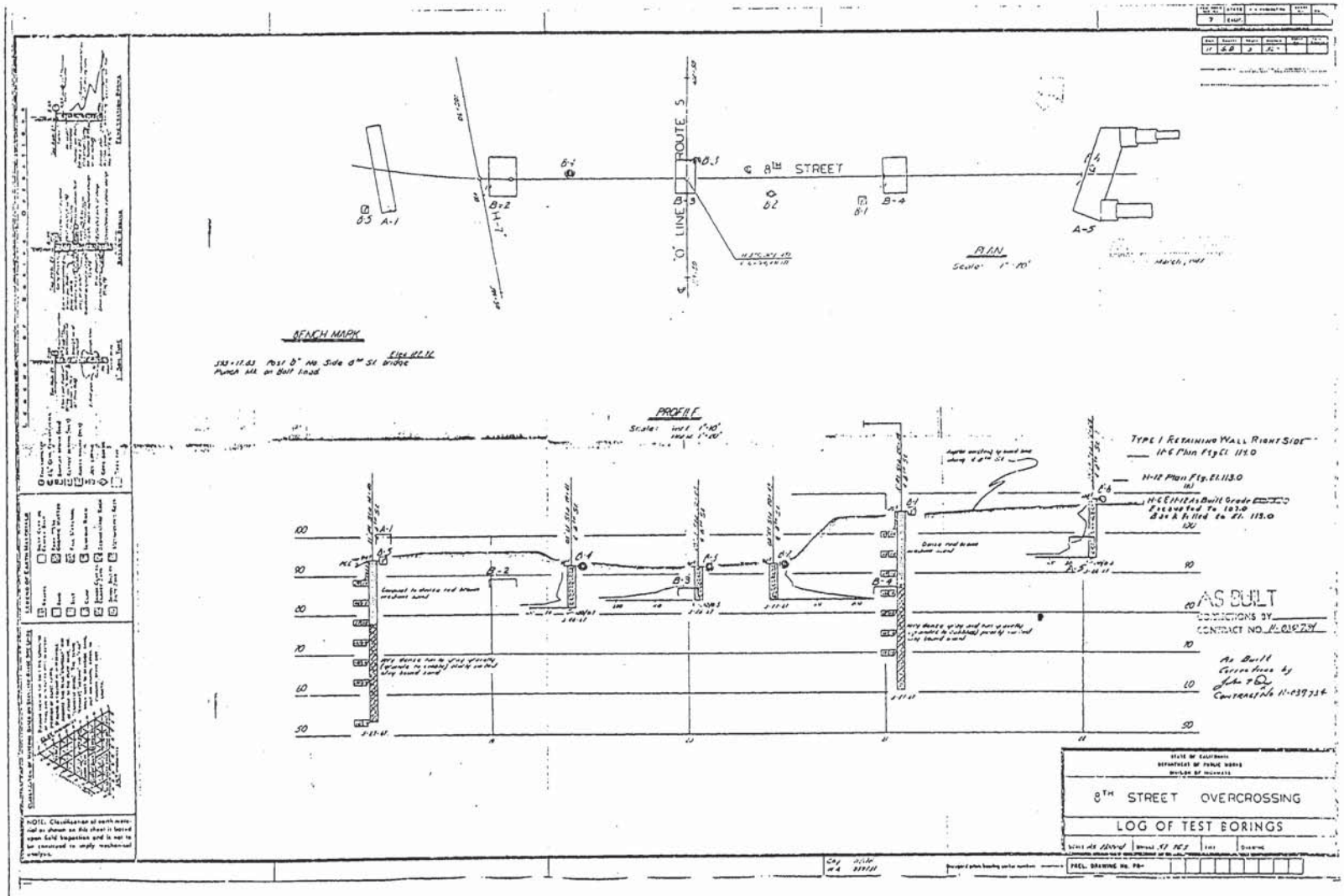


AS BUILT
CORRECTIONS BY CHRISTIAN JENSEN DOKKEN ENGR.
CONTRACT NO. 11-206904
DATE 9-2-97
NO AS BUILT CHANGES

EARTHQUAKE RETROFIT PROJECT NO. 284

EIGHTH STREET OVERCROSSING

AS-BUILT LOG OF TEST BORINGS

DESIGN OVERSIGHT
R. BRENT LEMON
SIGNOFF DATE 8-21-96

NOTE:
ADDITIONAL AS-BUILT FOUNDATION DATA MAY BE AVAILABLE AT THE OFFICE OF TRANSPORTATION MATERIALS AND RESEARCH 5900 FOLSOM BOULEVARD, SACRAMENTO, CALIFORNIA 95819

DESIGN	V. TARASSOLY	M. PALASKAS
DETAILS	A. JAUREGUI	V. TARASSOLY
QUANTITIES	R. SMITTIPATANA	R. ROLLINS

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

P. YOUNG
PROJECT ENGINEER

BRIDGE NO. 57-0703
POST MILE 53.75

CU 11273
EA 206901

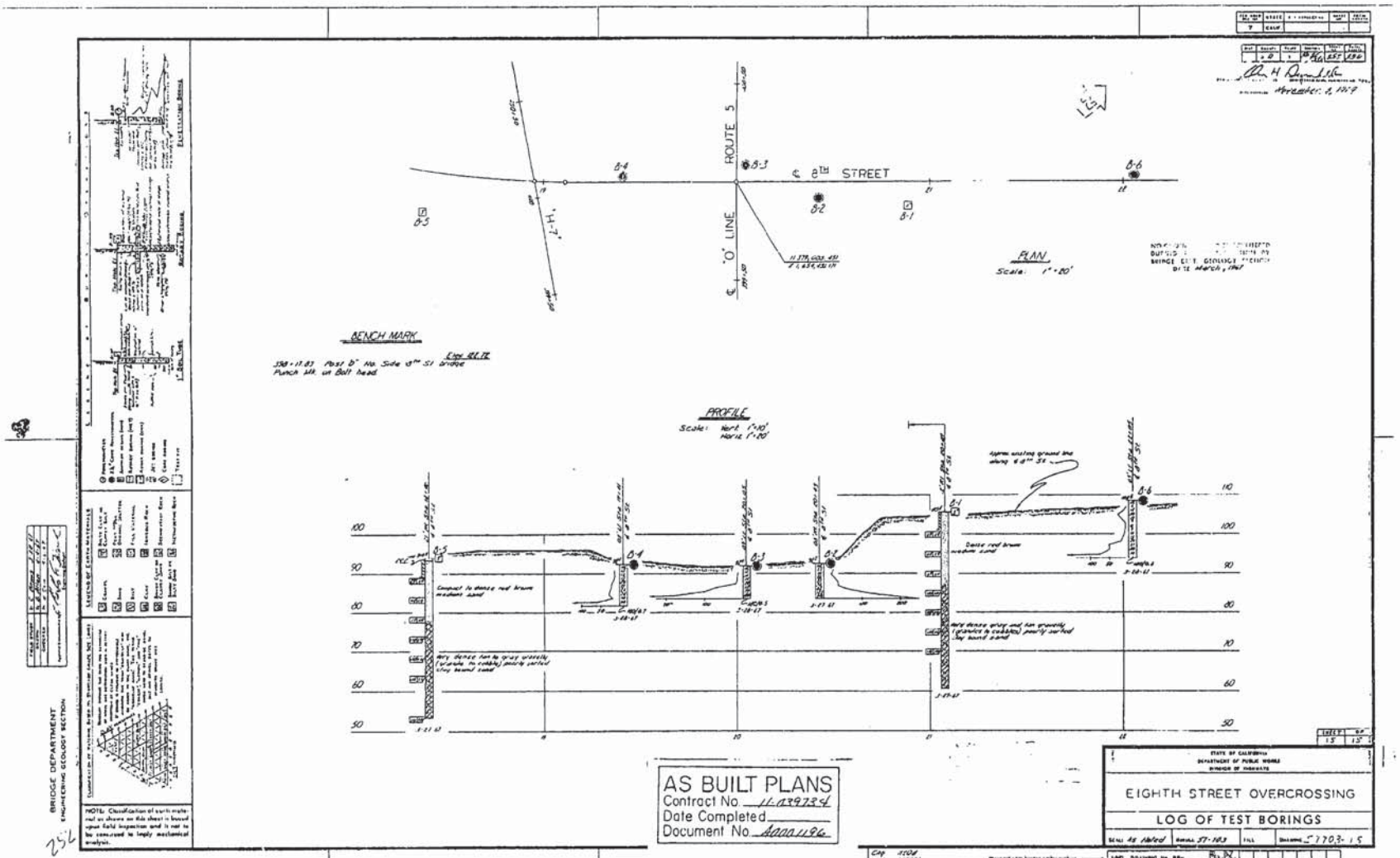
DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGES ONLY) 5/16/96

SHEET 5 OF 5

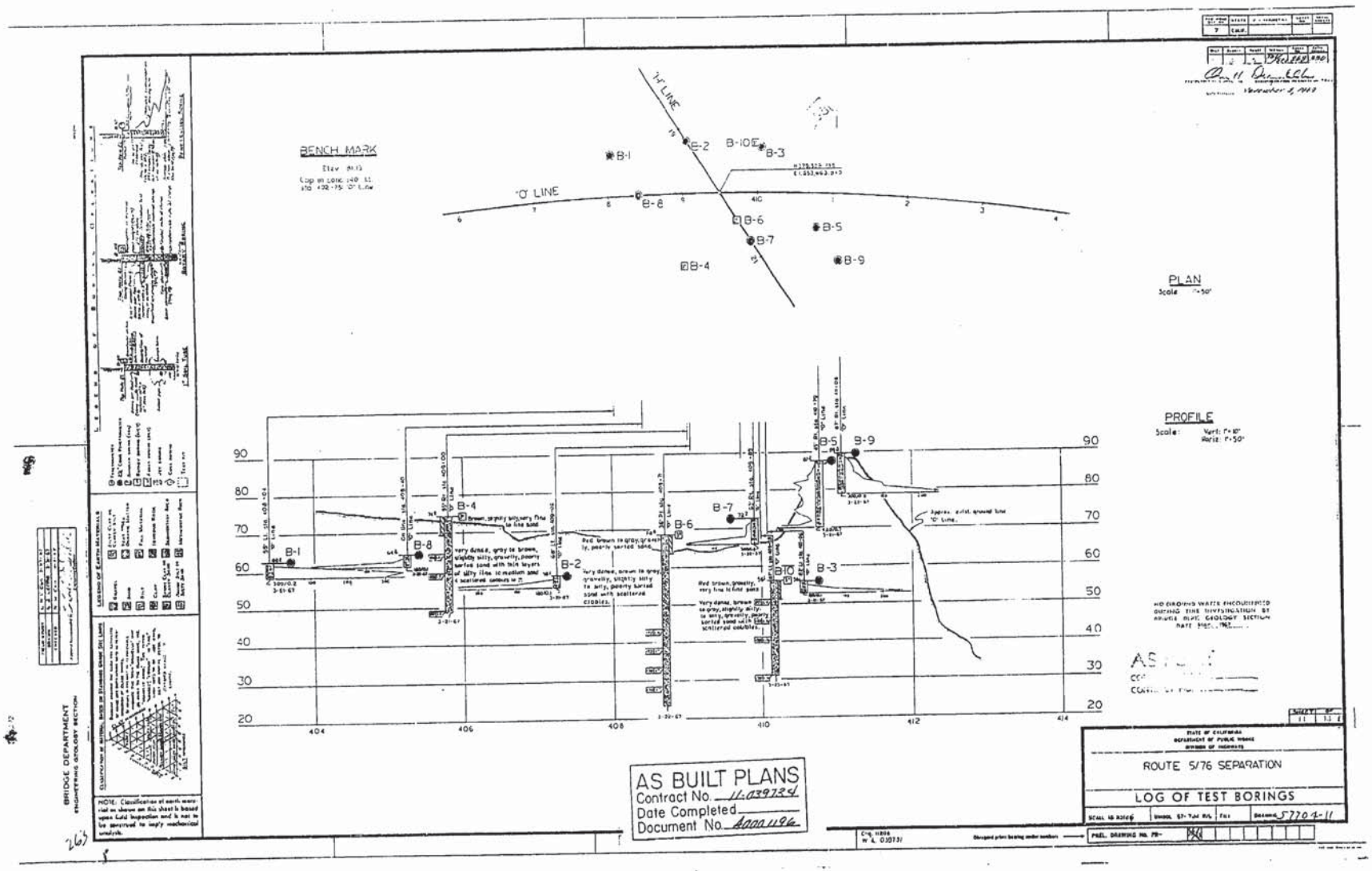
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

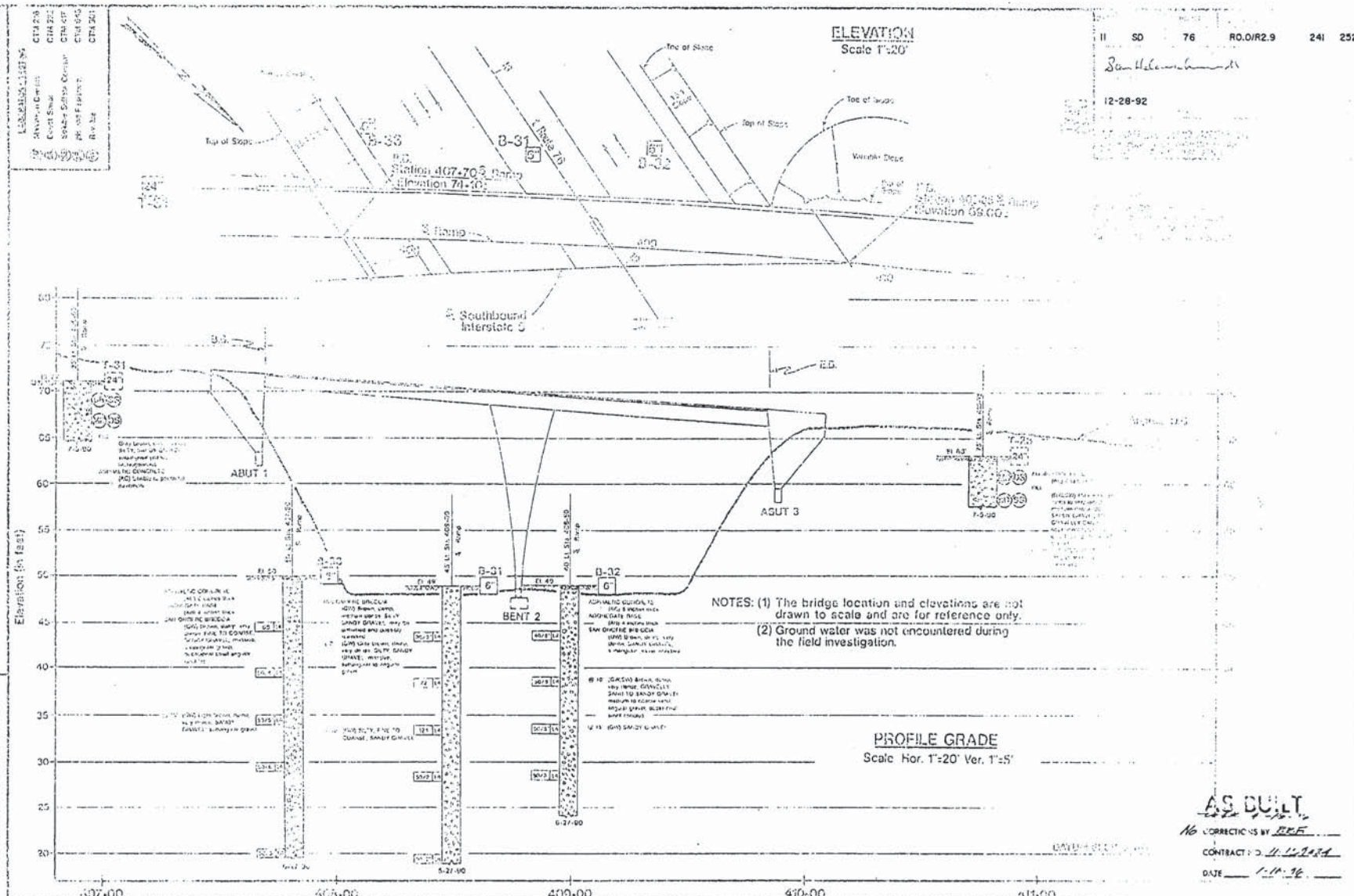
32223SG05.DWG



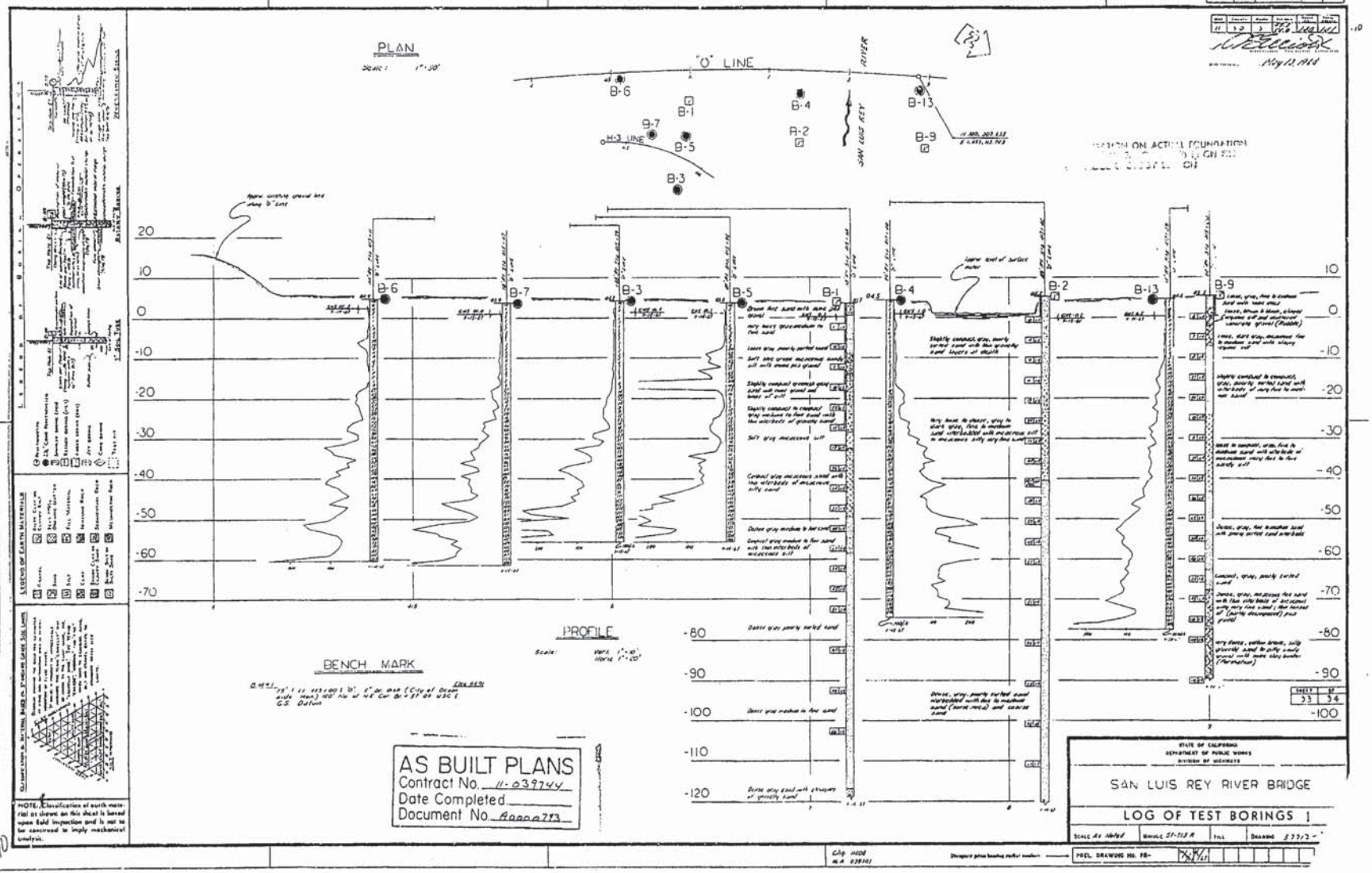
I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE: 5 MAY 67 SIGNATURE: [signature] TITLE: [illegible]


BENCH MARK
"H" LINE
"O" LINE
B-1
B-2
B-3
B-4
B-5
B-6
B-7
B-8
B-9
B-10
PLAN
Scale 1"=50'
PROFILE
Scale: Vert: 1"=10' Horiz: 1"=50'
Approx. exist. ground line "O" Line.
Very dense, gray to brown, slightly silty, gravelly, poorly sorted sand with thin layers of silty fine to medium sand & scattered cobbles
Red brown to gray, gravelly, poorly sorted sand
Very dense, brown to gray, gravelly, slightly silty to silty, poorly sorted sand with scattered cobbles.
Red brown, gravelly, very fine to fine sand
Very dense, brown to gray, slightly silty to silty, gravelly, poorly sorted sand with scattered cobbles.
NO GROUND WATER ENCOUNTERED DURING THE INVESTIGATION BY BRIDGE DEPT. GEOLOGY SECTION DATE MAR. 1967
AS BUILT PLANS
Contract No. 11-039734
Date Completed
Document No. A0001196
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
ROUTE 5/76 SEPARATION
LOG OF TEST BORINGS
DRAWING 57704-11
BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION
NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.
I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.
DATE
SIGNATURE
TITLE



ROUTE 5/76 SEPARATION



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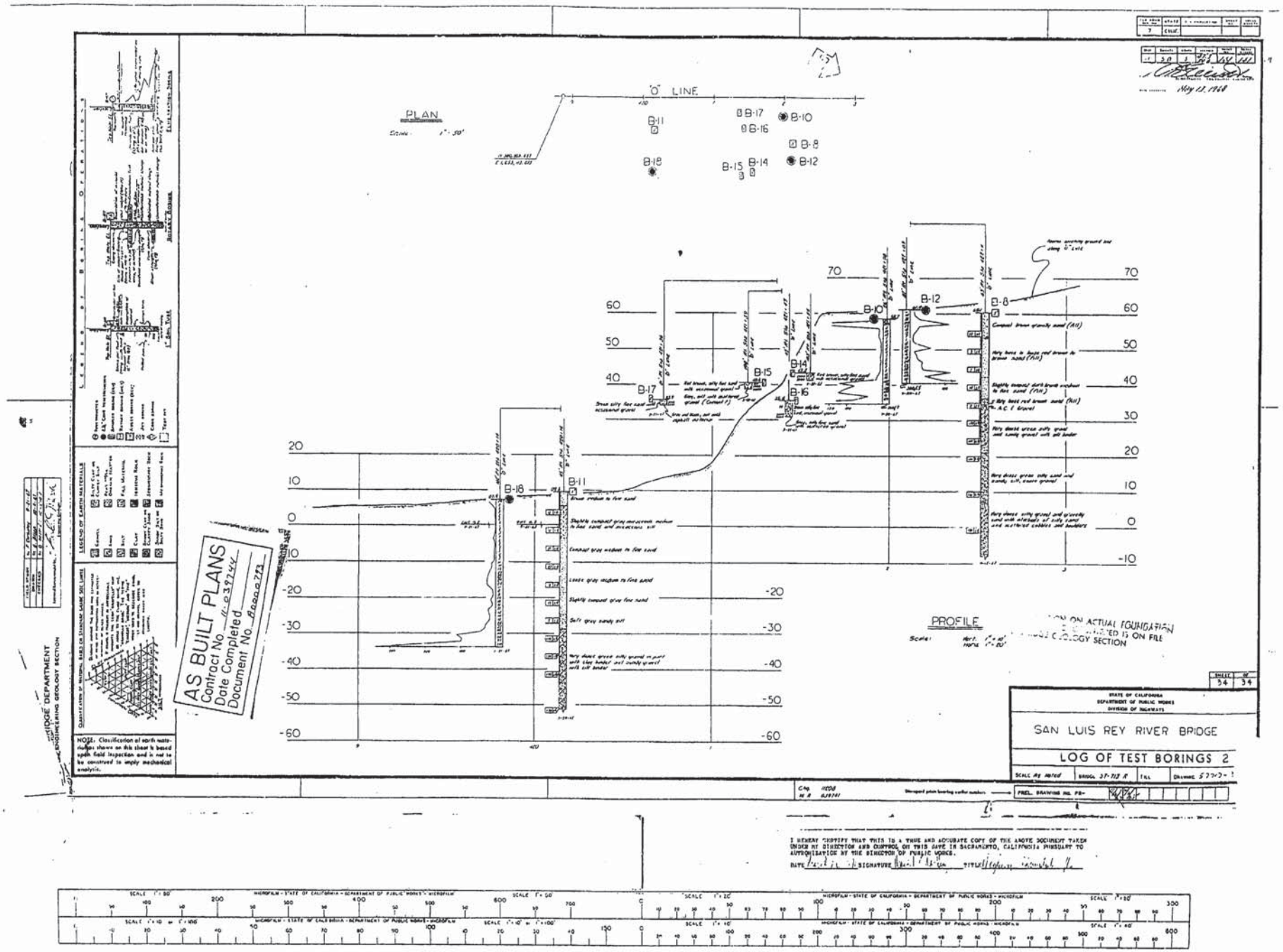
DATE SIGNATURE TITLE


PLAN
Scale 1" = 50'
"O" LINE
B-11
B-17
B-16
B-10
B-8
B-18
B-15
B-14
B-12
PROFILE
Scale: Vert. 1" = 10' Horiz. 1" = 20'
AS BUILT PLANS
Contract No. 11-039744
Date Completed
Document No. A0000793
LEGEND OF EARTH MATERIALS
NOTE: Classification of earth materials shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.
BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
SAN LUIS REY RIVER BRIDGE
LOG OF TEST BORINGS 2
SHEET 34 OF 34
May 13, 1968
I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.
DATE
SIGNATURE
TITLE
MICROFILM - STATE OF CALIFORNIA - DEPARTMENT OF PUBLIC WORKS - MICROFILM

DIST.	COUNTY	ROUTE	TOTAL PROJECT	NO	SHEETS
11	SD	5	R49.1/R54.0	136	137

REGISTERED ENGINEER - CIVIL

9-9-96
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER JAMES J. STONE No. C25081 Exp. 12/31/97 CIVIL STATE OF CALIFORNIA

ROBERT BEIN, WILLIAM FROST AND ASSOCIATES
14725 ALTON PARKWAY
IRVINE, CA. 92718

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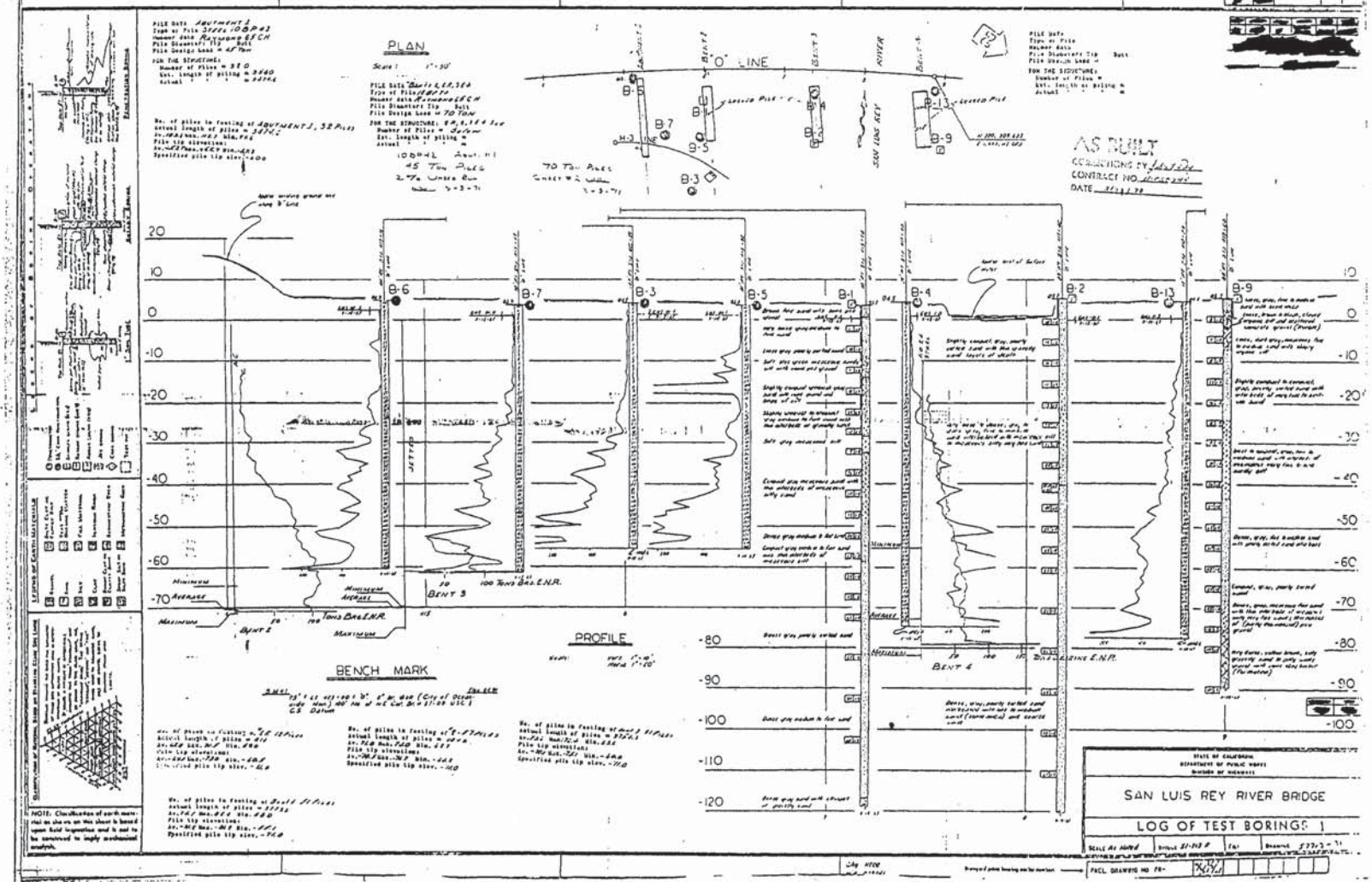

AS BUILT
CORRECTIONS BY CHRISTIAN JENSEN DOKKEN ENGR.
CONTRACT NO. 11-206904
DATE 9-5-97
NO AS BUILT CHANGES

EARTHQUAKE RETROFIT PROJECT NO. 284

SAN LUIS REY RIVER BRIDGE (R)

AS-BUILT LOG OF TEST BORINGS No.1

DESIGN OVERSIGHT R.BRENT LEMON
SIGNOFF DATE 8-21-96

NOTE:
ADDITIONAL AS-BUILT FOUNDATION DATA MAY BE AVAILABLE AT THE OFFICE OF TRANSPORTATION MATERIALS AND RESEARCH 5900 FOLSOM BOULEVARD, SACRAMENTO, CALIFORNIA 95819

DESIGN	B.REZNIKOV/P.NICHOLSON	CHECKED	S.HUQ
DETAILS	P.HOPKINS	CHECKED	P.NICHOLSON
QUANTITIES	B.REZNIKOV	CHECKED	J.YAO

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

P. YOUNG
PROJECT ENGINEER

BRIDGE NO. 57-0713R
POST MILE 53.3

CU 11273
EA 206901

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGES ONLY)

SHEET 12 OF 13

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

32235H12.DWG

DIST	COUNTY	ROUTE	TOTAL PROJECT	NO	SHEETS
11	SD	5	R49.1/R54.0	137	137

REGISTERED ENGINEER - CIVIL

9-9-96

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER JAMES J. STOW No. C25081 Exp. 12/31/97 CIVIL STATE OF CALIFORNIA

ROBERT BEIN, WILLIAM FROST AND ASSOCIATES
14725 ALTON PARKWAY
IRVINE, CA. 92718

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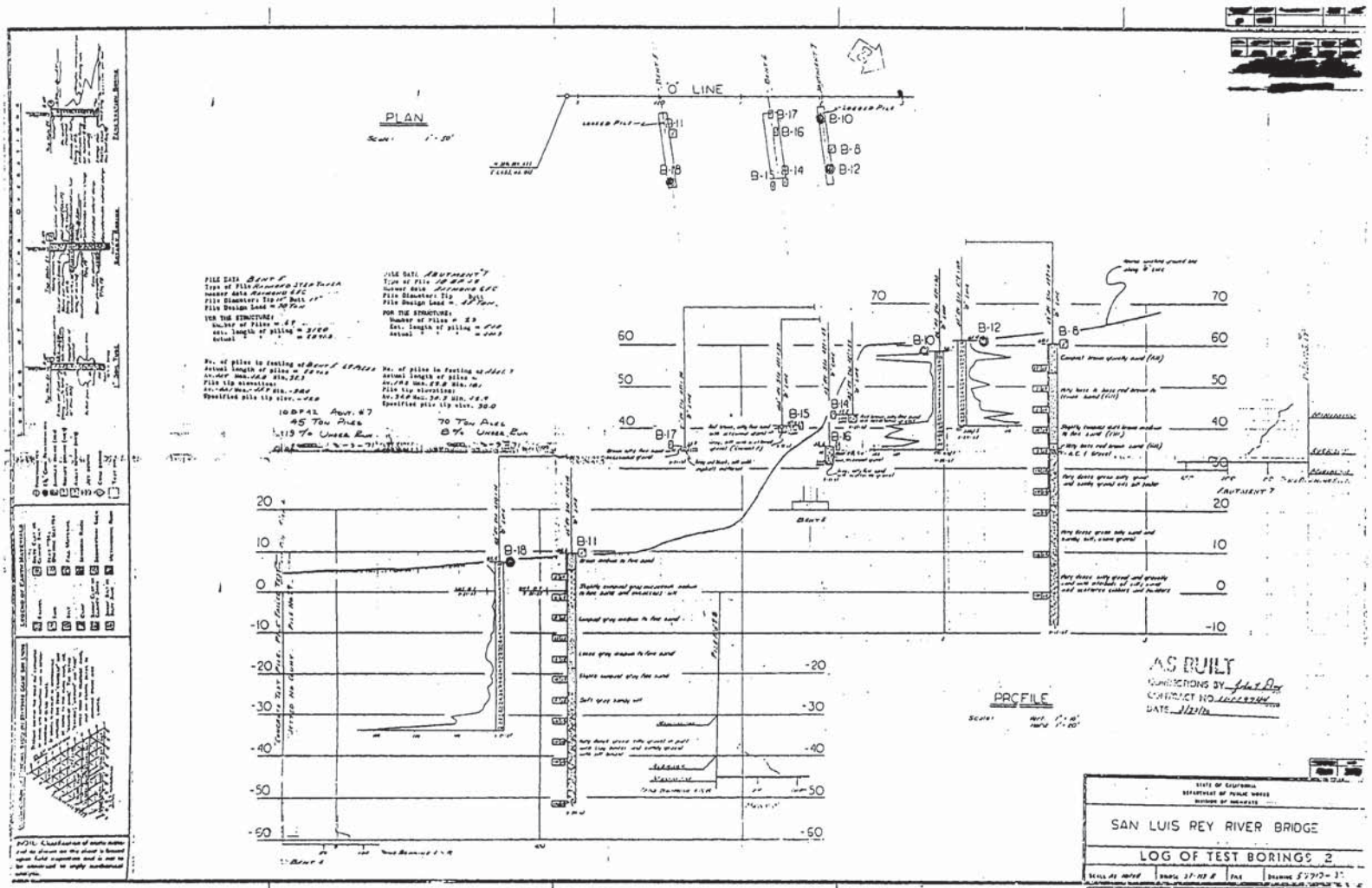

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

SAN LUIS REY RIVER BRIDGE

LOG OF TEST BORINGS 2

AS BUILT
CHRISTIAN JENSEN
CORRECTIONS BY DOKKEN ENGR.
CONTRACT NO. 11-206904
DATE 9-2-97
NO AS BUILT CHANGES

EARTHQUAKE RETROFIT PROJECT NO. 284

SAN LUIS REY RIVER BRIDGE (R)

AS-BUILT LOG OF TEST BORINGS No.2

DESIGN OVERSIGHT BRENT LEMON
CHIEF DATE 6-21-96

NOTE:
ADDITIONAL AS-BUILT FOUNDATION DATA MAY BE AVAILABLE AT THE OFFICE OF TRANSPORTATION MATERIALS AND RESEARCH 5900 FOLSOM BOULEVARD, SACRAMENTO, CALIFORNIA 95819

DESIGN	B.REZNIKOV/P.NICHOLSON	CHECKED	S.HUQ
DETAILS	P.HOPKINS	CHECKED	P.NICHOLSON
QUANTITIES	V.REZNIKOV	CHECKED	J. YAO

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

P. YOUNG
PROJECT ENGINEER

CU 11273
EA 206901

BRIDGE NO. 57-0713R
POST MILE 53.3

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGES ONLY)

SHEET 13 OF 13

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

32235112.DWG

DIST	COUNTY	ROUTE	TOTAL PROJECT	NO	SHEETS
11	SD	5	R49.1/R54.0	123	137

REGISTERED ENGINEER - CIVIL

9-9-96
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER JAMES J. FROST No. C25081 Exp. 12/31/97 CIVIL STATE OF CALIFORNIA

ROBERT BEIN, WILLIAM FROST AND ASSOCIATES
14725 ALTON PARKWAY
IRVINE, CA. 92718

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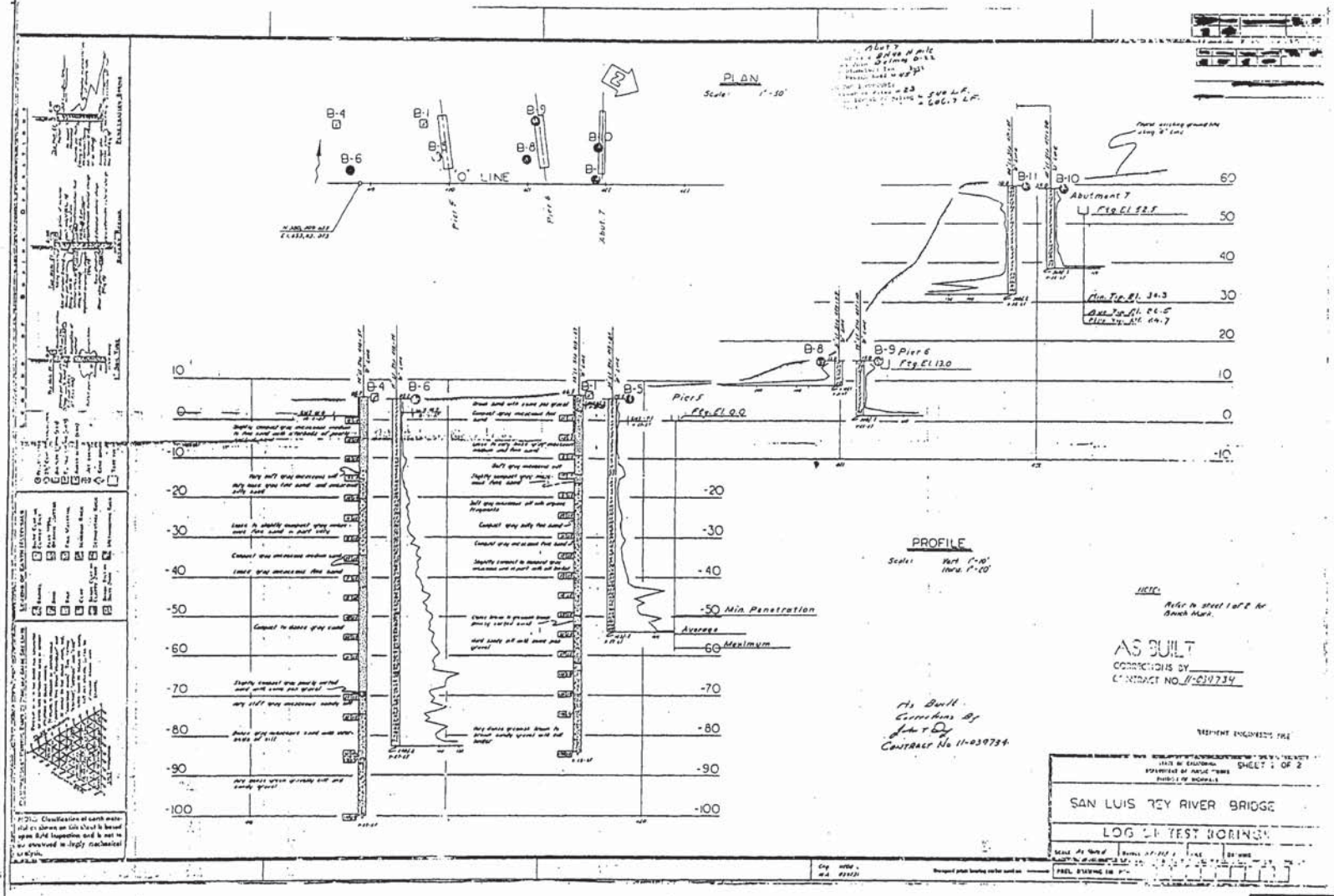

AS BUILT

CORRECTIONS BY CHRISTIAN JENSEN DOKKEN ENGR.

CONTRACT NO. 11-206904

DATE 9-2-97

NO AS BUILT CHANGES

NOTE:
THE AS-BUILT LOG OF TEST BORING SHEETS WERE USED TO PREPARE THE GEOTECHNICAL REPORT.

DESIGN OVERSIGHT R.BRENT LEMON
SIGNOFF DATE 8-21-96

NOTE:
ADDITIONAL AS-BUILT FOUNDATION DATA MAY BE AVAILABLE AT THE OFFICE OF TRANSPORTATION MATERIALS AND RESEARCH 5900 FOLSOM BOULEVARD, SACRAMENTO, CALIFORNIA 95819

	BY	CHECKED
DESIGN	B.REZNIKOV/P.NICHOLSON	S. HUQ
DETAILS	P.HOPKINS	P.NICHOLSON
QUANTITIES	B.REZNIKOV	J. YAO

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

P. YOUNG
PROJECT ENGINEER

CU 11273
EA 205901

BRIDGE NO. 57-0713L
POST MILE 53.3

DISREGARD PRINTS BEARING EARLIER REVISION DATES

EARTHQUAKE RETROFIT PROJECT NO. 284

SAN LUIS REY RIVER BRIDGE (L)

AS-BUILT LOG OF TEST BORINGS No.1

REVISION DATES (PRELIMINARY STAGES ONLY) 8/16/96

SHEET 15 OF 16

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

32235H14.DNG

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
11	SD	5	R49.1/R54.0	124	137

REGISTERED ENGINEER - CIVIL

9-9-96
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER JAMES J. STONE No. C25081 Exp. 12/31/97 CIVIL STATE OF CALIFORNIA

ROBERT BEIN, WILLIAM FROST AND ASSOCIATES
14725 ALTON PARKWAY
IRVINE, CA. 92718

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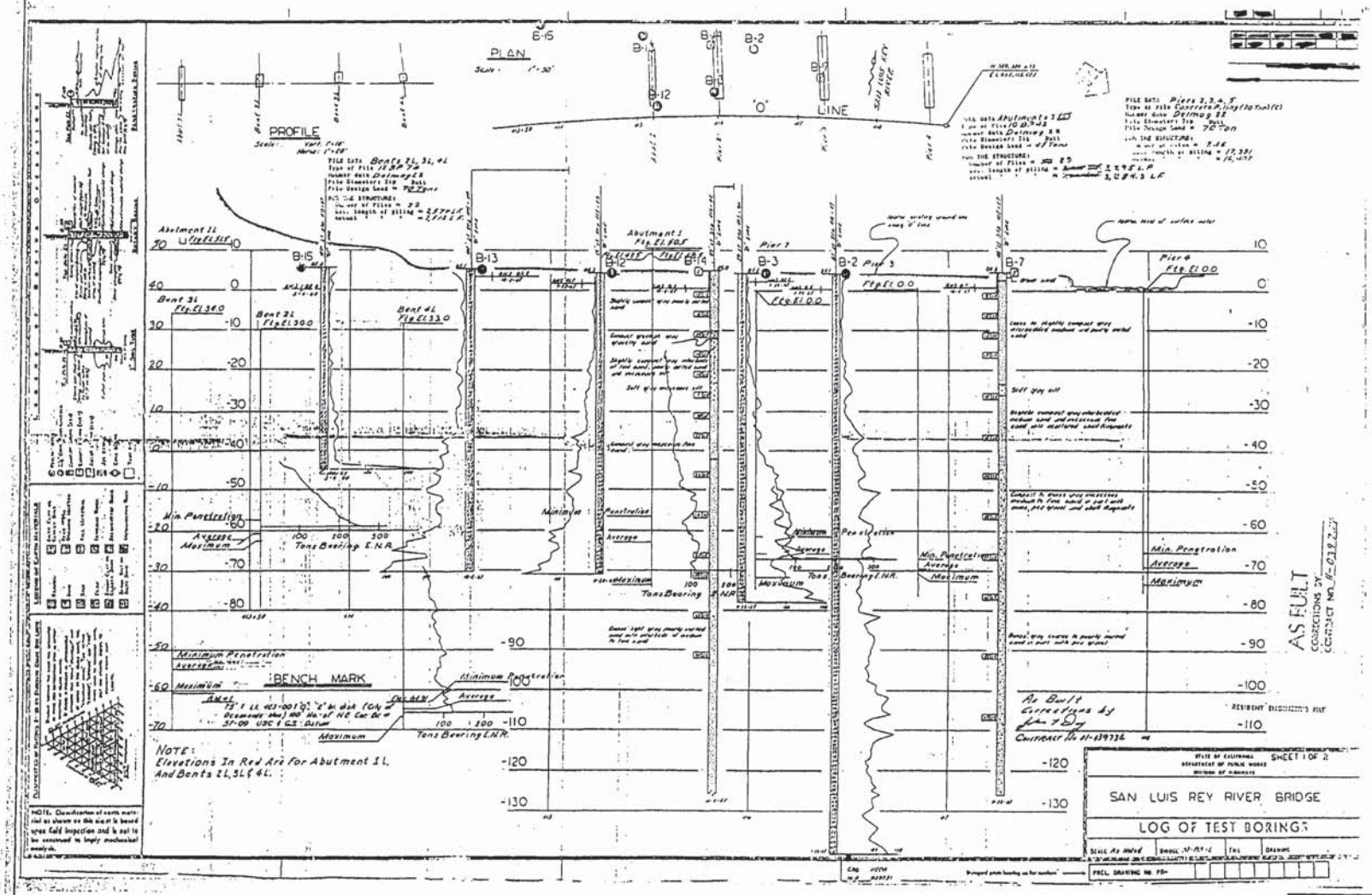
NOTE:
THE AS-BUILT LOG OF TEST BORING SHEETS WERE USED TO PREPARE THE GEOTECHNICAL REPORT.



AS BUILT

CORRECTIONS BY CHRISTIAN JENSEN DOKKEN ENGR

CONTRACT NO. 11-208904

DATE 9-2-97

NO AS BUILT CHANGES

EARTHQUAKE RETROFIT PROJECT NO. 284

SAN LUIS REY RIVER BRIDGE (L)

AS-BUILT LOG OF TEST BORINGS No.2

DESIGN OVERSIGHT R.BRENT LEMON
SIGNOFF DATE 8-21-96

NOTE:
ADDITIONAL AS-BUILT FOUNDATION DATA MAY BE AVAILABLE AT THE OFFICE OF TRANSPORTATION MATERIALS AND RESEARCH 5900 FOLSOM BOULEVARD, SACRAMENTO, CALIFORNIA 95819

DESIGN	BY B.REZNIKOV/P.NICHOLSON	CHECKED	S. HUQ
DETAILS	BY P. HOPKINS	CHECKED	P. NICHOLSON
QUANTITIES	BY B.REZNIKOV	CHECKED	J. YAO

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

P. YOUNG
PROJECT ENGINEER

BRIDGE NO. 57-0713L
POST MILE 53.3

CU 11273
EA 208901

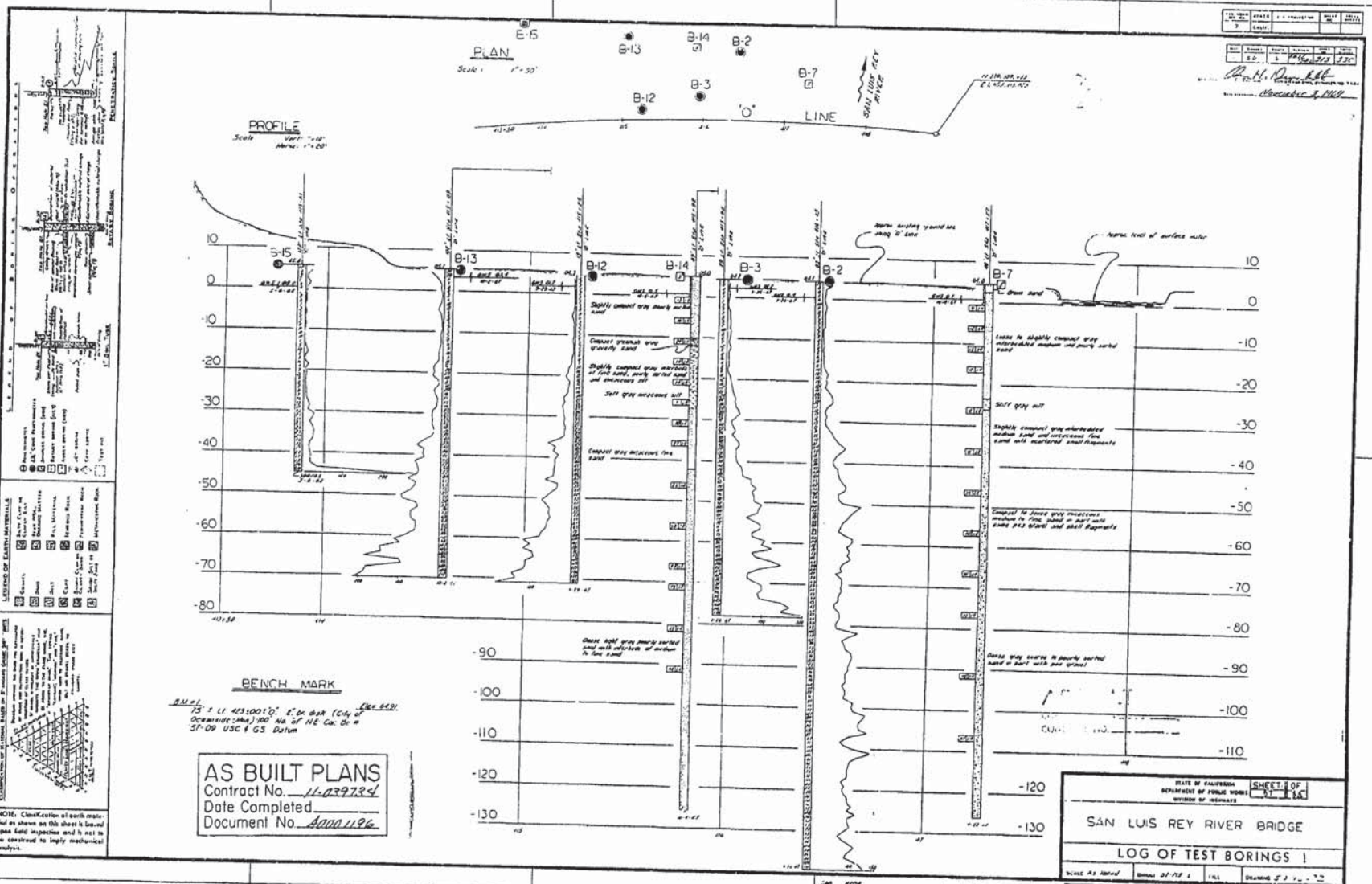
DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGES ONLY) 5/16/96

SHEET 16 OF 16

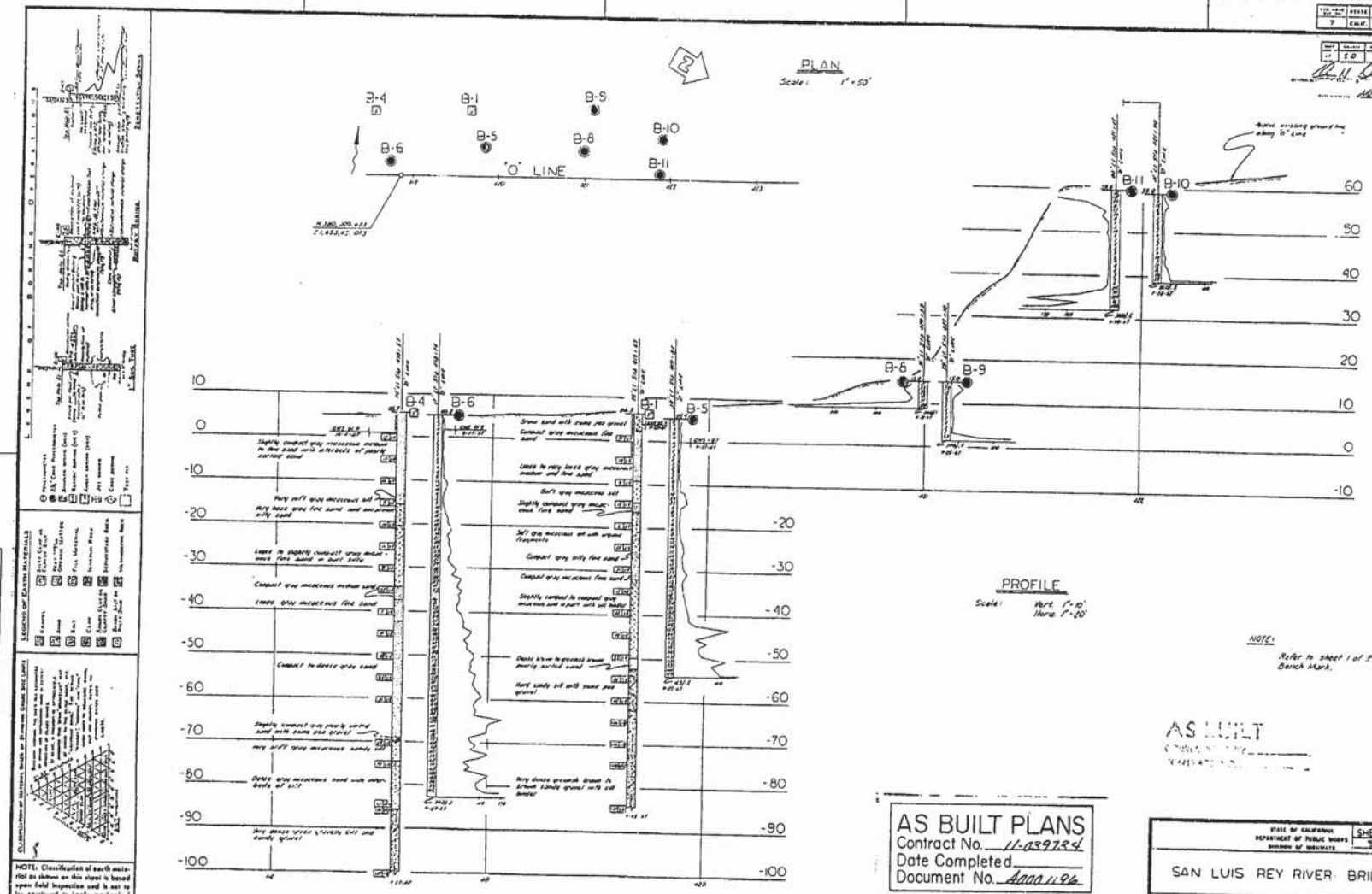
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

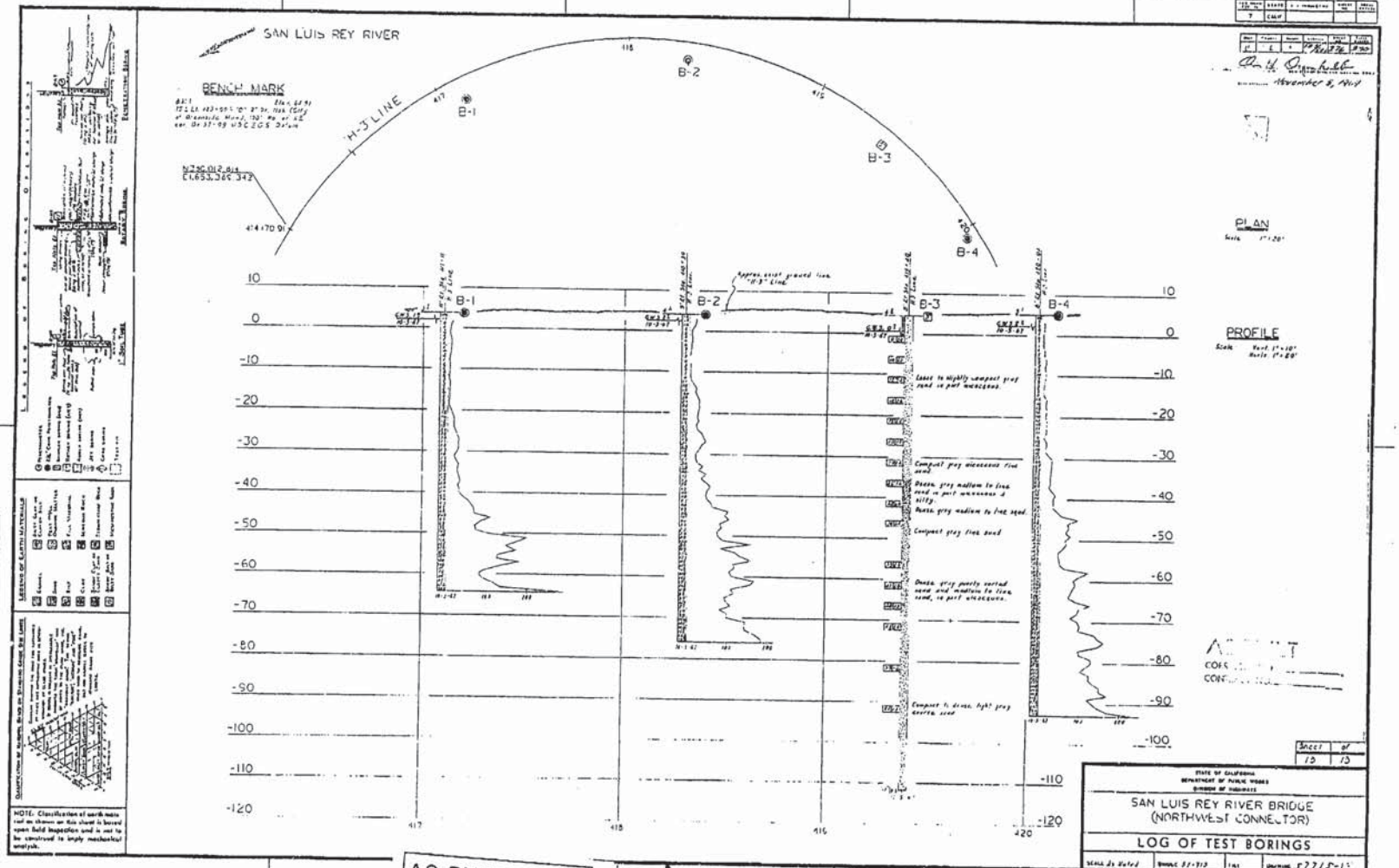
32235H14.DWG



I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE _____ SIGNATURE _____ TITLE _____

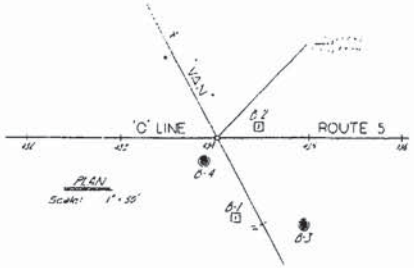

PLAN
Scale: 1" = 50'
B-4
B-1
B-9
B-6
B-5
B-8
B-10
B-11
'O' LINE
PROFILE
Scale: Vert. 1" = 10'
Horz. 1" = 20'
NOTE:
Refer to sheet 1 of 2 for Bench Mark.
AS BUILT
AS BUILT PLANS
Contract No. 11-039724
Date Completed
Document No. A000 1196
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
SHEET 58 OF 58
SAN LUIS REY RIVER BRIDGE
LOG OF TEST BORINGS 2
BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION
LEGEND OF BORING OPERATIONS
LEGEND OF EARTH MATERIALS
NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.
I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.
DATE
SIGNATURE
TITLE

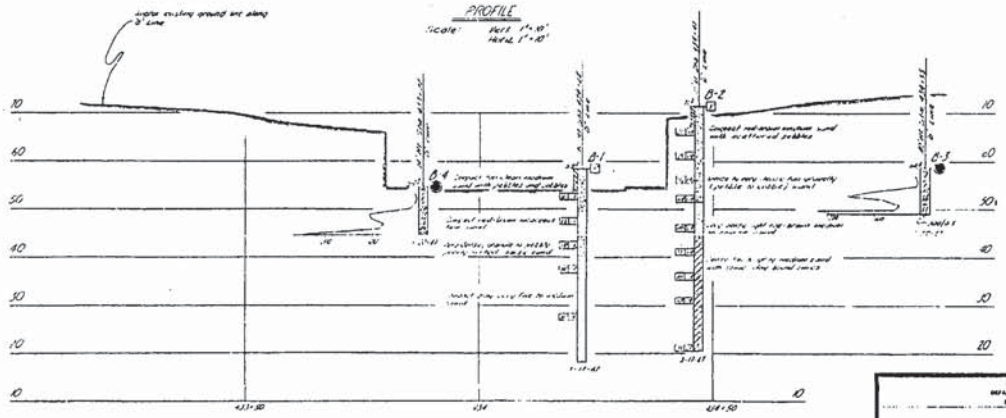


AS BUILT PLANS
Contract No. 11-039734
Date Completed
Document No. A0001196

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND COMPARED ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE 5 MAY 72 SIGNATURE [illegible] TITLE [illegible]





BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

AS BUILT PLANS
Contract No. 11-089734
Date Completed
Document No. A0001196

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

CAMP PENDLETON UNDERCROSSING
(NEW & MODIFICATIONS)
LOG OF TEST BORINGS

SHEET 12 OF 12

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT MADE UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE _____ SIGNATURE _____ TITLE _____

BRIDGE DEPARTMENT

AS BUILT PLANS
Contract No. 55-11K616
Date Completed
Document No. A000107P

No ground water encountered

Classification of Material Based on Standard Grade Size Limits

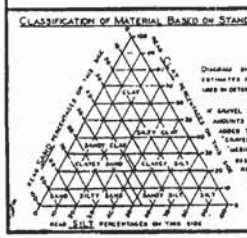


Diagram showing the basis for estimates of grade size distribution used in determination of class names.

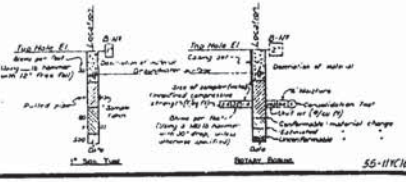
If gravel is present in appreciable amounts the term "gravelly" may be added to the class name. The terms "coarse," "medium" and "fine" when used to describe gravel, sand and silt refer to standard grade size limits.

Legend of Earth Materials

- Gravel
- Sand
- Silt
- Clay
- Sandy Clay or Clayey Sand
- Sandy Silt or Silty Sand
- Silty Clay or Clayey Silt
- Peat and/or Organic Clay
- Filled Material
- Igneous Rock
- Sedimentary Rock
- Metamorphic Rock

Legend of Boring Operations

- Plan of any boring
- Penetrometer
- 2½" Cone Penetrometer
- Sampler boring (SPT)
- Rotary boring (RB)
- Auger boring (BA)
- Jet boring
- Core boring
- Test pit



Notes

The contractor's attention is directed to Section 2, Article 22 of the Standard Specifications and to the special provisions accompanying this set of plans. Classification of earth materials as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis. Penetrometer borings having a rate of penetration measured in seconds per foot are driven with a 140 Waterman-Terry air hammer at 60 PSI.

State of California
Department of Public Works
Division of Highways

CAMP PENDELTON

LOG OF TEST BORINGS

Scale 1" = 5' | Bridge 57-135 | File | Drawing

55-11K616

Full drawing No. 5726

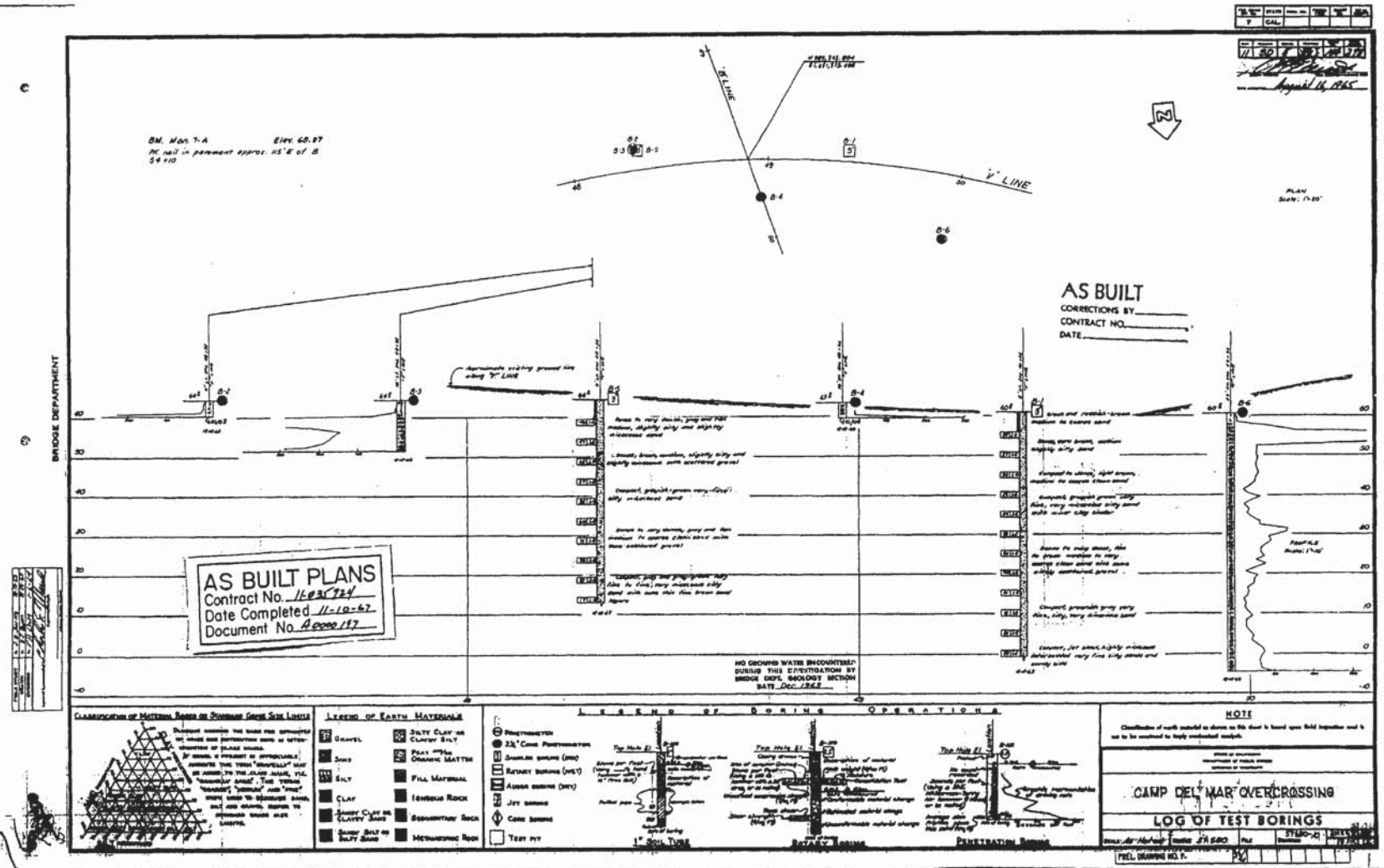
I hereby certify that this is a true and accurate copy of the above document filed under my direction and control on this day in Sacramento, California, pursuant to authorization of the Director of Public Works.

Date ____ Accounting ____ Time ____

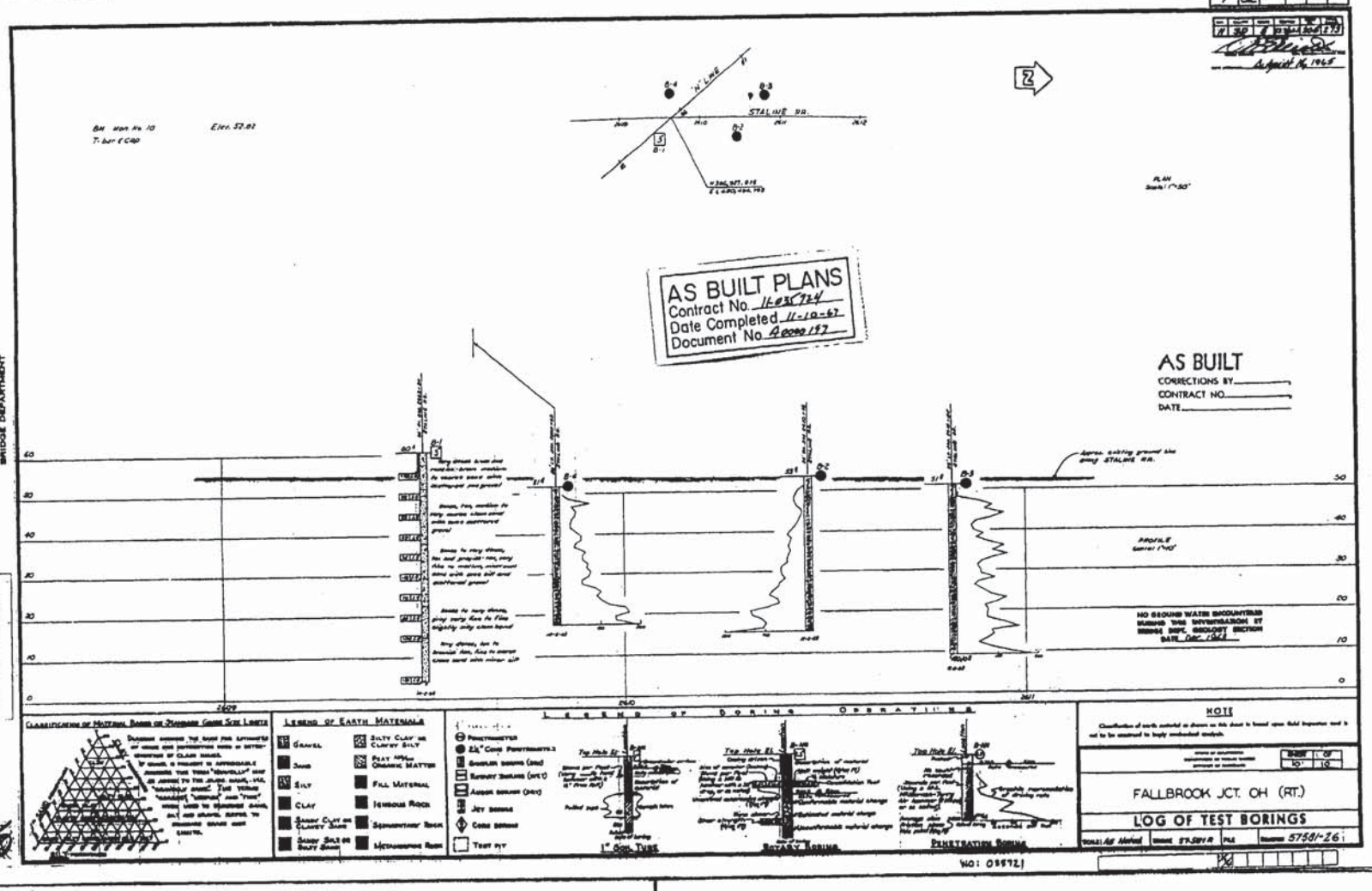
CAMP PENDELTON UC

Scale 1" = 5'

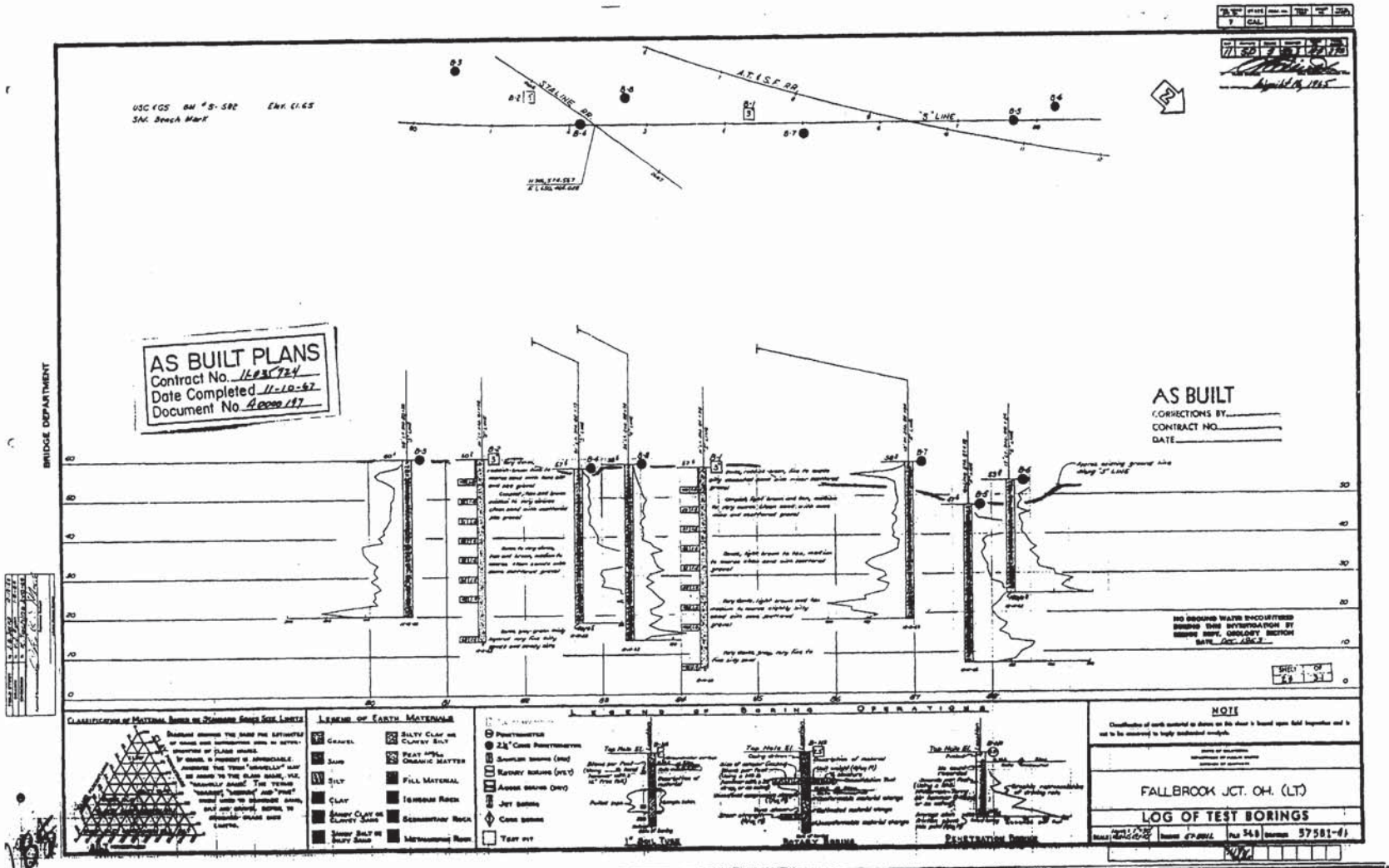
Department of Public Works



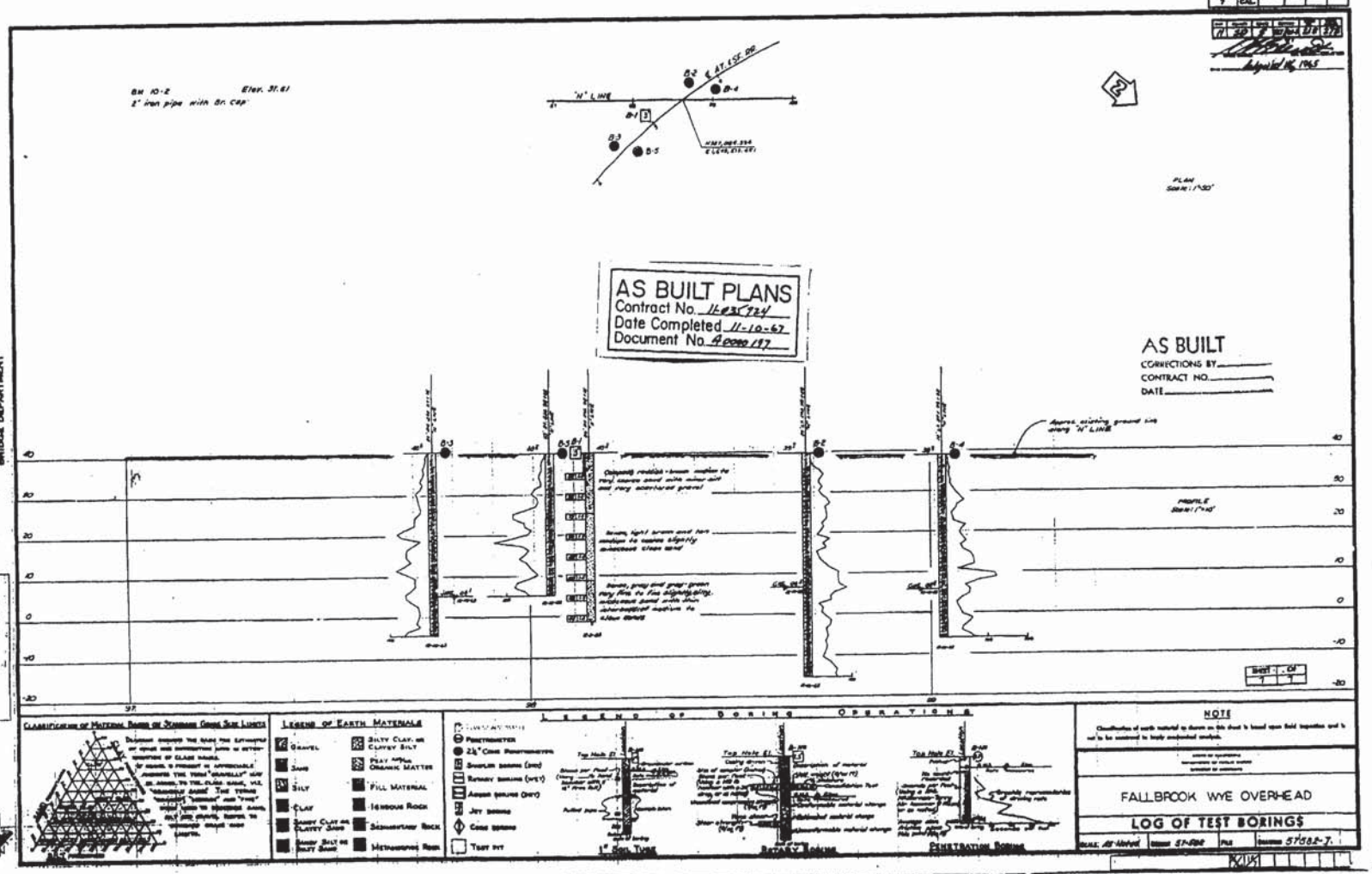
BRIDGE DEPARTMENT
BM. Mon. 7-A Elev. 68.87
PK nail in pavement approx. 115' E of B
54+10
"B" LINE
"V" LINE
PLAN
Scale: 1"=20'
AS BUILT
CORRECTIONS BY
CONTRACT NO.
DATE
AS BUILT PLANS
Contract No. 11-035924
Date Completed 11-10-67
Document No. A0000197
NO GROUND WATER ENCOUNTERED DURING THIS INVESTIGATION BY BRIDGE DEPT. GEOLOGY SECTION
DATE Dec 1963
PROFILE
Scale: 1"=10'
CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS
LEGEND OF EARTH MATERIALS
GRAVEL
SAND
SILT
CLAY
SANDY CLAY OR CLAYEY SAND
SANDY SILT OR SILTY SAND
SILTY CLAY OR CLAYEY SILT
PEAT OR ORGANIC MATTER
FILL MATERIAL
IGNEOUS ROCK
SEDIMENTARY ROCK
METAMORPHIC ROCK
LEGEND OF BORING OPERATIONS
PENETROMETER
2½" CONE PENETROMETER
SAMPLER BORING (DRY)
ROTARY BORING (WET)
AUGER BORING (DRY)
JET BORING
CORE BORING
TEST PIT
1" SOIL TUBE
ROTARY BORING
PENETRATION BORING
NOTE
CAMP DEL MAR OVERCROSSING
LOG OF TEST BORINGS
PREL. DRAWING NO. F.



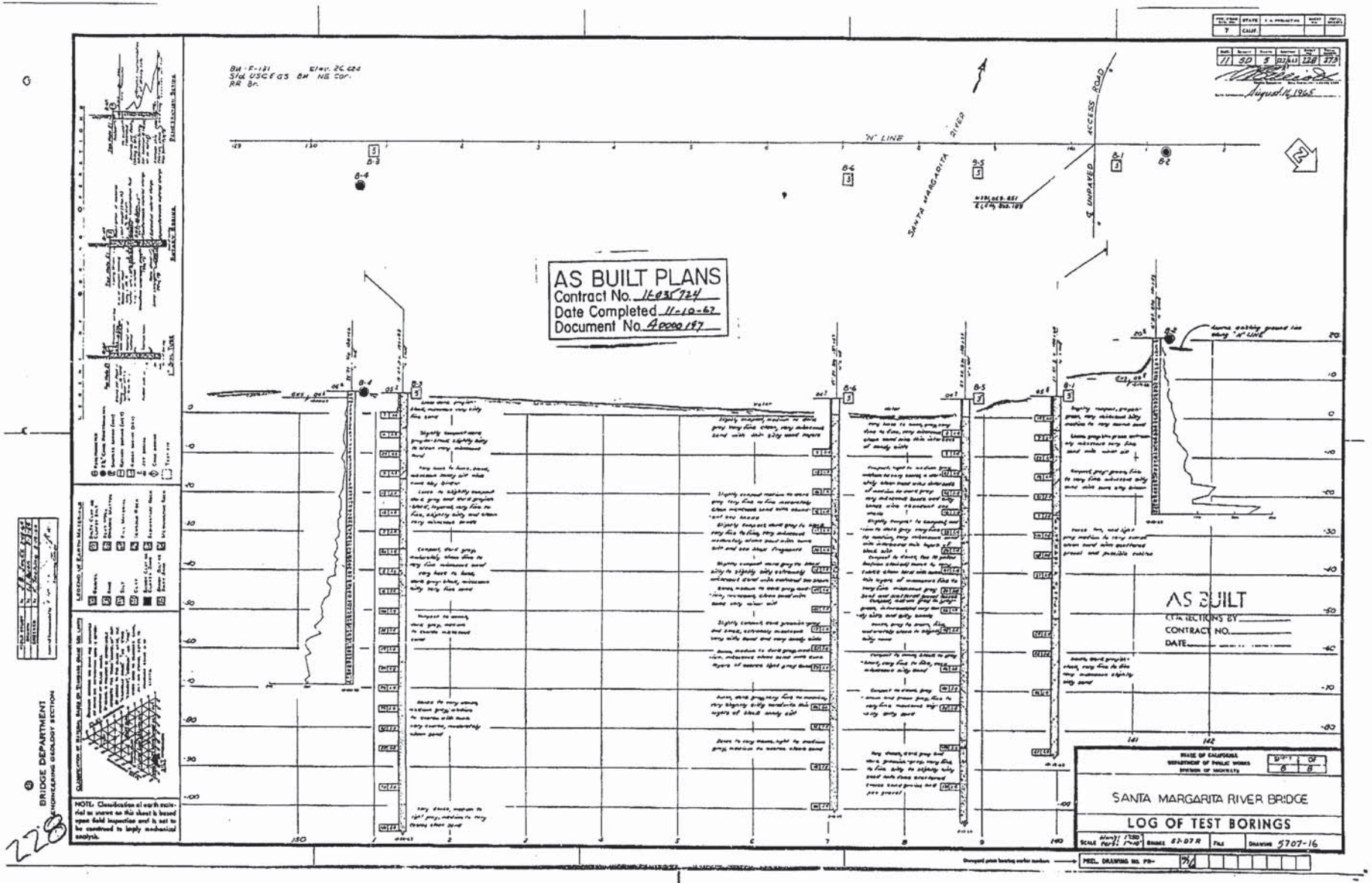
AS BUILT PLANS
Contract No. 11-035724
Date Completed 11-10-67
Document No. A0000197
AS BUILT
CORRECTIONS BY
CONTRACT NO.
DATE
STALINE RR.
PROFILE
BRIDGE DEPARTMENT
LEGEND OF EARTH MATERIALS
LEGEND OF BORING OPERATIONS
NOTE
FALLBROOK JCT. OH (RT.)
LOG OF TEST BORINGS
57581-26

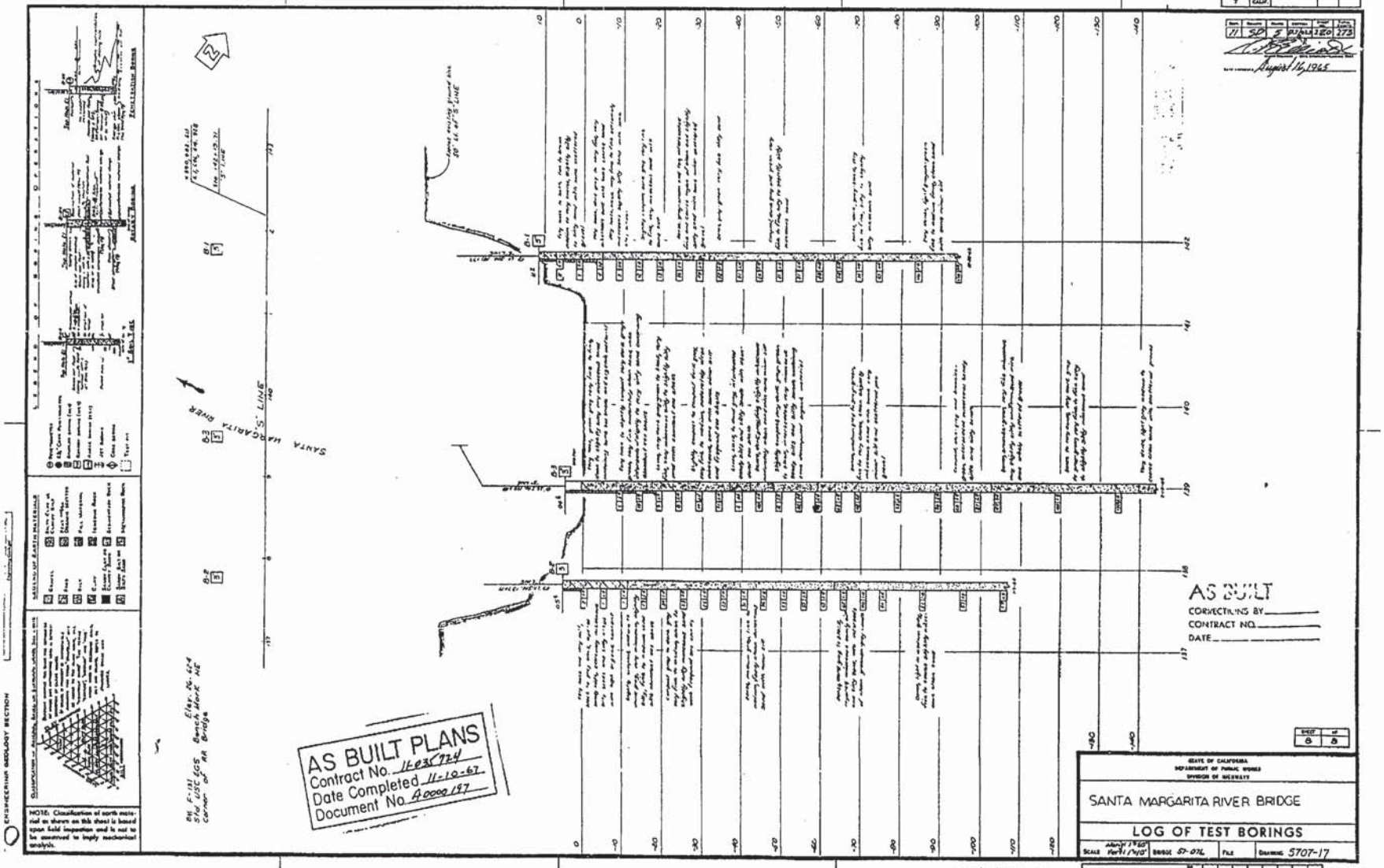


AS BUILT PLANS
Contract No. 11-035724
Date Completed 11-10-67
Document No. A0000197
AS BUILT
CORRECTIONS BY
CONTRACT NO.
DATE
BRIDGE DEPARTMENT
A.T. & S.F. RR.
STALINE RR.
"S" LINE
LEGEND OF EARTH MATERIALS
LEGEND OF BORING OPERATIONS
NOTE
FALLBROOK JCT. OH. (LT)
LOG OF TEST BORINGS
57581-41

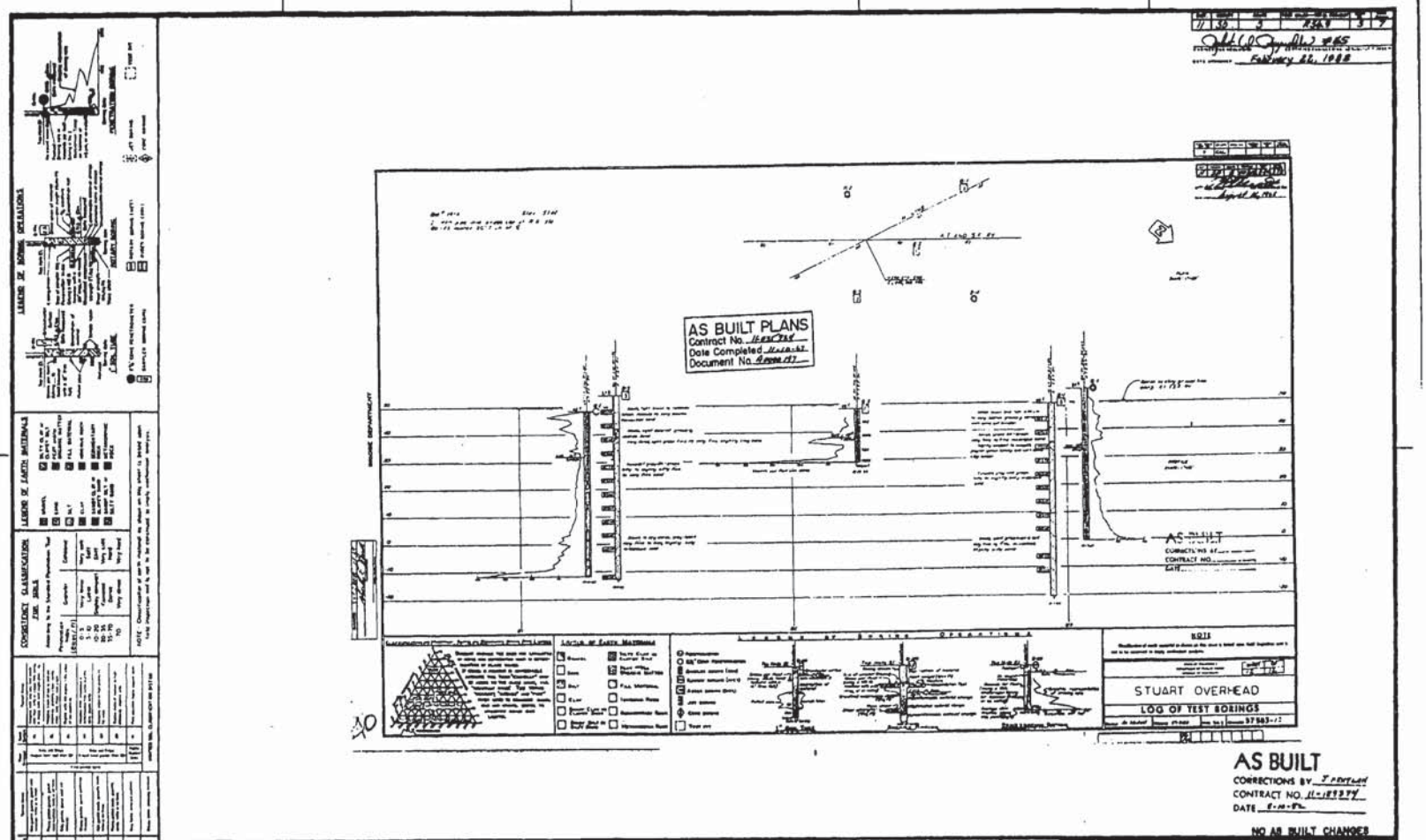


BM 10-2
Elev. 31.61
2" iron pipe with Br. cap
"N" LINE
B-1
B-2
B-3
B-4
B-5
PLAN
Scale: 1"=50'
AS BUILT PLANS
Contract No. 11-035724
Date Completed 11-10-67
Document No. A0000197
AS BUILT
CORRECTIONS BY
CONTRACT NO.
DATE
PROFILE
Scale: 1"=10'
BRIDGE DEPARTMENT
CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS
LEGEND OF EARTH MATERIALS
GRAVEL
SAND
SILT
CLAY
SANDY CLAY OR CLAYEY SAND
SANDY SILT OR SILTY SAND
SILTY CLAY OR CLAYEY SILT
PEAT AND ORGANIC MATTER
FILL MATERIAL
IGNEOUS ROCK
SEDIMENTARY ROCK
METAMORPHIC ROCK
LEGEND OF BORING OPERATIONS
PENETROMETER
2½" CONE PENETROMETER
SAMPLER BORING (DRY)
ROTARY BORING (WET)
AUGER BORING (DRY)
JET BORING
CORE BORING
TEST PIT
1" SOIL TUBE
ROTARY BORING
PENETRATION BORING
NOTE
FALLBROOK WYE OVERHEAD
LOG OF TEST BORINGS
57582-7


AS BUILT PLANS
Contract No. 11-035724
Date Completed 11-10-62
Document No. A0000197
"N" LINE
SANTA MARGARITA RIVER
UNPAVED ACCESS ROAD
AS BUILT
CORRECTIONS BY
CONTRACT NO.
DATE
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
SANTA MARGARITA RIVER BRIDGE
LOG OF TEST BORINGS
DRAWING 5707-16
BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION
NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.
August 14, 1965
228

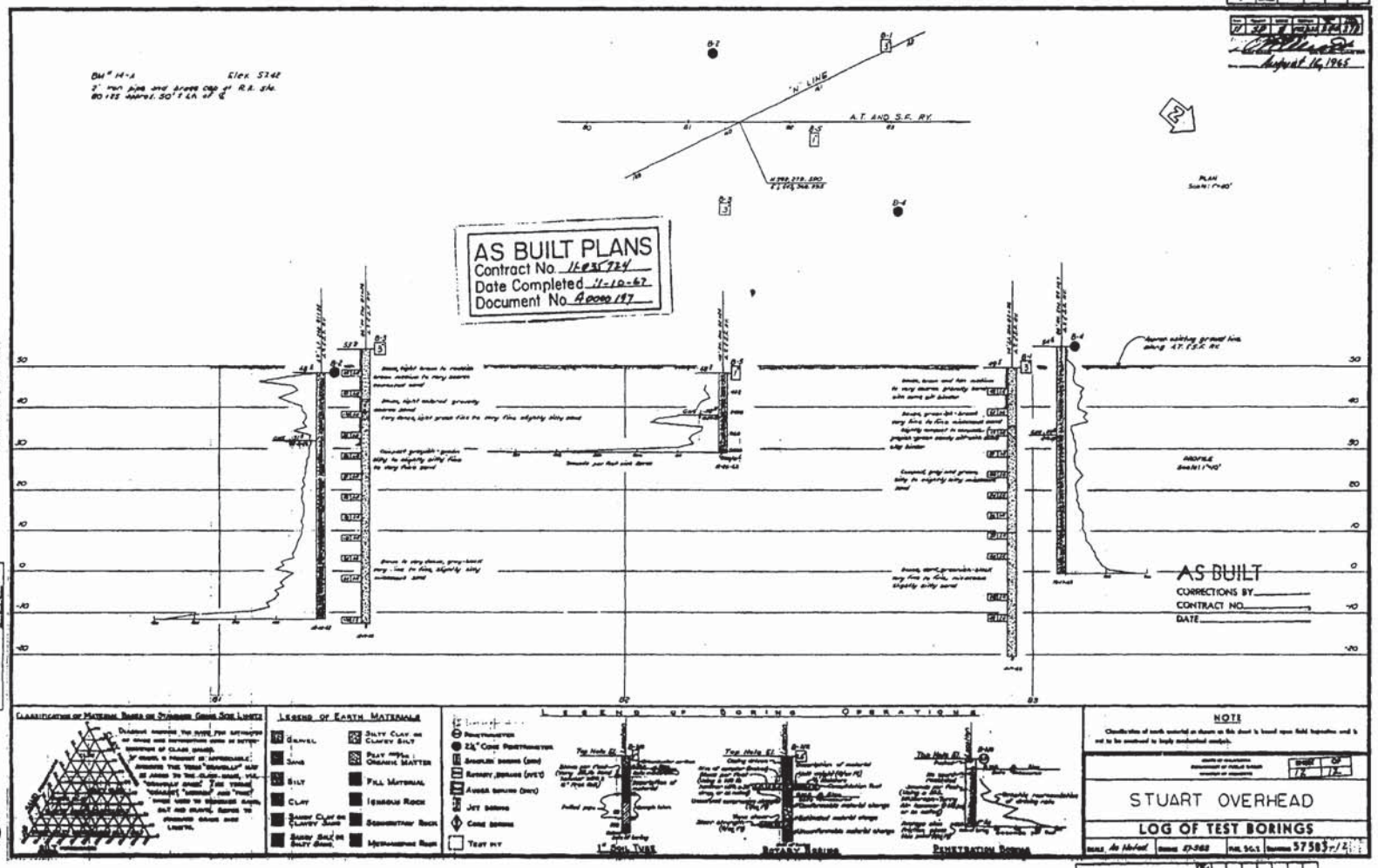


AS BUILT PLANS
Contract No. 11-035724
Date Completed 11-10-67
Document No. A0000197
AS BUILT
CORRECTIONS BY
CONTRACT NO.
DATE
SANTA MARGARITA RIVER BRIDGE
LOG OF TEST BORINGS
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
SCALE
BRIDGE 57-076
FILE
DRAWING 5707-17
PREL. DRAWING No. PB-
August 16, 1965
NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.
ENGINEERING GEOLOGY SECTION



5

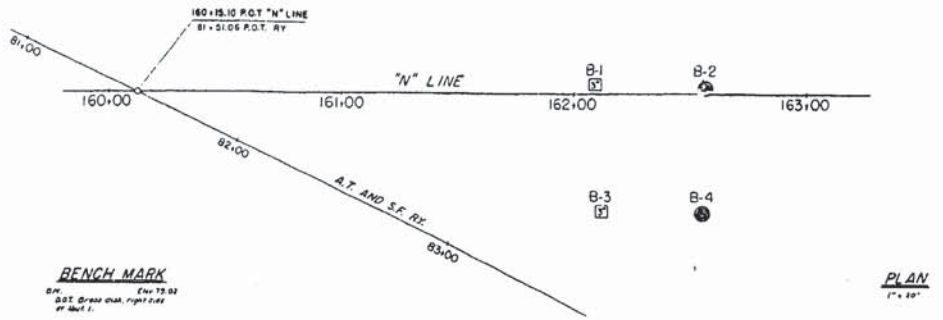
AS BUILT PLANS
Contract No. 11-189374
Date Completed
Document No.

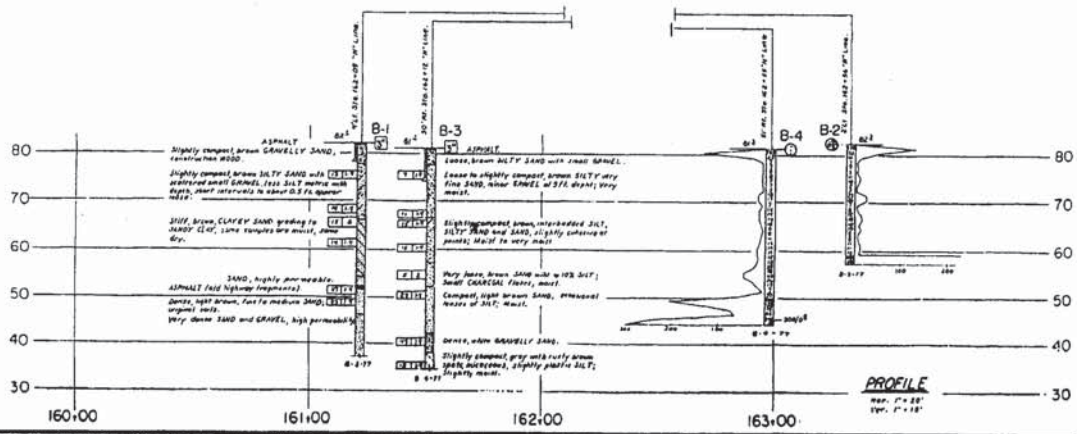


AS BUILT PLANS
Contract No. 11-035724
Date Completed 11-10-67
Document No. A0000197
BRIDGE DEPARTMENT
"N" LINE
A.T. AND S.F. RY.
PLAN
PROFILE
AS BUILT
CORRECTIONS BY
CONTRACT NO.
DATE
CLASSIFICATION OF MATERIAL BASED ON STANDARD GRAIN SIZE LIMITS
LEGEND OF EARTH MATERIALS
GRAVEL
SAND
SILT
CLAY
SANDY CLAY OR CLAYEY SAND
SANDY SILT OR SILTY SAND
SILTY CLAY OR CLAYEY SILT
PEAT MOSS OR ORGANIC MATTER
FILL MATERIAL
IGNEOUS ROCK
SEDIMENTARY ROCK
METAMORPHIC ROCK
LEGEND OF BORING OPERATIONS
PENETROMETER
2½" CORE PENETROMETER
SAMPLER BORING (SPT)
ROTARY BORING (RVT)
AUGER BORING (DRY)
JET BORING
CORE BORING
TEST PIT
1" SOIL TUBE
ROTARY BORING
PENETRATION BORING
NOTE
STUART OVERHEAD
LOG OF TEST BORINGS
57583-1/2

11	50	5	R3.6	4	7

February 23, 1982





AS BUILT
CORRECTIONS BY J. DONTSUK
CONTRACT NO. 11-189374
DATE 8-10-92
NO AS BUILT CHANGES

ENGINEERING GEOLOGY AND TECHNICAL SERVICES BRANCH - TRANSPORTATION LABORATORY

DRAWN BY: JOHN CHAPPEL 11/81 — F.C. Reed 7-31
CHECKED BY: EUGENE BAND 10-1-81 — T.T. Pringle 3-18

State of CALIFORNIA DEPARTMENT OF TRANSPORTATION

STRUCTURES - DESIGN

BRIDGE NO. 57-0583
PART NO. 56.2
CU 11212
WO 189371

STUART OVERHEAD - REPAIR
LOG OF TEST BORINGS 1 OF 2

4 5

AS BUILT PLANS
Contract No. 11-189374
Date Completed
Document No.

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND SIGNED, ON THE DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION OF THE DIRECTOR OF TRANSPORTATION.

12-8-83 — SUPERVISOR OF MICROFILM SERVICES

APPENDIX B

APPENDIX II
LABORATORY TESTING

The laboratory test program was design to fit the specific need of this project and was limited to testing on-site materials. A brief description of each type of test is presented below. Results are given on the following pages and on the boring logs in Appendix I.

Moisture contents and dry densities were determined for numerous relatively undisturbed samples. Results are listed on the boring logs in Appendix I.

The grain size distributions of 17 samples were determined in general accordance with ASTM D 422. Results are plotted on Plates II-1 through II-17.

The Atterberg limits of 4 samples were determined in general accordance with ASTM D 4318. Results are shown on the corresponding grain size distribution on Plates II-1, 2,3 and 7.

One-dimensional consolidation tests were performed on 4 relatively undisturbed samples in general accordance with ASTM D 2435. Results are shown on Plates II-18 through II-21.

In addition to in-situ field tests, strength characteristics of the subsurface soils were determined in the laboratory by direct shear tests performed on 13 relatively undisturbed samples. Specimens were submerged and tested at 3 normal loads. All samples were tested in a 71.4mm I.D. circular shear box, using a controlled displacement rate. The direct shear tests were performed in general accordance with ASTM D 3080. Results are shown on Plates II-22 through II-34.

R-value tests were performed on 7 samples of soil considered reasonably representative of final subgrade materials. The tests were performed in accordance with California Test 301 procedures. Results are presented on Plate II-35

Corrosivity tests were performed on 11 samples. The pH and minimum resistivity were determined in general accordance with California Test 643. Soluble sulfate content was determined in accordance with California Test 417. Total chloride ion content was determined in accordance with California Test 532. Results are presented on Plate II-36.

Soil samples not tested are now stored in our laboratory for future reference and analysis, if needed. Unless notified to the contrary, all samples will be disposed of 30 days from the date of this report.

SOIL TEST SCHEDULING SHEET

JOB NAME: MANCHESTER AVENUE AT INTERSTATE 5 OB NO: 0111146 SAMPLED BY:

ASSIGNED BY: DATE REQ'D: IN LAB: SHELF #

SAMPLE		Sieve			NAT'L γ & M.C.		CONSOLIDATION				DIR. SHEAR											
Number	Type	P. I.		-200 %	Dry Density (kg/m³)	% moisture	$C_c/(1+e_o)$				Φ	cohesion (kPa)			R' VALUES	SOL. CHLORIDES	SOL. SULFATES	PH	Resistivity (Ω - cm)			
B1 0-1.5 m	Bag	11		31.4																		
B1 - 1.5m	US				1691.5	12.5																
3.0 m	US				1721.8	12.6					36	1.1										
4.5 m	US				1891.3	11.5																
6.0 m	US	11		33.7	1764.5	14.2					34	10.3										
7.5 m	US				1614.4	24.8																
9.5 m	US				1497.3	29.7																
10.7 m	US				1493.2	30.9					31	13.0										
12.2 m	US				1586.8	24.5																
B1 4-5 m	Bag	12		28.3																		
B1 13.7 m	US			5.3	1639.2	25.5					31	10.7										
B1 16.7 m	SPT																					
B1 18.3 m	SPT																					
B1 19.8 m	SPT																					
B1 21.3 m	SPT																					
B1 22.9 m	US			13.5	1659.9	24.4					32	8.2										
B1 24.4 m	SPT																					
B1 27.4	SPT	21		66.1																		
B1 30.48	SPT																					
CODE TOTALS																						

TIME CON PT.	710
MAX DEN 'B' OR 'D'	715
SINGLE PT. SHEAR	728
RES. SHEAR	731
SPEC. GRAVITY	734
S. E.	735
CBR - SD	736
CBR - NAVY	737

REMARKS

POSTED BY:

SOIL TEST SCHEDULING SHEET

JOB NAME: MANCHESTER AVENUE AT INTERSTATE 5 OB NO: 0111146 SAMPLED BY:

ASSIGNED BY: DATE REQ'D: IN LAB: SHELF #

SAMPLE		Sieve			NAT'L γ & M.C.		CONSOLIDATION				DIR. SHEAR												
Number	Type	P. I.		-200 %	Dry Density (kg/m³)	% moisture	$C_c/(1+e_o)$				Φ	cohesion (kPa)			R' VALUES	SOL. CHLORIDES	SOL. SULFATES	PH	Resistivity (Ω - cm)				
B1 0-1.5 m	Bag	11		31.4																			
B1 - 1.5m	US				1691.5	12.5																	
3.0 m	US				1721.8	12.6					36	1.1											
4.5 m	US				1891.3	11.5																	
6.0 m	US	11		33.7	1764.5	14.2					34	10.3											
7.5 m	US				1614.4	24.8																	
9.5 m	US				1497.3	29.7																	
10.7 m	US				1493.2	30.9					31	13.0											
12.2 m	US				1586.8	24.5																	
B1 4-5 m	Bag	12		28.3																			
B1 13.7 m	US			5.3	1639.2	25.5					31	10.7											
B1 16.7 m	SPT																						
B1 18.3 m	SPT																						
B1 19.8 m	SPT																						
B1 21.3 m	SPT																						
B1 22.9 m	US			13.5	1659.9	24.4					32	8.2											
B1 24.4 m	SPT																						
B1 27.4	SPT	21		66.1																			
B1 30.48	SPT																						
CODE TOTALS																							

TIME CON PT.	710
MAX DEN 'B' OR 'D'	715
SINGLE PT. SHEAR	728
RES. SHEAR	731
SPEC. GRAVITY	734
S. E.	735
CBR - SD	736
CBR - NAVY	737

REMARKS

POSTED BY:

SOIL TEST SCHEDULING SHEET

NAME: MANCHESTER AVENUE AT INTERSTATE JOB NO: 0111146 SAMPLED BY:

ASSIGNED BY: DATE REQ'D: IN LAB: SHELF #

SAMPLE		Sieve			NAT'L γ & M.C.		CONSOLIDATION				DIR. SHEAR										
Number	Type	P. I.		-200 %	Dry Density (kg/m³)	% moisture	$C_c/(1+e_o)$				Φ	cohesion (kPa)		R' VALUES	SOL. CHLORIDES	SOL. SULFATES	PH	Resistivity (Ω - cm)			
B2 0-1.5 m	Bag			18.3																	
B2 - 1.5m	US				1865.1	10.2															
3.0 m	US				1989.1	16.8					39	6.4									
4.5 m	US				1696.9	11.7															
6.0 m	US				1787.6	10.5	0.02														
7.6 m	US				1782.4	15.0															
9.1 m	US				1868.6	15.0					36	6.5									
10.7 m	US				1725.1	16.1															
B3 0-1.5m	BAG			16.7																	
B3 1.5	US				1674.1	15.6															
3.0 m	US				1626.6	21.6															
4.5 m	US				1776.0	10.6															
6.0 m	US				1692.2	14.3	0.01		1	5											
7.6 m	US				2064.8	15.3															
9.1 m	US				1749.5	14.8															
10.7 m	US				1649.3	22.6															
13.7 m	US				1593.1	25.2	0.02		1	5											
15.0 m	US				1517.8	28.6															
15.5 m	US				1517.8	28.6															
CODE TOTALS																					

TIME CON PT.	710
MAX DEN 'B' OR 'D'	715
SINGLE PT. SHEAR	728
RES. SHEAR	731
SPEC. GRAVITY	734
S. E.	735
CBR - SD	736
CBR - NAVY	737

REMARKS

POSTED BY:

SOIL TEST SC .DULING SHEET

J. NAME: MANCHESTER AVENUE AT INTERSTATE 5 JOB NO: 0111146 SAMPLED BY:

ASSIGNED BY: DATE REQ'D: IN LAB: SHELF #

SAMPLE		Sieve			NAT'L γ & M.C.		CONSOLIDATION				DIR. SHEAR												
Number	Type	P. I.		-200 %	Dry Density (kg/m³)	% moisture	$C_c/(1+e_o)$				Φ	cohesion (kPa)			R' VALUES	SOL. CHLORIDES %	SOL. SULFATES %	PH	Resistivity (Ω - cm)				REMARKS
B4 0-1.5 m	Bag			8.6												0.002	0.001	8.5	8016				
1.5 m	US										33	6.7											
3.0 m	SPT																						
B5 0-1.5m	Bag			8											72								
1.5 m	US				1623	12																	
3.0 m	US				1579	10																	
B6 0-1.5m	Bag																						
1.5 m	US				1879	10					42	0.5											
3.0 m	US				1853	7.7																	
B7 0-1.5m	Bag																						
1.5 m	US										36	2.5											
3.0 m	US				1760	10																	
B8 0-1.5m	Bag			15											73	0.003	0.002	8.8	4810				
1.5 m	US										32	7.5											
3.0 m	US				1825	11																	
B9 0-1.5m	Bag														75								
0.7m	US				1762	8																	
1.5m	US						0.02																
3.0m	US				1762	7.6																	
CODE TOTALS																							POSTED BY:

SOIL TEST SCHEDULING SHEET

JOB NAME: MANCHESTER AVENUE AT INTERSTATE 5

JOB NO: 0111146

SAMPLED BY:

ASSIGNED BY:

DATE REQ'D:

IN LAB:

SHELF #

SAMPLE		Sieve			NAT'L γ & M.C.		CONSOLIDATION				DIR. SHEAR											
Number	Type	P. I.		-200 %	Dry Density (kg/m³)	% moisture	$C_c/(1+e_o)$				Φ	cohesion (kPa)			R' VALUES	SOL. CHLORIDES %	SOL. SULFATES %	PH	Resistivity (Ω - cm)			REMARKS
B10 0-1.5 m	Bag			14											75	0.026	0	7.1	1002			
1.5 m	US				1638	19					30	17										
3.0 m	SPT																					
B11 0-1.5m	Bag																					
1.5 m	US				1736	13					41	1.3										
3.0 m	US				1723	6.2																
B12 0.3-1.2 m	Bag			18																		
B12 0.7 m	US				1614	5.9																
1.5 m	US				1584	4.9																
B13 0.6 1.2m	Bag														60							
0.7 m	US				1651	16.0																
1.5 m	US				1456	28.0																
B14 0-1.5m	Bag			25																		
.7 m	US				1764	17.4																
1.5 m	US				1624	15.2																
B15 0.3-1.2m	Bag																					
0.7m	US				1660	6.7																
1.5m	US				1612	7.3																
3.0m	US				1608	5.7																
CODE TOTALS																						POSTED BY:

SUMMARY C OIL TESTS

JOB NAME: MANCHESTER AVENUE AT INTERSTATE 5 JOB NO: 0111146

SAMPLE		Sieve			NAT'L γ & M.C.		CONSOLIDATION				DIR. SHEAR											
Number	Type	P. I.		-200 %	Dry Density (kg/m³)	% moisture	$C_c/(1+e_o)$				Φ	cohesion (kPa)			R' VALUES	SOL. CHLORIDES %	SOL. SULFATES %	PH	Resistivity (Ω - cm)			REMARKS
B16 0-1.5 m	Bag			12											60							
1.5 m	US				1818	14.3																
3.0 m	SPT																					
B17 0-1.5m	Bag														47							
0.7 m	US				1762	7.5																
1.5 m	US				1680	5.9																
3.0m	US				1692	11.7																
B18 0-.7m	US			21																		
0.7 m	US				1749	17.6																
1.5 m	US				1767	7																
3.0 m	US				1708	17.8																
CODE TOTALS																						POSTED BY:

SUMMARY C OIL TESTS

JO. AME: MANCHESTER AVENUE AT INTERSTATE 5 JOB NO: 0111146

SAMPLE		Sieve			NAT'L γ & M.C.			CONSOLIDATION				DIR. SHEAR											
Number	Type	P. I.		-200 %	Density	% moisture		$C_c/(1+e_o)$				Φ	cohesion			R' VALUES	SOL. CHLORIDES %	SOL. SULFATES %	PH	Resistivity (Ω - cm)			REMARKS
B1 1.5 m	US																0.262	0.068	6.6	130			
3.0 m	US																						
4.5 m	US																						
7.5 m	US																						
9.5 m	US																0.152	0.190	6.9	130			
10.7 m	US																						
12.2 m	US																0.129	0.164	6.5	110			
22.86 m	US																						
B2 1.5 m	US																0.002	0.140	6.8	2600			
3.0 m	US																						
6.1 m	US																0.007	0.026	7.5	2000			
4.5 m	US																						
7.6 m	US																0.014	0.038	7.4	1200			
9.2 m	US																						
B3 12.2 m	US																0.043	0.042	8.5	1200			
B3 13.7 m	US																						
B3 15 m	US																0.054	0.229	4.6	350			
CODE TOTALS																							POSTED BY:

TABLE OF CONTENTS

APPENDIX III

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APPENDIX II
LABORATORY TESTING

The laboratory test program was design to fit the specific need of this project and was limited to testing on-site materials. A brief description of each type of test is presented below. Results are given on the following pages and on the boring logs in Appendix I.

Moisture contents and dry densities were determined for numerous relatively undisturbed samples. Results are listed on the boring logs in Appendix I.

The grain size distributions of 23 samples were determined in general accordance with ASTM D 422. Results are plotted on Plates II-1 through II-23.

In addition to in-situ field tests, strength characteristics of the subsurface soils were determined in the laboratory by direct shear tests performed on 19 relatively undisturbed samples. Specimens were submerged and tested at 3 normal loads. All samples were tested in a 71.4mm I.D. circular shear box, using a controlled displacement rate. The direct shear tests were performed in general accordance with ASTM D 3080. Results are shown on Plates II-24 through II-42.

One-dimensional consolidation tests were performed on 5 relatively undisturbed samples in general accordance with ASTM D 2435. Results are shown on Plates II-43 through II-47.

R-value tests were performed on 5 samples of soil considered reasonably representative of final subgrade materials. The tests were performed in accordance with California Test 301 procedures. Results are presented on Plate II-48

Corrosivity tests were performed on 11 samples. The pH and minimum resistivity were determined in general accordance with California Test 643. Soluble sulfate content was determined in accordance with California Test 417. Total chloride ion content was determined in accordance with California Test 532. Results are presented on Plate II-49.

Soil samples not tested are now stored in our laboratory for future reference and analysis, if needed. Unless notified to the contrary, all samples will be disposed of 30 days from the date of this report.

SUMMARY OF SOIL TESTS

JOB NAME: LOMAS SANTA FE AT INTERSTATE 5 **JOB NO:** 0211248

SAMPLE		Sieve			NAT'L γ & M.C.		CONSOLIDATION				DIR. SHEAR												
Number	Type	P. I.		-200 %	Dry Density (kg/m³)	% moisture	$C_c/(1+e_o)$				Φ	cohesion (kPa)			R' VALUES	SOL. CHLORIDES %	SOL. SULFATES %	pH	Resistivity (Ω - cm)				REMARKS
B10 @ 0- 0.9 m	Bag														40								
B10 @ 0.9 m	US				1759	12.4																	
B11 @ 0.9 m	US				1480	7.2																	
1.5 m	US				1563	5.8																	
B11 0.3-1.0 m	Bag			11.5												0.004	0.001	7.7	8684				
T-1 @ 0 - 0.5 m	Bag																						
T-1 @ 1 - 1.5 m	Bag															0.016	0.018	5.4	1670				
T-1 @ 1 m	CK				1812	8.8																	
T-2 @ 0 - 0.5 m	Bag																						
T-2 @ 1 m	cK				1790	10.6																	
CODE TOTALS																							POSTED BY:

US - Relatively Undisturbed Sample

Bag - Bag Sample

Ck - Chunk Sample

SUMMARY OF SOIL TESTS

JOB NAME: LOMAS SANTA FE AT INTERSTATE 5 **JOB NO:** 0211248

SAMPLE		Sieve			NAT'L γ & M.C.		CONSOLIDATION				DIR. SHEAR												
Number	Type	P. I.		-200 %	Dry Density (kg/m³)	% moisture	$C_c/(1+e_o)$				Φ	cohesion (kPa)			R' VALUES	SOL. CHLORIDES %	SOL. SULFATES %	pH	Resistivity (Ω - cm)				REMARKS
B6 @ 0.9 m	US				1826	13.4																	
1.5 m	US				1684	20.5																	
3.0 m	US				1692	12.1																	
B6 @ 0.3- 1.0 m	Bag			20.1																			
B7 @ 0.9 m	US										34	12.4				0.004	0.006	8.1	2004				
1.5 m	US																						
3.0 m	US																						
B7 @ 0- 0.9 m	Bag																						
B7 @ 1.5 - 3.0 m	Bag			40.3																			
B8 @ 1.5 m	US										34	10.6											
3.0 m	US																						
B8 @ 0- 0.9 m	Bag			25.6											28	0.033	0.027	7.8	802				
B9 @ 0.9 m	US																						
1.5 m	US																						
3.0 m	SPT			19.1																			
B9 @ 0- 0.9 m	Bag			16.2											61								
CODE TOTALS																							POSTED BY:

SUMMARY OF SOIL TESTS

JOB NAME: LOMAS SANTA FE AT INTERSTATE 5 JOB NO: 0211248

SAMPLE		Sieve			NAT'L γ & M.C.		CONSOLIDATION				DIR. SHEAR												
Number	Type	P. I.		-200 %	Dry Density (kg/m³)	% moisture	$C_c/(1+e_o)$				Φ	cohesion (kPa)			R' VALUES	SOL. CHLORIDES %	SOL. SULFATES %	pH	Resistivity (Ω - cm)				REMARKS
B3 @ 0.9 m	US			12.1	1531	6.4																	
1.5 m	US				1543	7.0					34	2.1											
3.0 m	US				1599	4.8										0.018	0.001	8.1	16032				
B3 @ 0- 0.9 m	Bag																						
B4 @ 0.9 m	US				1796	13.8																	
1.5 m	US				1807	16.2																	
3.0 m	US				1884	6.7									58								
B4 @ 0.3- 1.0 m	Bag			12.1																			
B5 @ 1.5	US				1776	16.0					37	1.7											
3.0 m	US				1646	11.7	0.01																
4.6 m	US				1707	12.4					38	6.2											
6.1 m	US				1796	10.5																	
7.6 m	US			24	1786	15.0																	
9.1 m	US				1539	7.6									58								
0 - 0.9m	Bag			18.6																			
9.1 - 10.7 m	Bag			19.2																			
10.7 m	SPT																						
12.2 m	SPT			5.7																			
5 - 6 m	Bag			21.5																			
																							POSTED BY:
CODE TOTALS																							

SUMMARY OF SOIL TESTS

JOB NAME: LOMAS SANTA FE AT INTERSTATE 5 JOB NO: 0211248

SAMPLE		Sieve			NAT'L γ & M.C.		CONSOLIDATION				DIR. SHEAR												
Number	Type	P. I.		-200 %	Dry Density (kg/m³)	% moisture	$C_c/(1+e_o)$				Φ	cohesion (kPa)			R' VALUES	SOL. CHLORIDES %	SOL. SULFATES %	pH	Resistivity (Ω - cm)				REMARKS
2 @ 0.9 m	US				1698.0	10.0																	
.8 m	US				1757	10.4																	
.4 m	US				1697	9.1					36	1.9											
.9 m	US				1774	9.2	0.01																
.4 m	US				1865	14.4																	
.9 m	US				1880	11.1					43	0.4											
.4 m	US				1818	11.9																	
1.0 m	US				1802	11.7					37	2.8											
2.5 m	US				1898	13.8																	
5.2 m	US				1905	10.3					39	5.8											
8.3 m	US																						
1.3 m	US				1714	10.6																	
2.9 m	US				1630	11.8	0.01																
32 0.6 - 0.9 m	Bag			15.3												0.001	0.001	8.2	5077				
.1 - 3.0 m	Bag			16.4																			
.2 - 6.1 m	Bag			21.5												0.010	0.001	7.5	3006				
.5 - 9.1 m	Bag			27.2																			
2.8 - 13.7 m	Bag			31.1																			
7.1 - 18.3 m	Bag			23.6												0.017	0.100	7.8	1403				
CODE TOTALS																							POSTED BY:

SUMMARY OF SOIL TESTS

JOB NAME: LOMAS SANTA FE AT INTERSTATE 5 JOB NO: 0211248

SAMPLE		Sieve			NAT'L γ & M.C.		CONSOLIDATION				DIR. SHEAR													REMARKS
Number	Type	P. I.		-200 %	Dry Density (kg/m³)	% moisture	$C_c/(1+e_o)$				Φ	cohesion (kPa)			R' VALUES	SOL. CHLORIDES %	SOL. SULFATES %	PH	Resistivity (Ω - cm)					
0.3 - 1.0 m	Bag			17												0.005	0.003	8.5	3803					
@ 1.5m	US				1951	10.3					43	0.8												
0 m	US				1678	12.2					33	8.4												
6 m	US				1705	12.0	0.01				36	0.8												
.1 m	US				1782	12.0					35	6.4												
.6 m	US				1835	11.9					33	22.0												
.1 m	US				1800	12.8	0.01				35	4.4												
0.7 m	US				1806	13.1					38	2.2												
2.2 m	US				1810	13.8					37	11.8												
3.7 m	US				1759	11.4					37	11.8												
15.2 m	US				1797	15.7					37	3.8												
31 4-5 m	Bag			20												0.006	0.005	8.1	1670					
31 6-7 m	Bag			20																				
31 8-9 m	Bag			24												0.004	0.009	7.5	1603					
31 10 - 11 m	Bag			22																				
CODE TOTALS																								POSTED BY:

APPENDIX II
LABORATORY TESTING

The laboratory test program was design to fit the specific need of this project and was limited to testing on-site materials. A brief description of each type of test is presented below. Results are given on the following pages and on the boring logs in Appendix I.

Moisture contents and dry densities were determined for numerous relatively undisturbed samples. Results are listed on the boring logs in Appendix I.

The grain size distributions of 9 samples were determined in general accordance with ASTM D 422. Results are plotted on Plates II-1 through II-9.

The Atterberg limits of 4 samples were determined in general accordance with ASTM D 4318. Results are shown on the corresponding grain size distribution on Plates II-1, 2,3 and 7.

One-Dimensional Consolidation tests were performed on 4 relatively undisturbed samples in general accordance with ASTM D 2435. Results are shown on Plates II-10 through II-12.

In addition to in-situ field tests, strength characteristics of the subsurface soils were determined in the laboratory by direct shear tests performed on 13 relatively undisturbed samples. Specimens were submerged and tested at 3 normal loads. All samples were tested in a 71.4mm I.D. circular shear box, using a controlled displacement rate. The direct shear tests were performed in general accordance with ASTM D 3080. Results are shown on Plates II-13 through II-19.

Corrosivity tests were performed on 8 samples. The pH and minimum resistivity were determined in general accordance with California Test 643. Soluble sulfate content was determined in accordance with California Test 417. Total chloride ion content was determined in accordance with California Test 532. Results are presented on Plate II-20.

Soil samples not tested are now stored in our laboratory for future reference and analysis, if needed. Unless notified to the contrary, all samples will be disposed of 30 days from the date of this report.

SOIL TEST SCHEDULING SHEET

JOB NAME: MANCHESTER AVENUE AT INTERSTATE 5 OB NO: 0111146 SAMPLED BY:

ASSIGNED BY: DATE REQ'D: IN LAB: SHELF #

SAMPLE		Sieve			NAT'L γ & M.C.		CONSOLIDATION				DIR. SHEAR												
Number	Type	P. I.		-200 %	Dry Density (kg/m³)	% moisture	$C_c/(1+e_o)$				Φ	cohesion (kPa)			R' VALUES	SOL. CHLORIDES	SOL. SULFATES	PH	Resistivity (Ω - cm)				
1 0-1.5 m	Bag	11		31.4																			
1 - 1.5m	US				1691.5	12.5																	
0 m	US				1721.8	12.6					36	1.1											
.5 m	US				1891.3	11.5																	
.0 m	US	11		33.7	1764.5	14.2					34	10.3											
.5 m	US				1614.4	24.8																	
.5 m	US				1497.3	29.7																	
0.7 m	US				1493.2	30.9					31	13.0											
2.2 m	US				1586.8	24.5																	
1 4-5 m	Bag	12		28.3																			
1 13.7 m	US			5.3	1639.2	25.5					31	10.7											
1 16.7 m	SPT																						
1 18.3 m	SPT																						
1 19.8 m	SPT																						
1 21.3 m	SPT																						
1 22.9 m	US			13.5	1659.9	24.4					32	8.2											
1 24.4 m	SPT																						
1 27.4	SPT	21		66.1																			
1 30.48	SPT																						
CODE TOTALS																							

TIME CON PT.	710
MAX DEN 'B' OR 'D'	715
SINGLE PT. SHEAR	728
RES. SHEAR	731
SPEC. GRAVITY	734
S. E.	735
CBR - SD	736
CBR - NAVY	737

REMARKS

POSTED BY:

SOIL TEST SCHEDULING SHEET

JOB NAME: MANCHESTER AVENUE AT INTERSTATE 5 JOB NO: 0111146 SAMPLED BY:

ASSIGNED BY: DATE REQ'D: IN LAB: SHELF #

SAMPLE		Sieve			NAT'L γ & M.C.		CONSOLIDATION				DIR. SHEAR											
Number	Type	P. I.		-200 %	Dry Density (kg/m³)	% moisture	$C_c/(1+e_o)$				Φ	cohesion (kPa)		R' VALUES	SOL. CHLORIDES	SOL. SULFATES	PH	Resistivity (Ω - cm)				
B2 0-1.5 m	Bag			18.3																		
B2 - 1.5m	US				1865.1	10.2																
3.0 m	US				1989.1	16.8					39	6.4										
4.5 m	US				1696.9	11.7																
6.0 m	US				1787.6	10.5	0.02															
7.6 m	US				1782.4	15.0																
9.1 m	US				1868.6	15.0					36	6.5										
10.7 m	US				1725.1	16.1																
B3 0-1.5m	BAG			16.7																		
B3 1.5	US				1674.1	15.6																
3.0 m	US				1626.6	21.6																
4.5 m	US				1776.0	10.6																
6.0 m	US				1692.2	14.3	0.01		1	5												
7.6 m	US				2064.8	15.3																
9.1 m	US				1749.5	14.8																
10.7 m	US				1649.3	22.6																
13.7 m	US				1593.1	25.2	0.02		1	5												
15.0 m	US				1517.8	28.6																
15.5 m	US				1517.8	28.6																
CODE TOTALS																						

TIME CON PT.	710
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REMARKS

POSTED BY:

SUMMARY OF ' . TESTS

JOB I ME: MANCHESTER AVENUE AT INTERSTATE 5

JOB NO: 0111146

SAMPLE		Sieve			NAT'L γ & M.C.		CONSOLIDATION				DIR. SHEAR											
Number	Type	P. I.		-200 %	Density	% moisture	$C_c/(1+e_o)$				Φ	cohesion			R' VALUES	SOL. CHLORIDES %	SOL. SULFATES %	PH	Resistivity (Ω - cm)			REMARKS
1 1.5 m	US															0.262	0.068	6.6	130			
0 m	US																					
5 m	US																					
5 m	US															0.152	0.190	6.9	130			
5 m	US																					
0.7 m	US															0.129	0.164	6.5	110			
2.2 m	US																					
2.86 m	US															0.002	0.140	6.8	2600			
2 1.5 m	US																					
.0 m	US															0.007	0.026	7.5	2000			
.1 m	US																					
.5 m	US															0.014	0.038	7.4	1200			
.6 m	US																					
.2 m	US															0.043	0.042	8.5	1200			
33 12.2 m	US																					
33 13.7 m	US															0.054	0.229	4.6	350			
33 15 m	US																					
CODE TOTALS																						POSTED BY:

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APPENDIX III

DESCRIPTION	PAGE
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Deep Foundation Analysis Class 625 305mm Pile Vertical Analysis	6 – 29
6 Foot CISS Vertical Analysis	30 – 39
Class 625 305mm Pile Lateral Analysis	40 – 56
6 – Foot CISS Lateral Analysis	57 – 73
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Liquefaction Analysis	86 – 87
Lateral Deformation and Spreading	88
ARS Development	89 - 123

Summarization of Calculated Results

Calculations consisted of slope stability, shallow foundation, deep foundation, and *Shake2000* analyses. Slope stability analysis was performed using the computer software *GSTABL7 V.2.®* Shallow foundation analysis was performed using an *Excel* spreadsheet. Vertical deep foundation analysis was performed with *All-Pile®*. Lateral deep foundation analysis was performed using *L-Pile®*. The ARS curve was developed by performing a *Shake®* analysis.

Slope Stability – Fill slopes should be constructed at a 1:2 (vertical:horizontal) inclination.

Shallow Foundations – Net bearing 80 kPa

Deep Foundations – Vertical capacity, Class 625 – 625 kN, 1.8 m CISS – Dependent on depth.
Lateral capacity, Class 625 1.6 kN(free), 3.5 kN(fixed)
Lateral capacity, 1.8 m CISS 57 kN(free), 58 kN(fixed

Liquefaction Analysis – 240mm of settlement

Lateral Deformation and Spreading – 3m

State of California

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MRS. Karen Jewel – 11

Date: July 20, 2003

File: 11-SD-5-KP R56.0/R57.5
EA 065101
San Dieguito River Bridge
57-448

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design - South

Subject: Limited Hydrogeologic Assessment

GENERAL

In response to requests made by the District 11 Hydraulics June 2003, the office of Geotechnical Design Services – South performed a limited hydrogeologic assessment at the proposed detention basin locations. The proposed basin is located along Interstate 5 (I-5), adjacent to the San Dieguito River, near the city of Del Mar. The 2 test locations are delineated on figure 1, and are located between the toe of the I-5 embankment and an existing concrete lined drainage ditch south of the San Dieguito River.

Our limited hydrolgeologic assessment consisted of exploratory drilling at 2 locations, engineering analysis of percolation rates and a written report. The exploratory drilling was performed to characterize and evaluate the subsurface soil conditions, and to perform insitu percolation testing. The groundwater elevation was not assessed during drilling due to the limited capability of the handheld motorized auger. Groundwater elevations were estimated by local expertise and available literature.

ENGINEERING DISCUSSION AND ANALYSIS

The site investigation was conducted by developing 2 solid stem auger borings to depths of 1.5m below original ground. Groundwater was not encountered in either of the borings. The borings were terminated at 1.5m below original ground because the proposed design is estimated not to exceed that depth. The borings were not logged due to the homogeneous nature of the subsurface soil. Upon completion of drilling approximately 50mm of pea gravel was placed in the bottom of the hole. Both borings where fitted with 102mm inside diameter PVC pipes and the space between the pipe and boring wall was filled with pea gavel to within approximately 0.9m of the ground surface, the remainder of the hole was then backfilled with excavated soil. Percolation tests were performed at each location in accordance with California Test Method 750.

After installation of the perforated PVC pipe and gravel, the percolation holes were pre-saturated. Upon completion of the pre-saturation, percolation tests were performed. The percolation rates

were determined by measuring the time required for the water level in each test hole to drop 25.4 mm. The field percolation rates were then normalized to that of a standard 300 mm drill shaft. Percolation tests where performed at both borings locations. Potential bottom elevation of the proposed basin determined the depth at which these tests were performed. The normalized test results for each of the percolation tests are presented in Table 1.

Percolation rates can be effected by many different variables, such as grain size, relative sorting, and depth to ground water (as well as other factors).

SUBSURFACE SOILS CONDITIONS

The soil encountered during the subsurface exploration consisted of a moist medium to fine sand. The density of the sand encountered was very loose from 0 to 0.75m in both borings. Boring #1 encountered a thin medium dense layer from approximately 0.75 to 0.9m, below which the soil density was approximated to be loose. Boring #2 the soil density below 0.75m to the bottom of the boring was approximated to be loose. The soil densities are approximate and are based on the speed with which the auger was able to penetrate. A bulk sample was retrieved from boring #2 during the drilling operation. A mechanical analysis was performed on the bulk sample. The results of the analysis are presented in Table 2.

CONCLUSIONS AND RECOMMENDATIONS

The percolation rates determined from the insitu testing differed by approximately 1 % between locations. The percolation rates where determined to be 0.97 min/cm at boring location #1 and 0.99 min/cm at the location of boring #2. The groundwater elevation in the area is approximately the same as the water level of the lagoon. It is possible that the ground water depths may fluctuate slightly. The introduction of agricultural water in the adjacent field could also effect the ground water elevation. The effect of agricultural water on the groundwater elevation is considered to be minor and the creation of a perched water table is unlikely based on the relatively permeable nature of the soils encountered. During the subsurface investigation the same soils were encountered in both borings. The Subsurface condition changed little from the location of boring #1 to the location of boring #2, and the soil profile remained constant throughout the development of each boring. The soil encountered can be described as nonplastic fine-grained sand.

We recommend that the final bottom elevation of each basin be a minimum of 1.5 m above the stabilized ground water elevation. In addition a buffer zone should be considered to account for the possibility of higher groundwater elevation. This should reduce the possibility of ground water infiltrating into the basins. Based on the elevation difference between the bottom elevation of the proposed basin and the lagoon, groundwater infiltration is not anticipated to be a problem.

Should you have any questions, please contact Mike Fordham (858-467-3290) or Brian Hinman (858-467-4051)

Prepared by: Date: 8/18/03

Mike Fordham, P.E.
Transportation Engineer
Geotechnical Branch D

Supervised by: Date:

Brian Hinman, P.E.
Branch D
Office of Geotechnical Design – South 2

cc: Abbas Abghari
Brian Hinman

TABLE 1 - PERCOLATION TEST

Engineer/Geologist: M. Fordham						**Date**:7/29/2003	
EA 065101							
District-County-Route; PM: 11-SD-5; 35.05							
Remarks:							
Hole #: B1		**Hole #**:		**Hole #**: B2		**Hole #**:	
Hole Depth (ft):		**Hole Depth (ft)**:		**Hole Depth (ft)**:		**Hole Depth (ft)**:	
Hole Dia (inch):	6	**Hole Dia (inch)**:		**Hole Dia (inch)**:	6	**Hole Dia (inch)**:	
Time (min)	**Reading (in)**	**Time (min)**	**Reading (in)**	**Time (min)**	**Reading (in)**	**Time (min)**	**Reading (in)**
0.83	9 - 8			0.81	8 - 7		
0.87	9 - 8			0.87	8 - 7		
0.84	9 - 8			0.87	8 - 7		
0.80	9 - 8			0.84	8 - 7		
0.81	9 - 8			0.84	8 - 7		
				~~0.94~~	~~8 - 7~~		
Ave (last 3)	0.817	**Ave (last 3)**	0	**Ave (last 3)**	0.850	**Ave (last 3)**	0
Remarks: Time measured for 1" drop		**Remarks**: Time measured for 1" drop		**Remarks**:Time measured for 1" drop		**Remarks**: Time measured for 1" drop	
Conversion Factor **(K)**	1.72	Conversion Factor **(K)**	#DIV/0!	Conversion Factor **(K)**	1.72	Conversion Factor **(K)**	#DIV/0!
Correction Factor **(C)**	0.5757	Correction Factor **(C)**	#DIV/0!	Correction Factor **(C)**	0.5757	Correction Factor **(C)**	#DIV/0!
Percolation Rate (min/in):	**2.4400**	Percolation Rate (min/in):	#DIV/0!	Percolation Rate (min/in):	**2.5395**	Percolation Rate (min/in):	#DIV/0!
Percolation Rate (min/cm):	**0.9606**	Percolation Rate (min/cm):	#DIV/0!	Percolation Rate (min/cm):	**0.9998**	Percolation Rate (min/cm):	#DIV/0!

Porosity(n): 0.3 of gravel used for percolation test.

Outside diameter of perforated pipe used (inch): 4.5

Inside Diameter of perforated Pipe used (inch): 4.0

NOTE: Porosity (n) is a conservative estimate which maybe subject to change.

STATE OF CALIFORNIA
DEPT OF TRANSPORTATION
GEOTECHNICAL LAB

E.A. 11-065101

Br. #

CLASSIFICATION TEST SUMMARY

LOCATION	% FINER THAN															ATT. LIMITS		Gs	AS RECEIVED		LAB. COMP	
Sample I.D.	1 1/2	1	3/4	1/2	3/8	4	8	16	30	50	100	200	5μ	2μ	1μ	LL	PI		γ_d	%m	γ_d	%m
2-1							100	98	88	62	37	26	11	-	8							

NP - Non-plastic
* Sample received fractured -- Not suitable for testing
Sample disintegrated while preparing for testing -- Not suitable for testi
Sample received desiccated -- Test results may not represent the true conditions

Brief Summary of "Preliminary Materials Report", 4/1990

By B. Corbin and M. Wagner

- **Contains very good geological description**
- Soledad Valley is a tidal marsh with a small, shallow estuary called Penasquitos Lagoon. Rapid siltation during the past 1000 years has reduced the size and depth of a larger lagoon which was formed at the mouth of a drowning river as the sea level rose after the last glaciation period 10,000 years ago.
- The valley walls are comprised of soft marine sediments deposited by a transgressing sea during the Eocene period about 45 million years ago.
- The valley floor has a thick accumulation of very young alluvial and estuarine sediments. Alluvium is a coarse deltaic type in the higher reaches of the valley, but they grade into silt, sand and clayey estuarine deposits toward the ocean.
- The Delmar Formation is a lagoonal deposit composed of yellowish-green, sandy claystone interbedded with medium-gray, coarse-grained sandston.
- The Torrey Sandstone, a beach barrier, is composed of white to light brown, medium to coarse grained, well indurated, arkosic sandstone.
- The Ardath Shale, an outer shelf accumulation of fine sediments, is weakly fissile and olive-gray. Locally, up to 25% of the shale is expansive and landslides are commonly associated with these area.
- The foundation soils in the coastal peneplain consist mainly of coastal alluvium where the soils are geologically young but predominantly granular.
- Fine-grained soils, clayey sands and sandy clays, are limited to depths of 25' to 45' below ground level. The clayey material is only slightly compressible.
- The fills should be constructed at a maximum rate of 2' vertically per week.
- The maximum settlement of about 1.5' under 50' embankment load is expected to be completed during the construction period.
- The environment is highly corrosive to corrugated steel pipe.
- **Earthquake considerations, such as liquefaction, are covered in the Geotechnical Report dated December 1988.**

Brief Summary of "Special Studies, Pavement Distress and Settlement between Genesee and Sorrento Valley," 10/5/1982

By W. B. Calland,

- This section was completed in August of 1966.
- By September 1969, visible settlement of the embankment and distress of the PCC pavement were apparent at the 72" PCC culvert near old Station 655 (MSE Wall STA 14+98) in Sorrento Valley.

A report dated 1/27/70 from HQ materials and Research Department found the culvert had settled about 4' maximum under the westerly hinge; the roadway surface settlement was about 0.8' maximum; and the ¾ of the settlement had occurred during embankment construction. The report further concluded that future settlement would be minimal.

Brief Summary of "Record of Observations & Studies to Date", 6/25/1982

- In the early 1970's subsidence and instability of the fills became apparent in several areas between Genesee Avenue and Carmel Valley Road.
- The fills were constructed in part of hard shale soils removed from adjacent cuts.
- The years of 1978 and 1980 were exceptionally wet periods when the fill became more saturated with water which apparently accelerated the shale soil breakdown and resulting fill subsidence.
- This manifested into extensive pavement distress and considerable alignment change in the 72" RCP cross-drain.
- The embankment between old Stations 650+00 and 660+00 was constructed in part with degradable shales.
- The pavement has 3.5', and additional 1.5' to 2' could still occur over next 10 to 20 years from 1982.

Brief Summary of "Geotechnical Report, Interstate 5 Fill Settlement and PCC Pavement Distress", 4/1982

By R.M. Mattox, District 11 Materials Branch

- Contains Description on Geologic Setting and Geologic Units.
- The relationship of pavement distress to cut/fill contact areas is evident.

Brief Summary of "Settlement Analyses of Shale Embankment on I-5", 3/22/1982

By Ken Jackura

- The embankment at this area was constructed between 1964 and 1966.
- The embankment material consisted, in part, of hard shale soils excavated from nearby cuts.
- After construction, fill settlement and pavement cracking became prominent.
- A testing program conducted in 1970 (memo to Dekema, 1/27/70) suggested further fill settlement would be minor since according to laboratory test of the soft foundation soils indicated primary consolidation was virtually complete. However, it also suggested the secondary compression may be a contributing but an unknown part of the settlement.

- Following the date of the 1970 memo, unusually heavy rainstorms during the early 1970s may accelerated fill settlement to where surface distress has again manifested.
- This report suggested the settlement might be attributed to the degradation of the shale due to water infiltration.
- In late 1980, District 11 investigated relative compaction of the embankment fill. The fill has an average relative compaction (Rc) of 89% and shallow foundation soils have an average Rc of 87%.
- In 1981, bucket auger cuttings of the embankment indicated 36% of the fill material was comprised of moderately hard gravel size shale particles with a maximum size of 2-1/2 inches.
- Have as-built and existing grade between old station ST 654 and ST 657.
- Experienced a maximum settlement of 3 feet under the highest embankment fill.
- The borings on the profile were conducted in 1969.
- Bucket auger near centerline conducted in 1980 (not shown on the profile) retrieved soil samples from the fill and foundation to depths about 66 feet. Performed remolded consolidation tests.
- No undisturbed samples were available for test.
- The fill material was classified as gravelly sandy clay, with gravel size particles composed of water susceptible shale.
- The foundation soil classified as sandy clay.
- $\gamma_{d\ max\ fill} = 116$ pcf , $\gamma_{d\ max\ foundation\ soils} = 126$ pcf.
- Assuming 55' fill at the Big Dipper, the estimated settlement is 3% of the fill thickness or 1.7 feet. Questionable approach.
- Suggested the settlement variation may be attributed to the proportion of plus #4 particle size, relative compaction Rc, variation in fill height, and thickness of the compacted shale zone.
- Suggested the remaining settlement within the fill be between 0.5 and 1 foot over the remaining 10 to 20 years.
- The maximum probable settlement is 5% to 10%, or 2' to 4' within an assumed 40-foot thick foundation soil.
- Estimated only 25% of the settlement due to consolidation of foundation soil during construction.
- Suggested the remaining EP settlement at the roadway surface is 1.5' to 3' (fill plus foundation) over the remaining 10 to 20 years.
- Triaxial tests on remolded fill material, compacted to 89%, obtained: $\phi = 17°$ and c = 700 psf, and $\phi' = 39°$ and c' = 350 psf
- Maximum creditable seismic event, the Rose Canyon, was a magnitude 7 earthquake and generated peak site bedrock acceleration of 0.62 g. Computer analysis conducted of the site and based on shear wave velocity measurements at Station 573 indicated a peak ground acceleration of 0.36 g.
- Used a lateral earthquake force of 0.12 g (about 1/3 of the peak ground acceleration) for pseudo-static slope stability analysis.
- $FOS_{static} = 1.39$, $FOS_{dynamic} = 1.06$.
- Attached boring logs D-1, D-2, and D-3 (@ very important locations) performed in 1969.

- Comments from Jerry DiMaggio, FHWA
  - Settlements associated with shale embankment deterioration generally terminate at 2 to 3 feet. However, the stability condition tends to worsen with time. Problem slopes normally require permanent slope stabilization treatment.
  - Suggested TXCUE. Direct shear tests may overestimate the in-situ strength of the soil based on back analyzed factors of safety.
  - Shale material's typical shear strength: $\phi' = 20°$ and $c' = 200$ psf

Brief Summary of "embankment Settlement on Route 5 near Sorrento Valley interchange", 1/27/70

By Paul E. Ruplinger, Materials and Research Department

- The main objective of the investigation was to determine if the visible distress was a result of post construction settlement or an indication of a massive embankment slip-out.
- Plan and profile sheets, logs of three test borings with 2" undisturbed samples, the results of the roadway condition in the area with existing and design profiles and photographs of distress within the 72" RCP pipe under the embankment were produced.
- This section of roadway was constructed as part of Contract 11-022454 between October 1964 and August 1966.
- It is a six-lane divided paved roadway with a centerline embankment height of 55'.
- Embankment side slopes were constructed at 2H:1V.
- Early 1969, District Maintenance personnel observed pavement distress on the roadway surface of the roadway section that transverses a natural drainage swale between old Station 653+50 and 657.
- This distress was in the form of separation of concrete pavement slabs and a certain amount of longitudinal cracking on the asphalt shoulders on both right and left side of the roadway.
- Skewed 72" diameter gravel bedded RCP crosses centerline at old Station 655+19 revealed joint separation of up to 2" in the zone of maximum settlement (about 4') approximately 30 feet on each side of the westerly embankment hinge point (?).
- Longitudinal cracks of up to ¼" in both the soffet and flow-line and compression of the vertical axis of approximately 0.18' were also observed in this area.
- Joint separation and cracking in the remainder of the pipe was minimal.
- On the surface, a maximum settlement of approximately 0.8' as of September, 1969.
- Rather symmetrical nature of visible distress and the absence of any signs of movement on the fill slope or in the area of the toe suggested that the visible distress was probably the result of a long-term settlement.
- The foundation materials consisted primarily of silty sands and sandy silts with scattered organic materials.
- The clay fraction was found to be consistently between the 20 to 25% level.

- A maximum of 36% clay was noted on Sample D-1 (about 30m west of MSE wall alignment) at 55' below ground.
- Predicted settlement is between 2.6' and 4.1'.
- These soils are relatively fast draining with a maximum to 50% settlement in 42 days.
- A considerable deviation between field and predicted settlement time frame.
- However, the settlement under the RCP conduit of approximately 4' with a surface maximum settlement of 0.8' suggested over ¾ of the settlement occurred between embankment construction and paving.
- Suggested the 0.8' settlement, which occurred after paving may be the result of secondary consolidation or long-term compression of a clay lens, which was not detected.
- Suggested, based on both field survey and laboratory test, the settlement is virtually complete (in January 1970).
- The distress of the 72" RCP was confined primarily to three sections in the area of maximum settlement beneath the westerly embankment hinge point.
- The elliptical reinforcement was rotated 72° of arc out of its proper position which was a major factor in the visible distress.
- Suggested repair existing roadway surfacing primarily with sealing of open cracks and fissures to preclude the entrance of surface runoff into the embankment.
- Suggested repair of 72" RCP consist of the sealing of all open cracks with the epoxy grout under high pressure in order to prevent further corrosion of exposed steel.
- Suggested it was not necessary to strengthen the conduit by installing steel liner plate, since settlement was virtually complete.

Transcription: Culvert Investigation, 3/27/69

By Marcon Joe

72" x 440' RCP

Mr. A.Z. Clark, W. Cross, and Marcon Joe inspected the 72" x 440' RCP at Station 655+20, P.M. 31.5, SD-5.

1. The joints of the pipe were pulled apart, some measurements on the joints as big as 1.5". Also some sections of the pipe were shifted laterally as much as 0.5". All these movements of the pipe could be caused by the settlement and the differential settlement by the fill on the top of the pipe.
2. Another problem is that the pipe is under-designed. For the 72" RCP Class V, the maximum allowable over-height fill is 41', but the actual condition is 55'. Since the pipe is over-loaded, the crack on the 50' of pipe are visible. There are 4 sections of pipe with cracks as big as 3/8". These sections could collapse.
3. The Materials Department installed control points on the pavements on the east and westbound to determine the rate of settlement. The result was a definite settlement.

4. The pavement on the westbound has a gap (lateral) about 2" between the second and the third lane.

Some solutions were suggested after the inspection.

1. Use epoxy to grout the joints.
2. For the over-loaded pipe, use 7 4" x 6" wooden posts jacked in place for the 4 sections temporarily preventing structural collapse.
3. Ultimately a liner of concrete or steel has to be installed that could carry the dead load on top of the pipe; the liner has to be special design.
4. The Material Department will investigate the possibility of additional settlement. Mr. W. Cross will send the Hydraulic Department a report. By that time the Hydraulics Department will have more data to work with and hope to find a good solution for this problem.

* Reference for steel lining: Handbook of Steel Drainage Construction Products, page 264, Fig. 14-3.

Brief Summary of "Report on a Foundation Investigation of a Portion of the Proposed Del Mar Freeway" at S.E. Quadrant of Los Penasquitos Lagoon (Gun Club Area)" April 5, 1961

By Foundation Section

- 13 hand sampling to depths of 13' to 38', and 9 power borings (D-110 to D-118) were performed between October 26, 1960 and November 21, 1960.
- Locations and profiles of these borings are shown on attached sheets Nos. 2 to 5.
- Unconfined compression tests on loose sandy and silty soil was less than 0.4 tons per square foot (c = 400 psf).
- The foundation material would drain rapidly and settlement during construction will result in a considerable increase in strength of this material.
- Consolidation tests indicated settlement of 1.5' to 2.5' will occur.

Boring Number 896-1

Depth, ft		Depth, m	SPT N Value	w_n	w_P	w_L	PI	c, kPa	ϕ, degree	Consolidation Test	% Gravel	% Sand	% Fine
7		2.13	1										
10		3.05			15	26	11				0	40	60
13		3.96	2										
15		4.57						9.	35.3		2	52	46
16		4.88	0										
20		6.10	1										
25		7.62	18										
30		9.14	7		17	32	15				0	41	59
35		10.76		21	16	23	7			x			
37		11.28	29										
40		12.19	11										
45		13.72	11		18	29	11				0	43	57
50		15.24		29	17	32	15			x			
52		15.79	11										
55		16.76									0	44	56
57		17.37	18										
63		19.20		22	15	30	15			x			
64		19.60	14										
70		21.34		22	14	25	11	26.	32.5	x			
72		22.04	23										
75		22.86	26								3	50	47
80		24.38	25								0	45	55
85		25.91	> 70										

Consolication Test Summary

Water Depth

ft	m	
8	2.44	19

γ_s 2.67

Boring Number	Depth, ft		Depth, m	σ'_{vo}, kPa	w_P	w_n	w_L	PI	γ^{sat}, kN/m^3	γ^{wet}, kN/m^3	γ^{dry}, kN/m^3	e_o	C_c	C_r	C_v m^2/sec	λ^*	M (E^{oed}), kPa	Poisson's Ration, ν	E, kPa	k, m/sec	k, m/day	c, kPa	ϕ degree	% Gravel	% Sand	% Fine
610-6	5		1.52	25	15	20	25	10	20.1	19.4	16.1	0.66	0.15	0.015	1.0 E-6	0.039	624	0.30	463	1.6 E- 8	1.4 E-3					
610-6	10		3.05	49	15	23	27	12	20.9	21.5	17.5	0.53	0.10	0.012	2.0 E-6	0.028	1736	0.30	1289	1.1 E- 8	9.8 E-4					
610-6	15		4.57	63	13	22	25	12	20.4	20.3	16.7	0.60	0.14	0.015	1.0 E-6	0.038	1666	0.30	1237	5.9 E- 9	5.1 E-4					
610-6	20		6.10	84	16	21	27	11	21.0	21.3	17.6	0.52	0.11	0.010	2.0 E-7	0.031	2661	0.30	1977	7.4 E-10	6.4 E-5					
610-6	25		7.62	99	13	20	24	11	20.8	20.9	17.3	0.54	0.15	0.020	8.0 E-7	0.042	2349	0.30	1745	3.3 E- 9	2.9 E-4					
610-6	30		9.14	118	13	19	23	10	21.0	20.8	17.6	0.52	0.12	0.010	1.0 E-6	0.034	3432	0.30	2549	2.9 E- 9	2.5 E-4					
610-5	15		4.57	64	14	20	25	11	20.6	20.3	16.9	0.58	0.12	0.010	3.0 E-6	0.033	1943	0.30	1444	1.5 E- 8	1.3 E-3					
610-5	20		6.10	78	15	32	27	12	20.2	21.4	16.3	0.64	0.14	0.012	9.0 E-7	0.037	2092	0.30	1554	4.2 E- 9	3.6 E-4					
610-5	30		9.14	113	16	22	27	11	20.5	20.5	16.8	0.59	0.13	0.025	6.0 E-7	0.036	3170	0.30	2355	1.9 E- 9	1.6 E-4	19	26.7			
610-5	35		10.67	131		19		NP	20.6	20.2	17.0	0.57	0.06	0.005	3.0 E-6	0.017	7860	0.30	5839	3.7 E- 9	3.2 E-4	86	13.7			
610-5	45		13.72	162	14	21	28	14	20.5	20.3	16.8	0.59	0.13	0.020	2.0 E-6	0.036	4545	0.30	3376	4.3 E- 9	3.7 E-4					
610-5	50		15.24	179		22		NP	20.6	20.6	16.9	0.58	0.11	0.010	3.0 E-6	0.030	5913	0.30	4393	5.0 E- 9	4.3 E-4					
610-5	55		16.76	197	14	21	24	10	20.6	20.6	17.0	0.57	0.13	0.010	1.5 E-6	0.036	5461	0.30	4057	2.7 E- 9	2.3 E-4					
610-5	60		18.29	193	17	25	29	12	19.6	19.2	15.3	0.74	0.18	0.030	1.3 E-6	0.045	4282	0.30	3181	3.0 E- 9	2.6 E-4					
610-5	70		21.34	236	15	23	29	14	20.2	20.0	16.3	0.64	0.16	0.015	9.0 E-7	0.042	5559	0.30	4129	1.6 E- 9	1.4 E-4					
896-1	35		10.76	128	16	21	23	7	20.4	20.1	16.6	0.61	0.14	0.012	2.0 E-6	0.038	3395	0.30	2522	5.8 E- 9	5.0 E-4					
896-1	50		15.24	156	17	29	32	15	19.2	18.9	14.7	0.82	0.19	0.020	2.5 E-6	0.045	3431	0.30	2548	7.1 E- 9	6.2 E-4					
896-1	63		19.20	193	15	22	30	15	19.2	17.8	14.7	0.82	0.19	0.020	2.5 E-7	0.045	4248	0.30	3156	5.8 E-10	5.0 E-5					
896-1	70		21.34	239	14	22	25	11	20.3	20.1	16.5	0.62	0.13	0.015	3.0 E-6	0.034	7114	0.30	5284	4.1 E- 9	3.6 E-4	26	32.5			
896-2	10		3.05	52		14		NP	21.4	20.8	18.3	0.46	0.05	0.003	1.0 E-5	0.015	3471	0.30	2579	2.8 E- 8	2.4 E-3	4	39.3			
896-2	55		16.86	189	15	24	32	17	20.2	20.1	16.3	0.64	0.16	0.020	3.0 E-6	0.042	4463	0.30	3315	6.6 E- 9	5.7 E-4					
896-4	20		6.10	79	18	22	55	37	20.4	20.2	16.6	0.61	0.16	0.045	5.0 E-8	0.043	1830	0.30	1360	2.7 E-10	2.3 E-5					
896-5	5		1.52	21	23	31	66	43	18.7	18.2	13.8	0.93	0.22	0.050	5.0 E-8	0.050	425	0.30	316	1.2 E- 9	1.0 E-4					
896-5	15		4.57	52	20	32	50	30	18.5	17.9	13.6	0.97	0.28	0.050	1.5 E-7	0.062	834	0.30	620	1.8 E- 9	1.5 E-4					
896-5	20		6.10	70	24	29	46	22	19.2	18.9	14.7	0.82	0.28	0.045	1.0 E-6	0.067	1047	0.30	778	9.4 E- 9	8.1 E-4					
896-5	25		7.62	85	18	29	32	14	19.2	19.0	14.8	0.81	0.18	0.030	1.2 E-6	0.043	1961	0.30	1457	6.0 E- 9	5.2 E-4					
896-5	30		9.14	94	22	31	51	29	18.8	18.4	14.1	0.90	0.27	0.055	3.0 E-7	0.062	1529	0.30	1136	1.9 E- 9	1.7 E-4					
999-2	22	II	6.71	83	29	22	40	11	20.1	19.6	16.1	0.66	0.05	0.018	1.0 E-5	0.013	6336	0.30	4707	1.5 E- 8	1.3 E-3					

Consolication Test Summary

Water Depth

ft	m	
8	2.44	19
γ_s	2.67	

Boring Number	Depth, ft		Depth, m	σ'_{vo}, kPa	w_P	w_n	w_L	PI	γ^{sat}, kN/m^3	γ^{wet}, kN/m^3	γ^{dry}, kN/m^3	e_o	C_c	C_r	C_v m^2/sec	λ^*	M (E^{oed}), kPa	Poisson's Ration, v	E, kPa	k, m/sec	k, m/day	c, kPa	ϕ, degree	% Gravel	% Sand	% Fine
999-3	12	I	3.66	54	14	19	26	12	20.4	19.8	16.7	0.60	0.10	0.008	2.7 E-6	0.027	1974	0.30	1467	1.3 E- 8	1.2 E-3	148	9.6			
999-3	32	IV	9.75	115	12	22	28	16	20.1	19.8	16.2	0.65	0.14	0.012	1.0 E-6	0.037	3115	0.30	2314	3.1 E- 9	2.7 E-4					
999-3	37	IV	11.28	134		20			20.4	19.9	16.6	0.61	0.14	0.010	3.0 E-7	0.036	3671	0.30	2727	8.0 E-10	6.9 E-5					
999-3	57	I	17.37	205	12	19	31	19	20.7	20.4	17.1	0.56	0.12	0.010	2.0 E-7	0.033	6115	0.30	4542	3.2 E-10	2.8 E-5	8	29.1			
999-4	7	I	2.13	34	14	22	28	14	19.9	19.4	15.9	0.68	0.14	0.008	5.0 E-7	0.036	936	0.30	695	5.2 E- 9	4.5 E-4			0	56	44
999-4	15	I	4.57	63	13	20	25	12	20.4	20.1	16.7	0.60	0.10	0.007	1.4 E-6	0.027	2332	0.30	1732	5.9 E- 9	5.1 E-4	0	37.6	0	49	51
999-4	20	I	6.10	83	14	19	24	10	20.8	20.7	17.3	0.54	0.09	0.007	3.0 E-6	0.024	3444	0.30	2558	8.5 E- 9	7.4 E-4					
999-4	25	I	7.62	106	15	16	21	6	21.5	21.3	18.4	0.45	0.06	0.005	1.0 E-6	0.018	5868	0.30	4359	1.7 E- 9	1.4 E-4			0	54	46
999-4	30	I	9.14	105	12	25	32	20	19.8	19.4	15.6	0.71	0.17	0.020	1.0 E-6	0.043	2426	0.30	1802	4.0 E- 9	3.5 E-4			0	42	58
999-4	42	I	12.80	157	13	20	29	16	20.8	20.8	17.3	0.54	0.15	0.015	1.0 E-6	0.042	3699	0.30	2748	2.7 E- 9	2.3 E-4			0	56	44
999-4	50	IV	15.24	165		27			19.7	19.7	15.5	0.72	0.10	0.012	4.0 E-6	0.025	6512	0.30	4838	6.0 E- 9	5.2 E-4					
999-4	60	II	18.29	209	14	21	28	14	20.4	20.2	16.7	0.60	0.09	0.008	3.0 E-6	0.024	8553	0.30	6354	3.4 E- 9	3.0 E-4			0	61	39
999-4	75	I	22.86	252	14	23	33	19	20.2	20.1	16.3	0.64	0.11	0.012	1.0 E-6	0.029	8627	0.30	6409	1.1 E- 9	9.8 E-5	0	21.3			
999-5	12	I	3.66	55	17	20	23	6	20.8	20.7	17.2	0.55	0.05	0.006	2.5 E-6	0.013	4387	0.30	3259	5.6 E- 9	4.8 E-4	184	0.0	0	68	32
999-5	40	I	12.19	141	21	23	27	6	20.2	20.1	16.3	0.64	0.12	0.007	4.0 E-6	0.032	4429	0.30	3290	8.9 E- 9	7.7 E-4	48	22.1	0	35	65
999-6	50	IV	15.24	191	12	19	25	13	21.3	21.4	18.0	0.48	0.10	0.010	4.0 E-7	0.029	6499	0.30	4828	6.0 E-10	5.2 E-5			0	50	50
999-9	30	I	9.14	102		28			19.5	19.4	15.2	0.76	0.08	0.015	2.5 E-6	0.024	4219	0.30	3134	5.8 E- 9	5.0 E-4					
999-12	70	I	21.34	268	14	15	24	10	21.6	21.3	18.5	0.44	0.09	0.005	1.5 E-6	0.026	10206	0.30	7581	1.4 E- 9	1.2 E-4	0	24.0	0	62	38
999-12	85	I	25.91	311	14	17	25	11	21.2	21.0	17.9	0.49	0.09	0.018	2.6 E-7	0.026	12171	0.30	9041	2.1 E-10	1.8 E-5	0	24.8	0	44	56
999-12	95	I	28.96	337	19	20	24	5	20.9	20.9	17.5	0.53	0.07	0.005	4.0 E-6	0.021	16061	0.30	11931	2.4 E- 9	2.1 E-4			0	52	48
999-13	60	I	18.29	231	16	13	22	6	21.5	20.9	18.4	0.45	0.04	0.005	5.0 E-6	0.010	21964	0.30	16316	2.2 E- 9	1.9 E-4			0	61	39
999-13	70	I	21.34	246		19		NP	20.6	20.3	17.0	0.57	0.05	0.006	6.0 E-6	0.012	19751	0.30	14672	3.0 E- 9	2.6 E-4			0	74	26

Review Summary on Consolidation Test Results – 5/805 Widening:

Boring 610-6 (STA 536+72):

The consolidation test results on the soil specimens from 610-6 should be considered as a combination of elastic and a normally consolidated response to the loading. The reasons are:

- The soils are CL materials with LL=23~27 and PL=13~16.
- The natural water contents are between 18.5% and 21.5%, which are at the midrange between LL and PL and suggest the soils be normally consolidated.
- The time-rate of consolidation curves more or less parallel to each other with the exception of the two soil specimens at deeper elevations.

Boring 610-5 (STA 537+41):

The consolidation test result shows that:

- The materials below elevation –7m show apparent consolidation behavior with primary consolidation complete within 2 minutes of the test, with the coefficient of consolidation $c_v \approx 1 \times 10^{-6}$ m^2/sec. This suggests the soils are more permeable than expected. For example, a soil layer with 10 m thick and with a drainage path of 5 m may reach 90% consolidation within 8 months.
- The maximum magnitude of secondary consolidation may be as high as 30% of the primary consolidation for the design life (100 years) of the highway.

Boring 896-1 (STA 537+90):

- The consolidation tests on soil specimens from boring 896-1 suggest the silty clay at elevations between –4m and –16m is normally consolidated with relatively high initial void ratio (e_i=0.8 compared with e_i=0.55~0.60 of other specimens).
- The specimen from elevation –9m has a coefficient of consolidation $c_v \approx 2 \times 10^{-7}$ m^2/sec, which is an order of magnitude lower than that of others. This low c_v value suggests the soil is less permeable than the others.

Boring 896-4 (STA 540+08):

- The soil at elevation 2m has a natural water content w=22% that is close to the plastic limit of the soil (PL=18, LL=55). The low water content associated with a low initial void ratio of e_i=0.62 suggest that the soil be normally consolidated.
- However, according to the consolidation-time curves, the soil may undergo substantial secondary compression over an extended time. Therefore, this soil layer should be dealt with caution.

Boring 896-5 (STA 540+75):

- With initial void ration e_i ranging from 0.8 to 1, natural water contents w=29~32, PL=17~24 and LL=32~66, the soils obtained from this boring may be identified as normally consolidated high plasticity clay. Since the soils, with average $c_v \approx 1 \times 10^{-7}$ m^2/sec, are relatively impermeable the primary consolidation may last an extended time (about 7 years for a soil layer with 5 m drainage path to reach 90% consolidation). The magnitude of secondary compression of these soils may be as high as 25% of the primary consolidation over the design life of the wall (100 years).
- The soil layer above elevation 1m, with similar low c_v values (~1×10^{-8} m^2/sec), may be the extension of the high plasticity clay identified in boring 896-4.

Transcription: Culvert Investigation, 3/27/69
By Marcon Joe

72" x 440' RCP

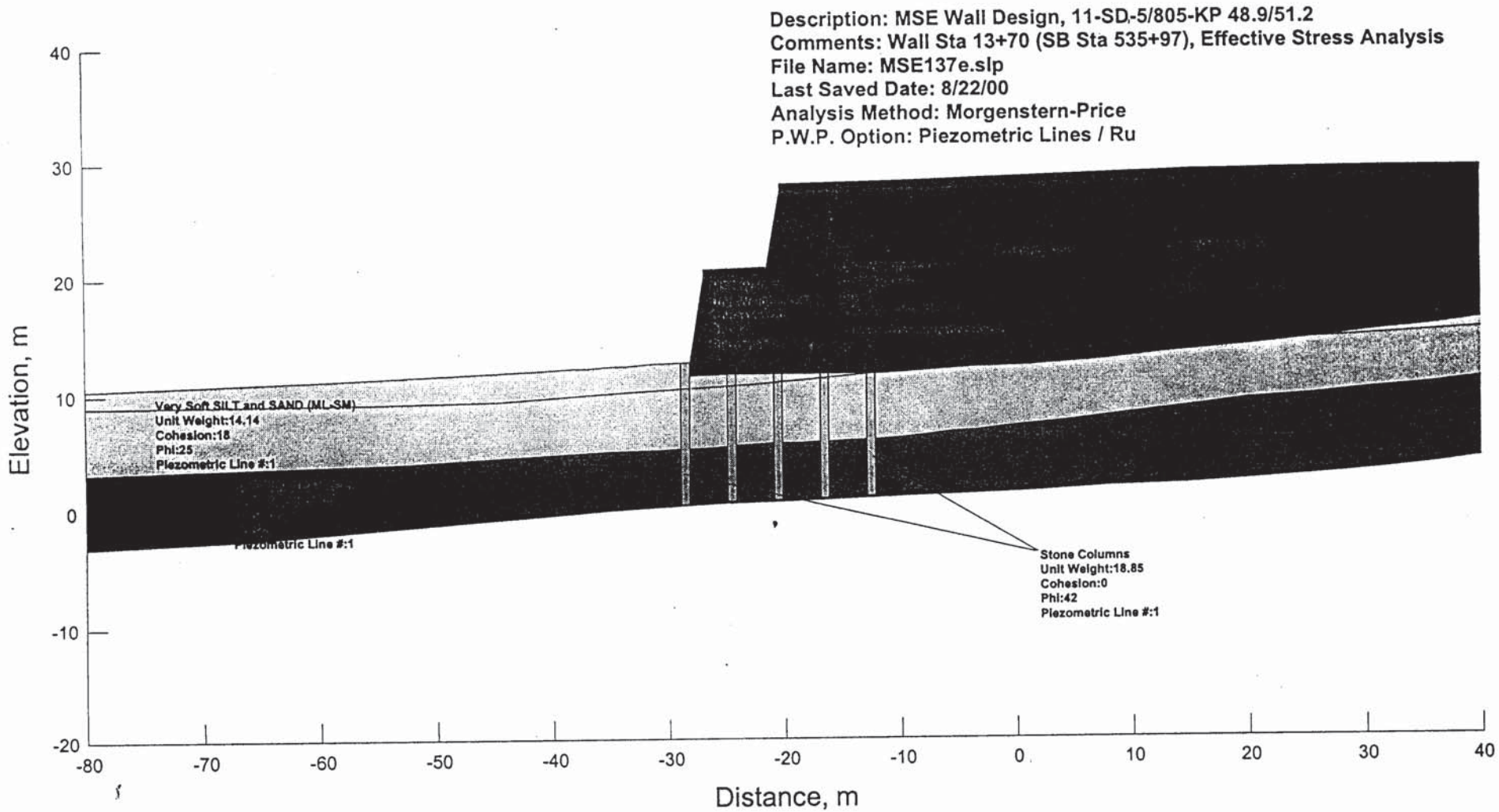
Mr. A.Z. Clark, W. Cross, and Marcon Joe inspected the 72" x 440' RCP at Station 655+20, P.M. 31.5, SD-5.

1. The joints of the pipe were pulled apart, some measurements on the joints as big as 1.5". Also some sections of the pipe were shifted laterally as much as 0.5". All these movements of the pipe could be caused by the settlement and the differential settlement by the fill on the top of the pipe.
2. Another problem is that the pipe is under-designed. For the 72" RCP Class V, the maximum allowable over-height fill is 41', but the actual condition is 55'. Since the pipe is over-loaded, the crack on the 50' of pipe are visible. There are 4 sections of pipe with cracks as big as 3/8". These sections could collapse.
3. The Materials Department installed control points on the pavements on the east and westbound to determine the rate of settlement. The result was a definite settlement.
4. The pavement on the westbound has a gap (lateral) about 2" between the second and the third lane.

Some solutions were suggested after the inspection.

1. Use epoxy to grout the joints.
2. For the over-loaded pipe, use 7 4" x 6" wooden posts jacked in place for the 4 sections temporarily preventing structural collapse.
3. Ultimately a liner of concrete or steel has to be installed that could carry the dead load on top of the pipe; the liner has to be special design.
4. The Material Department will investigate the possibility of additional settlement. Mr. W. Cross will send the Hydraulic Department a report. By that time the Hydraulics Department will have more data to work with and hope to find a good solution for this problem.

* Reference for steel lining: Handbook of Steel Drainage Construction Products, page 264, Fig. 14-3.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P.W.P. Option: Piezometric Lines / Ru
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Phi:25
Piezometric Line #:1
Piezometric Line #:1
Stone Columns
Unit Weight:18.85
Cohesion:0
Phi:42
Piezometric Line #:1
Elevation, m
Distance, m
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30
20
10
0
-10
-20
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20
30
40

Description: MSE Wall Design, 11-SD-5/805-KP 48.9/51.2
Comments: Wall Sta 13+70 (SB Sta 535+97), Total Stress Analysis
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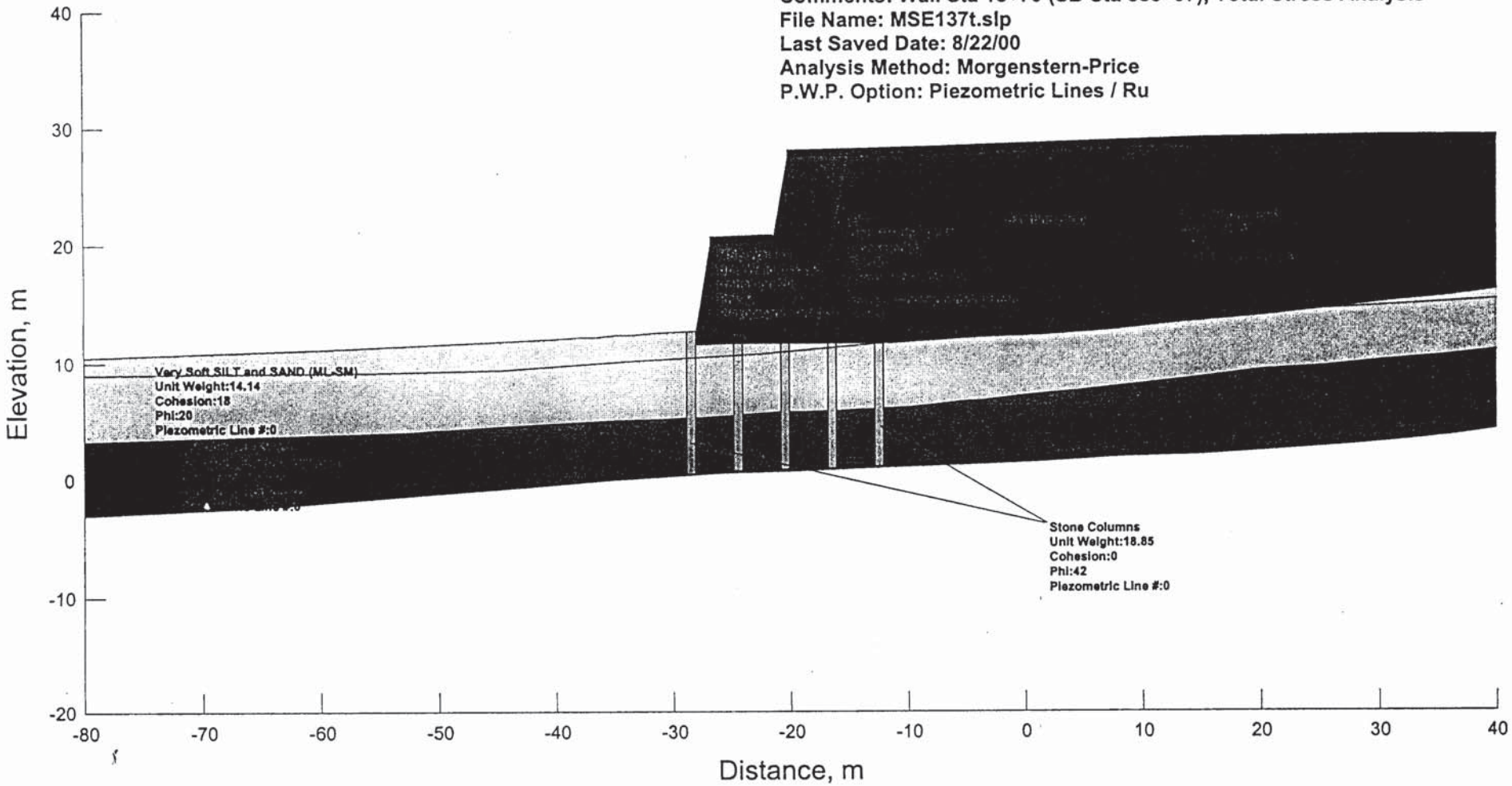
P.W.P. Option: Piezometric Lines / Ru



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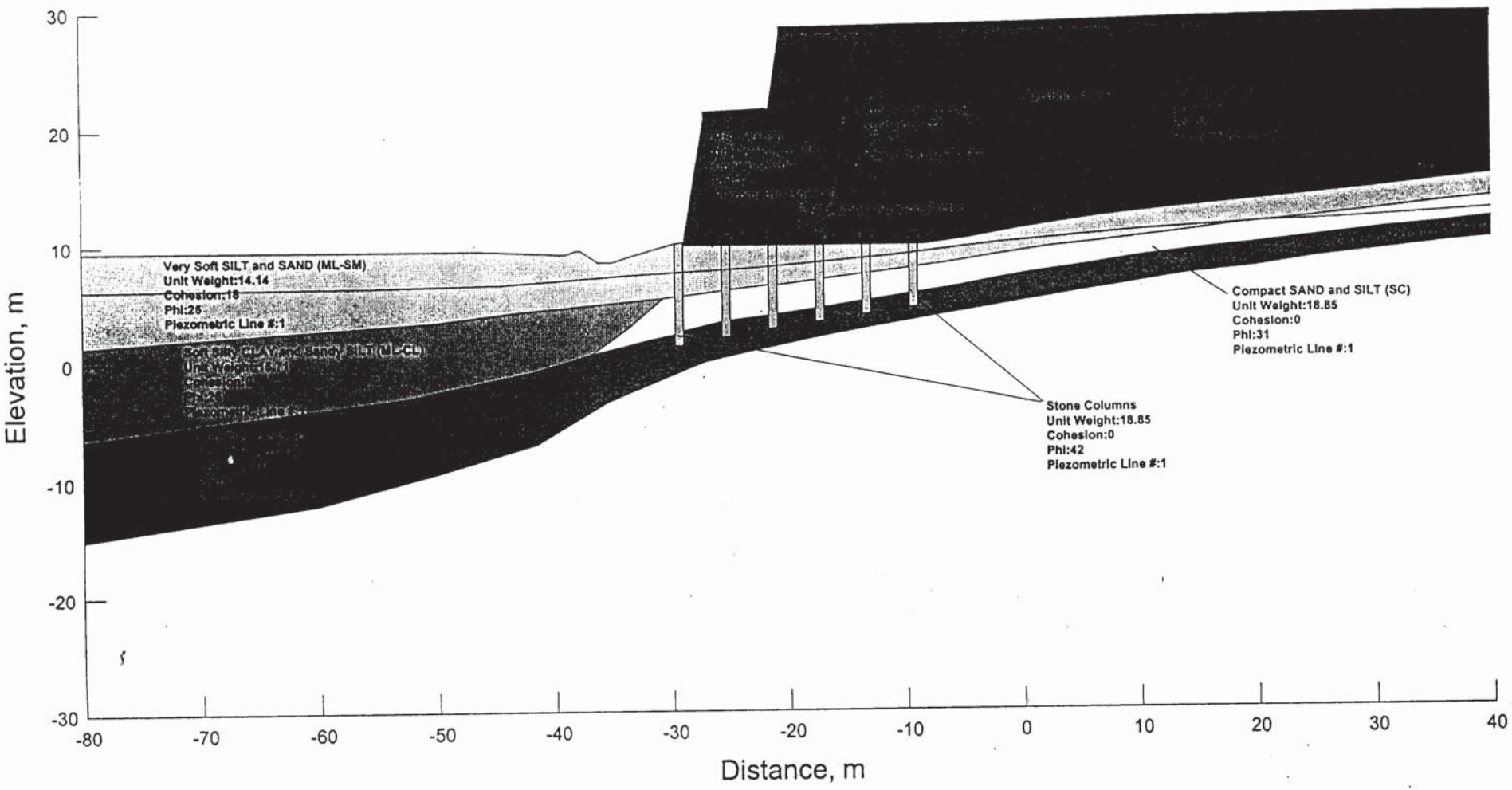
Analysis Method: Morgenstern-Price
P.W.P. Option: Piezometric Lines / Ru



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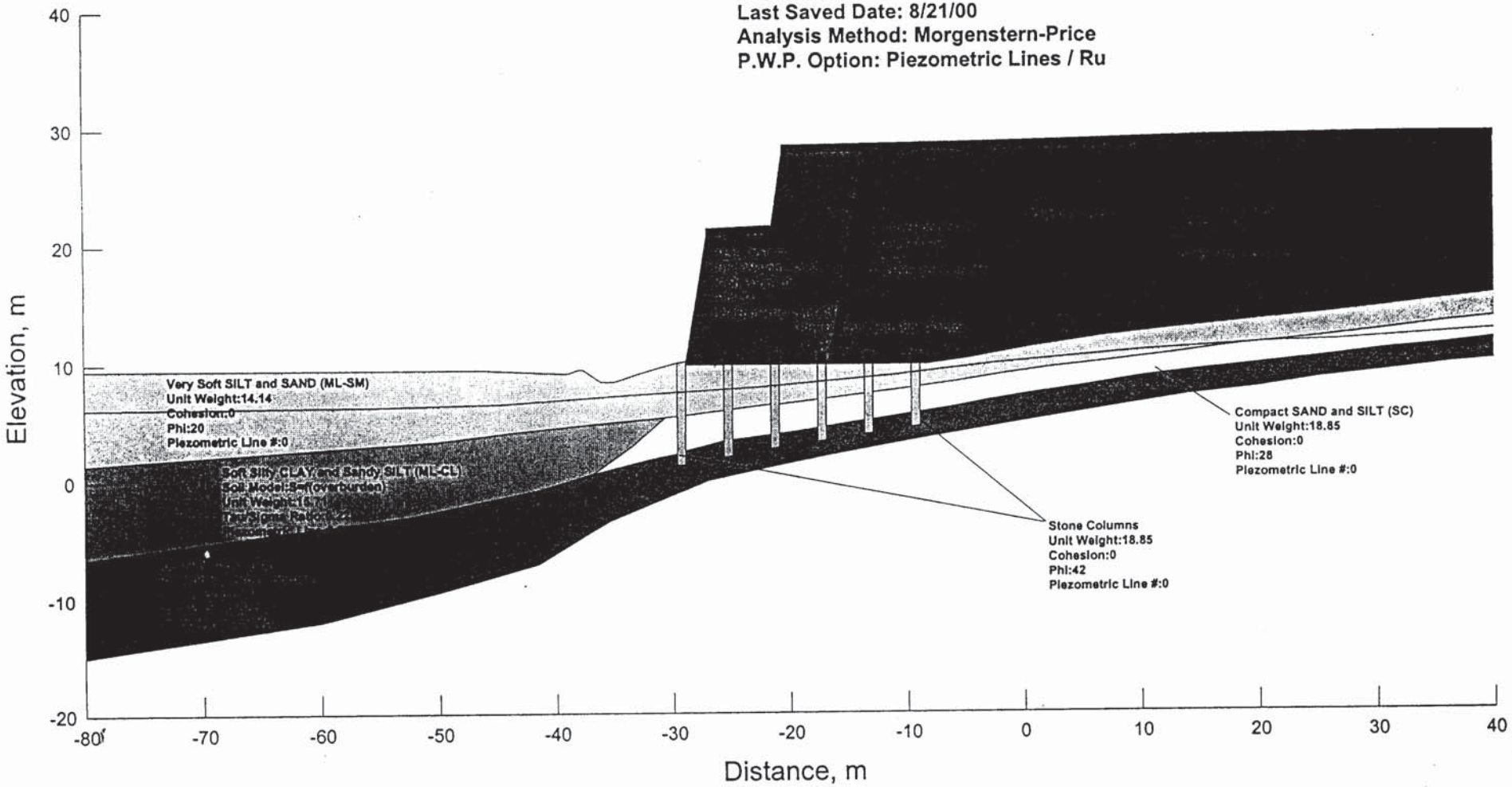

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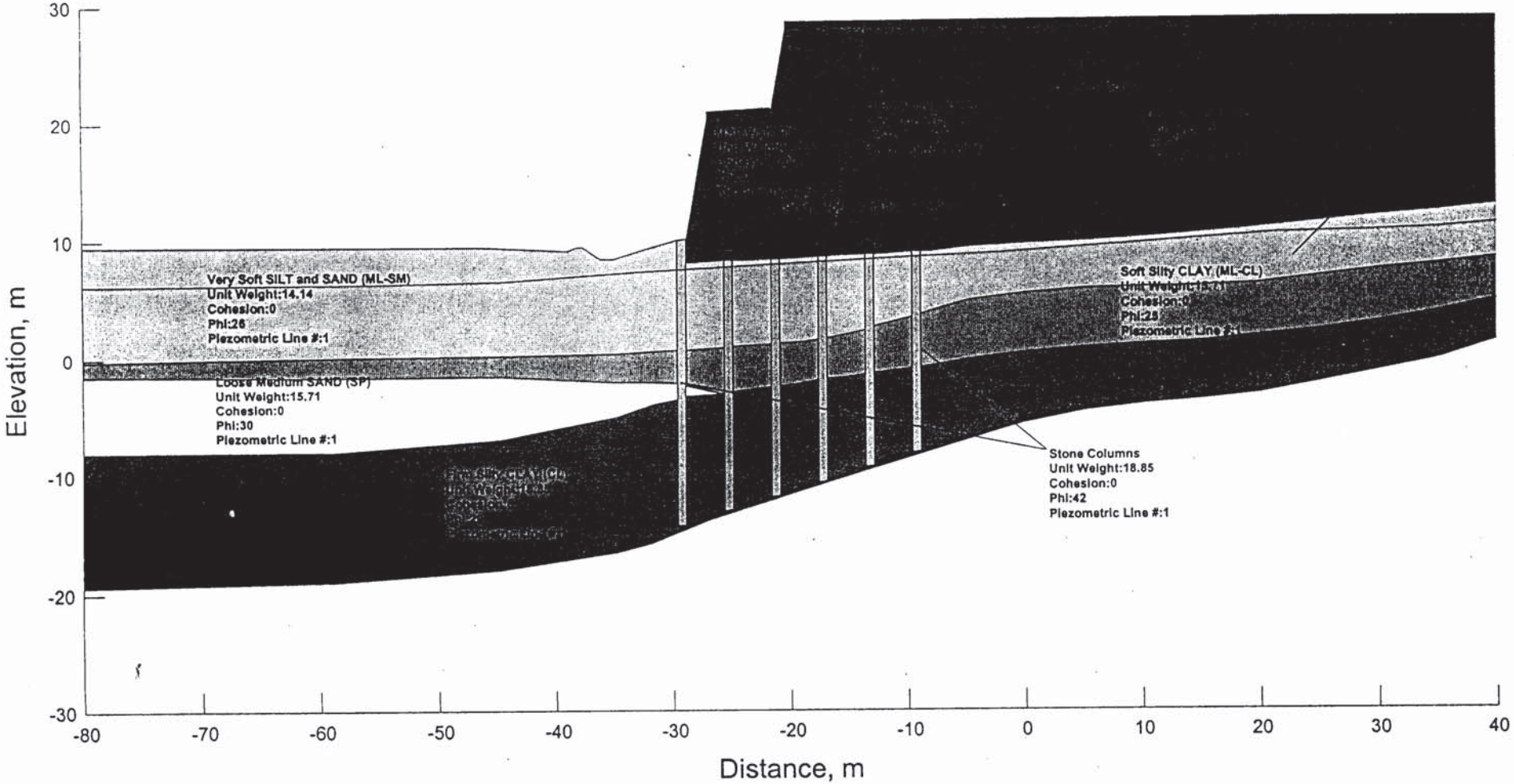

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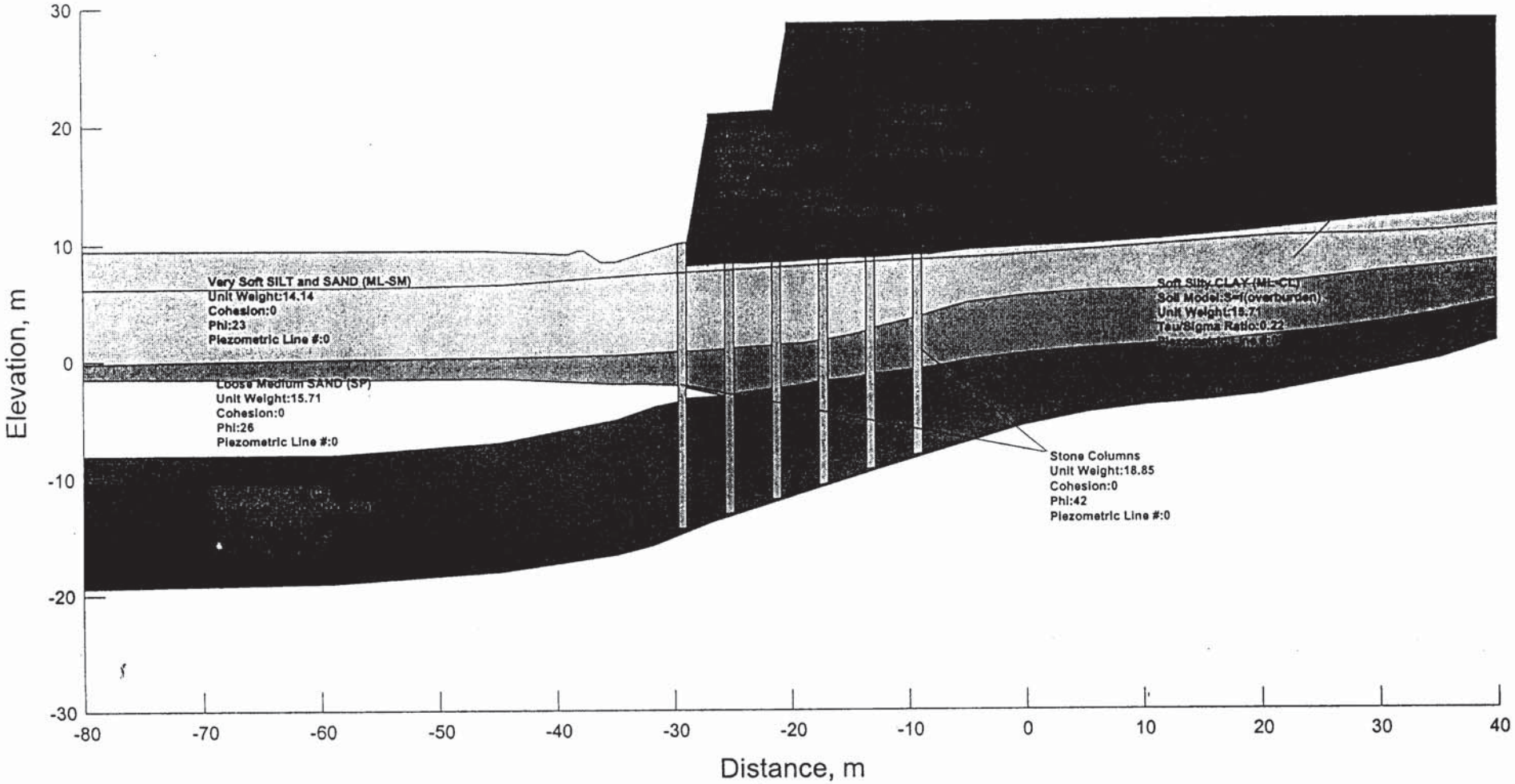

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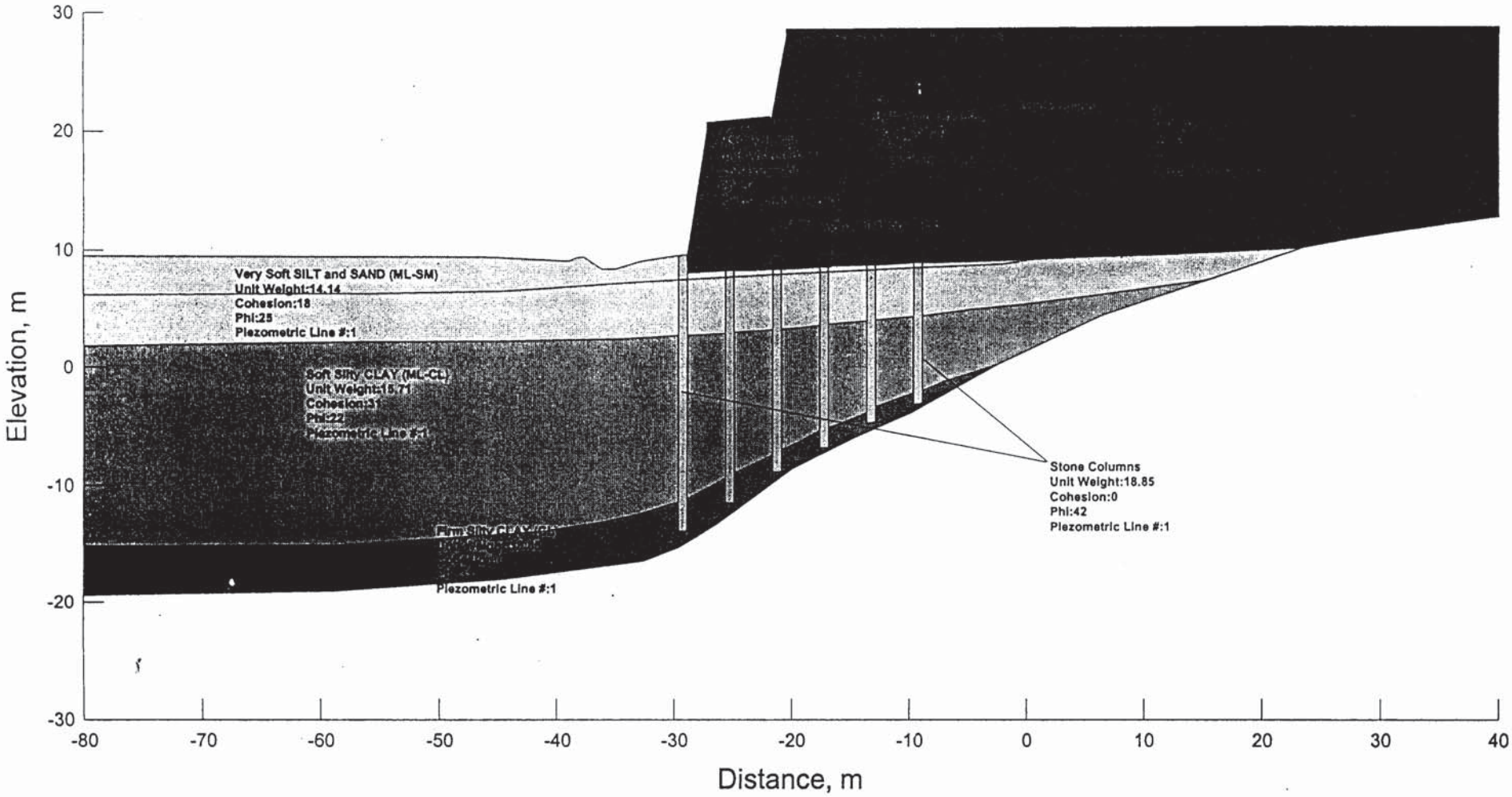
Analysis Method: Morgenstern-Price
P.W.P. Option: Piezometric Lines / Ru



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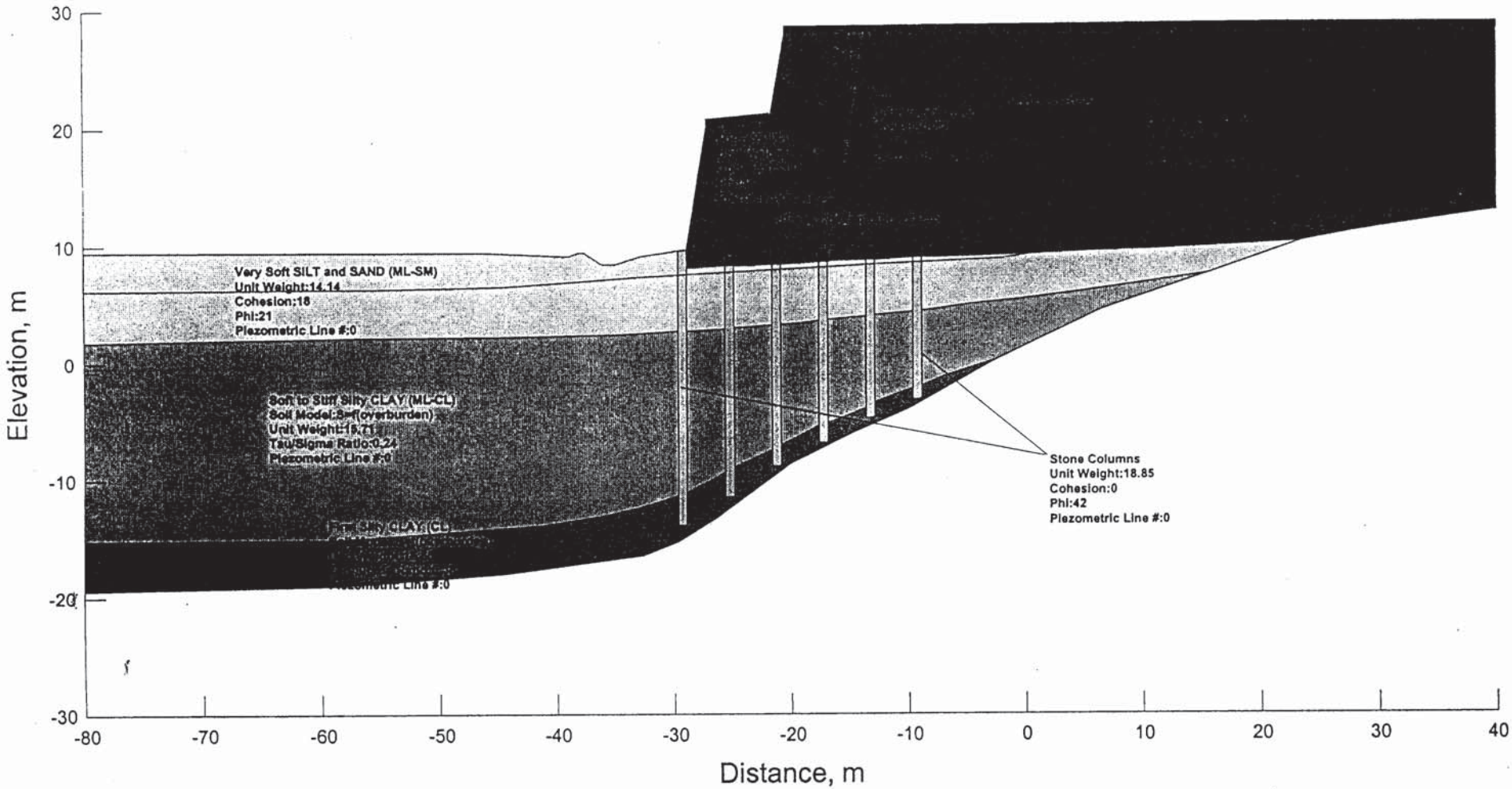
P.W.P. Option: Piezometric Lines / Ru



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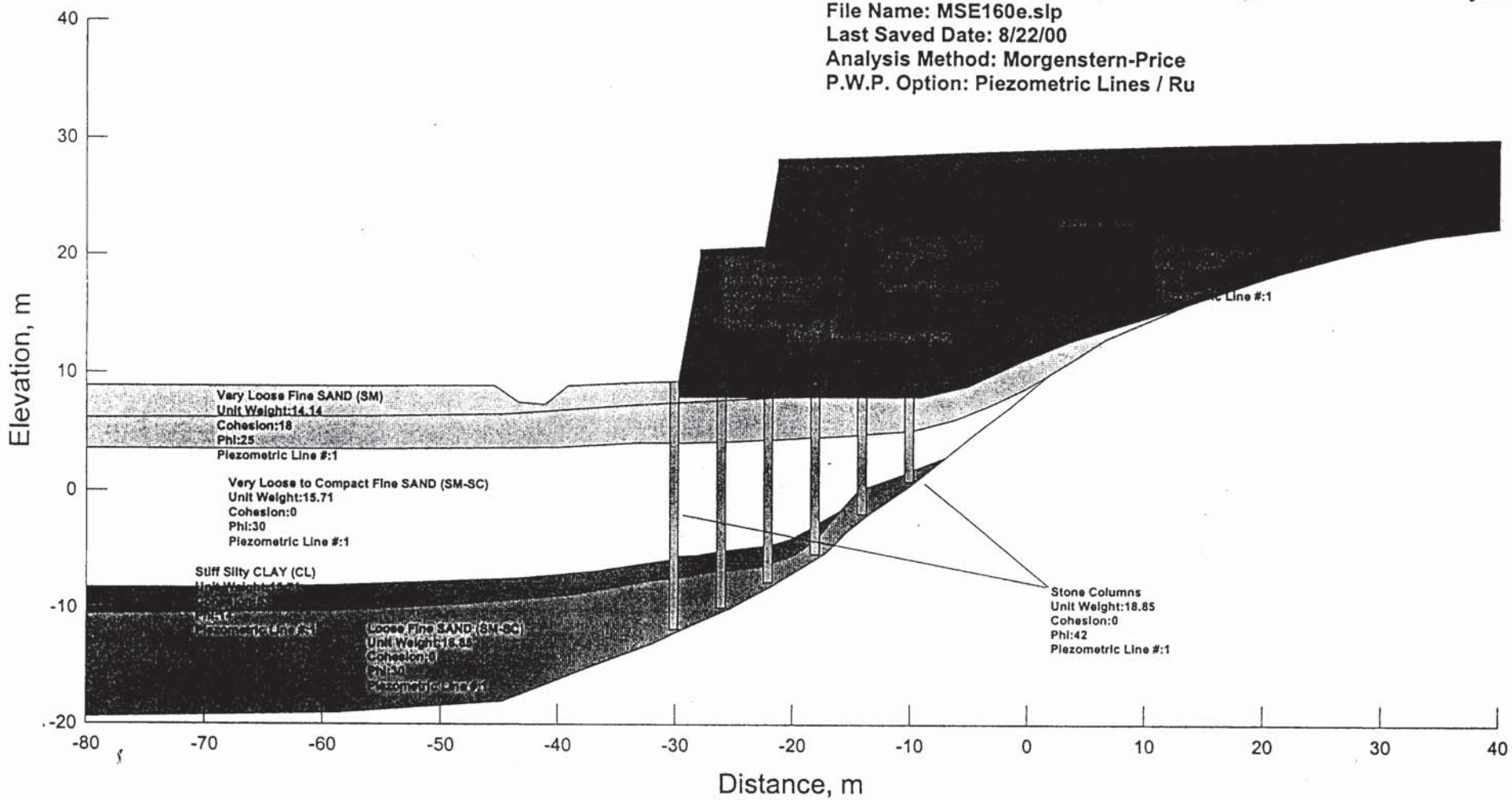
P.W.P. Option: Piezometric Lines / Ru



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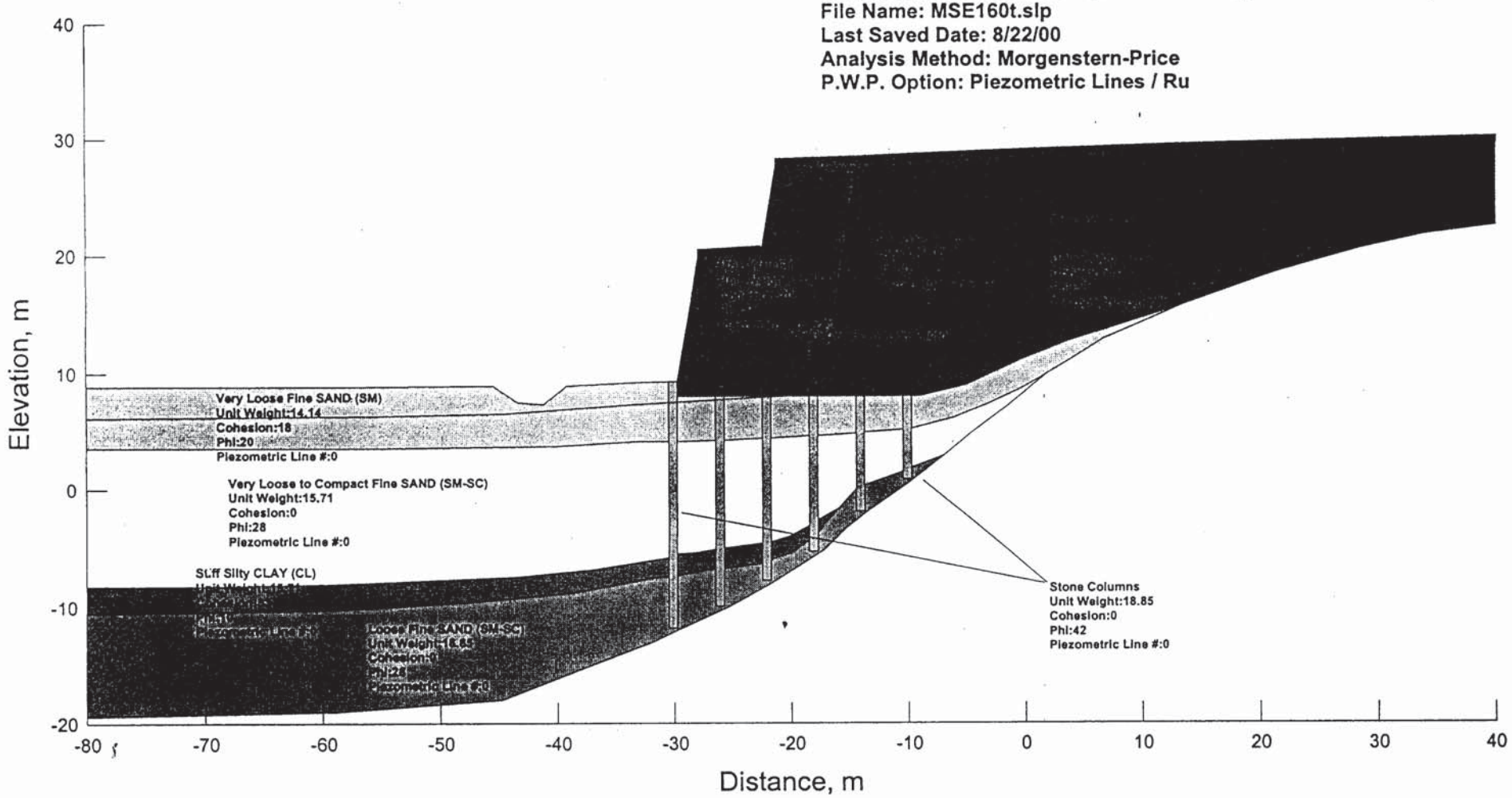
P.W.P. Option: Piezometric Lines / Ru



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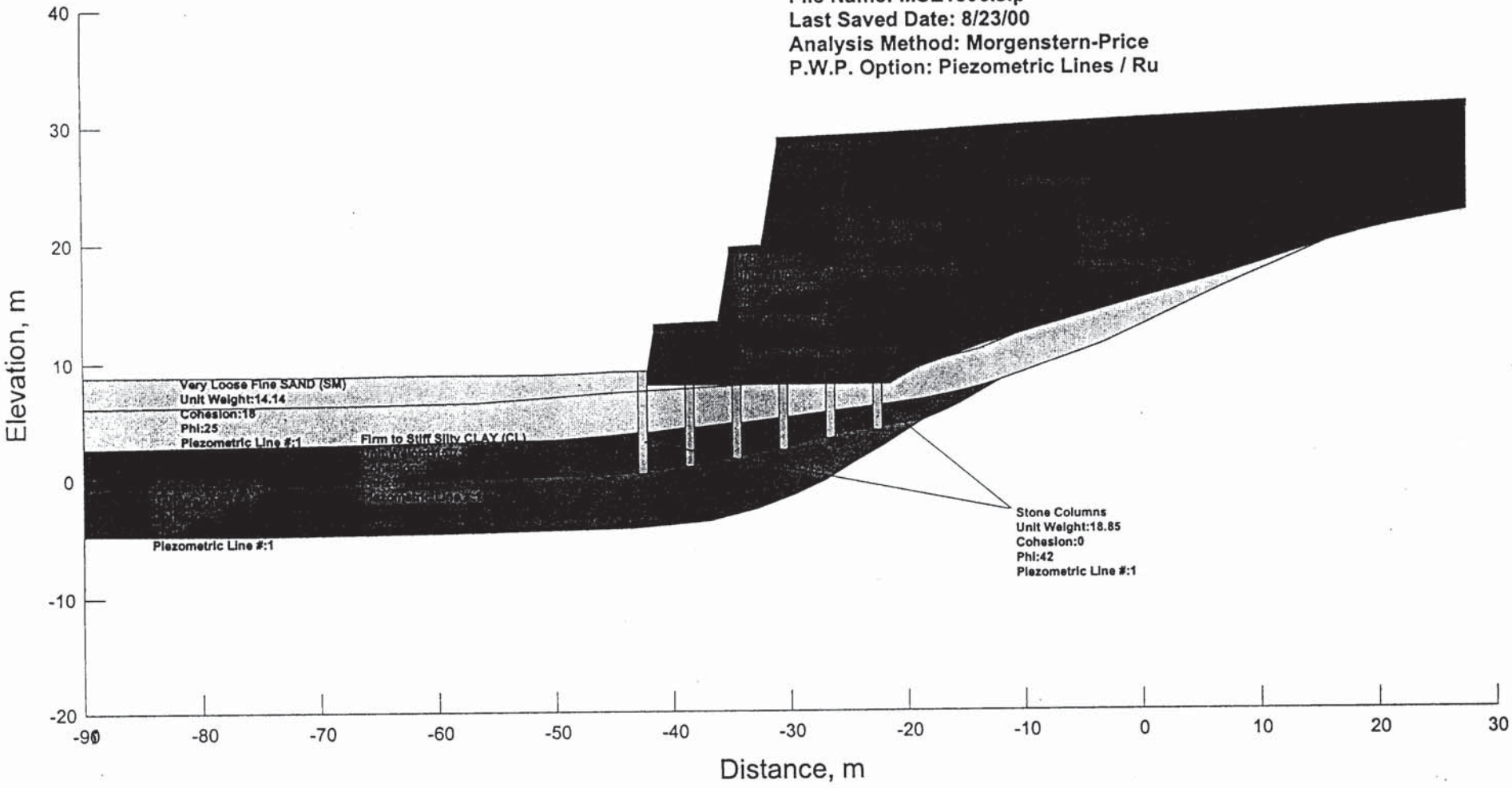
P.W.P. Option: Piezometric Lines / Ru



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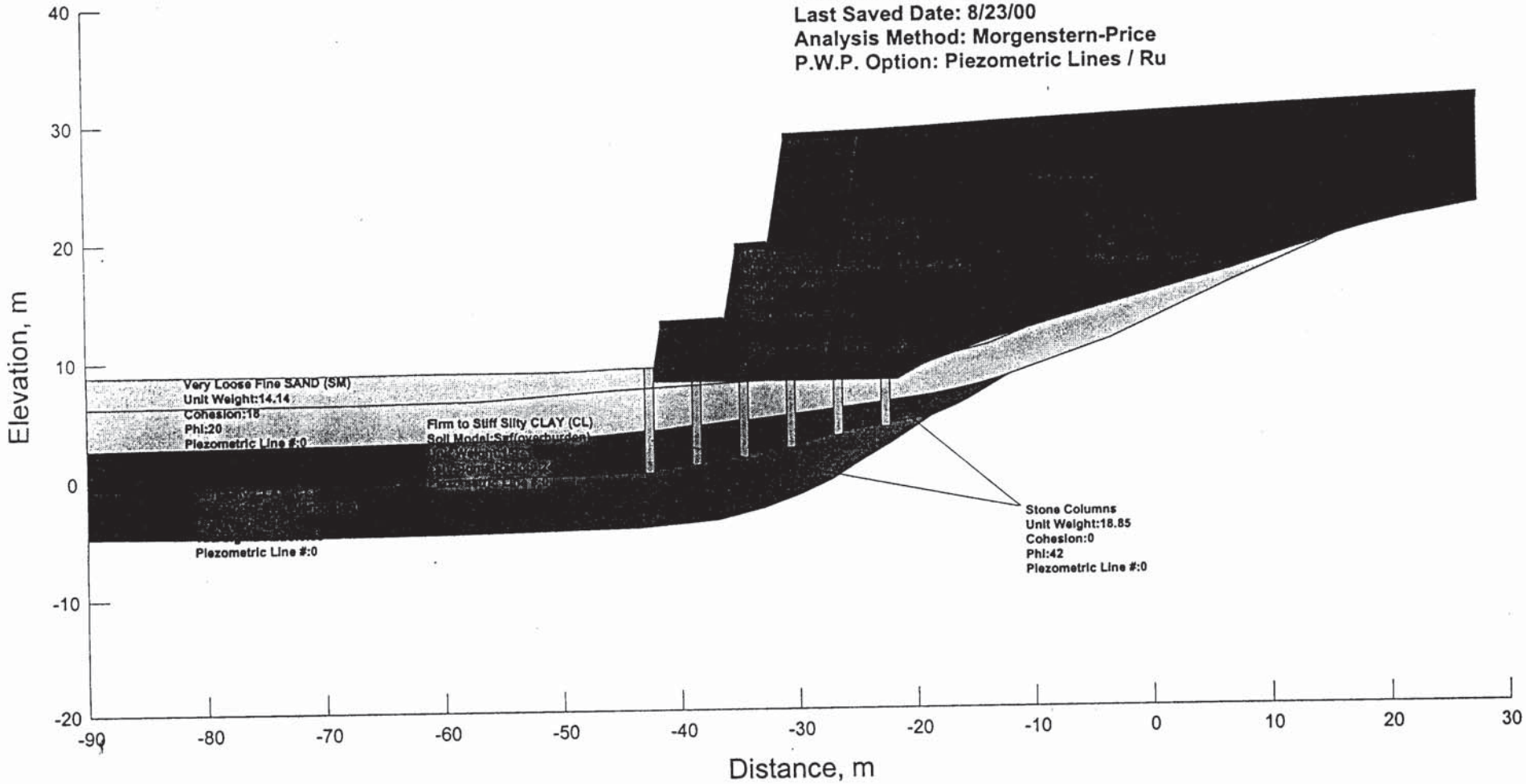
P.W.P. Option: Piezometric Lines / Ru



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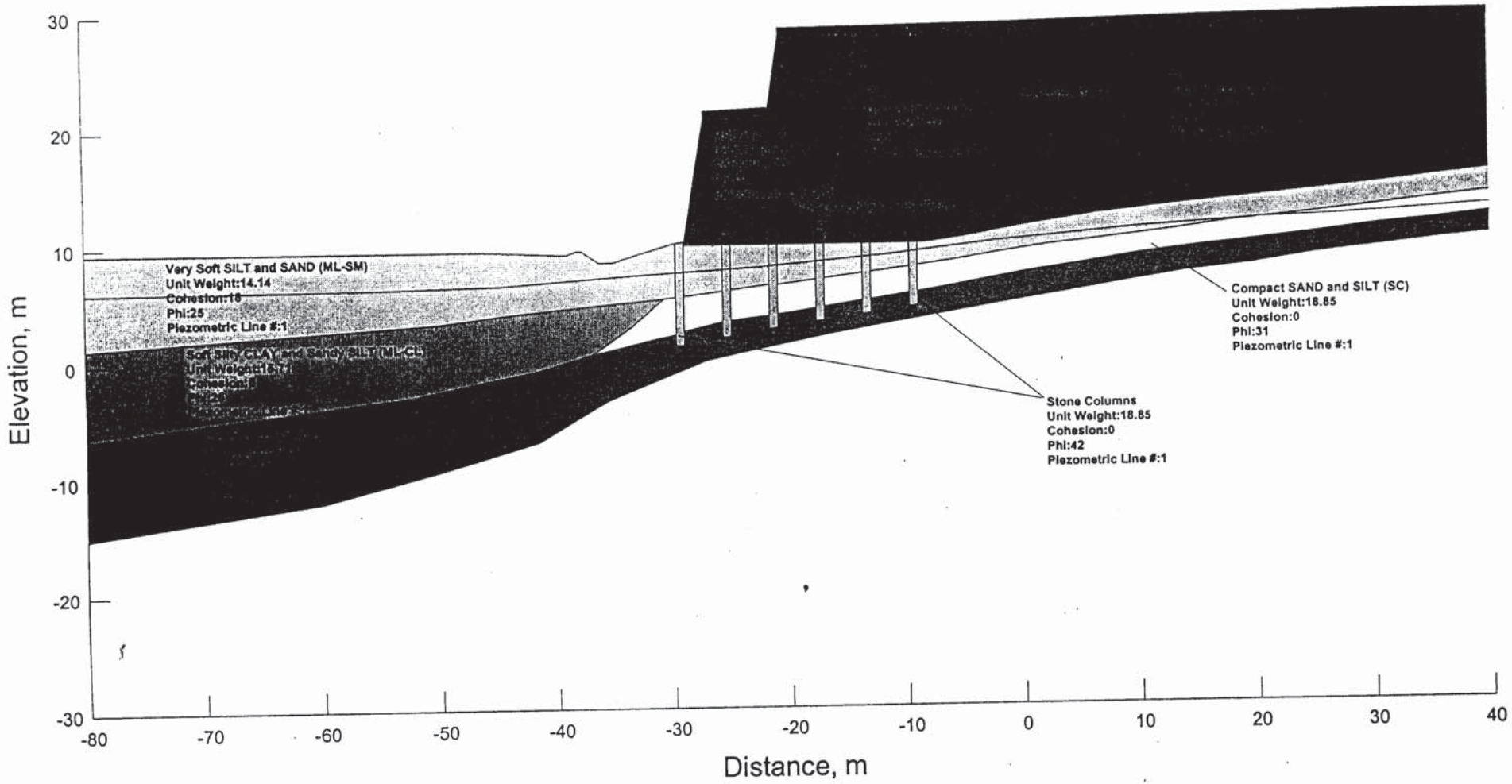
Analysis Method: Morgenstern-Price
P.W.P. Option: Piezometric Lines / Ru



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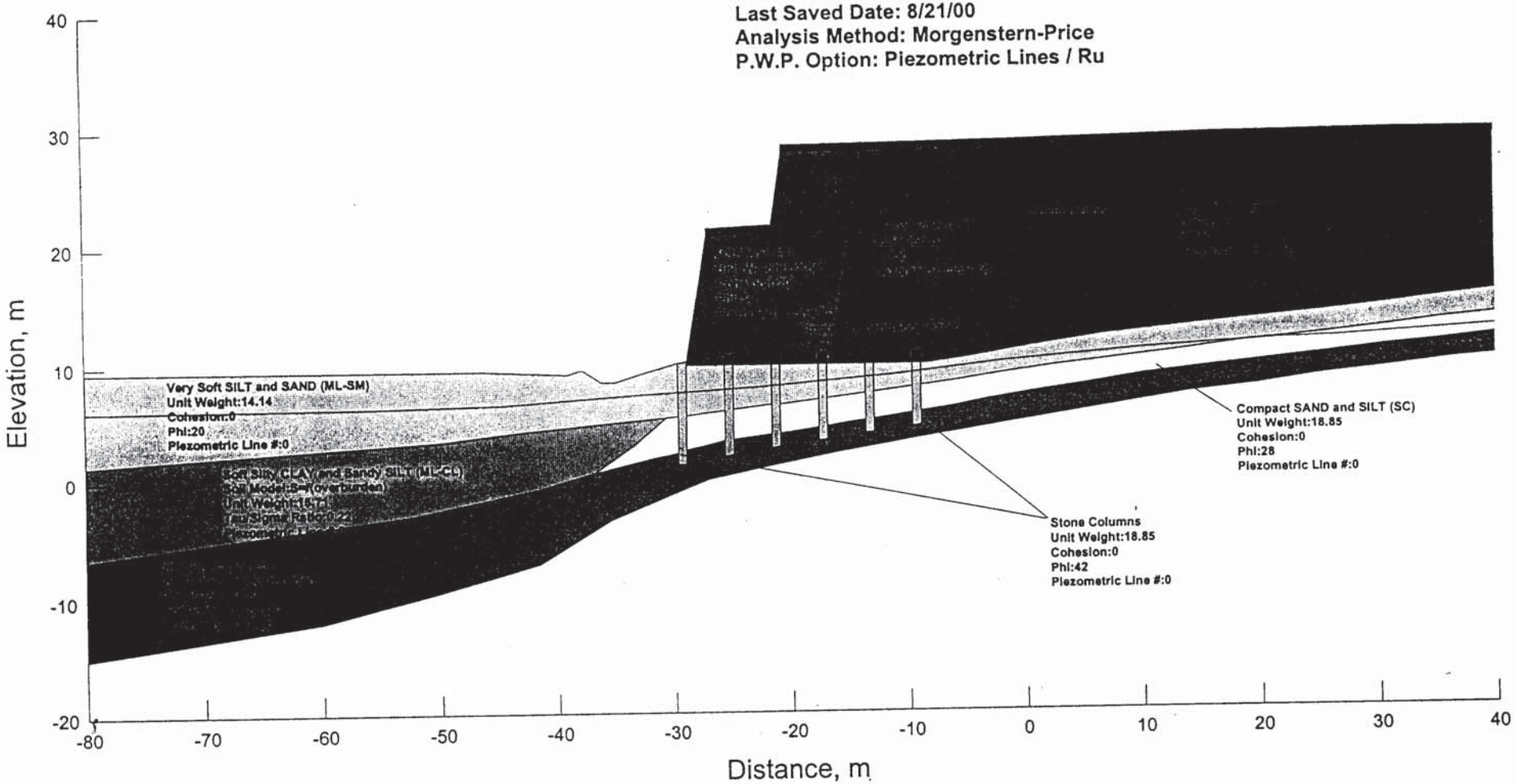
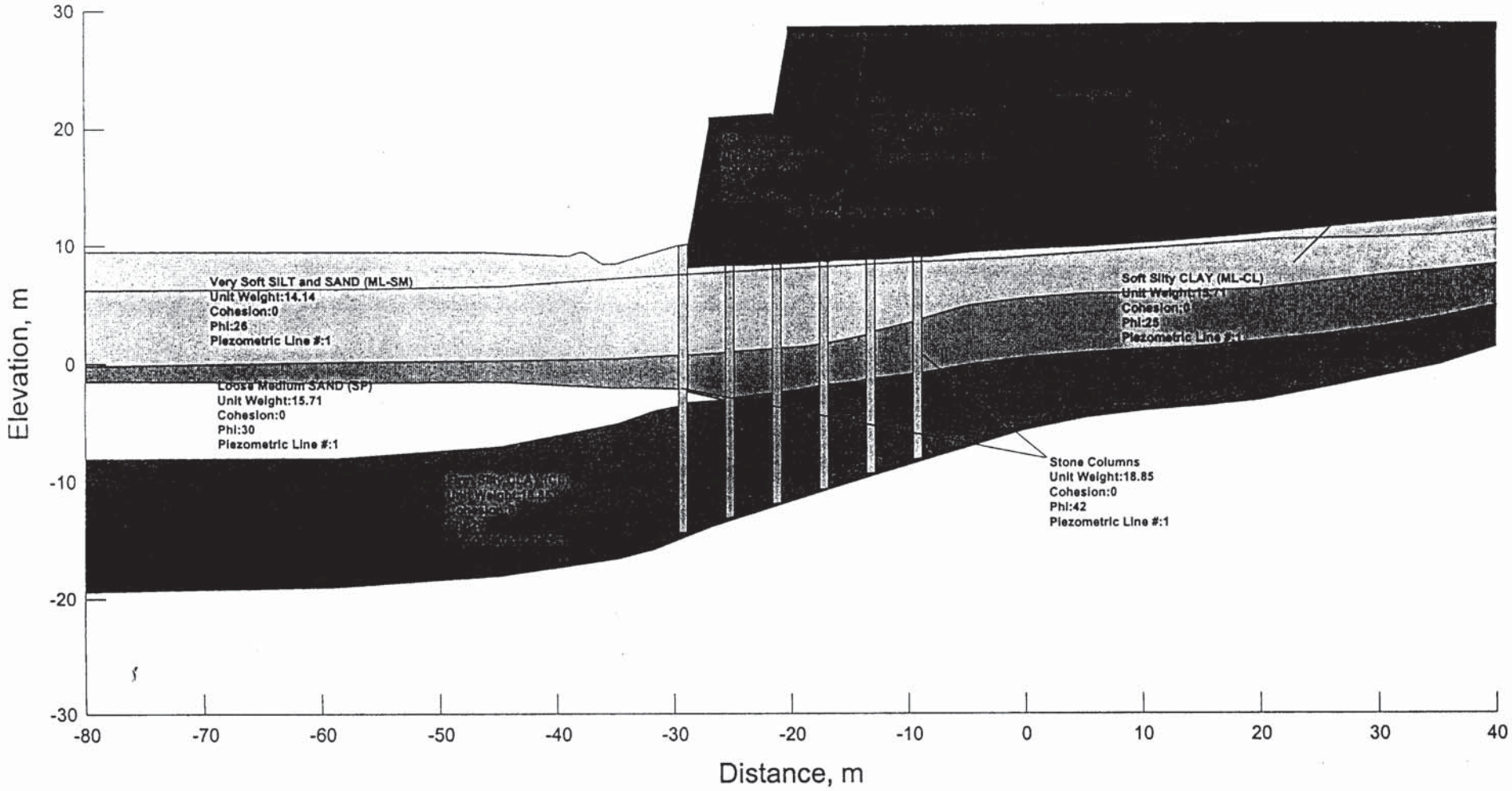
Comments: Wall Sta 14+30 (SB Sta 536+56), Total Stress Analysis, a=0.17g
File Name: MSE143t.slp
Last Saved Date: 8/21/00
Analysis Method: Morgenstern-Price
P.W.P. Option: Piezometric Lines / Ru



Description: MSE Wall Design, 11-SD-5/805-KP 48.9/51.2
Comments: Wall Sta 15+00 (SB Sta 537+26), Effective Stress Analysis
File Name: MSE150e.slp
Last Saved Date: 8/2/2000
Analysis Method: Morgenstern-Price
P.W.P. Option: Piezometric Lines / Ru



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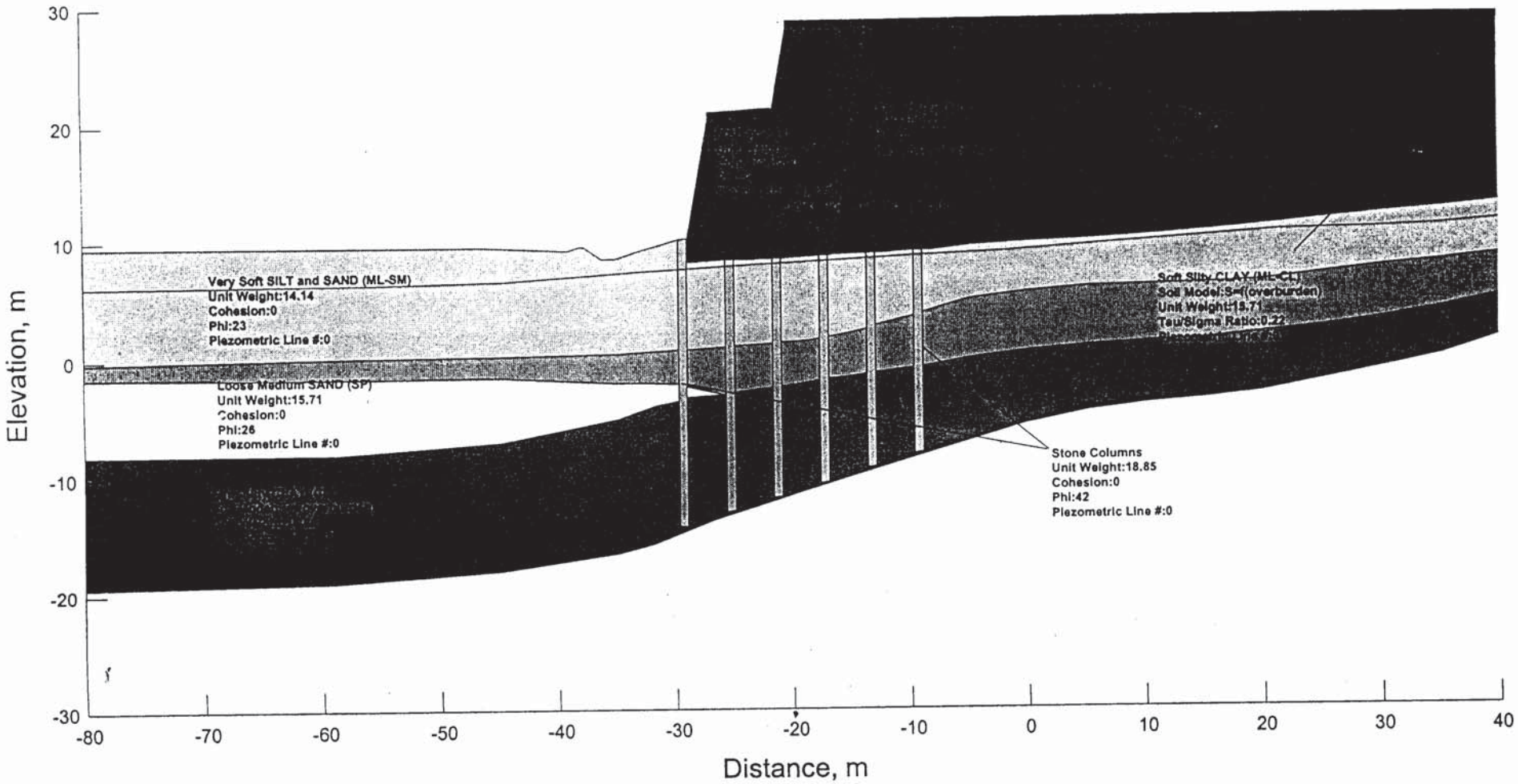
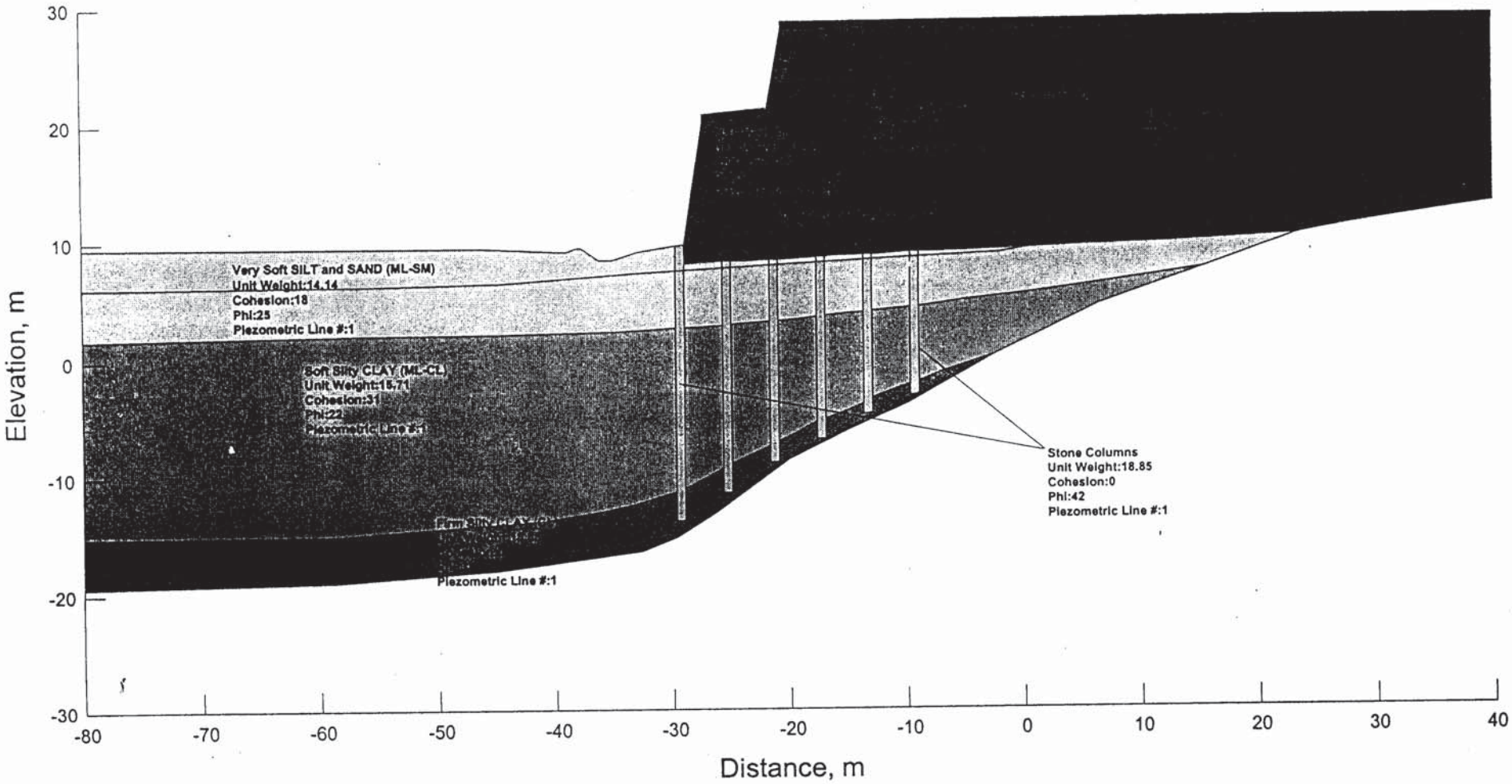
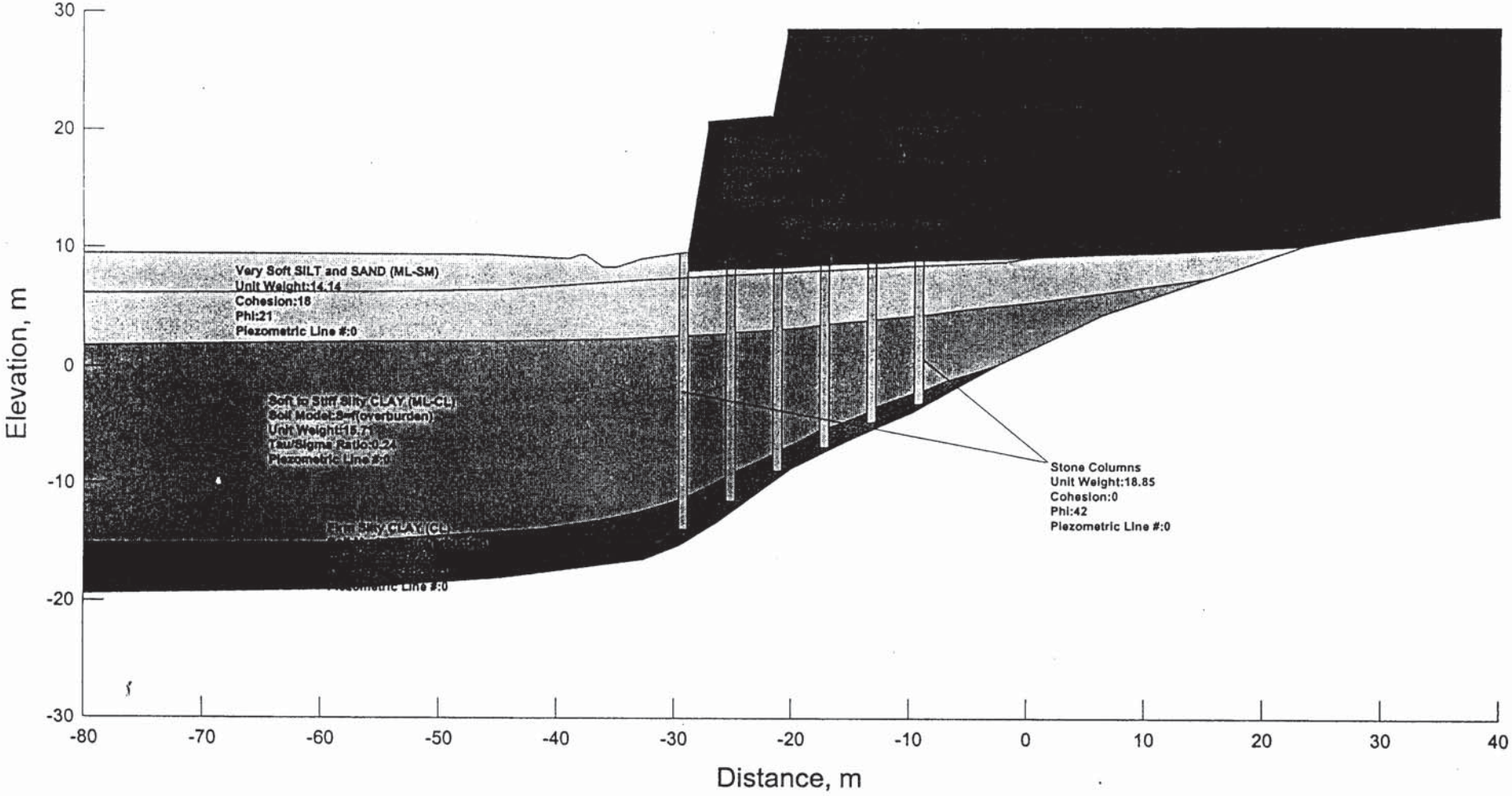
Comments: Wall Sta 15+00 (SB Sta 537+26), Total Stress Analysis
File Name: MSE150t.slp
Last Saved Date: 8/3/00
Analysis Method: Morgenstern-Price
P.W.P. Option: Piezometric Lines / Ru



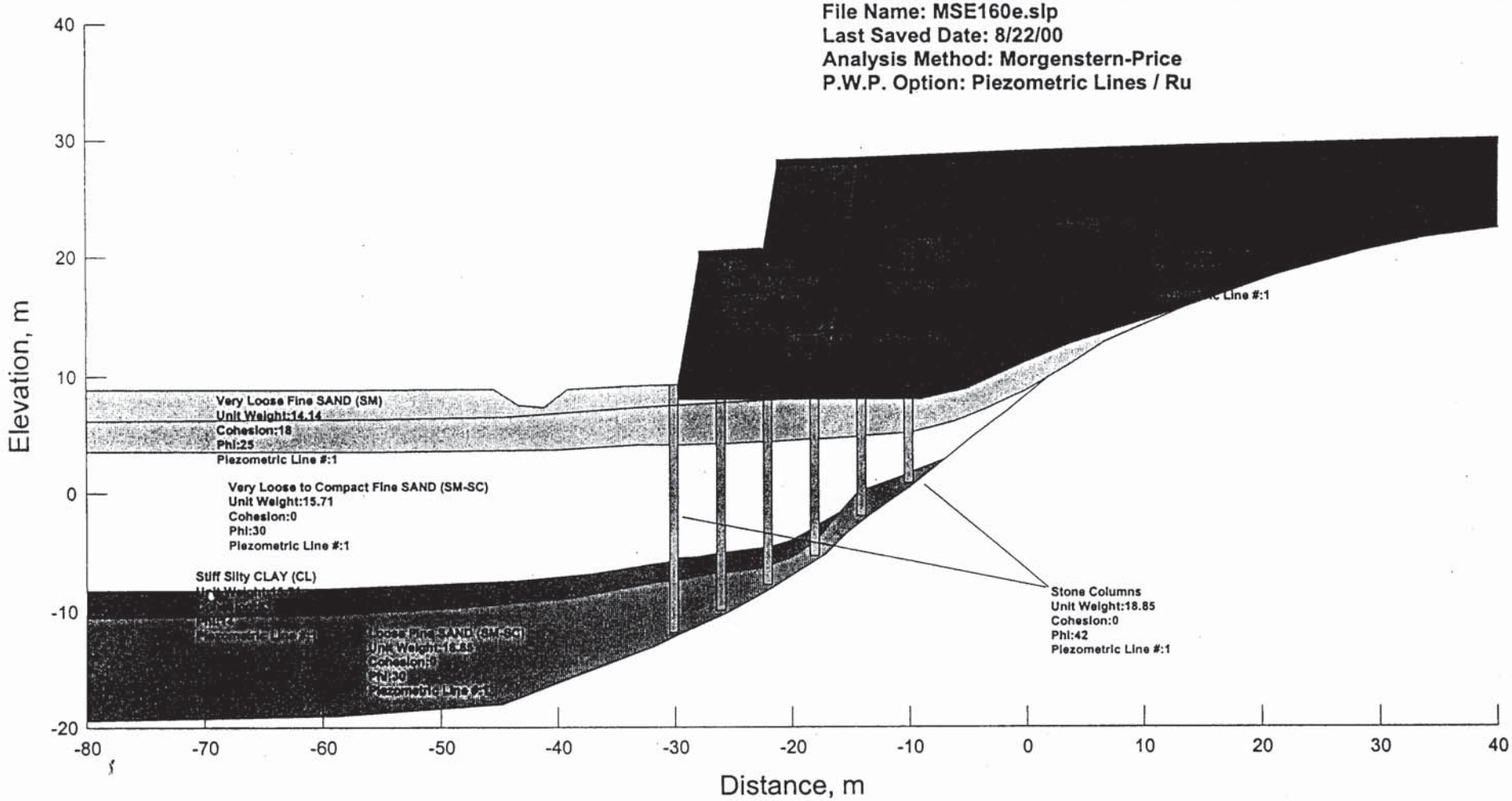
Description: MSE Wall Design, 11-SD-5/805-KP 48.9/51.2
Comments: Wall Sta 15+50 (SB Sta 537+76), Effective Stress Analysis
File Name: MSE155e.slp
Last Saved Date: 8/18/00
Analysis Method: Morgenstern-Price
P.W.P. Option: Piezometric Lines / Ru



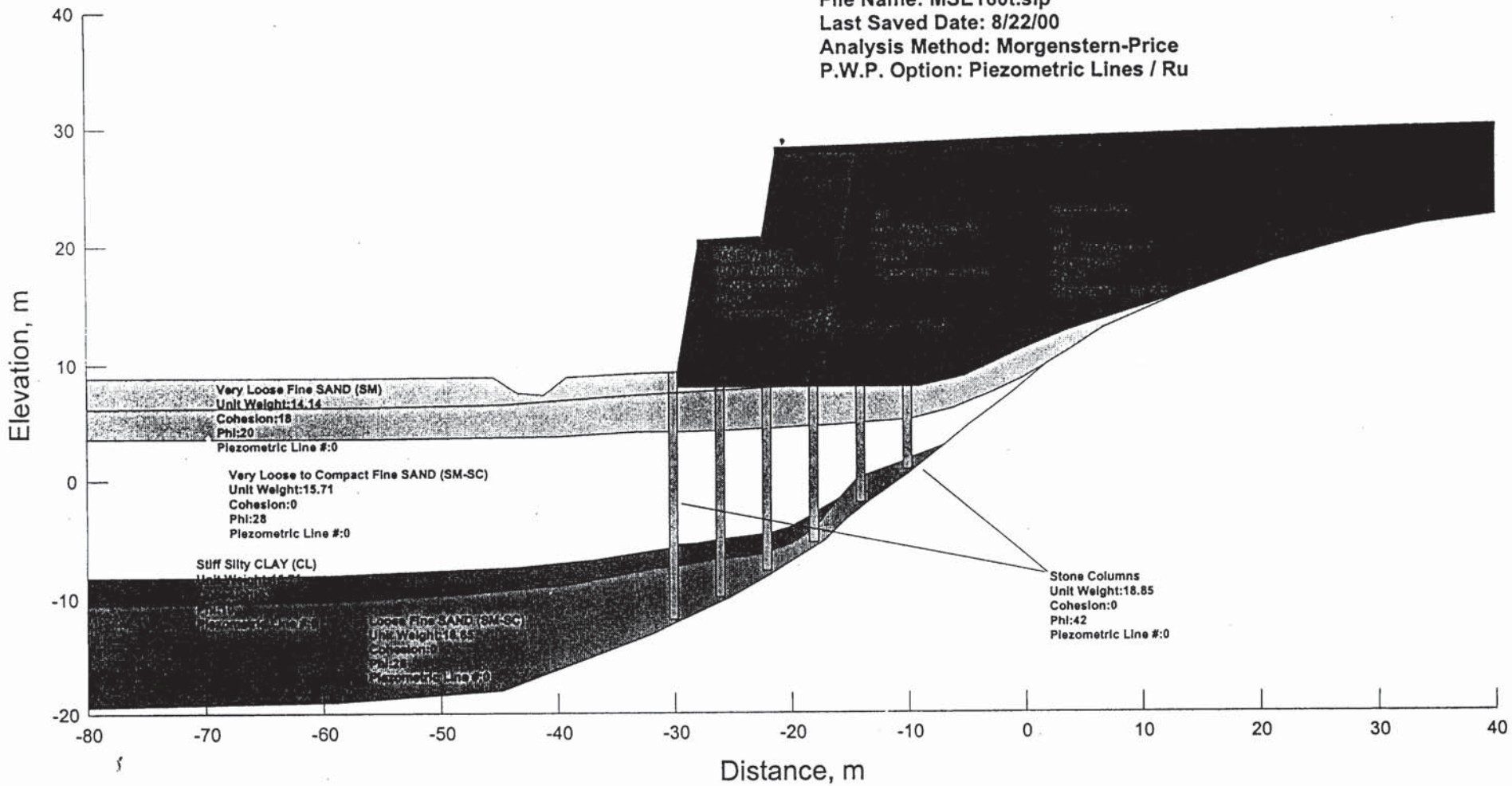
Description: MSE Wall Design, 11-SD-5/805-KP 48.9/51.2
Comments: Wall Sta 15+50 (SB Sta 537+76), Total Stress Analysis
File Name: MSE155t.slp
Last Saved Date: 8/18/00
Analysis Method: Morgenstern-Price
P.W.P. Option: Piezometric Lines / Ru



Description: MSE Wall Design, 11-SD-5/805-KP 48.9/51.2
Comments: Wall Sta 16+00 (SB Sta 538+29), Effective Stress Analysis
File Name: MSE160e.slp
Last Saved Date: 8/22/00
Analysis Method: Morgenstern-Price
P.W.P. Option: Piezometric Lines / Ru



Description: MSE Wall Design, 11-SD-5/805-KP 48.9/51.2
Comments: Wall Sta 16+00 (SB Sta 538+29), Total Stress Analysis
File Name: MSE160t.slp
Last Saved Date: 8/22/00
Analysis Method: Morgenstern-Price
P.W.P. Option: Piezometric Lines / Ru



APPENDIX C

```
                    *** GSTABL7 ***
              ** GSTABL7 by Garry H. Gregory, P.E. **
   ** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
          (All Rights Reserved-Unauthorized Use Prohibited)
*******************************************************************************
                  SLOPE STABILITY ANALYSIS SYSTEM
      Modified Bishop, Simplified Janbu, or GLE Method of Slices.
      (Includes Spencer & Morgenstern-Price Type Analysis)
      Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
      Nonlinear Undrained Shear Strength, Curved Phi Envelope,
      Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
      Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
*******************************************************************************
Analysis Run Date:          10/14/2004
Time of Run:                07:55AM
Run By:                     mike fordham
Input Data Filename:        C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
Output Filename:            C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
Unit System:                SI
Plotted Output Filename:    C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
PROBLEM DESCRIPTION:  I-5 Preliminary Geotechnical Report
                      Fill Slope SD Lagoon (1:1.5)12Mno benchC
BOUNDARY COORDINATES
    3 Top   Boundaries
    6 Total Boundaries
Boundary     X-Left     Y-Left     X-Right    Y-Right    Soil Type
   No.        (m)        (m)        (m)        (m)      Below Bnd
    1        25.00      10.00      40.00      10.00        2
    2        40.00      10.00      58.00      22.00        1
    3        58.00      22.00      85.00      22.00        1
    4        40.00      10.00      52.00      11.00        2
    5        52.00      11.00      62.00      16.00        2
    6        62.00      16.00      80.00      22.00        2
Default Y-Origin = 0.00(m)
Default X-Plus Value = 0.00(m)
Default Y-Plus Value = 0.00(m)
ISOTROPIC SOIL PARAMETERS
 2 Type(s) of Soil
Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
 No. (kN/m3)  (kN/m3)    (kPa)     (deg)    Param.   (kPa)     No.
  1    18.9     18.9      9.6      36.0    0.00      0.0       0
  2    18.9     18.9      9.6      32.0    0.00      0.0       0
Searching Routine Will Be Limited To An Area Defined By  1 Boundaries
Of Which The First  1 Boundaries Will Deflect Surfaces Upward
Boundary     X-Left     Y-Left     X-Right    Y-Right
   No.        (m)        (m)        (m)        (m)
    1         0.00       0.00       0.00       0.00
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
 400 Trial Surfaces Have Been Generated.
  40 Surface(s) Initiate(s) From Each Of    10 Points Equally Spaced
Along The Ground Surface Between  X =  25.00(m)
                              and  X =  40.00(m)
Each Surface Terminates Between   X =  54.00(m)
                              and  X =  85.00(m)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is  Y =      0.00(m)
 2.00(m)  Line Segments Define Each Trial Failure Surface.
Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -15.0
And  25.0 deg.
Following Are Displayed The Ten Most Critical Of The Trial
      Failure Surfaces Evaluated. They Are
```

Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 400
Number of Trial Surfaces With Valid FS = 400
Statistical Data On All Valid FS Values:
FS Max = 3.865 FS Min = 1.773 FS Ave = 2.407
Standard Deviation = 0.397 Coefficient of Variation = 16.49 %
Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	38.333	10.000
2	40.332	9.926
3	42.329	10.040
4	44.306	10.342
5	46.246	10.828
6	48.132	11.494
7	49.946	12.335
8	51.674	13.342
9	53.299	14.508
10	54.808	15.821
11	56.187	17.270
12	57.423	18.842
13	58.506	20.523
14	59.270	22.000

Circle Center At X = 40.125 ; Y = 31.140 ; and Radius = 21.215
Factor of Safety
*** 1.773 ***
Individual data on the 16 slices

Slice No.	Width (m)	Weight (kN)	Water Force Top (kN)	Water Force Bot (kN)	Tie Force Norm (kN)	Tie Force Tan (kN)	Earthquake Force Hor (kN)	Earthquake Force Ver (kN)	Surcharge Load (kN)
1	1.7	1.0	0.0	0.0	0.	0.	0.0	0.0	0.0
2	0.3	1.1	0.0	0.0	0.	0.	0.0	0.0	0.0
3	2.0	34.1	0.0	0.0	0.	0.	0.0	0.0	0.0
4	2.0	75.5	0.0	0.0	0.	0.	0.0	0.0	0.0
5	0.1	4.9	0.0	0.0	0.	0.	0.0	0.0	0.0
6	1.8	102.6	0.0	0.0	0.	0.	0.0	0.0	0.0
7	1.9	129.4	0.0	0.0	0.	0.	0.0	0.0	0.0
8	1.8	141.0	0.0	0.0	0.	0.	0.0	0.0	0.0
9	1.7	142.6	0.0	0.0	0.	0.	0.0	0.0	0.0
10	1.6	135.2	0.0	0.0	0.	0.	0.0	0.0	0.0
11	1.5	119.9	0.0	0.0	0.	0.	0.0	0.0	0.0
12	1.4	98.6	0.0	0.0	0.	0.	0.0	0.0	0.0
13	1.2	73.5	0.0	0.0	0.	0.	0.0	0.0	0.0
14	0.6	27.5	0.0	0.0	0.	0.	0.0	0.0	0.0
15	0.5	17.9	0.0	0.0	0.	0.	0.0	0.0	0.0
16	0.8	10.7	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	40.000	10.000
2	42.000	10.036
3	43.983	10.292
4	45.927	10.763
5	47.807	11.444
6	49.602	12.327
7	51.288	13.402
8	52.847	14.655
9	54.259	16.072
10	55.507	17.634
11	56.577	19.324
12	57.455	21.122
13	57.697	21.798

Circle Center At X = 40.670 ; Y = 28.206 ; and Radius = 18.219
Factor of Safety
*** 1.787 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	36.667	10.000
2	38.652	9.756
3	40.651	9.696
4	42.647	9.819
5	44.624	10.125
6	46.564	10.611
7	48.451	11.273
8	50.269	12.106
9	52.004	13.101
10	53.639	14.252
11	55.163	15.548
12	56.560	16.979
13	57.821	18.532
14	58.934	20.194
15	59.889	21.951
16	59.910	22.000

Circle Center At X = 40.310 ; Y = 31.454 ; and Radius = 21.761

Factor of Safety

*** 1.791 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	40.000	10.000
2	41.954	10.424
3	43.886	10.943
4	45.790	11.555
5	47.662	12.258
6	49.498	13.052
7	51.293	13.933
8	53.044	14.901
9	54.745	15.953
10	56.393	17.085
11	57.985	18.297
12	59.515	19.584
13	60.982	20.944
14	62.015	22.000

Circle Center At X = 32.268 ; Y = 50.381 ; and Radius = 41.114

Factor of Safety

*** 1.799 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	38.333	10.000
2	40.290	9.586
3	42.281	9.392
4	44.280	9.422
5	46.264	9.675
6	48.208	10.147
7	50.086	10.833
8	51.877	11.725
9	53.556	12.811
10	55.104	14.077
11	56.501	15.508
12	57.730	17.086
13	58.775	18.791
14	59.624	20.603
15	60.096	22.000

Circle Center At X = 43.014 ; Y = 27.278 ; and Radius = 17.901

Factor of Safety

*** 1.801 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	40.000	10.000

2	42.000	9.996
3	43.987	10.226
4	45.933	10.688
5	47.811	11.374
6	49.597	12.275
7	51.264	13.380
8	52.791	14.672
9	54.156	16.133
10	55.340	17.745
11	56.327	19.484
12	57.104	21.327
13	57.131	21.421

Circle Center At X = 41.034 ; Y = 27.016 ; and Radius = 17.048

Factor of Safety

*** 1.805 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	36.667	10.000
2	38.646	9.715
3	40.643	9.598
4	42.642	9.653
5	44.630	9.877
6	46.591	10.269
7	48.511	10.826
8	50.378	11.545
9	52.176	12.420
10	53.894	13.445
11	55.518	14.612
12	57.037	15.913
13	58.440	17.339
14	59.716	18.879
15	60.857	20.521
16	61.707	22.000

Circle Center At X = 41.010 ; Y = 33.064 ; and Radius = 23.469

Factor of Safety

*** 1.808 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	36.667	10.000
2	38.635	9.647
3	40.628	9.473
4	42.628	9.477
5	44.619	9.662
6	46.586	10.024
7	48.513	10.561
8	50.383	11.268
9	52.183	12.141
10	53.897	13.171
11	55.512	14.351
12	57.014	15.672
13	58.392	17.121
14	59.634	18.689
15	60.731	20.361
16	61.606	22.000

Circle Center At X = 41.576 ; Y = 31.713 ; and Radius = 22.261

Factor of Safety

*** 1.809 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	36.667	10.000
2	38.607	9.513
3	40.588	9.239
4	42.587	9.180
5	44.581	9.337

6	46.546	9.709
7	48.459	10.291
8	50.299	11.076
9	52.042	12.056
10	53.670	13.217
11	55.163	14.548
12	56.503	16.033
13	57.676	17.653
14	58.666	19.391
15	59.463	21.225
16	59.704	22.000

Circle Center At X = 42.134 ; Y = 27.616 ; and Radius = 18.445

Factor of Safety

*** 1.813 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	36.667	10.000
2	38.665	9.910
3	40.664	9.971
4	42.652	10.185
5	44.619	10.549
6	46.552	11.061
7	48.441	11.719
8	50.274	12.518
9	52.041	13.455
10	53.732	14.523
11	55.337	15.716
12	56.847	17.028
13	58.252	18.451
14	59.545	19.977
15	60.719	21.596
16	60.967	22.000

Circle Center At X = 38.863 ; Y = 36.157 ; and Radius = 26.249

Factor of Safety

*** 1.815 ***

**** END OF GSTABL7 OUTPUT ****

```
                    *** GSTABL7 ***
              ** GSTABL7 by Garry H. Gregory, P.E. **
   ** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
              (All Rights Reserved-Unauthorized Use Prohibited)
*******************************************************************************
                    SLOPE STABILITY ANALYSIS SYSTEM
        Modified Bishop, Simplified Janbu, or GLE Method of Slices.
        (Includes Spencer & Morgenstern-Price Type Analysis)
        Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
        Nonlinear Undrained Shear Strength, Curved Phi Envelope,
        Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
        Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
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   Analysis Run Date:          10/14/2004
   Time of Run:                07:52AM
   Run By:                     mike fordham
   Input Data Filename:        C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
   Output Filename:            C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
   Unit System:                SI
   Plotted Output Filename:    C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
   PROBLEM DESCRIPTION:  I-5 Preliminary Geotechnical Report
                         Fill Slope SD Lagoon (1:2)12M no bench C
   BOUNDARY COORDINATES
       3 Top   Boundaries
       6 Total Boundaries
   Boundary     X-Left     Y-Left     X-Right    Y-Right    Soil Type
      No.         (m)        (m)        (m)        (m)      Below Bnd
       1        25.00      10.00      40.00      10.00        2
       2        40.00      10.00      64.00      22.00        1
       3        64.00      22.00      85.00      22.00        1
       4        40.00      10.00      52.00      11.00        2
       5        52.00      11.00      62.00      16.00        2
       6        62.00      16.00      80.00      22.00        2
   Default Y-Origin = 0.00(m)
   Default X-Plus Value = 0.00(m)
   Default Y-Plus Value = 0.00(m)
  ISOTROPIC SOIL PARAMETERS
    2 Type(s) of Soil
   Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
   Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
    No. (kN/m3)  (kN/m3)    (kPa)     (deg)    Param.   (kPa)     No.
     1    18.9     18.9       9.6      36.0    0.00      0.0      0
     2    18.9     18.9       9.6      32.0    0.00      0.0      0
  Searching Routine Will Be Limited To An Area Defined By  1 Boundaries
   Of Which The First  1 Boundaries Will Deflect Surfaces Upward
   Boundary     X-Left     Y-Left     X-Right    Y-Right
      No.         (m)        (m)        (m)        (m)
       1         0.00       0.00       0.00       0.00
   A Critical Failure Surface Searching Method, Using A Random
   Technique For Generating Circular Surfaces, Has Been Specified.
    400 Trial Surfaces Have Been Generated.
     40 Surface(s) Initiate(s) From Each Of    10 Points Equally Spaced
   Along The Ground Surface Between  X =  25.00(m)
                                 and  X =  40.00(m)
   Each Surface Terminates Between   X =  58.00(m)
                                 and  X =  85.00(m)
   Unless Further Limitations Were Imposed, The Minimum Elevation
   At Which A Surface Extends Is  Y =       0.00(m)
    2.00(m)  Line Segments Define Each Trial Failure Surface.
   Restrictions Have Been Imposed Upon The Angle Of Initiation.
   The Angle Has Been Restricted Between The Angles Of -15.0
   And  25.0 deg.
   Following Are Displayed The Ten Most Critical Of The Trial
         Failure Surfaces Evaluated. They Are
```

Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 400
Number of Trial Surfaces With Valid FS = 400
Statistical Data On All Valid FS Values:
FS Max = 3.724 FS Min = 2.014 FS Ave = 2.531
Standard Deviation = 0.299 Coefficient of Variation = 11.80 %
Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	38.333	10.000
2	40.292	9.594
3	42.275	9.339
4	44.273	9.239
5	46.272	9.293
6	48.261	9.500
7	50.229	9.860
8	52.162	10.371
9	54.051	11.030
10	55.883	11.831
11	57.648	12.772
12	59.335	13.846
13	60.935	15.047
14	62.437	16.367
15	63.833	17.800
16	65.114	19.335
17	66.273	20.965
18	66.895	22.000

Circle Center At X = 44.580 ; Y = 35.122 ; and Radius = 25.887
Factor of Safety
*** 2.014 ***
Individual data on the 22 slices

Slice No.	Width (m)	Weight (kN)	Water Force Top (kN)	Water Force Bot (kN)	Tie Force Norm (kN)	Tie Force Tan (kN)	Earthquake Force Hor (kN)	Earthquake Force Ver (kN)	Surcharge Load (kN)
1	1.7	5.4	0.0	0.0	0.	0.	0.0	0.0	0.0
2	0.3	2.5	0.0	0.0	0.	0.	0.0	0.0	0.0
3	2.0	44.1	0.0	0.0	0.	0.	0.0	0.0	0.0
4	2.0	88.6	0.0	0.0	0.	0.	0.0	0.0	0.0
5	2.0	127.4	0.0	0.0	0.	0.	0.0	0.0	0.0
6	2.0	159.3	0.0	0.0	0.	0.	0.0	0.0	0.0
7	2.0	183.8	0.0	0.0	0.	0.	0.0	0.0	0.0
8	1.8	182.9	0.0	0.0	0.	0.	0.0	0.0	0.0
9	0.2	17.5	0.0	0.0	0.	0.	0.0	0.0	0.0
10	1.9	208.9	0.0	0.0	0.	0.	0.0	0.0	0.0
11	1.8	209.6	0.0	0.0	0.	0.	0.0	0.0	0.0
12	1.8	202.8	0.0	0.0	0.	0.	0.0	0.0	0.0
13	1.7	189.3	0.0	0.0	0.	0.	0.0	0.0	0.0
14	1.6	169.9	0.0	0.0	0.	0.	0.0	0.0	0.0
15	1.1	105.1	0.0	0.0	0.	0.	0.0	0.0	0.0
16	0.0	2.9	0.0	0.0	0.	0.	0.0	0.0	0.0
17	0.4	37.8	0.0	0.0	0.	0.	0.0	0.0	0.0
18	1.4	118.3	0.0	0.0	0.	0.	0.0	0.0	0.0
19	0.2	12.8	0.0	0.0	0.	0.	0.0	0.0	0.0
20	1.1	70.2	0.0	0.0	0.	0.	0.0	0.0	0.0
21	1.2	40.5	0.0	0.0	0.	0.	0.0	0.0	0.0
22	0.6	6.1	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	38.333	10.000
2	40.304	9.659
3	42.293	9.453
4	44.292	9.383
5	46.291	9.450
6	48.281	9.652

7	50.252	9.989
8	52.196	10.460
9	54.103	11.061
10	55.965	11.792
11	57.773	12.647
12	59.519	13.623
13	61.194	14.716
14	62.790	15.921
15	64.301	17.231
16	65.720	18.641
17	67.039	20.145
18	68.252	21.734
19	68.428	22.000

Circle Center At X = 44.319 ; Y = 38.747 ; and Radius = 29.363

Factor of Safety

*** 2.024 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	36.667	10.000
2	38.625	9.594
3	40.607	9.329
4	42.604	9.206
5	44.604	9.227
6	46.597	9.390
7	48.573	9.695
8	50.523	10.140
9	52.436	10.724
10	54.303	11.443
11	56.113	12.293
12	57.858	13.271
13	59.528	14.370
14	61.116	15.587
15	62.613	16.913
16	64.011	18.343
17	65.303	19.870
18	66.483	21.484
19	66.806	22.000

Circle Center At X = 43.320 ; Y = 37.173 ; and Radius = 27.976

Factor of Safety

*** 2.024 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	38.333	10.000
2	40.275	9.523
3	42.251	9.207
4	44.245	9.057
5	46.245	9.071
6	48.237	9.251
7	50.207	9.596
8	52.142	10.102
9	54.028	10.766
10	55.853	11.584
11	57.604	12.551
12	59.269	13.659
13	60.837	14.900
14	62.297	16.268
15	63.638	17.751
16	64.852	19.340
17	65.931	21.024
18	66.447	22.000

Circle Center At X = 45.069 ; Y = 33.153 ; and Radius = 24.113

Factor of Safety

*** 2.031 ***

Failure Surface Specified By 17 Coordinate Points

Point	X-Surf	Y-Surf

No.	(m)	(m)
1	38.333	10.000
2	40.289	9.582
3	42.274	9.335
4	44.273	9.261
5	46.270	9.359
6	48.252	9.630
7	50.203	10.071
8	52.108	10.678
9	53.954	11.448
10	55.726	12.375
11	57.412	13.452
12	58.998	14.670
13	60.473	16.020
14	61.826	17.493
15	63.047	19.077
16	64.126	20.761
17	64.776	22.000

Circle Center At X = 44.135 ; Y = 32.385 ; and Radius = 23.125

Factor of Safety

*** 2.038 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	36.667	10.000
2	38.626	9.597
3	40.609	9.343
4	42.607	9.239
5	44.606	9.285
6	46.597	9.482
7	48.566	9.828
8	50.505	10.321
9	52.400	10.958
10	54.243	11.737
11	56.021	12.652
12	57.726	13.698
13	59.347	14.870
14	60.875	16.160
15	62.302	17.561
16	63.619	19.066
17	64.819	20.666
18	65.671	22.000

Circle Center At X = 42.993 ; Y = 35.761 ; and Radius = 26.527

Factor of Safety

*** 2.038 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	38.333	10.000
2	40.275	9.519
3	42.251	9.212
4	44.247	9.083
5	46.246	9.131
6	48.233	9.358
7	50.193	9.760
8	52.108	10.334
9	53.965	11.077
10	55.749	11.982
11	57.445	13.042
12	59.040	14.249
13	60.521	15.593
14	61.877	17.063
15	63.097	18.648
16	64.171	20.335
17	65.033	22.000

Circle Center At X = 44.702 ; Y = 31.543 ; and Radius = 22.464

Factor of Safety

*** 2.043 ***
Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	36.667	10.000
2	38.605	9.507
3	40.577	9.172
4	42.569	8.996
5	44.569	8.981
6	46.564	9.126
7	48.540	9.432
8	50.486	9.895
9	52.388	10.513
10	54.234	11.282
11	56.013	12.196
12	57.712	13.251
13	59.321	14.439
14	60.830	15.752
15	62.228	17.183
16	63.506	18.720
17	64.657	20.356
18	65.626	22.000

Circle Center At X = 43.758 ; Y = 33.829 ; and Radius = 24.862
Factor of Safety
*** 2.045 ***
Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	40.000	10.000
2	41.945	9.533
3	43.925	9.250
4	45.922	9.151
5	47.920	9.238
6	49.902	9.511
7	51.849	9.966
8	53.746	10.601
9	55.575	11.409
10	57.322	12.383
11	58.970	13.516
12	60.506	14.796
13	61.917	16.214
14	63.190	17.757
15	64.313	19.412
16	65.279	21.163
17	65.643	22.000

Circle Center At X = 45.983 ; Y = 30.654 ; and Radius = 21.503
Factor of Safety
*** 2.050 ***
Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	35.000	10.000
2	36.960	9.602
3	38.941	9.329
4	40.936	9.182
5	42.936	9.160
6	44.933	9.265
7	46.920	9.496
8	48.888	9.851
9	50.830	10.330
10	52.737	10.931
11	54.603	11.650
12	56.420	12.486
13	58.181	13.435
14	59.878	14.493
15	61.505	15.657
16	63.056	16.920

```
   17          64.523        18.279
   18          65.902        19.727
   19          67.187        21.260
   20          67.732        22.000
Circle Center At X =    42.277 ; Y =    40.790 ; and Radius =    31.638
      Factor of Safety
     ***    2.053   ***
         **** END OF GSTABL7 OUTPUT ****
```

```
                    *** GSTABL7 ***
              ** GSTABL7 by Garry H. Gregory, P.E. **
   ** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
              (All Rights Reserved-Unauthorized Use Prohibited)
*******************************************************************************
                    SLOPE STABILITY ANALYSIS SYSTEM
        Modified Bishop, Simplified Janbu, or GLE Method of Slices.
        (Includes Spencer & Morgenstern-Price Type Analysis)
        Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
        Nonlinear Undrained Shear Strength, Curved Phi Envelope,
        Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
        Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
*******************************************************************************
   Analysis Run Date:          11/9/2004
   Time of Run:                01:13PM
   Run By:                     mike fordham
   Input Data Filename:        C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
   Output Filename:            C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
   Unit System:                SI
   Plotted Output Filename:    C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
   PROBLEM DESCRIPTION:  I-5 Preliminary Geotechnical Report
                         Fill Slope SD Lagoon (1:1.5)12M C

   BOUNDARY COORDINATES
       4 Top   Boundaries
       7 Total Boundaries
   Boundary     X-Left     Y-Left     X-Right    Y-Right    Soil Type
      No.        (m)        (m)        (m)        (m)      Below Bnd
       1        25.00      10.00      40.00      10.00        2
       2        40.00      10.00      58.00      22.00        1
       3        58.00      22.00      80.00      22.00        1
       4        80.00      22.00      95.00      22.00        2
       5        40.00      10.00      52.00      11.00        2
       6        52.00      11.00      62.00      16.00        2
       7        62.00      16.00      80.00      22.00        2
   Default Y-Origin = 0.00(m)
   Default X-Plus Value = 0.00(m)
   Default Y-Plus Value = 0.00(m)
  ISOTROPIC SOIL PARAMETERS
    2 Type(s) of Soil
   Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
   Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
    No. (kN/m3)  (kN/m3)    (kPa)     (deg)   Param.   (kPa)     No.
     1    18.9     18.9      9.6      36.0    0.00      0.0      0
     2    18.9     18.9      9.6      32.0    0.00      0.0      0
  Searching Routine Will Be Limited To An Area Defined By  1 Boundaries
   Of Which The First  1 Boundaries Will Deflect Surfaces Upward
   Boundary     X-Left     Y-Left     X-Right    Y-Right
      No.        (m)        (m)        (m)        (m)
       1         0.00       0.00       0.00       0.00
   A Critical Failure Surface Searching Method, Using A Random
   Technique For Generating Circular Surfaces, Has Been Specified.
    400 Trial Surfaces Have Been Generated.
     40 Surface(s) Initiate(s) From Each Of    10 Points Equally Spaced
   Along The Ground Surface Between  X =  25.00(m)
                                 and  X =  40.00(m)
   Each Surface Terminates Between   X =  52.00(m)
                                 and  X =  90.00(m)
   Unless Further Limitations Were Imposed, The Minimum Elevation
   At Which A Surface Extends Is  Y =       0.00(m)
    2.00(m)  Line Segments Define Each Trial Failure Surface.
   Restrictions Have Been Imposed Upon The Angle Of Initiation.
   The Angle Has Been Restricted Between The Angles Of -15.0
   And  25.0 deg.
   Following Are Displayed The Ten Most Critical Of The Trial
```

Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 400
Number of Trial Surfaces With Valid FS = 400
Statistical Data On All Valid FS Values:
FS Max = 4.047 FS Min = 1.769 FS Ave = 2.492
Standard Deviation = 0.511 Coefficient of Variation = 20.49 %
Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	40.000	10.000
2	41.954	10.424
3	43.882	10.958
4	45.777	11.598
5	47.632	12.344
6	49.443	13.193
7	51.204	14.142
8	52.909	15.188
9	54.552	16.328
10	56.129	17.558
11	57.634	18.875
12	59.063	20.274
13	60.411	21.751
14	60.614	22.000

Circle Center At X = 33.439 ; Y = 44.976 ; and Radius = 35.587
Factor of Safety
*** 1.769 ***
Individual data on the 14 slices

Slice No.	Width (m)	Weight (kN)	Water Force Top (kN)	Water Force Bot (kN)	Tie Force Norm (kN)	Tie Force Tan (kN)	Earthquake Force Hor (kN)	Earthquake Force Ver (kN)	Surcharge Load (kN)
1	2.0	16.2	0.0	0.0	0.	0.	0.0	0.0	0.0
2	1.9	45.7	0.0	0.0	0.	0.	0.0	0.0	0.0
3	1.9	69.5	0.0	0.0	0.	0.	0.0	0.0	0.0
4	1.9	87.6	0.0	0.0	0.	0.	0.0	0.0	0.0
5	1.8	100.1	0.0	0.0	0.	0.	0.0	0.0	0.0
6	1.8	107.0	0.0	0.0	0.	0.	0.0	0.0	0.0
7	1.7	108.7	0.0	0.0	0.	0.	0.0	0.0	0.0
8	1.6	105.5	0.0	0.0	0.	0.	0.0	0.0	0.0
9	1.6	97.9	0.0	0.0	0.	0.	0.0	0.0	0.0
10	1.5	86.4	0.0	0.0	0.	0.	0.0	0.0	0.0
11	0.4	19.5	0.0	0.0	0.	0.	0.0	0.0	0.0
12	1.1	45.1	0.0	0.0	0.	0.	0.0	0.0	0.0
13	1.3	25.2	0.0	0.0	0.	0.	0.0	0.0	0.0
14	0.2	0.5	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	38.333	10.000
2	40.323	9.799
3	42.323	9.806
4	44.312	10.020
5	46.267	10.440
6	48.168	11.061
7	49.995	11.876
8	51.727	12.876
9	53.345	14.051
10	54.833	15.388
11	56.174	16.872
12	57.353	18.487
13	58.358	20.216
14	59.161	22.000

Circle Center At X = 41.259 ; Y = 28.997 ; and Radius = 19.221
Factor of Safety
*** 1.771 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	36.667	10.000
2	38.640	9.676
3	40.636	9.541
4	42.635	9.596
5	44.620	9.840
6	46.573	10.272
7	48.476	10.888
8	50.311	11.681
9	52.064	12.646
10	53.716	13.772
11	55.255	15.050
12	56.665	16.469
13	57.933	18.015
14	59.050	19.674
15	60.003	21.432
16	60.245	22.000

Circle Center At X = 41.064 ; Y = 30.524 ; and Radius = 20.990

Factor of Safety

*** 1.790 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	36.667	10.000
2	38.637	9.656
3	40.631	9.505
4	42.631	9.547
5	44.617	9.783
6	46.571	10.210
7	48.474	10.824
8	50.309	11.620
9	52.058	12.590
10	53.705	13.724
11	55.234	15.013
12	56.631	16.444
13	57.884	18.004
14	58.979	19.677
15	59.907	21.449
16	60.130	22.000

Circle Center At X = 41.200 ; Y = 30.075 ; and Radius = 20.581

Factor of Safety

*** 1.791 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	38.333	10.000
2	40.325	9.813
3	42.325	9.800
4	44.318	9.960
5	46.290	10.293
6	48.226	10.797
7	50.110	11.466
8	51.930	12.297
9	53.670	13.283
10	55.318	14.416
11	56.861	15.688
12	58.288	17.090
13	59.588	18.610
14	60.750	20.237
15	61.767	21.959
16	61.787	22.000

Circle Center At X = 41.478 ; Y = 32.774 ; and Radius = 22.990

Factor of Safety

*** 1.794 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	40.000	10.000
2	41.978	9.705
3	43.977	9.644
4	45.970	9.819
5	47.927	10.227
6	49.824	10.863
7	51.632	11.717
8	53.328	12.778
9	54.887	14.030
10	56.288	15.458
11	57.511	17.040
12	58.540	18.755
13	59.360	20.579
14	59.806	22.000

Circle Center At X = 43.497 ; Y = 26.574 ; and Radius = 16.939

Factor of Safety

*** 1.798 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	36.667	10.000
2	38.643	9.693
3	40.639	9.563
4	42.638	9.612
5	44.625	9.837
6	46.585	10.239
7	48.500	10.813
8	50.358	11.556
9	52.141	12.460
10	53.838	13.520
11	55.433	14.726
12	56.915	16.069
13	58.271	17.539
14	59.491	19.124
15	60.566	20.810
16	61.183	22.000

Circle Center At X = 41.103 ; Y = 31.980 ; and Radius = 22.423

Factor of Safety

*** 1.799 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	40.000	10.000
2	41.938	10.492
3	43.852	11.073
4	45.737	11.742
5	47.590	12.496
6	49.405	13.334
7	51.181	14.256
8	52.912	15.257
9	54.595	16.338
10	56.226	17.494
11	57.803	18.724
12	59.322	20.026
13	60.779	21.396
14	61.365	22.000

Circle Center At X = 30.310 ; Y = 52.272 ; and Radius = 43.369

Factor of Safety

*** 1.802 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	36.667	10.000
2	38.618	9.562
3	40.603	9.318

4	42.603	9.270
5	44.597	9.419
6	46.567	9.763
7	48.494	10.300
8	50.358	11.023
9	52.143	11.927
10	53.830	13.001
11	55.403	14.236
12	56.846	15.620
13	58.147	17.139
14	59.292	18.779
15	60.271	20.524
16	60.917	22.000

Circle Center At X = 42.090 ; Y = 29.544 ; and Radius = 20.282

Factor of Safety

*** 1.809 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	38.333	10.000
2	40.285	9.564
3	42.274	9.349
4	44.274	9.355
5	46.260	9.584
6	48.209	10.033
7	50.096	10.696
8	51.898	11.564
9	53.592	12.628
10	55.157	13.873
11	56.573	15.285
12	57.824	16.846
13	58.894	18.536
14	59.769	20.334
15	60.360	22.000

Circle Center At X = 43.213 ; Y = 27.275 ; and Radius = 17.951

Factor of Safety

*** 1.809 ***

**** END OF GSTABL7 OUTPUT ****

```
                    *** GSTABL7 ***
          ** GSTABL7 by Garry H. Gregory, P.E. **
   ** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
             (All Rights Reserved-Unauthorized Use Prohibited)
*******************************************************************************
                    SLOPE STABILITY ANALYSIS SYSTEM
        Modified Bishop, Simplified Janbu, or GLE Method of Slices.
        (Includes Spencer & Morgenstern-Price Type Analysis)
        Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
        Nonlinear Undrained Shear Strength, Curved Phi Envelope,
        Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
        Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
*******************************************************************************
Analysis Run Date:        10/12/2004
Time of Run:              02:21PM
Run By:                   mike fordham
Input Data Filename:      C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
Output Filename:          C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
Unit System:              SI
Plotted Output Filename:  C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
PROBLEM DESCRIPTION:  I-5 Preliminary Geotechnical Report
                      Fill Slope SD Lagoon (1:2)12M C
BOUNDARY COORDINATES
    5 Top   Boundaries
    9 Total Boundaries
Boundary     X-Left     Y-Left     X-Right    Y-Right     Soil Type
   No.        (m)        (m)        (m)        (m)       Below Bnd
    1        25.00      10.00      40.00      10.00         2
    2        40.00      10.00      52.00      16.00         1
    3        52.00      16.00      58.00      16.00         1
    4        58.00      16.00      70.00      22.00         1
    5        70.00      22.00      85.00      22.00         1
    6        40.00      10.00      52.00      11.00         2
    7        52.00      11.00      62.00      16.00         2
    8        62.00      16.00      68.00      16.00         2
    9        68.00      16.00      80.00      22.00         2
Default Y-Origin = 0.00(m)
Default X-Plus Value = 0.00(m)
Default Y-Plus Value = 0.00(m)
ISOTROPIC SOIL PARAMETERS
  2 Type(s) of Soil
Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
 No. (kN/m3)  (kN/m3)    (kPa)     (deg)    Param.   (kPa)     No.
  1    18.9     18.9      9.6      36.0    0.00      0.0       0
  2    18.9     18.9      9.6      32.0    0.00      0.0       0
Searching Routine Will Be Limited To An Area Defined By  1 Boundaries
Of Which The First  1 Boundaries Will Deflect Surfaces Upward
Boundary     X-Left     Y-Left     X-Right    Y-Right
   No.        (m)        (m)        (m)        (m)
    1         0.00       0.00       0.00       0.00
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
  400 Trial Surfaces Have Been Generated.
   40 Surface(s) Initiate(s) From Each Of    10 Points Equally Spaced
Along The Ground Surface Between  X =  25.00(m)
                              and  X =  40.00(m)
Each Surface Terminates Between   X =  58.00(m)
                              and  X =  85.00(m)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is  Y =       0.00(m)
  2.00(m)  Line Segments Define Each Trial Failure Surface.
Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -15.0
```

And 25.0 deg.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 400
Number of Trial Surfaces With Valid FS = 400
Statistical Data On All Valid FS Values:
FS Max = 3.979 FS Min = 2.514 FS Ave = 2.879
Standard Deviation = 0.271 Coefficient of Variation = 9.40 %
Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	40.000	10.000
2	41.984	9.751
3	43.979	9.610
4	45.979	9.578
5	47.978	9.655
6	49.969	9.841
7	51.947	10.135
8	53.907	10.537
9	55.841	11.045
10	57.745	11.658
11	59.612	12.373
12	61.438	13.189
13	63.217	14.104
14	64.943	15.114
15	66.612	16.216
16	68.218	17.408
17	69.756	18.686
18	71.223	20.046
19	72.613	21.483
20	73.061	22.000

Circle Center At X = 45.568 ; Y = 46.203 ; and Radius = 36.628
Factor of Safety
*** 2.514 ***
Individual data on the 24 slices

Slice No.	Width (m)	Weight (kN)	Water Force Top (kN)	Water Force Bot (kN)	Tie Force Norm (kN)	Tie Force Tan (kN)	Earthquake Force Hor (kN)	Earthquake Force Ver (kN)	Surcharge Load (kN)
1	2.0	23.3	0.0	0.0	0.	0.	0.0	0.0	0.0
2	2.0	68.3	0.0	0.0	0.	0.	0.0	0.0	0.0
3	2.0	109.4	0.0	0.0	0.	0.	0.0	0.0	0.0
4	2.0	146.3	0.0	0.0	0.	0.	0.0	0.0	0.0
5	2.0	178.3	0.0	0.0	0.	0.	0.0	0.0	0.0
6	2.0	205.3	0.0	0.0	0.	0.	0.0	0.0	0.0
7	0.1	5.8	0.0	0.0	0.	0.	0.0	0.0	0.0
8	1.9	203.9	0.0	0.0	0.	0.	0.0	0.0	0.0
9	1.9	190.4	0.0	0.0	0.	0.	0.0	0.0	0.0
10	1.9	167.3	0.0	0.0	0.	0.	0.0	0.0	0.0
11	0.3	20.7	0.0	0.0	0.	0.	0.0	0.0	0.0
12	1.6	132.2	0.0	0.0	0.	0.	0.0	0.0	0.0
13	1.8	154.7	0.0	0.0	0.	0.	0.0	0.0	0.0
14	0.6	48.0	0.0	0.0	0.	0.	0.0	0.0	0.0
15	1.2	103.8	0.0	0.0	0.	0.	0.0	0.0	0.0
16	1.7	144.6	0.0	0.0	0.	0.	0.0	0.0	0.0
17	1.3	107.7	0.0	0.0	0.	0.	0.0	0.0	0.0
18	0.3	25.5	0.0	0.0	0.	0.	0.0	0.0	0.0
19	1.6	118.2	0.0	0.0	0.	0.	0.0	0.0	0.0
20	1.5	100.2	0.0	0.0	0.	0.	0.0	0.0	0.0
21	0.2	14.5	0.0	0.0	0.	0.	0.0	0.0	0.0
22	1.2	58.3	0.0	0.0	0.	0.	0.0	0.0	0.0
23	1.4	32.5	0.0	0.0	0.	0.	0.0	0.0	0.0
24	0.4	2.2	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 21 Coordinate Points

Point	X-Surf	Y-Surf

No.	(m)	(m)
1	38.333	10.000
2	40.317	9.743
3	42.310	9.583
4	44.309	9.521
5	46.309	9.557
6	48.305	9.690
7	50.291	9.921
8	52.264	10.249
9	54.219	10.674
10	56.150	11.193
11	58.054	11.806
12	59.925	12.512
13	61.760	13.308
14	63.553	14.193
15	65.301	15.165
16	67.000	16.221
17	68.644	17.359
18	70.231	18.576
19	71.757	19.870
20	73.217	21.236
21	73.957	22.000

Circle Center At X = 44.578 ; Y = 50.382 ; and Radius = 40.862

Factor of Safety

*** 2.515 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	40.000	10.000
2	41.981	9.723
3	43.974	9.557
4	45.973	9.503
5	47.972	9.561
6	49.965	9.730
7	51.945	10.010
8	53.907	10.400
9	55.844	10.900
10	57.749	11.506
11	59.618	12.218
12	61.445	13.034
13	63.222	13.950
14	64.946	14.964
15	66.611	16.073
16	68.211	17.273
17	69.741	18.560
18	71.197	19.931
19	72.575	21.381
20	73.100	22.000

Circle Center At X = 45.948 ; Y = 45.244 ; and Radius = 35.743

Factor of Safety

*** 2.518 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	40.000	10.000
2	41.996	9.871
3	43.995	9.830
4	45.995	9.878
5	47.990	10.013
6	49.978	10.237
7	51.953	10.549
8	53.913	10.947
9	55.854	11.432
10	57.771	12.002
11	59.661	12.656
12	61.520	13.392
13	63.345	14.211

14	65.132	15.109
15	66.878	16.085
16	68.578	17.137
17	70.231	18.264
18	71.832	19.462
19	73.379	20.730
20	74.796	22.000

Circle Center At X = 43.921 ; Y = 55.079 ; and Radius = 45.249

Factor of Safety

*** 2.518 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	38.333	10.000
2	40.326	9.825
3	42.324	9.738
4	44.324	9.739
5	46.322	9.828
6	48.314	10.004
7	50.297	10.268
8	52.266	10.619
9	54.217	11.056
10	56.148	11.578
11	58.054	12.184
12	59.931	12.874
13	61.776	13.646
14	63.586	14.497
15	65.356	15.428
16	67.084	16.435
17	68.766	17.518
18	70.398	18.673
19	71.979	19.899
20	73.504	21.193
21	74.374	22.000

Circle Center At X = 43.304 ; Y = 55.236 ; and Radius = 45.508

Factor of Safety

*** 2.524 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	36.667	10.000
2	38.641	9.680
3	40.628	9.457
4	42.624	9.331
5	44.624	9.302
6	46.623	9.370
7	48.616	9.536
8	50.599	9.798
9	52.567	10.156
10	54.514	10.610
11	56.438	11.158
12	58.332	11.799
13	60.193	12.531
14	62.017	13.353
15	63.798	14.263
16	65.532	15.259
17	67.217	16.337
18	68.846	17.497
19	70.418	18.734
20	71.927	20.046
21	73.371	21.430
22	73.910	22.000

Circle Center At X = 44.223 ; Y = 50.341 ; and Radius = 41.043

Factor of Safety

*** 2.525 ***

Failure Surface Specified By 22 Coordinate Points

Point	X-Surf	Y-Surf

No.	(m)	(m)
1	36.667	10.000
2	38.617	9.557
3	40.589	9.224
4	42.577	9.003
5	44.574	8.893
6	46.574	8.895
7	48.571	9.009
8	50.558	9.235
9	52.529	9.572
10	54.479	10.019
11	56.400	10.574
12	58.287	11.236
13	60.134	12.003
14	61.935	12.873
15	63.685	13.842
16	65.377	14.907
17	67.008	16.066
18	68.570	17.314
19	70.061	18.648
20	71.474	20.063
21	72.805	21.555
22	73.160	22.000

Circle Center At X = 45.537 ; Y = 44.512 ; and Radius = 35.634

Factor of Safety

*** 2.533 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	36.667	10.000
2	38.651	9.752
3	40.645	9.593
4	42.644	9.521
5	44.644	9.537
6	46.641	9.642
7	48.631	9.834
8	50.612	10.115
9	52.578	10.482
10	54.526	10.936
11	56.452	11.475
12	58.352	12.098
13	60.223	12.805
14	62.061	13.594
15	63.862	14.463
16	65.623	15.410
17	67.341	16.435
18	69.012	17.534
19	70.633	18.705
20	72.201	19.947
21	73.712	21.257
22	74.496	22.000

Circle Center At X = 43.275 ; Y = 54.795 ; and Radius = 45.280

Factor of Safety

*** 2.535 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	36.667	10.000
2	38.616	9.551
3	40.587	9.213
4	42.574	8.986
5	44.571	8.873
6	46.571	8.873
7	48.568	8.986
8	50.555	9.211
9	52.526	9.549
10	54.475	9.998

11	56.395	10.557
12	58.281	11.223
13	60.126	11.995
14	61.925	12.870
15	63.671	13.845
16	65.359	14.917
17	66.984	16.084
18	68.540	17.340
19	70.022	18.683
20	71.426	20.107
21	72.748	21.608
22	73.055	22.000

Circle Center At X = 45.575 ; Y = 44.157 ; and Radius = 35.299

Factor of Safety

*** 2.535 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	40.000	10.000
2	41.968	9.646
3	43.954	9.404
4	45.950	9.276
5	47.950	9.261
6	49.947	9.360
7	51.936	9.573
8	53.909	9.898
9	55.861	10.335
10	57.784	10.883
11	59.674	11.539
12	61.523	12.301
13	63.325	13.167
14	65.076	14.135
15	66.768	15.200
16	68.398	16.360
17	69.958	17.611
18	71.445	18.949
19	72.854	20.369
20	74.179	21.866
21	74.285	22.000

Circle Center At X = 47.206 ; Y = 44.401 ; and Radius = 35.147

Factor of Safety

*** 2.537 ***

**** END OF GSTABL7 OUTPUT ****

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                    *** GSTABL7 ***
              ** GSTABL7 by Garry H. Gregory, P.E. **
   ** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
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*****************************************************************************
                  SLOPE STABILITY ANALYSIS SYSTEM
       Modified Bishop, Simplified Janbu, or GLE Method of Slices.
       (Includes Spencer & Morgenstern-Price Type Analysis)
       Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
       Nonlinear Undrained Shear Strength, Curved Phi Envelope,
       Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
       Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
*****************************************************************************
Analysis Run Date:        10/14/2004
Time of Run:              08:15AM
Run By:                   mike fordham
Input Data Filename:      C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
Output Filename:          C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
Unit System:              SI
Plotted Output Filename:  C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
PROBLEM DESCRIPTION:  I-5 Preliminary Geotechnical Report
                      Fill Slope SD Lagoon (1:1.5)30M C
BOUNDARY COORDINATES
    6 Top   Boundaries
   10 Total Boundaries
Boundary     X-Left     Y-Left     X-Right    Y-Right    Soil Type
   No.        (m)        (m)        (m)        (m)      Below Bnd
    1        25.00      10.00      40.00      10.00        2
    2        40.00      10.00      62.50      25.00        1
    3        62.50      25.00      72.50      25.00        1
    4        72.50      25.00      95.00      40.00        1
    5        95.00      40.00     125.00      40.00        1
    6       125.00      40.00     140.00      40.00        2
    7        40.00      10.00      55.00      11.00        2
    8        55.00      11.00      85.00      24.00        2
    9        85.00      24.00      95.00      24.00        2
   10        95.00      24.00     125.00      40.00        2
Default Y-Origin = 0.00(m)
Default X-Plus Value = 0.00(m)
Default Y-Plus Value = 0.00(m)
ISOTROPIC SOIL PARAMETERS
  2 Type(s) of Soil
Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
Type Unit Wt. Unit Wt.  Intercept  Angle  Pressure Constant Surface
 No. (kN/m3)  (kN/m3)     (kPa)    (deg)    Param.   (kPa)     No.
  1    18.9     18.9       9.6     36.0    0.00      0.0      0
  2    18.9     18.9       9.6     32.0    0.00      0.0      0
Searching Routine Will Be Limited To An Area Defined By  1 Boundaries
 Of Which The First  1 Boundaries Will Deflect Surfaces Upward
Boundary     X-Left     Y-Left     X-Right    Y-Right
   No.        (m)        (m)        (m)        (m)
    1         0.00       0.00       0.00       0.00
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
 400 Trial Surfaces Have Been Generated.
  40 Surface(s) Initiate(s) From Each Of    10 Points Equally Spaced
Along The Ground Surface Between  X =  25.00(m)
                              and  X =  40.00(m)
Each Surface Terminates Between   X =  90.00(m)
                              and   X = 135.00(m)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is  Y =       0.00(m)
 2.00(m)  Line Segments Define Each Trial Failure Surface.
Restrictions Have Been Imposed Upon The Angle Of Initiation.
```

The Angle Has Been Restricted Between The Angles Of -15.0
And 25.0 deg.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 400
Number of Trial Surfaces With Valid FS = 400
Statistical Data On All Valid FS Values:
FS Max = 2.461 FS Min = 1.696 FS Ave = 1.995
Standard Deviation = 0.189 Coefficient of Variation = 9.48 %
Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	38.333	10.000
2	40.331	9.907
3	42.331	9.869
4	44.331	9.887
5	46.329	9.961
6	48.325	10.091
7	50.317	10.277
8	52.302	10.517
9	54.280	10.813
10	56.249	11.165
11	58.207	11.571
12	60.153	12.031
13	62.086	12.546
14	64.004	13.114
15	65.905	13.735
16	67.788	14.410
17	69.651	15.136
18	71.493	15.915
19	73.313	16.744
20	75.109	17.624
21	76.880	18.553
22	78.624	19.532
23	80.341	20.559
24	82.028	21.633
25	83.684	22.754
26	85.308	23.921
27	86.900	25.132
28	88.456	26.388
29	89.978	27.686
30	91.462	29.027
31	92.908	30.408
32	94.316	31.829
33	95.683	33.289
34	97.009	34.786
35	98.292	36.320
36	99.533	37.889
37	100.729	39.492
38	101.086	40.000

Circle Center At X = 42.682 ; Y = 81.536 ; and Radius = 71.668
Factor of Safety
*** 1.696 ***
Individual data on the 44 slices

Slice No.	Width (m)	Weight (kN)	Water Force Top (kN)	Water Force Bot (kN)	Tie Force Norm (kN)	Tie Force Tan (kN)	Earthquake Force Hor (kN)	Earthquake Force Ver (kN)	Surcharge Load (kN)
1	1.7	1.2	0.0	0.0	0.	0.	0.0	0.0	0.0
2	0.3	1.2	0.0	0.0	0.	0.	0.0	0.0	0.0
3	2.0	37.8	0.0	0.0	0.	0.	0.0	0.0	0.0
4	2.0	88.5	0.0	0.0	0.	0.	0.0	0.0	0.0
5	2.0	137.1	0.0	0.0	0.	0.	0.0	0.0	0.0
6	2.0	183.3	0.0	0.0	0.	0.	0.0	0.0	0.0
7	2.0	227.0	0.0	0.0	0.	0.	0.0	0.0	0.0

8	2.0	268.0	0.0	0.0	0.	0.	0.0	0.0	0.0
9	2.0	306.4	0.0	0.0	0.	0.	0.0	0.0	0.0
10	0.7	120.9	0.0	0.0	0.	0.	0.0	0.0	0.0
11	1.2	221.0	0.0	0.0	0.	0.	0.0	0.0	0.0
12	2.0	374.5	0.0	0.0	0.	0.	0.0	0.0	0.0
13	1.9	404.1	0.0	0.0	0.	0.	0.0	0.0	0.0
14	1.9	430.7	0.0	0.0	0.	0.	0.0	0.0	0.0
15	0.4	95.9	0.0	0.0	0.	0.	0.0	0.0	0.0
16	1.5	344.1	0.0	0.0	0.	0.	0.0	0.0	0.0
17	1.9	415.9	0.0	0.0	0.	0.	0.0	0.0	0.0
18	1.9	388.9	0.0	0.0	0.	0.	0.0	0.0	0.0
19	1.9	360.2	0.0	0.0	0.	0.	0.0	0.0	0.0
20	1.8	329.9	0.0	0.0	0.	0.	0.0	0.0	0.0
21	1.0	168.5	0.0	0.0	0.	0.	0.0	0.0	0.0
22	0.8	133.9	0.0	0.0	0.	0.	0.0	0.0	0.0
23	1.8	304.1	0.0	0.0	0.	0.	0.0	0.0	0.0
24	1.8	309.3	0.0	0.0	0.	0.	0.0	0.0	0.0
25	1.7	311.8	0.0	0.0	0.	0.	0.0	0.0	0.0
26	1.7	311.7	0.0	0.0	0.	0.	0.0	0.0	0.0
27	1.7	309.1	0.0	0.0	0.	0.	0.0	0.0	0.0
28	1.7	304.0	0.0	0.0	0.	0.	0.0	0.0	0.0
29	1.3	240.5	0.0	0.0	0.	0.	0.0	0.0	0.0
30	0.3	56.1	0.0	0.0	0.	0.	0.0	0.0	0.0
31	0.1	18.9	0.0	0.0	0.	0.	0.0	0.0	0.0
32	1.5	268.1	0.0	0.0	0.	0.	0.0	0.0	0.0
33	1.6	275.4	0.0	0.0	0.	0.	0.0	0.0	0.0
34	1.5	261.8	0.0	0.0	0.	0.	0.0	0.0	0.0
35	1.5	246.6	0.0	0.0	0.	0.	0.0	0.0	0.0
36	1.4	229.8	0.0	0.0	0.	0.	0.0	0.0	0.0
37	1.4	211.6	0.0	0.0	0.	0.	0.0	0.0	0.0
38	0.7	98.0	0.0	0.0	0.	0.	0.0	0.0	0.0
39	0.7	91.3	0.0	0.0	0.	0.	0.0	0.0	0.0
40	1.3	149.4	0.0	0.0	0.	0.	0.0	0.0	0.0
41	1.3	107.9	0.0	0.0	0.	0.	0.0	0.0	0.0
42	1.2	67.9	0.0	0.0	0.	0.	0.0	0.0	0.0
43	1.2	29.6	0.0	0.0	0.	0.	0.0	0.0	0.0
44	0.4	1.7	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 40 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	33.333	10.000
2	35.322	9.786
3	37.316	9.628
4	39.313	9.525
5	41.312	9.479
6	43.312	9.489
7	45.311	9.555
8	47.308	9.678
9	49.300	9.856
10	51.286	10.090
11	53.265	10.380
12	55.235	10.725
13	57.194	11.126
14	59.142	11.581
15	61.076	12.091
16	62.994	12.655
17	64.897	13.272
18	66.781	13.943
19	68.646	14.666
20	70.489	15.442
21	72.310	16.269
22	74.107	17.146
23	75.879	18.074
24	77.624	19.051
25	79.341	20.077
26	81.028	21.151
27	82.685	22.271

28	84.310	23.438
29	85.901	24.650
30	87.457	25.906
31	88.978	27.205
32	90.461	28.546
33	91.906	29.929
34	93.312	31.351
35	94.678	32.813
36	96.001	34.312
37	97.283	35.848
38	98.520	37.419
39	99.713	39.024
40	100.397	40.000

Circle Center At X = 41.958 ; Y = 80.678 ; and Radius = 71.203

Factor of Safety

*** 1.707 ***

Failure Surface Specified By 40 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	35.000	10.000
2	36.996	9.878
3	38.995	9.806
4	40.995	9.786
5	42.995	9.817
6	44.993	9.899
7	46.989	10.031
8	48.980	10.215
9	50.966	10.450
10	52.946	10.735
11	54.917	11.071
12	56.880	11.457
13	58.832	11.892
14	60.772	12.378
15	62.699	12.913
16	64.612	13.497
17	66.509	14.130
18	68.390	14.811
19	70.252	15.540
20	72.095	16.316
21	73.918	17.139
22	75.719	18.008
23	77.498	18.923
24	79.252	19.883
25	80.982	20.887
26	82.685	21.936
27	84.361	23.027
28	86.008	24.161
29	87.626	25.337
30	89.214	26.554
31	90.769	27.811
32	92.293	29.107
33	93.782	30.441
34	95.237	31.813
35	96.657	33.222
36	98.040	34.667
37	99.385	36.147
38	100.693	37.660
39	101.961	39.206
40	102.579	40.000

Circle Center At X = 40.795 ; Y = 88.062 ; and Radius = 78.277

Factor of Safety

*** 1.708 ***

Failure Surface Specified By 36 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	40.000	10.000
2	41.999	9.952

3	43.999	9.964
4	45.998	10.036
5	47.994	10.168
6	49.984	10.360
7	51.969	10.612
8	53.944	10.923
9	55.909	11.294
10	57.863	11.724
11	59.802	12.212
12	61.726	12.759
13	63.633	13.363
14	65.520	14.024
15	67.387	14.742
16	69.231	15.515
17	71.052	16.344
18	72.846	17.227
19	74.613	18.164
20	76.351	19.153
21	78.059	20.195
22	79.734	21.287
23	81.376	22.429
24	82.983	23.620
25	84.553	24.859
26	86.085	26.144
27	87.578	27.475
28	89.030	28.850
29	90.440	30.269
30	91.807	31.729
31	93.129	33.229
32	94.406	34.769
33	95.635	36.347
34	96.817	37.960
35	97.949	39.609
36	98.201	40.000

Circle Center At X = 42.610 ; Y = 76.393 ; and Radius = 66.444

Factor of Safety

*** 1.710 ***

Failure Surface Specified By 37 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	38.333	10.000
2	40.330	9.882
3	42.329	9.826
4	44.329	9.831
5	46.328	9.898
6	48.324	10.027
7	50.315	10.216
8	52.299	10.467
9	54.274	10.779
10	56.239	11.152
11	58.192	11.585
12	60.130	12.078
13	62.053	12.630
14	63.957	13.242
15	65.841	13.911
16	67.705	14.639
17	69.544	15.423
18	71.359	16.263
19	73.147	17.160
20	74.907	18.110
21	76.636	19.115
22	78.334	20.172
23	79.998	21.281
24	81.628	22.440
25	83.221	23.650
26	84.776	24.908
27	86.291	26.213

28	87.766	27.564
29	89.198	28.960
30	90.587	30.399
31	91.931	31.880
32	93.228	33.402
33	94.478	34.964
34	95.679	36.563
35	96.831	38.198
36	97.931	39.868
37	98.013	40.000

Circle Center At X = 43.156 ; Y = 74.772 ; and Radius = 64.951

Factor of Safety

*** 1.710 ***

Failure Surface Specified By 42 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	31.667	10.000
2	33.657	9.806
3	35.652	9.662
4	37.650	9.568
5	39.649	9.525
6	41.649	9.532
7	43.649	9.590
8	45.646	9.698
9	47.639	9.857
10	49.628	10.065
11	51.612	10.324
12	53.588	10.633
13	55.555	10.992
14	57.513	11.400
15	59.460	11.857
16	61.395	12.364
17	63.316	12.919
18	65.223	13.522
19	67.114	14.174
20	68.988	14.873
21	70.844	15.619
22	72.680	16.411
23	74.496	17.250
24	76.290	18.134
25	78.061	19.063
26	79.808	20.037
27	81.530	21.054
28	83.225	22.114
29	84.894	23.217
30	86.534	24.362
31	88.144	25.548
32	89.725	26.774
33	91.273	28.039
34	92.790	29.343
35	94.273	30.685
36	95.721	32.064
37	97.135	33.479
38	98.512	34.929
39	99.852	36.414
40	101.154	37.932
41	102.418	39.482
42	102.819	40.000

Circle Center At X = 40.364 ; Y = 88.749 ; and Radius = 79.228

Factor of Safety

*** 1.714 ***

Failure Surface Specified By 42 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	30.000	10.000
2	31.987	9.769
3	33.978	9.589

4	35.974	9.460
5	37.973	9.381
6	39.973	9.354
7	41.972	9.378
8	43.971	9.453
9	45.967	9.579
10	47.959	9.755
11	49.946	9.983
12	51.927	10.261
13	53.900	10.590
14	55.863	10.969
15	57.817	11.397
16	59.759	11.876
17	61.688	12.404
18	63.603	12.981
19	65.502	13.607
20	67.385	14.281
21	69.251	15.003
22	71.097	15.772
23	72.923	16.588
24	74.727	17.450
25	76.509	18.358
26	78.267	19.312
27	80.001	20.310
28	81.708	21.351
29	83.388	22.437
30	85.040	23.564
31	86.662	24.733
32	88.254	25.944
33	89.815	27.194
34	91.343	28.485
35	92.838	29.813
36	94.299	31.180
37	95.724	32.583
38	97.113	34.022
39	98.465	35.496
40	99.778	37.004
41	101.053	38.545
42	102.195	40.000

Circle Center At X = 40.040 ; Y = 87.707 ; and Radius = 78.353

Factor of Safety

*** 1.718 ***

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	36.667	10.000
2	38.653	9.770
3	40.646	9.602
4	42.644	9.496
5	44.643	9.453
6	46.643	9.472
7	48.641	9.553
8	50.636	9.697
9	52.625	9.903
10	54.607	10.171
11	56.580	10.501
12	58.541	10.892
13	60.490	11.344
14	62.423	11.857
15	64.339	12.430
16	66.236	13.063
17	68.113	13.754
18	69.967	14.503
19	71.797	15.311
20	73.601	16.174
21	75.377	17.094
22	77.123	18.069

23	78.839	19.098
24	80.521	20.179
25	82.168	21.313
26	83.780	22.498
27	85.353	23.732
28	86.888	25.015
29	88.381	26.345
30	89.833	27.721
31	91.240	29.142
32	92.603	30.606
33	93.919	32.112
34	95.188	33.658
35	96.407	35.243
36	97.577	36.865
37	98.695	38.523
38	99.626	40.000

Circle Center At X = 45.033 ; Y = 73.505 ; and Radius = 64.054

Factor of Safety

*** 1.719 ***

Failure Surface Specified By 39 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	33.333	10.000
2	35.321	9.778
3	37.314	9.614
4	39.312	9.510
5	41.311	9.466
6	43.311	9.480
7	45.310	9.555
8	47.305	9.688
9	49.296	9.881
10	51.280	10.133
11	53.256	10.444
12	55.221	10.814
13	57.175	11.241
14	59.115	11.727
15	61.040	12.270
16	62.948	12.870
17	64.837	13.526
18	66.706	14.239
19	68.553	15.006
20	70.376	15.828
21	72.174	16.704
22	73.945	17.633
23	75.688	18.614
24	77.401	19.647
25	79.082	20.730
26	80.731	21.863
27	82.345	23.044
28	83.923	24.272
29	85.464	25.547
30	86.966	26.867
31	88.429	28.231
32	89.850	29.638
33	91.229	31.087
34	92.565	32.576
35	93.855	34.104
36	95.099	35.669
37	96.297	37.271
38	97.446	38.908
39	98.165	40.000

Circle Center At X = 41.811 ; Y = 76.747 ; and Radius = 67.283

Factor of Safety

*** 1.719 ***

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)

1	38.333	10.000
2	40.325	9.817
3	42.321	9.694
4	44.320	9.630
5	46.320	9.626
6	48.319	9.681
7	50.316	9.795
8	52.308	9.970
9	54.295	10.203
10	56.273	10.495
11	58.242	10.846
12	60.200	11.256
13	62.144	11.724
14	64.074	12.249
15	65.987	12.832
16	67.882	13.471
17	69.758	14.167
18	71.611	14.918
19	73.442	15.724
20	75.247	16.584
21	77.026	17.497
22	78.778	18.463
23	80.499	19.481
24	82.190	20.550
25	83.848	21.668
26	85.472	22.836
27	87.061	24.051
28	88.612	25.313
29	90.126	26.620
30	91.599	27.972
31	93.032	29.368
32	94.423	30.805
33	95.770	32.283
34	97.073	33.801
35	98.330	35.356
36	99.540	36.949
37	100.702	38.577
38	101.655	40.000

Circle Center At X = 45.469 ; Y = 76.767 ; and Radius = 67.147

Factor of Safety

*** 1.719 ***

**** END OF GSTABL7 OUTPUT ****

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                    *** GSTABL7 ***
              ** GSTABL7 by Garry H. Gregory, P.E. **
   ** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
              (All Rights Reserved-Unauthorized Use Prohibited)
*******************************************************************************
                    SLOPE STABILITY ANALYSIS SYSTEM
        Modified Bishop, Simplified Janbu, or GLE Method of Slices.
        (Includes Spencer & Morgenstern-Price Type Analysis)
        Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
        Nonlinear Undrained Shear Strength, Curved Phi Envelope,
        Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
        Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
*******************************************************************************
   Analysis Run Date:        10/14/2004
   Time of Run:              08:17AM
   Run By:                   mike fordham
   Input Data Filename:      C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
   Output Filename:          C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
   Unit System:              SI
   Plotted Output Filename:  C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
   PROBLEM DESCRIPTION:  I-5 Preliminary Geotechnical Report
                         Fill Slope SD Lagoon (1:2)30M C
   BOUNDARY COORDINATES
       6 Top   Boundaries
      10 Total Boundaries
   Boundary     X-Left     Y-Left    X-Right    Y-Right    Soil Type
      No.         (m)        (m)        (m)        (m)     Below Bnd
       1         25.00      10.00      40.00      10.00        2
       2         40.00      10.00      70.00      25.00        1
       3         70.00      25.00      80.00      25.00        1
       4         80.00      25.00     110.00      40.00        1
       5        110.00      40.00     125.00      40.00        1
       6        125.00      40.00     140.00      40.00        2
       7         40.00      10.00      55.00      11.00        2
       8         55.00      11.00      85.00      24.00        2
       9         85.00      24.00      95.00      24.00        2
      10         95.00      24.00     125.00      40.00        2
   Default Y-Origin = 0.00(m)
   Default X-Plus Value = 0.00(m)
   Default Y-Plus Value = 0.00(m)
  ISOTROPIC SOIL PARAMETERS
    2 Type(s) of Soil
   Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
   Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
    No. (kN/m3)  (kN/m3)    (kPa)     (deg)    Param.   (kPa)     No.
     1    18.9     18.9       9.6     36.0    0.00       0.0      0
     2    18.9     18.9       9.6     32.0    0.00       0.0      0
  Searching Routine Will Be Limited To An Area Defined By  1 Boundaries
   Of Which The First  1 Boundaries Will Deflect Surfaces Upward
   Boundary     X-Left     Y-Left    X-Right    Y-Right
      No.         (m)        (m)        (m)        (m)
       1          0.00       0.00       0.00       0.00
   A Critical Failure Surface Searching Method, Using A Random
   Technique For Generating Circular Surfaces, Has Been Specified.
    400 Trial Surfaces Have Been Generated.
     40 Surface(s) Initiate(s) From Each Of    10 Points Equally Spaced
   Along The Ground Surface Between  X =  25.00(m)
                                  and  X =  40.00(m)
   Each Surface Terminates Between   X = 100.00(m)
                                  and  X = 135.00(m)
   Unless Further Limitations Were Imposed, The Minimum Elevation
   At Which A Surface Extends Is  Y =       0.00(m)
    2.00(m)  Line Segments Define Each Trial Failure Surface.
   Restrictions Have Been Imposed Upon The Angle Of Initiation.
```

The Angle Has Been Restricted Between The Angles Of -15.0
And 25.0 deg.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 400
Number of Trial Surfaces With Valid FS = 400
Statistical Data On All Valid FS Values:
FS Max = 2.600 FS Min = 1.988 FS Ave = 2.137
Standard Deviation = 0.083 Coefficient of Variation = 3.88 %
Failure Surface Specified By 47 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	38.333	10.000
2	40.333	9.950
3	42.333	9.935
4	44.333	9.952
5	46.332	10.004
6	48.330	10.089
7	50.327	10.207
8	52.321	10.360
9	54.312	10.545
10	56.300	10.765
11	58.284	11.017
12	60.264	11.303
13	62.238	11.622
14	64.207	11.975
15	66.169	12.360
16	68.125	12.779
17	70.073	13.230
18	72.014	13.714
19	73.946	14.231
20	75.869	14.780
21	77.783	15.361
22	79.686	15.975
23	81.579	16.620
24	83.461	17.297
25	85.331	18.006
26	87.189	18.746
27	89.035	19.517
28	90.867	20.319
29	92.685	21.152
30	94.489	22.015
31	96.279	22.909
32	98.053	23.832
33	99.811	24.786
34	101.553	25.768
35	103.278	26.780
36	104.986	27.821
37	106.676	28.890
38	108.348	29.988
39	110.001	31.114
40	111.635	32.267
41	113.249	33.447
42	114.844	34.655
43	116.417	35.889
44	117.970	37.150
45	119.501	38.436
46	121.011	39.748
47	121.291	40.000

Circle Center At X = 42.277 ; Y = 128.804 ; and Radius = 118.869
Factor of Safety
*** 1.988 ***
Individual data on the 53 slices

Water Force	Water Force	Tie Force	Tie Force	Earthquake Force	Surcharge

Slice No.	Width (m)	Weight (kN)	Top (kN)	Bot (kN)	Norm (kN)	Tan (kN)	Hor (kN)	Ver (kN)	Load (kN)
1	1.7	0.7	0.0	0.0	0.	0.	0.0	0.0	0.0
2	0.3	0.8	0.0	0.0	0.	0.	0.0	0.0	0.0
3	2.0	27.4	0.0	0.0	0.	0.	0.0	0.0	0.0
4	2.0	65.1	0.0	0.0	0.	0.	0.0	0.0	0.0
5	2.0	101.6	0.0	0.0	0.	0.	0.0	0.0	0.0
6	2.0	136.7	0.0	0.0	0.	0.	0.0	0.0	0.0
7	2.0	170.4	0.0	0.0	0.	0.	0.0	0.0	0.0
8	2.0	202.7	0.0	0.0	0.	0.	0.0	0.0	0.0
9	2.0	233.6	0.0	0.0	0.	0.	0.0	0.0	0.0
10	0.7	87.7	0.0	0.0	0.	0.	0.0	0.0	0.0
11	1.3	175.2	0.0	0.0	0.	0.	0.0	0.0	0.0
12	2.0	290.8	0.0	0.0	0.	0.	0.0	0.0	0.0
13	2.0	317.1	0.0	0.0	0.	0.	0.0	0.0	0.0
14	2.0	341.9	0.0	0.0	0.	0.	0.0	0.0	0.0
15	2.0	365.1	0.0	0.0	0.	0.	0.0	0.0	0.0
16	2.0	386.7	0.0	0.0	0.	0.	0.0	0.0	0.0
17	2.0	406.7	0.0	0.0	0.	0.	0.0	0.0	0.0
18	1.9	408.8	0.0	0.0	0.	0.	0.0	0.0	0.0
19	0.1	16.3	0.0	0.0	0.	0.	0.0	0.0	0.0
20	1.9	422.8	0.0	0.0	0.	0.	0.0	0.0	0.0
21	1.9	402.7	0.0	0.0	0.	0.	0.0	0.0	0.0
22	1.9	381.5	0.0	0.0	0.	0.	0.0	0.0	0.0
23	1.9	359.1	0.0	0.0	0.	0.	0.0	0.0	0.0
24	1.9	335.8	0.0	0.0	0.	0.	0.0	0.0	0.0
25	0.3	53.2	0.0	0.0	0.	0.	0.0	0.0	0.0
26	1.6	270.0	0.0	0.0	0.	0.	0.0	0.0	0.0
27	1.9	330.8	0.0	0.0	0.	0.	0.0	0.0	0.0
28	1.5	277.1	0.0	0.0	0.	0.	0.0	0.0	0.0
29	0.3	60.4	0.0	0.0	0.	0.	0.0	0.0	0.0
30	1.9	342.5	0.0	0.0	0.	0.	0.0	0.0	0.0
31	1.8	346.1	0.0	0.0	0.	0.	0.0	0.0	0.0
32	1.8	348.3	0.0	0.0	0.	0.	0.0	0.0	0.0
33	1.8	348.9	0.0	0.0	0.	0.	0.0	0.0	0.0
34	1.8	348.1	0.0	0.0	0.	0.	0.0	0.0	0.0
35	0.5	98.7	0.0	0.0	0.	0.	0.0	0.0	0.0
36	1.3	247.2	0.0	0.0	0.	0.	0.0	0.0	0.0
37	1.8	342.4	0.0	0.0	0.	0.	0.0	0.0	0.0
38	1.8	337.5	0.0	0.0	0.	0.	0.0	0.0	0.0
39	1.7	331.3	0.0	0.0	0.	0.	0.0	0.0	0.0
40	1.7	323.9	0.0	0.0	0.	0.	0.0	0.0	0.0
41	1.7	315.2	0.0	0.0	0.	0.	0.0	0.0	0.0
42	1.7	305.4	0.0	0.0	0.	0.	0.0	0.0	0.0
43	1.7	294.4	0.0	0.0	0.	0.	0.0	0.0	0.0
44	1.7	282.3	0.0	0.0	0.	0.	0.0	0.0	0.0
45	1.6	256.6	0.0	0.0	0.	0.	0.0	0.0	0.0
46	1.6	217.9	0.0	0.0	0.	0.	0.0	0.0	0.0
47	1.3	146.1	0.0	0.0	0.	0.	0.0	0.0	0.0
48	0.3	33.1	0.0	0.0	0.	0.	0.0	0.0	0.0
49	1.6	140.6	0.0	0.0	0.	0.	0.0	0.0	0.0
50	1.6	102.1	0.0	0.0	0.	0.	0.0	0.0	0.0
51	1.5	63.9	0.0	0.0	0.	0.	0.0	0.0	0.0
52	1.5	25.9	0.0	0.0	0.	0.	0.0	0.0	0.0
53	0.3	0.7	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 47 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	35.000	10.000
2	36.989	9.786
3	38.981	9.615
4	40.977	9.484
5	42.975	9.396
6	44.974	9.349
7	46.974	9.344
8	48.974	9.381
9	50.973	9.459

10	52.969	9.580
11	54.962	9.742
12	56.952	9.945
13	58.937	10.190
14	60.916	10.477
15	62.889	10.805
16	64.855	11.174
17	66.812	11.584
18	68.761	12.034
19	70.700	12.526
20	72.628	13.057
21	74.544	13.629
22	76.448	14.241
23	78.339	14.893
24	80.216	15.583
25	82.078	16.313
26	83.925	17.082
27	85.755	17.889
28	87.567	18.734
29	89.362	19.617
30	91.138	20.537
31	92.894	21.494
32	94.630	22.487
33	96.344	23.517
34	98.037	24.582
35	99.707	25.682
36	101.354	26.817
37	102.977	27.986
38	104.575	29.189
39	106.147	30.424
40	107.694	31.693
41	109.213	32.993
42	110.705	34.325
43	112.169	35.688
44	113.604	37.081
45	115.010	38.503
46	116.386	39.955
47	116.426	40.000

Circle Center At X = 46.213 ; Y = 105.071 ; and Radius = 95.730

Factor of Safety

*** 1.999 ***

Failure Surface Specified By 47 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	35.000	10.000
2	36.985	9.754
3	38.974	9.551
4	40.968	9.390
5	42.964	9.271
6	44.963	9.194
7	46.963	9.160
8	48.963	9.169
9	50.962	9.219
10	52.960	9.313
11	54.955	9.448
12	56.947	9.626
13	58.935	9.846
14	60.918	10.108
15	62.895	10.412
16	64.864	10.759
17	66.827	11.146
18	68.780	11.576
19	70.724	12.046
20	72.657	12.558
21	74.579	13.111
22	76.489	13.704
23	78.386	14.338

24	80.269	15.012
25	82.138	15.725
26	83.990	16.479
27	85.827	17.271
28	87.646	18.102
29	89.447	18.971
30	91.229	19.879
31	92.992	20.824
32	94.734	21.806
33	96.455	22.825
34	98.154	23.880
35	99.830	24.972
36	101.483	26.098
37	103.111	27.259
38	104.714	28.455
39	106.292	29.684
40	107.843	30.946
41	109.367	32.241
42	110.864	33.569
43	112.331	34.927
44	113.770	36.316
45	115.179	37.736
46	116.557	39.185
47	117.300	40.000

Circle Center At X = 47.569 ; Y = 103.423 ; and Radius = 94.265

Factor of Safety

*** 2.001 ***

Failure Surface Specified By 48 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	33.333	10.000
2	35.318	9.751
3	37.307	9.544
4	39.300	9.378
5	41.296	9.253
6	43.294	9.169
7	45.294	9.127
8	47.294	9.125
9	49.294	9.166
10	51.292	9.247
11	53.288	9.370
12	55.281	9.535
13	57.271	9.740
14	59.256	9.987
15	61.235	10.274
16	63.208	10.603
17	65.173	10.972
18	67.131	11.381
19	69.080	11.832
20	71.019	12.322
21	72.947	12.852
22	74.864	13.422
23	76.769	14.032
24	78.661	14.681
25	80.539	15.368
26	82.402	16.095
27	84.250	16.860
28	86.082	17.663
29	87.896	18.504
30	89.693	19.382
31	91.472	20.297
32	93.231	21.248
33	94.970	22.236
34	96.688	23.259
35	98.385	24.318
36	100.059	25.412
37	101.711	26.540

38	103.339	27.702
39	104.942	28.897
40	106.521	30.126
41	108.073	31.386
42	109.599	32.679
43	111.099	34.003
44	112.570	35.357
45	114.013	36.742
46	115.427	38.156
47	116.812	39.599
48	117.181	40.000

Circle Center At X = 46.346 ; Y = 105.805 ; and Radius = 96.685

Factor of Safety

*** 2.002 ***

Failure Surface Specified By 47 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	35.000	10.000
2	36.984	9.744
3	38.972	9.530
4	40.965	9.359
5	42.961	9.230
6	44.959	9.143
7	46.958	9.099
8	48.958	9.098
9	50.958	9.139
10	52.956	9.223
11	54.952	9.350
12	56.945	9.519
13	58.934	9.730
14	60.917	9.984
15	62.895	10.280
16	64.867	10.618
17	66.830	10.998
18	68.785	11.419
19	70.731	11.882
20	72.666	12.387
21	74.591	12.932
22	76.503	13.519
23	78.402	14.146
24	80.287	14.813
25	82.158	15.521
26	84.013	16.268
27	85.852	17.054
28	87.674	17.879
29	89.478	18.743
30	91.262	19.646
31	93.028	20.586
32	94.773	21.563
33	96.496	22.577
34	98.198	23.628
35	99.877	24.715
36	101.532	25.837
37	103.164	26.995
38	104.770	28.187
39	106.350	29.412
40	107.904	30.671
41	109.431	31.963
42	110.929	33.288
43	112.400	34.643
44	113.841	36.030
45	115.252	37.447
46	116.633	38.894
47	117.644	40.000

Circle Center At X = 48.016 ; Y = 102.988 ; and Radius = 93.894

Factor of Safety

*** 2.003 ***

Failure Surface Specified By 44 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	38.333	10.000
2	40.333	9.985
3	42.333	10.006
4	44.332	10.063
5	46.330	10.157
6	48.326	10.287
7	50.319	10.453
8	52.309	10.655
9	54.294	10.894
10	56.276	11.168
11	58.251	11.479
12	60.221	11.825
13	62.184	12.207
14	64.140	12.624
15	66.088	13.077
16	68.028	13.566
17	69.958	14.089
18	71.879	14.647
19	73.789	15.241
20	75.687	15.868
21	77.575	16.530
22	79.450	17.227
23	81.311	17.957
24	83.160	18.721
25	84.994	19.518
26	86.813	20.349
27	88.617	21.212
28	90.405	22.108
29	92.177	23.037
30	93.931	23.997
31	95.668	24.989
32	97.386	26.013
33	99.086	27.067
34	100.766	28.152
35	102.426	29.268
36	104.065	30.413
37	105.683	31.588
38	107.280	32.793
39	108.855	34.026
40	110.407	35.287
41	111.936	36.577
42	113.441	37.894
43	114.922	39.238
44	115.732	40.000

Circle Center At X = 40.178 ; Y = 120.083 ; and Radius = 110.099

Factor of Safety

*** 2.008 ***

Failure Surface Specified By 49 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	31.667	10.000
2	33.663	9.881
3	35.661	9.797
4	37.661	9.746
5	39.661	9.729
6	41.661	9.746
7	43.660	9.797
8	45.658	9.882
9	47.655	10.001
10	49.649	10.153
11	51.640	10.340
12	53.628	10.560
13	55.612	10.814
14	57.591	11.102

15	59.565	11.423
16	61.533	11.778
17	63.495	12.165
18	65.450	12.587
19	67.398	13.041
20	69.338	13.528
21	71.269	14.048
22	73.191	14.601
23	75.104	15.187
24	77.006	15.804
25	78.897	16.454
26	80.777	17.136
27	82.646	17.850
28	84.502	18.595
29	86.345	19.372
30	88.174	20.180
31	89.990	21.019
32	91.791	21.888
33	93.577	22.788
34	95.348	23.718
35	97.102	24.678
36	98.840	25.668
37	100.561	26.687
38	102.264	27.735
39	103.950	28.812
40	105.617	29.917
41	107.264	31.050
42	108.893	32.212
43	110.501	33.400
44	112.089	34.616
45	113.656	35.859
46	115.202	37.128
47	116.726	38.423
48	118.228	39.743
49	118.510	40.000

Circle Center At X = 39.655 ; Y = 127.584 ; and Radius = 117.855

Factor of Safety

*** 2.008 ***

Failure Surface Specified By 43 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	38.333	10.000
2	40.332	9.922
3	42.331	9.884
4	44.331	9.887
5	46.331	9.931
6	48.329	10.016
7	50.325	10.141
8	52.318	10.307
9	54.308	10.514
10	56.292	10.761
11	58.272	11.048
12	60.244	11.376
13	62.210	11.744
14	64.168	12.152
15	66.118	12.600
16	68.057	13.087
17	69.987	13.614
18	71.905	14.180
19	73.811	14.785
20	75.705	15.429
21	77.585	16.111
22	79.450	16.832
23	81.301	17.590
24	83.136	18.386
25	84.954	19.219
26	86.755	20.089

27	88.538	20.996
28	90.302	21.938
29	92.046	22.917
30	93.770	23.930
31	95.473	24.979
32	97.154	26.062
33	98.813	27.180
34	100.449	28.330
35	102.061	29.514
36	103.648	30.731
37	105.211	31.979
38	106.747	33.260
39	108.257	34.571
40	109.740	35.913
41	111.196	37.284
42	112.623	38.686
43	113.908	40.000

Circle Center At X = 43.177 ; Y = 107.996 ; and Radius = 98.116

Factor of Safety

*** 2.009 ***

Failure Surface Specified By 47 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	40.000	10.000
2	41.998	9.901
3	43.997	9.837
4	45.996	9.810
5	47.996	9.818
6	49.996	9.861
7	51.994	9.941
8	53.991	10.056
9	55.985	10.207
10	57.977	10.393
11	59.964	10.615
12	61.948	10.872
13	63.926	11.165
14	65.899	11.493
15	67.866	11.856
16	69.826	12.254
17	71.778	12.688
18	73.723	13.156
19	75.659	13.658
20	77.585	14.195
21	79.502	14.767
22	81.408	15.372
23	83.303	16.012
24	85.186	16.685
25	87.057	17.392
26	88.915	18.132
27	90.760	18.905
28	92.590	19.711
29	94.406	20.550
30	96.206	21.421
31	97.991	22.323
32	99.759	23.258
33	101.510	24.224
34	103.244	25.221
35	104.960	26.249
36	106.657	27.307
37	108.334	28.396
38	109.992	29.514
39	111.630	30.662
40	113.247	31.839
41	114.843	33.044
42	116.417	34.278
43	117.969	35.540
44	119.498	36.829

45	121.004	38.145
46	122.486	39.488
47	123.030	40.000

Circle Center At X = 46.548 ; Y = 121.794 ; and Radius = 111.986
Factor of Safety
*** 2.010 ***

Failure Surface Specified By 50 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	33.333	10.000
2	35.323	9.801
3	37.317	9.638
4	39.313	9.510
5	41.311	9.418
6	43.310	9.363
7	45.310	9.343
8	47.310	9.359
9	49.309	9.411
10	51.307	9.498
11	53.303	9.622
12	55.297	9.781
13	57.287	9.977
14	59.274	10.207
15	61.256	10.474
16	63.233	10.776
17	65.204	11.113
18	67.169	11.486
19	69.127	11.894
20	71.078	12.337
21	73.020	12.815
22	74.953	13.328
23	76.877	13.875
24	78.790	14.457
25	80.693	15.073
26	82.584	15.723
27	84.464	16.407
28	86.331	17.124
29	88.184	17.875
30	90.024	18.659
31	91.850	19.476
32	93.660	20.326
33	95.455	21.208
34	97.234	22.122
35	98.996	23.068
36	100.741	24.045
37	102.469	25.053
38	104.177	26.093
39	105.867	27.162
40	107.538	28.262
41	109.188	29.392
42	110.818	30.551
43	112.427	31.739
44	114.014	32.956
45	115.579	34.201
46	117.121	35.475
47	118.641	36.775
48	120.137	38.103
49	121.608	39.457
50	122.178	40.000

Circle Center At X = 45.421 ; Y = 120.758 ; and Radius = 111.415
Factor of Safety
*** 2.012 ***

**** END OF GSTABL7 OUTPUT ****

```
                    *** GSTABL7 ***
              ** GSTABL7 by Garry H. Gregory, P.E. **
   ** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
              (All Rights Reserved-Unauthorized Use Prohibited)
*******************************************************************************
                    SLOPE STABILITY ANALYSIS SYSTEM
        Modified Bishop, Simplified Janbu, or GLE Method of Slices.
        (Includes Spencer & Morgenstern-Price Type Analysis)
        Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
        Nonlinear Undrained Shear Strength, Curved Phi Envelope,
        Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
        Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
*******************************************************************************
   Analysis Run Date:          10/12/2004
   Time of Run:                10:37AM
   Run By:                     mike fordham
   Input Data Filename:        C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
   Output Filename:            C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
   Unit System:                SI
   Plotted Output Filename:  C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
   PROBLEM DESCRIPTION:  I-5 Preliminary Geotechnical Report
                         Fill Slope SD Lagoon 580+00 (1:1.5)6M C
   BOUNDARY COORDINATES
       3 Top   Boundaries
       5 Total Boundaries
   Boundary     X-Left      Y-Left     X-Right     Y-Right     Soil Type
      No.         (m)         (m)         (m)         (m)      Below Bnd
       1         25.00       10.00       40.00       10.00        2
       2         40.00       10.00       49.00       16.00        1
       3         49.00       16.00       65.00       16.00        1
       4         40.00       10.00       50.00       11.00        2
       5         50.00       11.00       60.00       16.00        2
   Default Y-Origin = 0.00(m)
   Default X-Plus Value = 0.00(m)
   Default Y-Plus Value = 0.00(m)
  ISOTROPIC SOIL PARAMETERS
    2 Type(s) of Soil
   Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
   Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
    No. (kN/m3)  (kN/m3)    (kPa)     (deg)    Param.   (kPa)     No.
     1    18.9     18.9       9.6     36.0    0.00       0.0      0
     2    18.9     18.9       9.6     32.0    0.00       0.0      0
  Searching Routine Will Be Limited To An Area Defined By  1 Boundaries
   Of Which The First  1 Boundaries Will Deflect Surfaces Upward
   Boundary     X-Left      Y-Left     X-Right     Y-Right
      No.         (m)         (m)         (m)         (m)
       1          0.00        0.00        0.00        0.00
   A Critical Failure Surface Searching Method, Using A Random
   Technique For Generating Circular Surfaces, Has Been Specified.
    400 Trial Surfaces Have Been Generated.
     40 Surface(s) Initiate(s) From Each Of    10 Points Equally Spaced
   Along The Ground Surface Between  X =  25.00(m)
                                  and  X =  40.00(m)
   Each Surface Terminates Between   X =  49.00(m)
                                  and  X =  65.00(m)
   Unless Further Limitations Were Imposed, The Minimum Elevation
   At Which A Surface Extends Is  Y =       0.00(m)
    2.00(m)  Line Segments Define Each Trial Failure Surface.
   Restrictions Have Been Imposed Upon The Angle Of Initiation.
   The Angle Has Been Restricted Between The Angles Of -15.0
   And  25.0 deg.
   Following Are Displayed The Ten Most Critical Of The Trial
         Failure Surfaces Evaluated. They Are
         Ordered - Most Critical First.
```

* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 400
Number of Trial Surfaces With Valid FS = 400
Statistical Data On All Valid FS Values:
FS Max = 4.739 FS Min = 2.120 FS Ave = 3.274
Standard Deviation = 0.560 Coefficient of Variation = 17.09 %

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	40.000	10.000
2	42.000	9.996
3	43.963	10.378
4	45.816	11.131
5	47.488	12.228
6	48.918	13.627
7	50.051	15.275
8	50.364	16.000

Circle Center At X = 41.044 ; Y = 20.149 ; and Radius = 10.202
Factor of Safety
*** 2.120 ***

Individual data on the 9 slices

Slice No.	Width (m)	Weight (kN)	Water Force Top (kN)	Water Force Bot (kN)	Tie Force Norm (kN)	Tie Force Tan (kN)	Earthquake Force Hor (kN)	Earthquake Force Ver (kN)	Surcharge Load (kN)
1	2.0	25.3	0.0	0.0	0.	0.	0.0	0.0	0.0
2	2.0	66.8	0.0	0.0	0.	0.	0.0	0.0	0.0
3	0.1	2.6	0.0	0.0	0.	0.	0.0	0.0	0.0
4	1.8	85.1	0.0	0.0	0.	0.	0.0	0.0	0.0
5	1.7	87.1	0.0	0.0	0.	0.	0.0	0.0	0.0
6	1.4	68.7	0.0	0.0	0.	0.	0.0	0.0	0.0
7	0.1	3.5	0.0	0.0	0.	0.	0.0	0.0	0.0
8	1.1	29.6	0.0	0.0	0.	0.	0.0	0.0	0.0
9	0.3	2.1	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	40.000	10.000
2	41.994	9.845
3	43.984	10.048
4	45.905	10.604
5	47.696	11.494
6	49.298	12.691
7	50.662	14.154
8	51.741	15.838
9	51.808	16.000

Circle Center At X = 41.860 ; Y = 20.986 ; and Radius = 11.142
Factor of Safety
*** 2.180 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	40.000	10.000
2	41.988	9.782
3	43.966	10.076
4	45.805	10.864
5	47.383	12.093
6	48.597	13.682
7	49.367	15.528
8	49.432	16.000

Circle Center At X = 41.850 ; Y = 17.506 ; and Radius = 7.731
Factor of Safety
*** 2.187 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	38.333	10.000

```
    2          40.271        9.504
    3          42.270        9.433
    4          44.237        9.791
    5          46.083       10.562
    6          47.720       11.710
    7          49.075       13.182
    8          50.083       14.909
    9          50.436       16.000
Circle Center At X =    41.596 ; Y =    18.706 ; and Radius =     9.298
       Factor of Safety
      ***    2.193   ***
Failure Surface Specified By  9 Coordinate Points
  Point       X-Surf      Y-Surf
   No.         (m)         (m)
    1          38.333       10.000
    2          40.269        9.498
    3          42.269        9.446
    4          44.228        9.846
    5          46.047       10.678
    6          47.630       11.900
    7          48.898       13.447
    8          49.783       15.241
    9          49.961       16.000
Circle Center At X =    41.497 ; Y =    18.215 ; and Radius =     8.803
       Factor of Safety
      ***    2.205   ***
Failure Surface Specified By  9 Coordinate Points
  Point       X-Surf      Y-Surf
   No.         (m)         (m)
    1          38.333       10.000
    2          40.269        9.496
    3          42.266        9.387
    4          44.245        9.676
    5          46.127       10.353
    6          47.837       11.390
    7          49.307       12.746
    8          50.479       14.367
    9          51.220       16.000
Circle Center At X =    41.813 ; Y =    19.396 ; and Radius =    10.019
       Factor of Safety
      ***    2.208   ***
Failure Surface Specified By  8 Coordinate Points
  Point       X-Surf      Y-Surf
   No.         (m)         (m)
    1          40.000       10.000
    2          41.962       10.388
    3          43.862       11.012
    4          45.673       11.862
    5          47.366       12.926
    6          48.918       14.187
    7          50.306       15.628
    8          50.586       16.000
Circle Center At X =    37.842 ; Y =    26.145 ; and Radius =    16.288
       Factor of Safety
      ***    2.222   ***
Failure Surface Specified By 10 Coordinate Points
  Point       X-Surf      Y-Surf
   No.         (m)         (m)
    1          38.333       10.000
    2          40.291        9.591
    3          42.290        9.522
    4          44.271        9.796
    5          46.176       10.404
    6          47.949       11.330
    7          49.538       12.545
    8          50.896       14.013
    9          51.983       15.692
```

```
  10          52.114        16.000
Circle Center At X =    41.692 ; Y =    21.111 ; and Radius =    11.607
      Factor of Safety
     ***    2.230   ***
Failure Surface Specified By  8 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (m)          (m)
    1         38.333        10.000
    2         40.326         9.828
    3         42.315        10.032
    4         44.232        10.605
    5         46.006        11.527
    6         47.577        12.765
    7         48.888        14.276
    8         49.890        16.000
Circle Center At X =    40.240 ; Y =    20.457 ; and Radius =    10.629
      Factor of Safety
     ***    2.237   ***
Failure Surface Specified By 10 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (m)          (m)
    1         38.333        10.000
    2         40.283         9.555
    3         42.281         9.454
    4         44.265         9.702
    5         46.177        10.290
    6         47.957        11.200
    7         49.553        12.406
    8         50.915        13.870
    9         52.003        15.549
   10         52.194        16.000
Circle Center At X =    41.859 ; Y =    20.865 ; and Radius =    11.423
      Factor of Safety
     ***    2.240   ***
         **** END OF GSTABL7 OUTPUT ****
```

```
                    *** GSTABL7 ***
              ** GSTABL7 by Garry H. Gregory, P.E. **
   ** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
          (All Rights Reserved-Unauthorized Use Prohibited)
*******************************************************************************
                  SLOPE STABILITY ANALYSIS SYSTEM
       Modified Bishop, Simplified Janbu, or GLE Method of Slices.
       (Includes Spencer & Morgenstern-Price Type Analysis)
       Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
       Nonlinear Undrained Shear Strength, Curved Phi Envelope,
       Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
       Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
*******************************************************************************
   Analysis Run Date:        10/12/2004
   Time of Run:              10:34AM
   Run By:                   mike fordham
   Input Data Filename:      C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
   Output Filename:          C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
   Unit System:              SI
   Plotted Output Filename:  C:\Documents and Settings\tbmfordh\My Documents\Mike's Proje
cts\current projects\EA 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 58
   PROBLEM DESCRIPTION:  I-5 Preliminary Geotechnical Report
                         Fill Slope SD Lagoon 580+00 (1:2)6M C
   BOUNDARY COORDINATES
       3 Top   Boundaries
       5 Total Boundaries
   Boundary     X-Left     Y-Left    X-Right    Y-Right    Soil Type
      No.        (m)        (m)        (m)        (m)      Below Bnd
       1        25.00      10.00      40.00      10.00        2
       2        40.00      10.00      52.00      16.00        1
       3        52.00      16.00      65.00      16.00        1
       4        40.00      10.00      50.00      11.00        2
       5        50.00      11.00      60.00      16.00        2
   Default Y-Origin = 0.00(m)
   Default X-Plus Value = 0.00(m)
   Default Y-Plus Value = 0.00(m)
  ISOTROPIC SOIL PARAMETERS
    3 Type(s) of Soil
   Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
   Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
    No. (kN/m3)  (kN/m3)    (kPa)     (deg)    Param.   (kPa)     No.
     1    18.9     18.9       9.6     36.0    0.00       0.0      0
     2    18.9     18.9       9.6     32.0    0.00       0.0      0
     3    18.9     18.9       9.6     33.0    0.00       0.0      0
  Searching Routine Will Be Limited To An Area Defined By  1 Boundaries
   Of Which The First  1 Boundaries Will Deflect Surfaces Upward
   Boundary     X-Left     Y-Left    X-Right    Y-Right
      No.        (m)        (m)        (m)        (m)
       1         0.00       0.00       0.00       0.00
   A Critical Failure Surface Searching Method, Using A Random
   Technique For Generating Circular Surfaces, Has Been Specified.
    400 Trial Surfaces Have Been Generated.
     40 Surface(s) Initiate(s) From Each Of    10 Points Equally Spaced
   Along The Ground Surface Between  X =  25.00(m)
                                 and  X =  40.00(m)
   Each Surface Terminates Between   X =  49.00(m)
                                 and  X =  65.00(m)
   Unless Further Limitations Were Imposed, The Minimum Elevation
   At Which A Surface Extends Is  Y =       0.00(m)
    2.00(m)  Line Segments Define Each Trial Failure Surface.
   Restrictions Have Been Imposed Upon The Angle Of Initiation.
   The Angle Has Been Restricted Between The Angles Of -15.0
   And  25.0 deg.
   Following Are Displayed The Ten Most Critical Of The Trial
         Failure Surfaces Evaluated. They Are
```

Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 400
Number of Trial Surfaces With Valid FS = 400
Statistical Data On All Valid FS Values:
FS Max = 13.127 FS Min = 2.514 FS Ave = 3.572
Standard Deviation = 0.931 Coefficient of Variation = 26.06 %
Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	38.333	10.000
2	40.275	9.523
3	42.268	9.351
4	44.263	9.490
5	46.213	9.937
6	48.070	10.679
7	49.790	11.700
8	51.331	12.974
9	52.657	14.472
10	53.634	16.000

Circle Center At X = 42.372 ; Y = 22.211 ; and Radius = 12.861
Factor of Safety
*** 2.514 ***
Individual data on the 12 slices

Slice No.	Width (m)	Weight (kN)	Water Force Top (kN)	Water Force Bot (kN)	Tie Force Norm (kN)	Tie Force Tan (kN)	Earthquake Force Hor (kN)	Earthquake Force Ver (kN)	Surcharge Load (kN)
1	1.7	6.5	0.0	0.0	0.	0.	0.0	0.0	0.0
2	0.3	2.7	0.0	0.0	0.	0.	0.0	0.0	0.0
3	2.0	45.2	0.0	0.0	0.	0.	0.0	0.0	0.0
4	2.0	83.4	0.0	0.0	0.	0.	0.0	0.0	0.0
5	1.9	107.1	0.0	0.0	0.	0.	0.0	0.0	0.0
6	1.9	114.5	0.0	0.0	0.	0.	0.0	0.0	0.0
7	0.3	16.4	0.0	0.0	0.	0.	0.0	0.0	0.0
8	1.5	90.1	0.0	0.0	0.	0.	0.0	0.0	0.0
9	1.5	85.7	0.0	0.0	0.	0.	0.0	0.0	0.0
10	0.7	31.4	0.0	0.0	0.	0.	0.0	0.0	0.0
11	0.7	23.6	0.0	0.0	0.	0.	0.0	0.0	0.0
12	1.0	14.1	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	38.333	10.000
2	40.292	9.594
3	42.288	9.473
4	44.281	9.641
5	46.229	10.094
6	48.092	10.822
7	49.831	11.810
8	51.409	13.038
9	52.795	14.481
10	53.882	16.000

Circle Center At X = 42.124 ; Y = 23.323 ; and Radius = 13.852
Factor of Safety
*** 2.516 ***
Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (m)	Y-Surf (m)
1	40.000	10.000
2	41.945	9.533
3	43.943	9.450
4	45.920	9.754
5	47.801	10.433
6	49.516	11.462
7	51.001	12.802
8	52.199	14.403

```
    9          52.968        16.000
Circle Center At X =    43.371 ; Y =    19.763 ; and Radius =    10.329
       Factor of Safety
      ***    2.528   ***
Failure Surface Specified By 11 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (m)          (m)
    1          38.333       10.000
    2          40.267        9.490
    3          42.255        9.271
    4          44.254        9.349
    5          46.219        9.721
    6          48.107       10.381
    7          49.877       11.312
    8          51.489       12.496
    9          52.909       13.904
   10          54.104       15.508
   11          54.368       16.000
Circle Center At X =    42.731 ; Y =    22.741 ; and Radius =    13.478
       Factor of Safety
      ***    2.529   ***
Failure Surface Specified By 10 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (m)          (m)
    1          38.333       10.000
    2          40.275        9.519
    3          42.269        9.369
    4          44.260        9.555
    5          46.193       10.072
    6          48.011       10.904
    7          49.665       12.028
    8          51.108       13.414
    9          52.298       15.021
   10          52.795       16.000
Circle Center At X =    42.161 ; Y =    21.202 ; and Radius =    11.838
       Factor of Safety
      ***    2.533   ***
Failure Surface Specified By 11 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (m)          (m)
    1          38.333       10.000
    2          40.266        9.486
    3          42.253        9.260
    4          44.252        9.327
    5          46.220        9.685
    6          48.114       10.326
    7          49.895       11.238
    8          51.523       12.399
    9          52.963       13.786
   10          54.186       15.369
   11          54.540       16.000
Circle Center At X =    42.799 ; Y =    22.903 ; and Radius =    13.654
       Factor of Safety
      ***    2.535   ***
Failure Surface Specified By 11 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (m)          (m)
    1          38.333       10.000
    2          40.268        9.494
    3          42.256        9.270
    4          44.255        9.331
    5          46.225        9.677
    6          48.125       10.300
    7          49.917       11.188
    8          51.564       12.323
    9          53.032       13.681
   10          54.292       15.235
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   11          54.749        16.000
Circle Center At X =    42.828 ; Y =    23.241 ; and Radius =    13.983
       Factor of Safety
      ***    2.542   ***
Failure Surface Specified By 10 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (m)          (m)
    1          38.333       10.000
    2          40.289        9.582
    3          42.287        9.488
    4          44.274        9.720
    5          46.196       10.272
    6          48.003       11.129
    7          49.647       12.268
    8          51.084       13.659
    9          52.275       15.265
   10          52.653       16.000
Circle Center At X =    41.866 ; Y =    21.656 ; and Radius =    12.180
       Factor of Safety
      ***    2.547   ***
Failure Surface Specified By 11 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (m)          (m)
    1          38.333       10.000
    2          40.304        9.659
    3          42.302        9.570
    4          44.295        9.733
    5          46.252       10.146
    6          48.142       10.802
    7          49.933       11.691
    8          51.598       12.799
    9          53.110       14.109
   10          54.445       15.598
   11          54.722       16.000
Circle Center At X =    42.011 ; Y =    25.399 ; and Radius =    15.832
       Factor of Safety
      ***    2.547   ***
Failure Surface Specified By 10 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (m)          (m)
    1          40.000       10.000
    2          41.941        9.519
    3          43.935        9.356
    4          45.928        9.518
    5          47.870        9.998
    6          49.708       10.784
    7          51.397       11.857
    8          52.890       13.187
    9          54.149       14.741
   10          54.869       16.000
Circle Center At X =    43.938 ; Y =    21.664 ; and Radius =    12.311
       Factor of Safety
      ***    2.562   ***
          **** END OF GSTABL7 OUTPUT ****
```
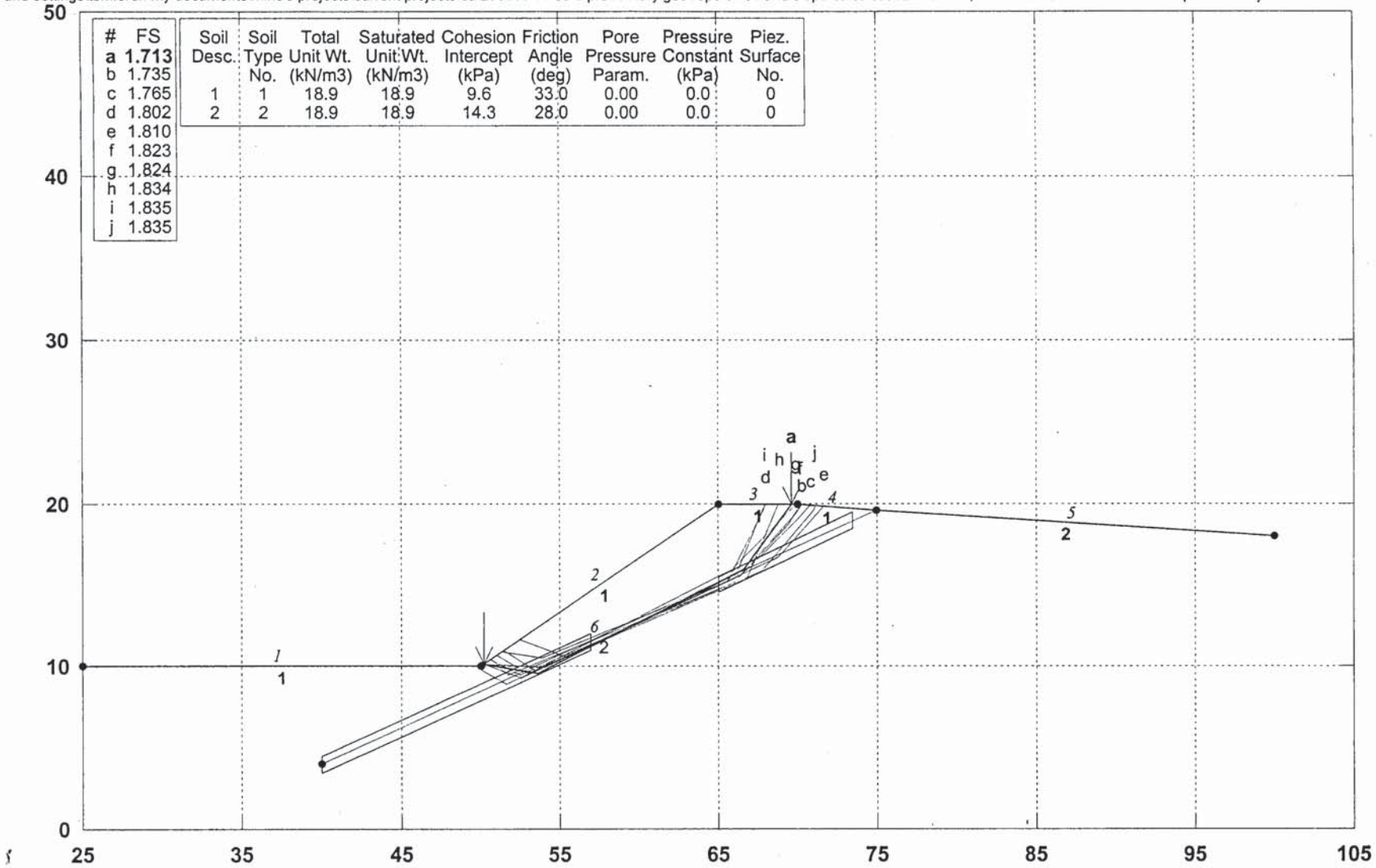

I-5 Preliminary Geotechnical Report Cut Slope 828+00 (1:1.5) 10 m combine b

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\cut 828+20 1-1,5 10m no bench combine block.pl2 Run By: mike fordham 11/10/2004

#	FS
a	**1.713**
b	1.735
c	1.765
d	1.802
e	1.810
f	1.823
g	1.824
h	1.834
i	1.835
j	1.835

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	33.0	0.00	0.0	0
2	2	18.9	18.9	14.3	28.0	0.00	0.0	0



GSTABL7 v.2 FSmin=1.713

Safety Factors Are Calculated By The Simplified Janbu Method

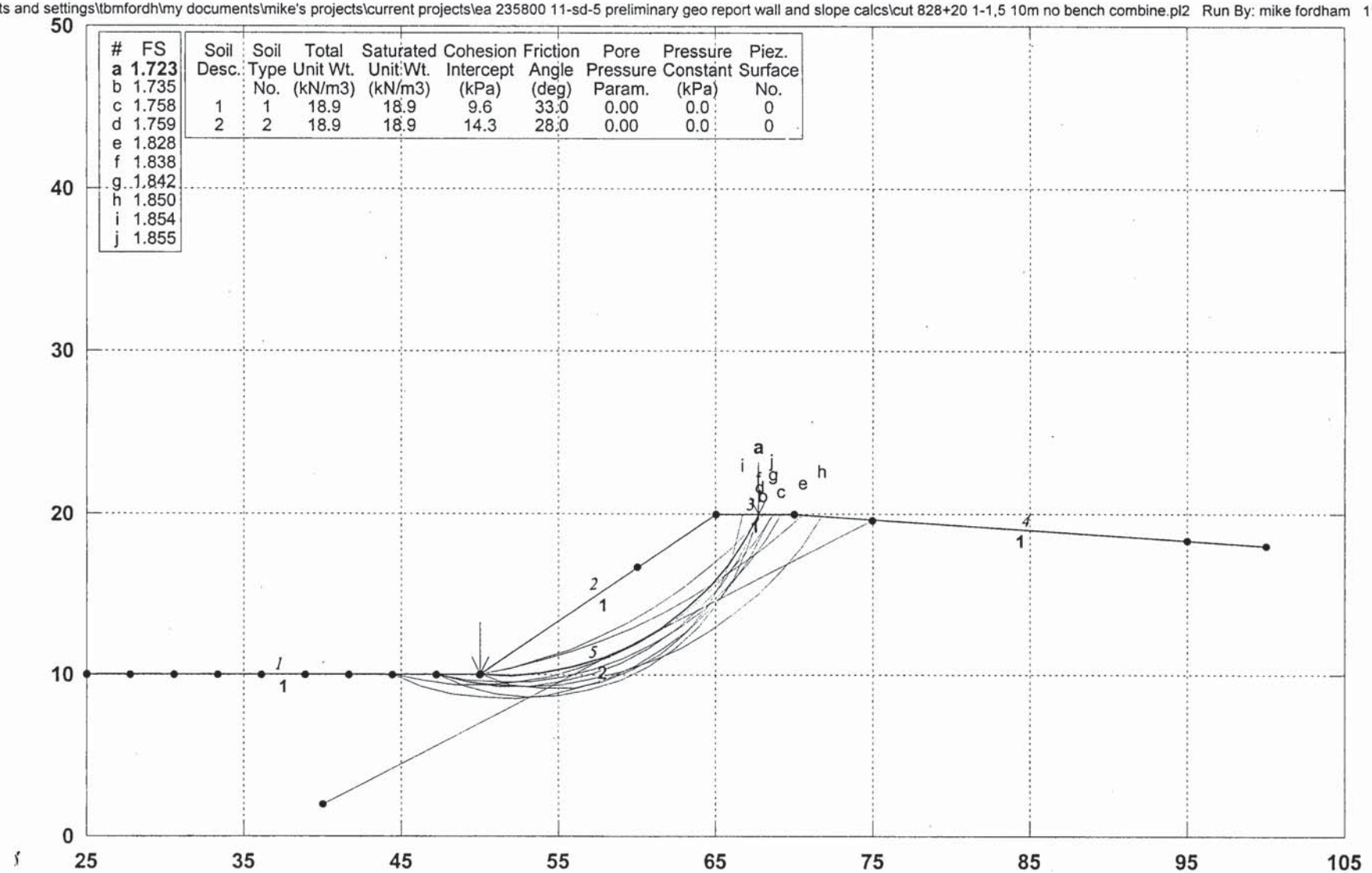
GSTABL7

I-5 Preliminary Geotechnical Report Cut Slope 828+00 (1:1.5) 10 m combine

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\cut 828+20 1-1,5 10m no bench combine.pl2 Run By: mike fordham 11/10/2004

#	FS
a	**1.723**
b	1.735
c	1.758
d	1.759
e	1.828
f	1.838
g	1.842
h	1.850
i	1.854
j	1.855

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	33.0	0.00	0.0	0
2	2	18.9	18.9	14.3	28.0	0.00	0.0	0



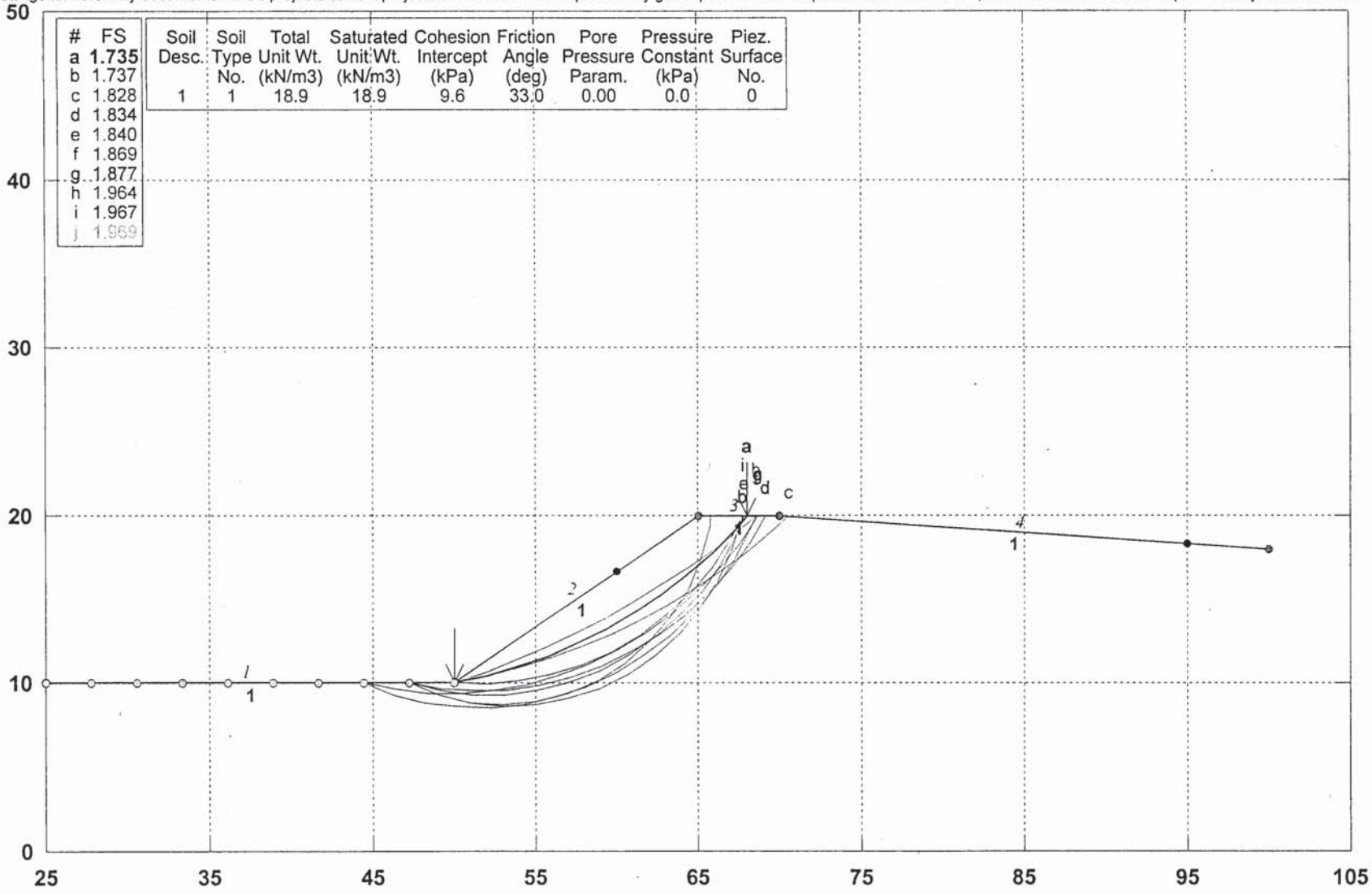
GSTABL7 v.2 FSmin=1.723

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

I-5 Preliminary Geotechnical Report Cut Slope 828+00 (1:1.5) 10 m sandstone

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\cut 828+20 1-1,5 10m no bench sandstone.pl2 Run By: mike fordham 11/10/2004



#	FS
a	1.735
b	1.737
c	1.828
d	1.834
e	1.840
f	1.869
g	1.877
h	1.964
i	1.967
j	1.969

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	33.0	0.00	0.0	0

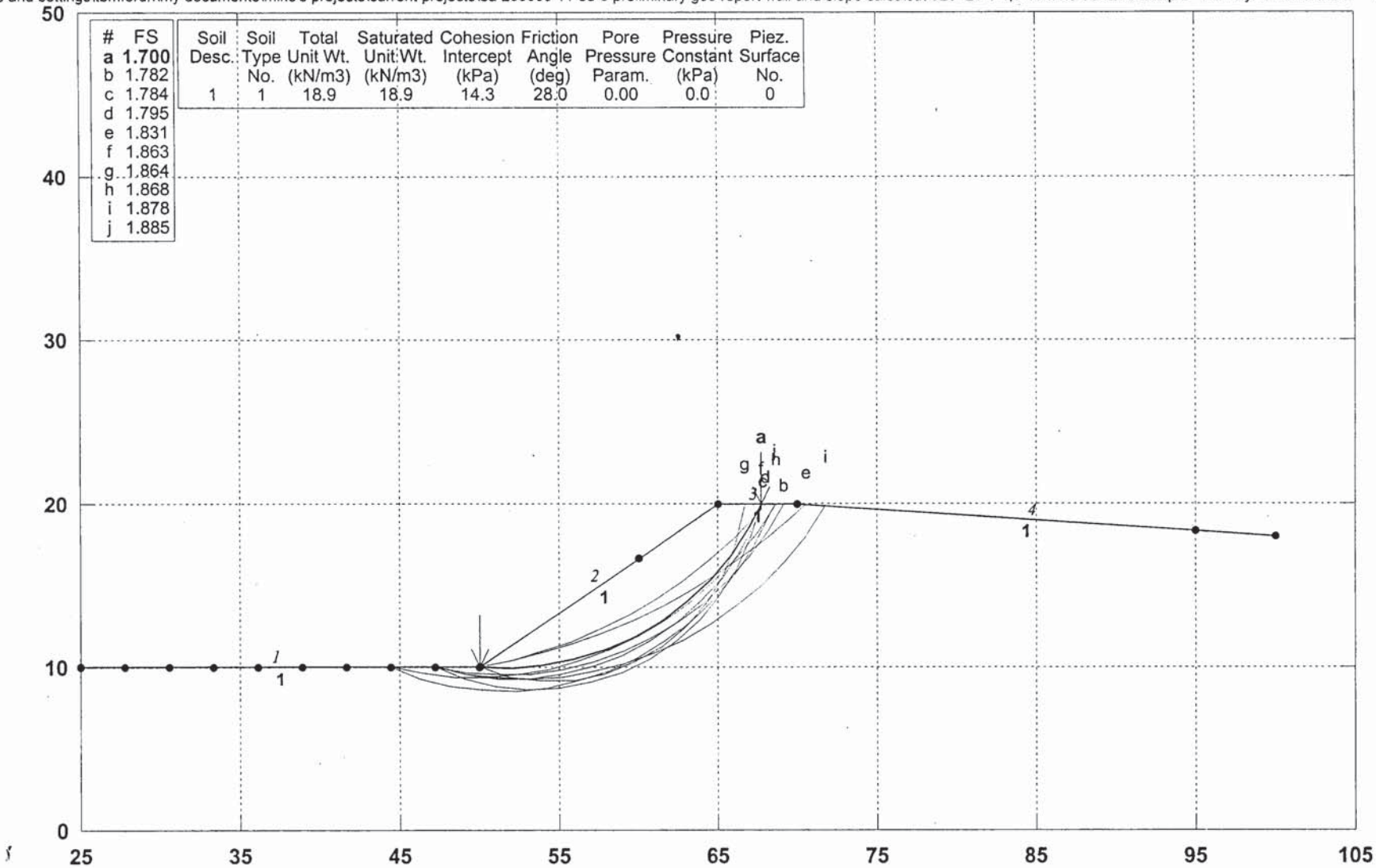
GSTABL7 v.2 FSmin=1.735

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

I-5 Preliminary Geotechnical Report Cut Slope 828+00 (1:1.5) 10 m shale

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\cut 828+20 1-1,5 10m no bench shale.pl2 Run By: mike fordham 11/10/2004 0



GSTABL7 v.2 FSmin=1.700

Safety Factors Are Calculated By The Modified Bishop Method

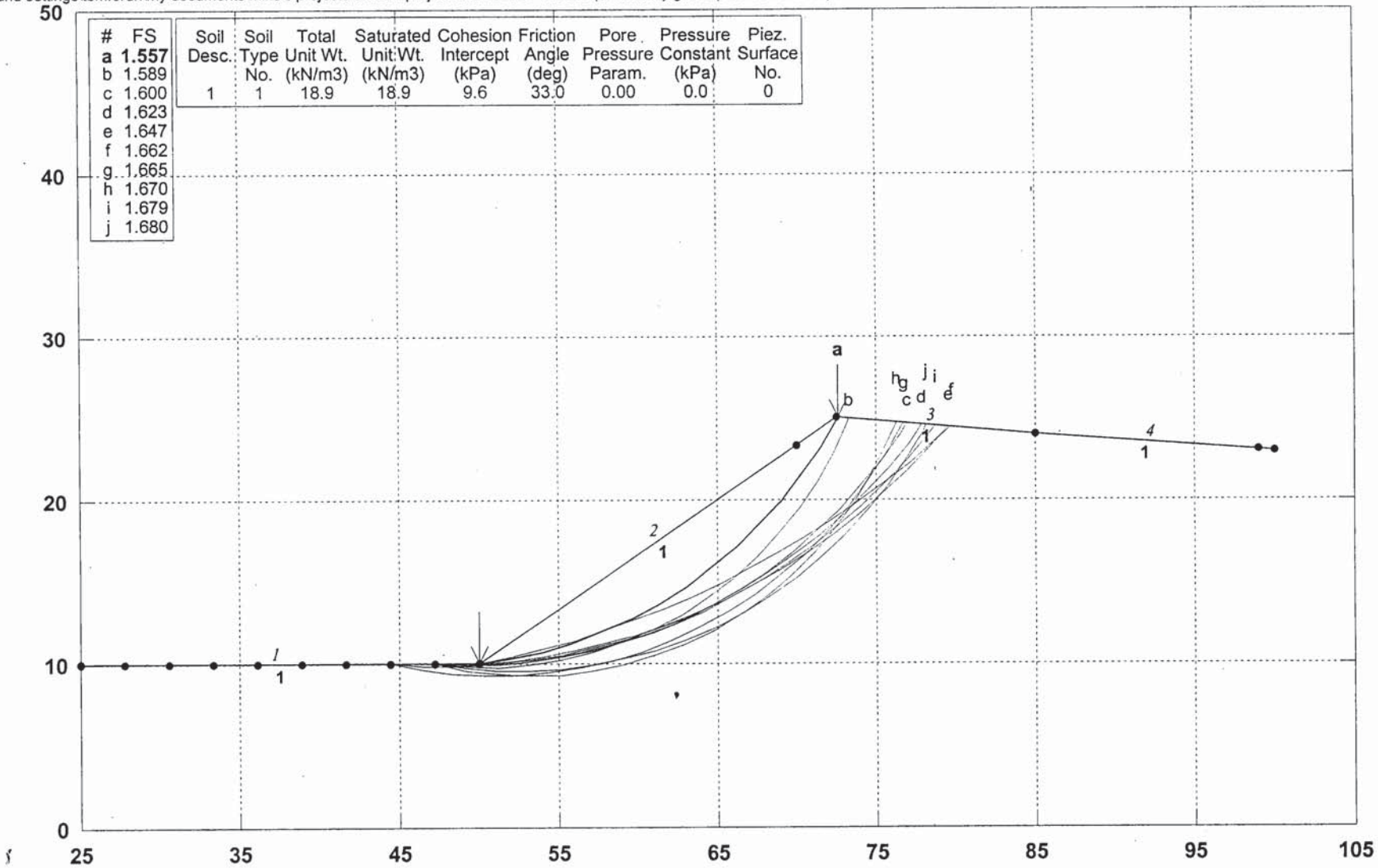
GSTABL7

I-5 Preliminary Geotechnical Report Cut Slope 828+00 (1:1.5) 15 m sandstone

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\cut 828+20 1-1,5 15m no bench sandstone.pl2 Run By: mike fordham 11/10/2004

#	FS
a	**1.557**
b	1.589
c	1.600
d	1.623
e	1.647
f	1.662
g	1.665
h	1.670
i	1.679
j	1.680

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	33.0	0.00	0.0	0



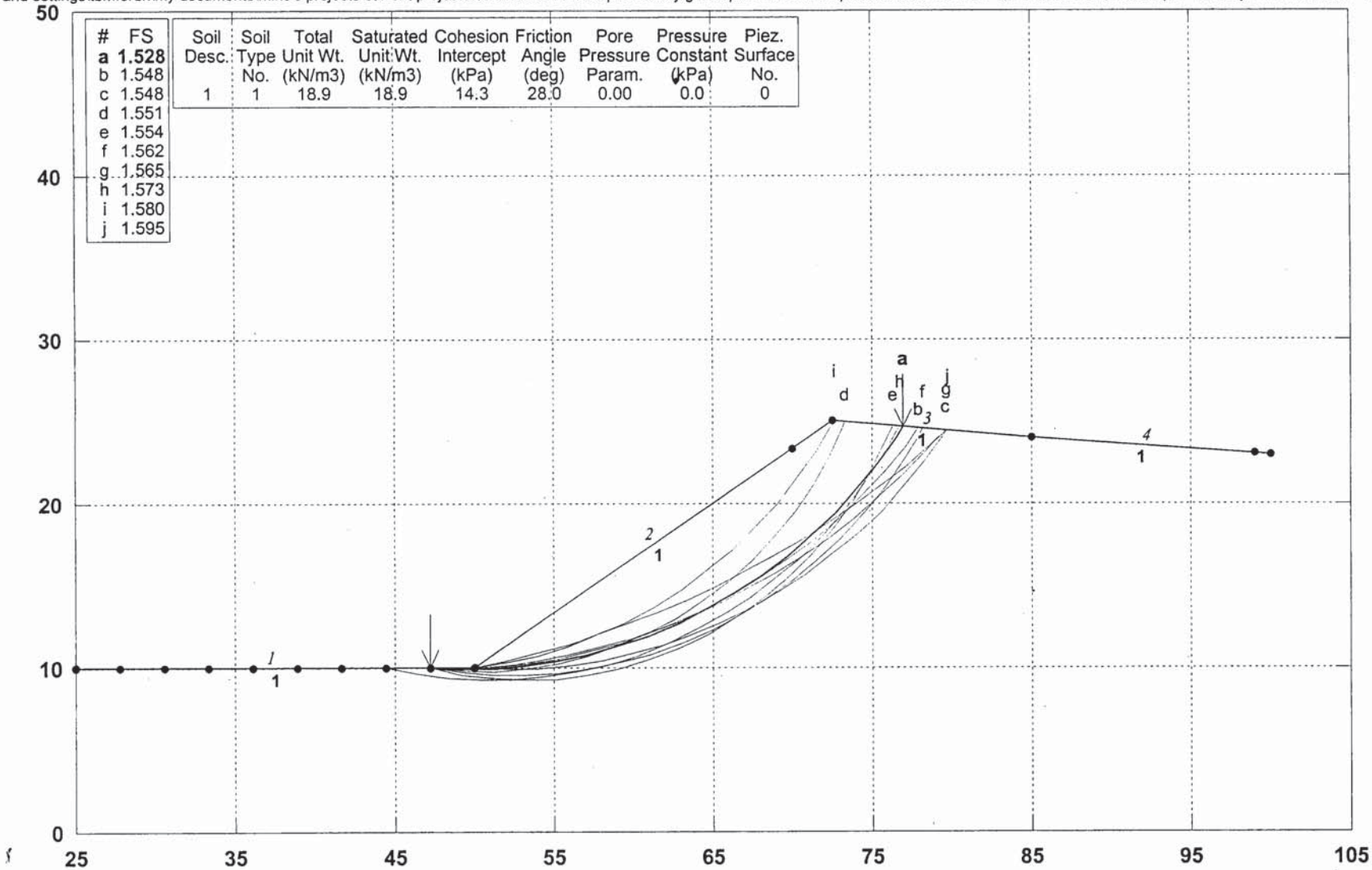
GSTABL7 v.2 FSmin=1.557

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

I-5 Preliminary Geotechnical Report Cut Slope 828+00 (1:1.5) 15 m shale

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\cut 828+20 1-1,5 15m no bench shale.pl2 Run By: mike fordham 11/10/2004 08



GSTABL7 v.2 FSmin=1.528

Safety Factors Are Calculated By The Modified Bishop Method

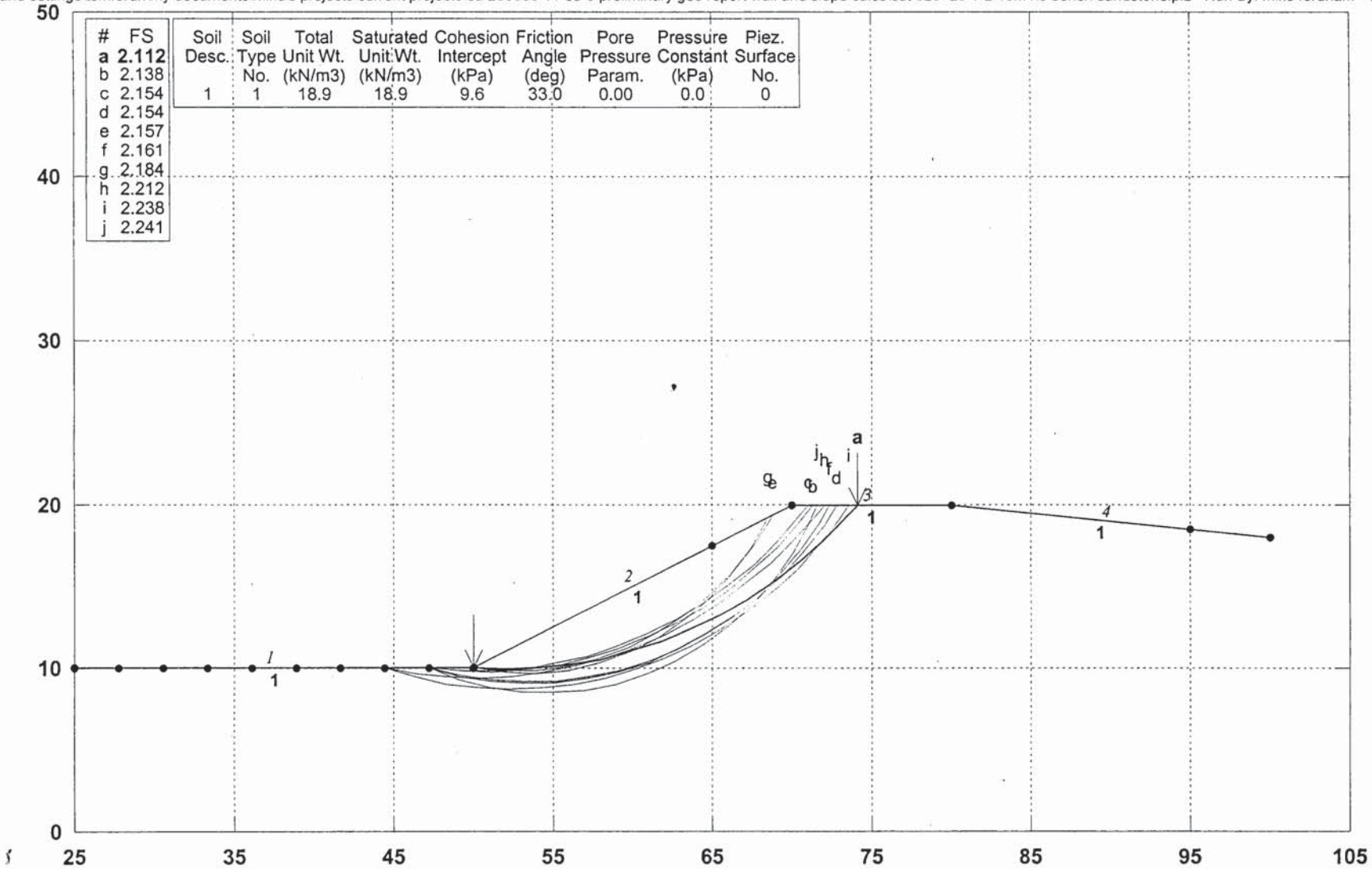
GSTABL7

I-5 Preliminary Geotechnical Report Cut Slope 828+00 (1:2) 10 m sandstone

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\cut 828+20 1-2 10m no bench sandstone.pl2 Run By: mike fordham 11/10/2004 0

#	FS
a	**2.112**
b	2.138
c	2.154
d	2.154
e	2.157
f	2.161
g	2.184
h	2.212
i	2.238
j	2.241

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	33.0	0.00	0.0	0



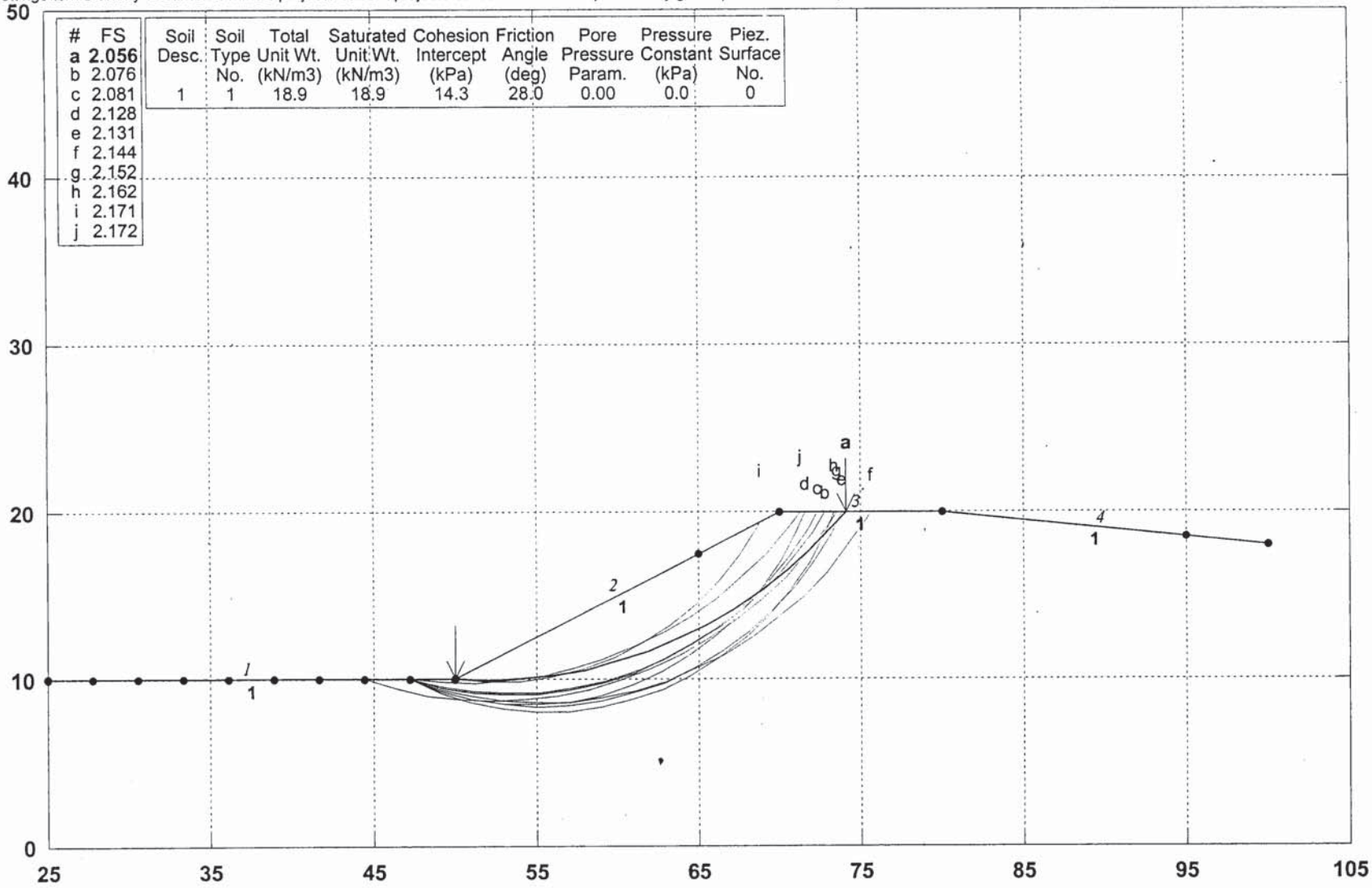
GSTABL7 v.2 FSmin=2.112

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

I-5 Preliminary Geotechnical Report Cut Slope 828+00 (1:2) 10 m shale

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\cut 828+20 1-2 10m no bench shale.pl2 Run By: mike fordham 11/10/2004 0



#	FS
a	2.056
b	2.076
c	2.081
d	2.128
e	2.131
f	2.144
g	2.152
h	2.162
i	2.171
j	2.172

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	14.3	28.0	0.00	0.0	0

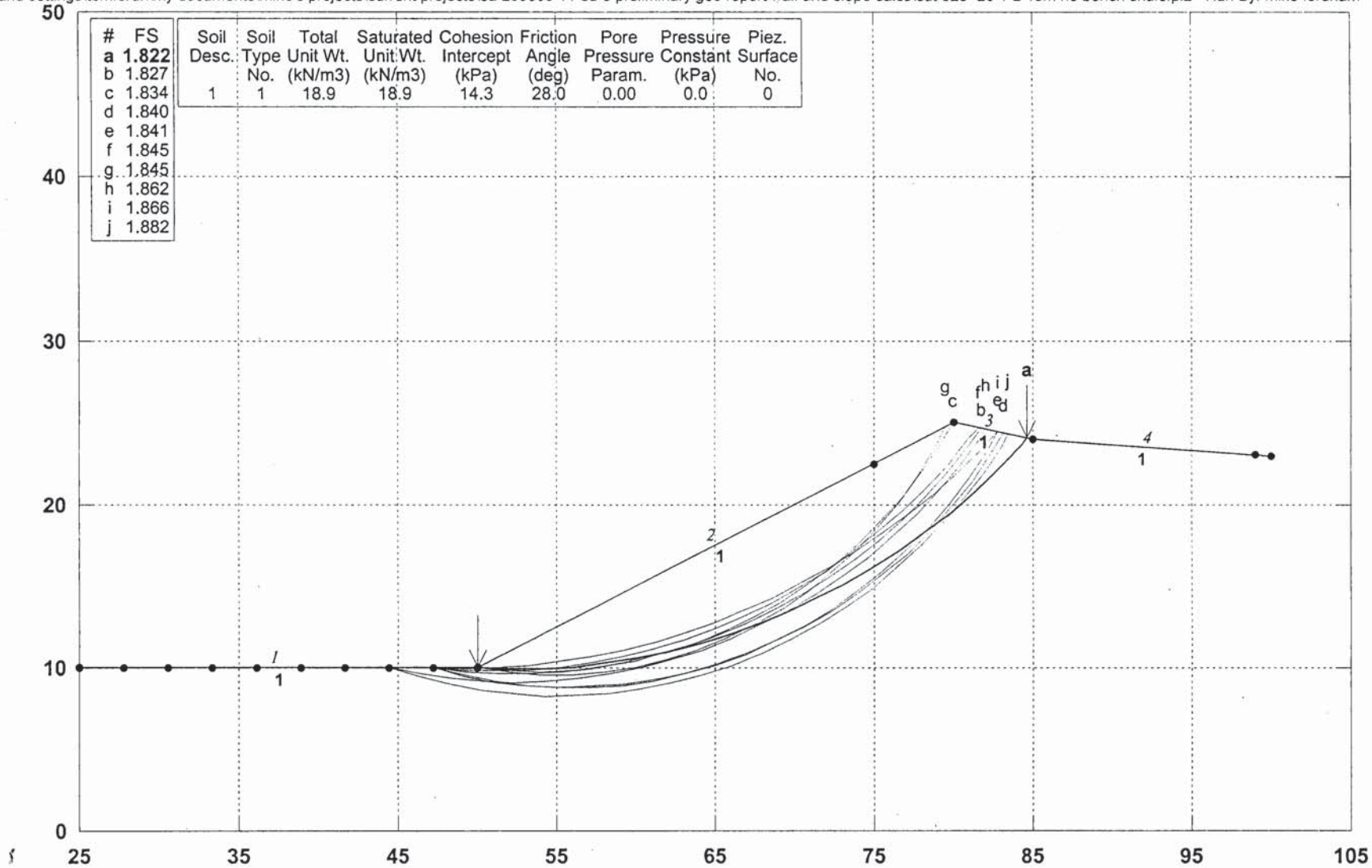
GSTABL7 v.2 FSmin=2.056

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

I-5 Preliminary Geotechnical Report Cut Slope 828+00 (1:2) 15 m shale

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\cut 828+20 1-2 15m no bench shale.pl2 Run By: mike fordham 11/10/2004



GSTABL7 v.2 FSmin=1.822

Safety Factors Are Calculated By The Modified Bishop Method

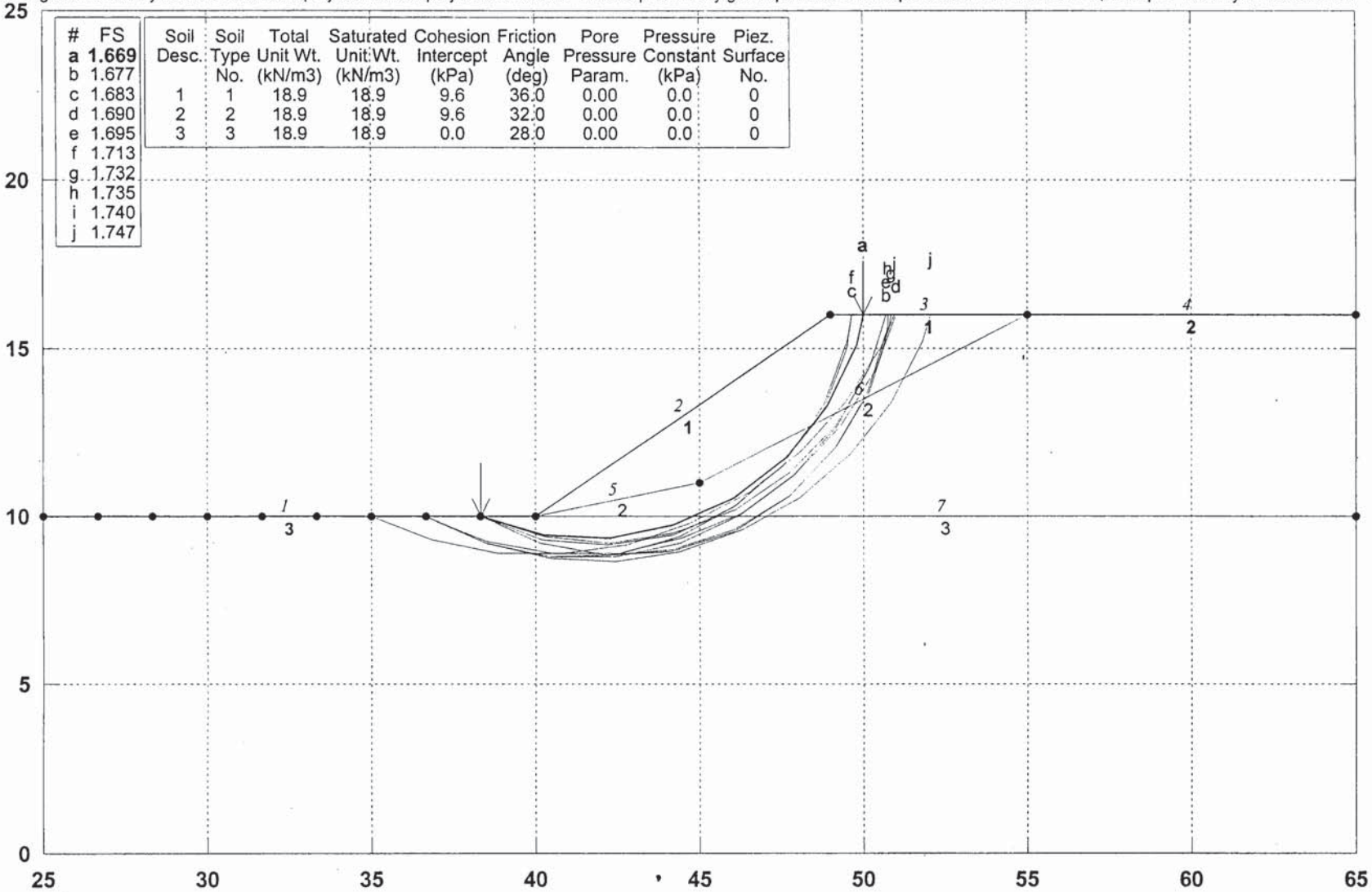
GSTABL7

I-5 Preliminary Geotechnical Report Fill Slope SD Lagoon 580+00 (1:1.5)6M C

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 580+00 1-1,5 6m.pl2 Run By: mike fordham 11/10/2004

#	FS
a	**1.669**
b	1.677
c	1.683
d	1.690
e	1.695
f	1.713
g	1.732
h	1.735
i	1.740
j	1.747

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	0
2	2	18.9	18.9	9.6	32.0	0.00	0.0	0
3	3	18.9	18.9	0.0	28.0	0.00	0.0	0



GSTABL7 v.2 FSmin=1.669

Safety Factors Are Calculated By The Modified Bishop Method

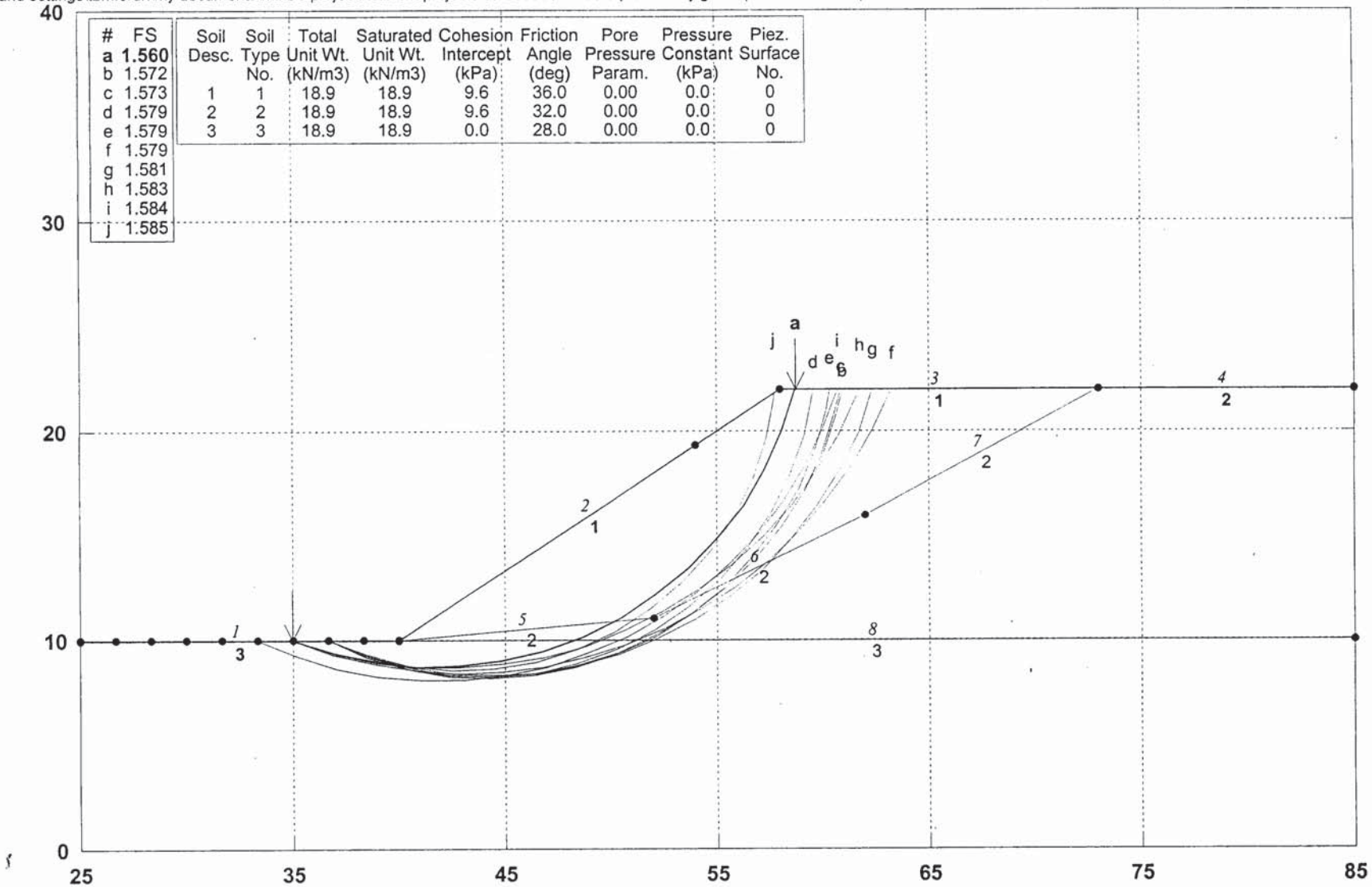
GSTABL7

I-5 Preliminary Geotechnical Report Fill Slope SD Lagoon(1:1.5)12M no benchC

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 580+00 1-1,5 12m no bench.pl2 Run By: mike fordham 11/10/2004 1

#	FS
a	**1.560**
b	1.572
c	1.573
d	1.579
e	1.579
f	1.579
g	1.581
h	1.583
i	1.584
j	1.585

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	0
2	2	18.9	18.9	9.6	32.0	0.00	0.0	0
3	3	18.9	18.9	0.0	28.0	0.00	0.0	0



GSTABL7 v.2 FSmin=1.560

Safety Factors Are Calculated By The Modified Bishop Method

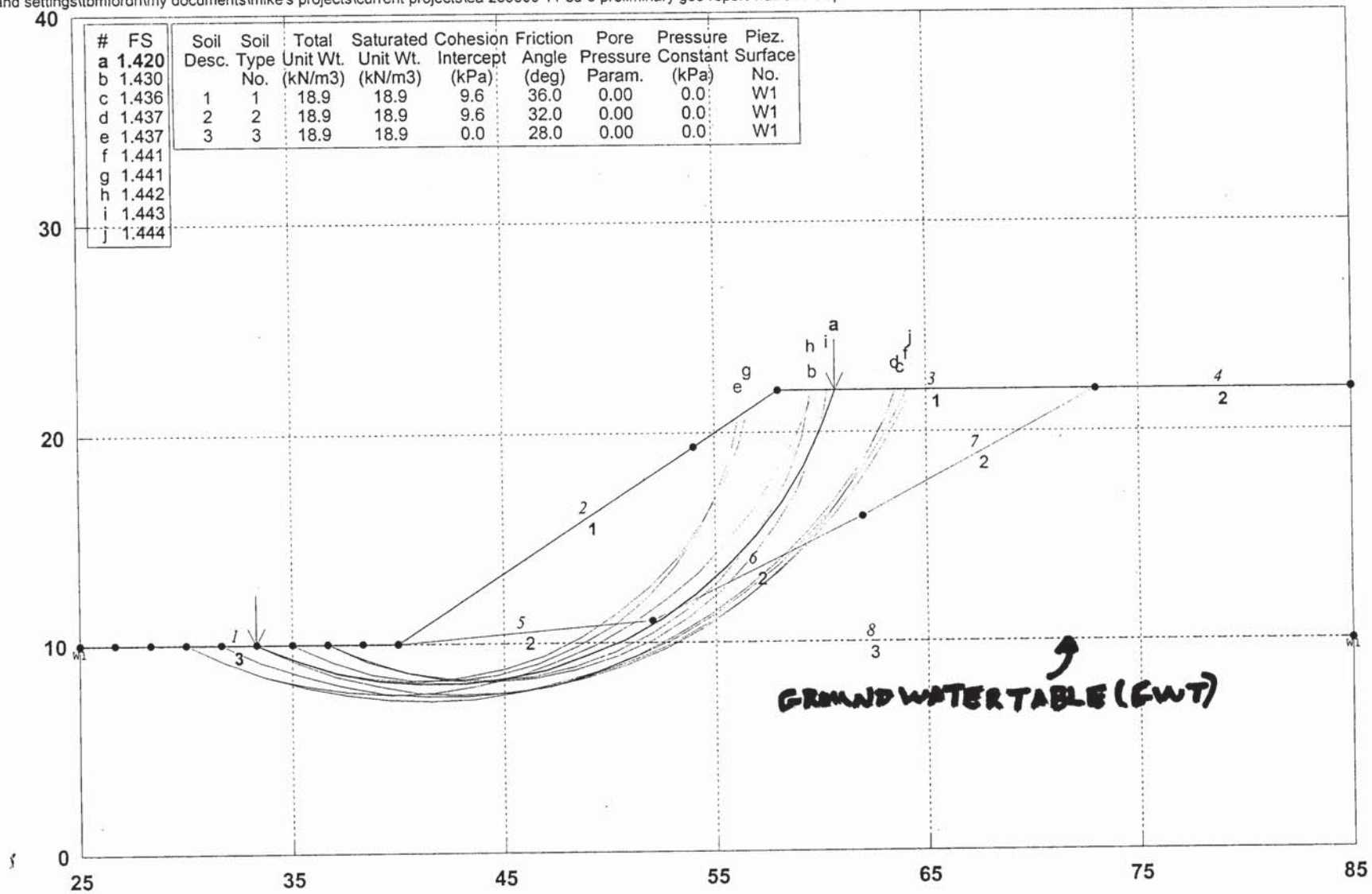
GSTABL7

I-5 Preliminary Geotechnical Report Fill Slope SD Lagoon(1:1.5)12M no benchC

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 580+00 1-1,5 12m no bench water.pl2 Run By: mike fordham 9/12/2005 11

#	FS
a	1.420
b	1.430
c	1.436
d	1.437
e	1.437
f	1.441
g	1.441
h	1.442
i	1.443
j	1.444

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	W1
2	2	18.9	18.9	9.6	32.0	0.00	0.0	W1
3	3	18.9	18.9	0.0	28.0	0.00	0.0	W1



GSTABL7 v.2 FSmin=1.420

Safety Factors Are Calculated By The Modified Bishop Method

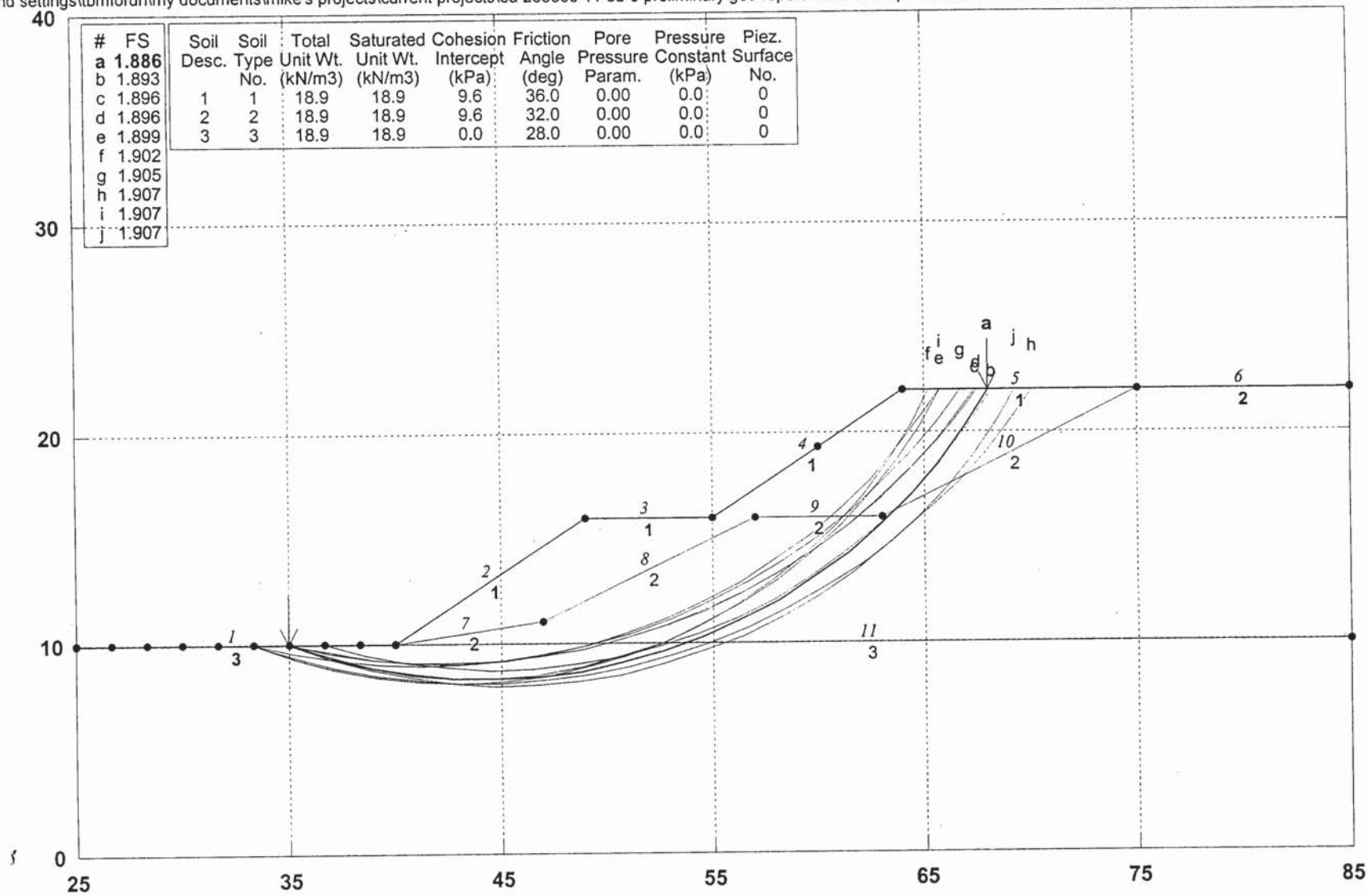
GSTABL7

I-5 Preliminary Geotechnical Report Fill Slope SD Lagoon (1:1.5)12M C

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 580+00 1-1,5 12m.pl2 Run By: mike fordham 11/10/2004 1

#	FS
a	1.886
b	1.893
c	1.896
d	1.896
e	1.899
f	1.902
g	1.905
h	1.907
i	1.907
j	1.907

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	0
2	2	18.9	18.9	9.6	32.0	0.00	0.0	0
3	3	18.9	18.9	0.0	28.0	0.00	0.0	0



GSTABL7 v.2 FSmin=1.886

Safety Factors Are Calculated By The Modified Bishop Method

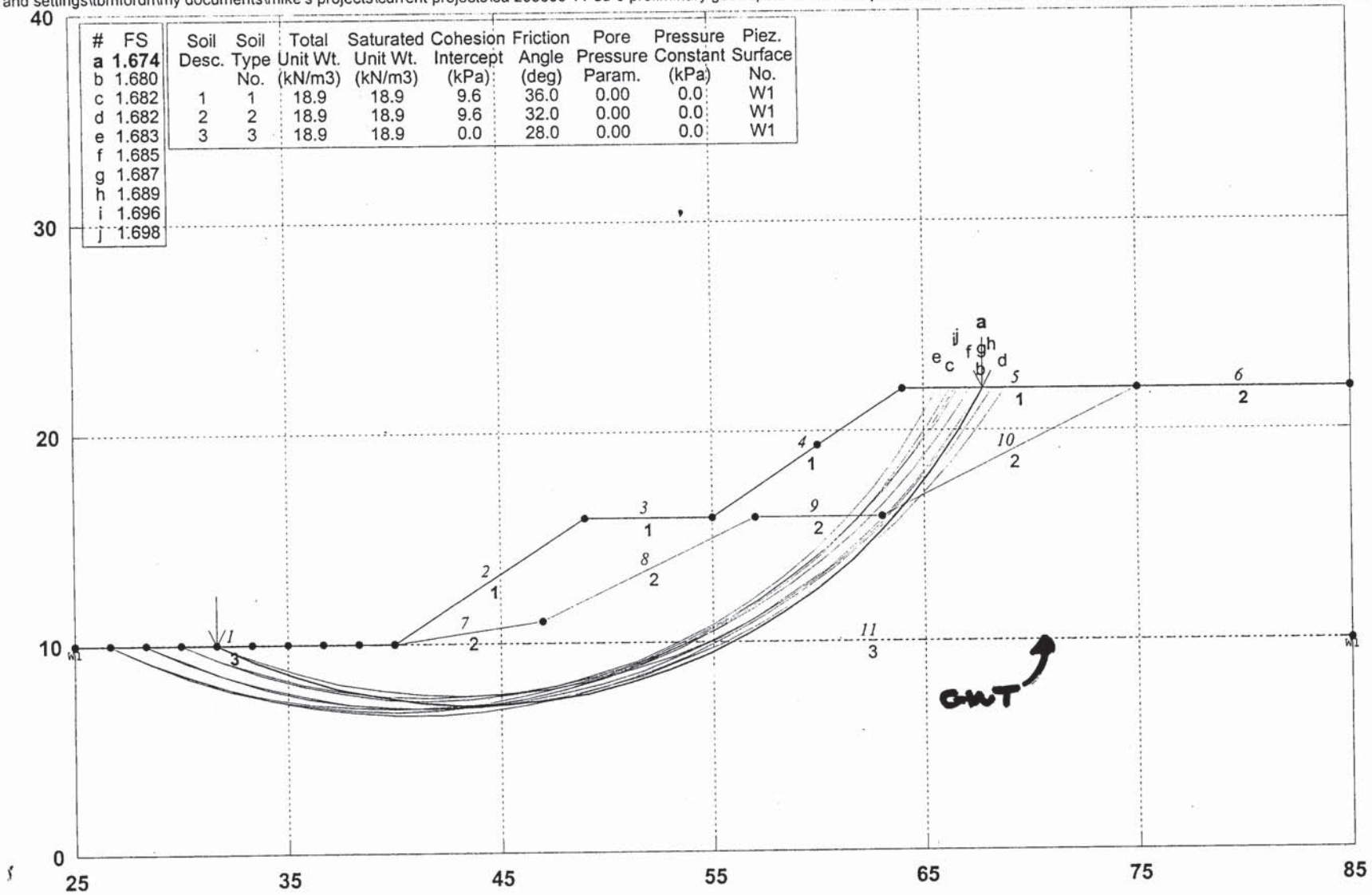
GSTABL7

I-5 Preliminary Geotechnical Report Fill Slope SD Lagoon (1:1.5)12M C

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 580+00 1-1,5 12m water.pl2 Run By: mike fordham 9/12/2005 11:5

#	FS
a	**1.674**
b	1.680
c	1.682
d	1.682
e	1.683
f	1.685
g	1.687
h	1.689
i	1.696
j	1.698

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	W1
2	2	18.9	18.9	9.6	32.0	0.00	0.0	W1
3	3	18.9	18.9	0.0	28.0	0.00	0.0	W1



GSTABL7 v.2 FSmin=1.674

Safety Factors Are Calculated By The Modified Bishop Method

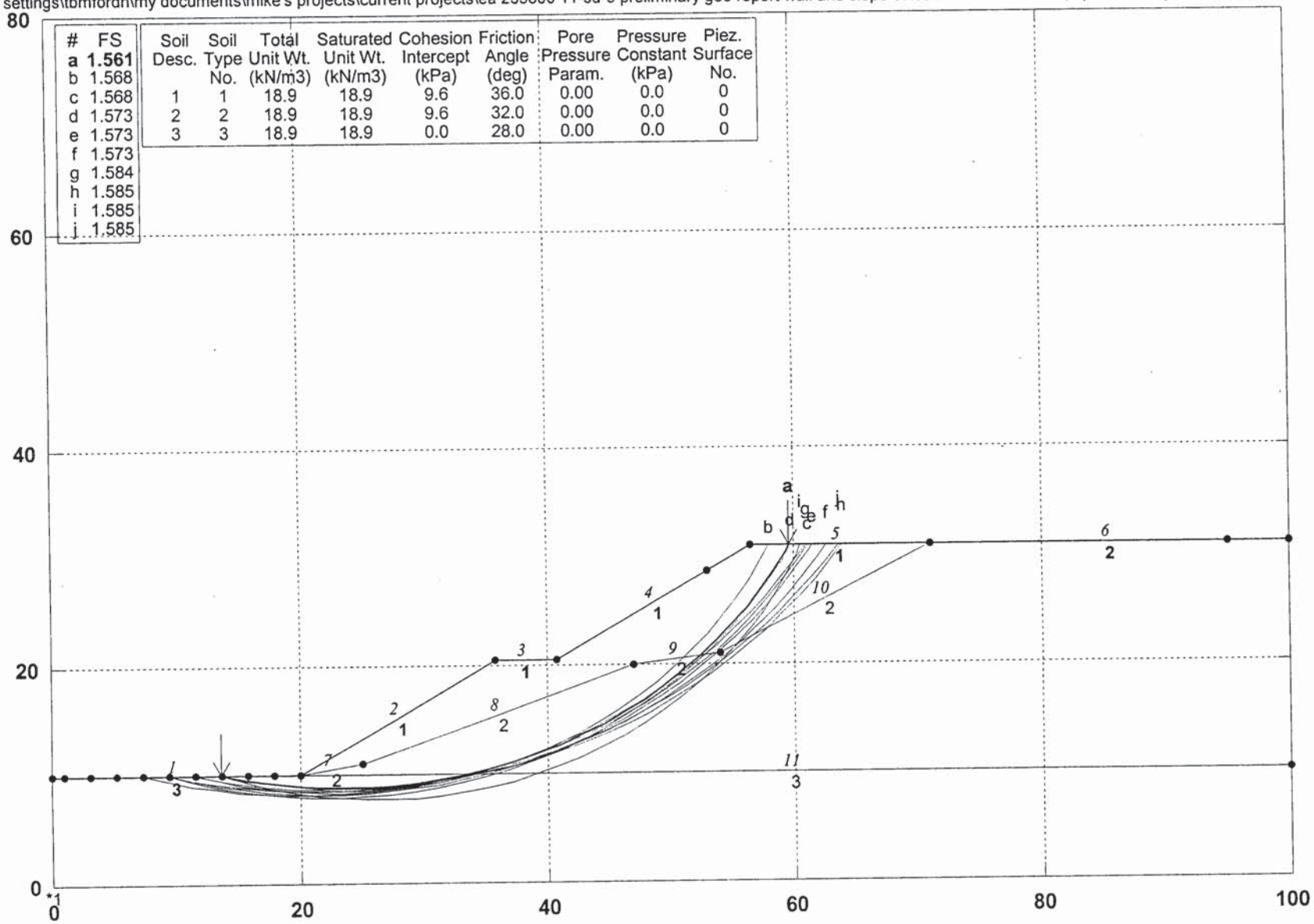
GSTABL7

I-5 Preliminary Geotechnical Report Fill Slope SD Lagoon 580+00 (1:1.5)20M C

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 580+00 1-1,5.pl2 Run By: mike fordham 11/10/2004 01

#	FS
a	**1.561**
b	1.568
c	1.568
d	1.573
e	1.573
f	1.573
g	1.584
h	1.585
i	1.585
j	1.585

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	0
2	2	18.9	18.9	9.6	32.0	0.00	0.0	0
3	3	18.9	18.9	0.0	28.0	0.00	0.0	0



GSTABL7 v.2 FSmin=1.561

Safety Factors Are Calculated By The Modified Bishop Method

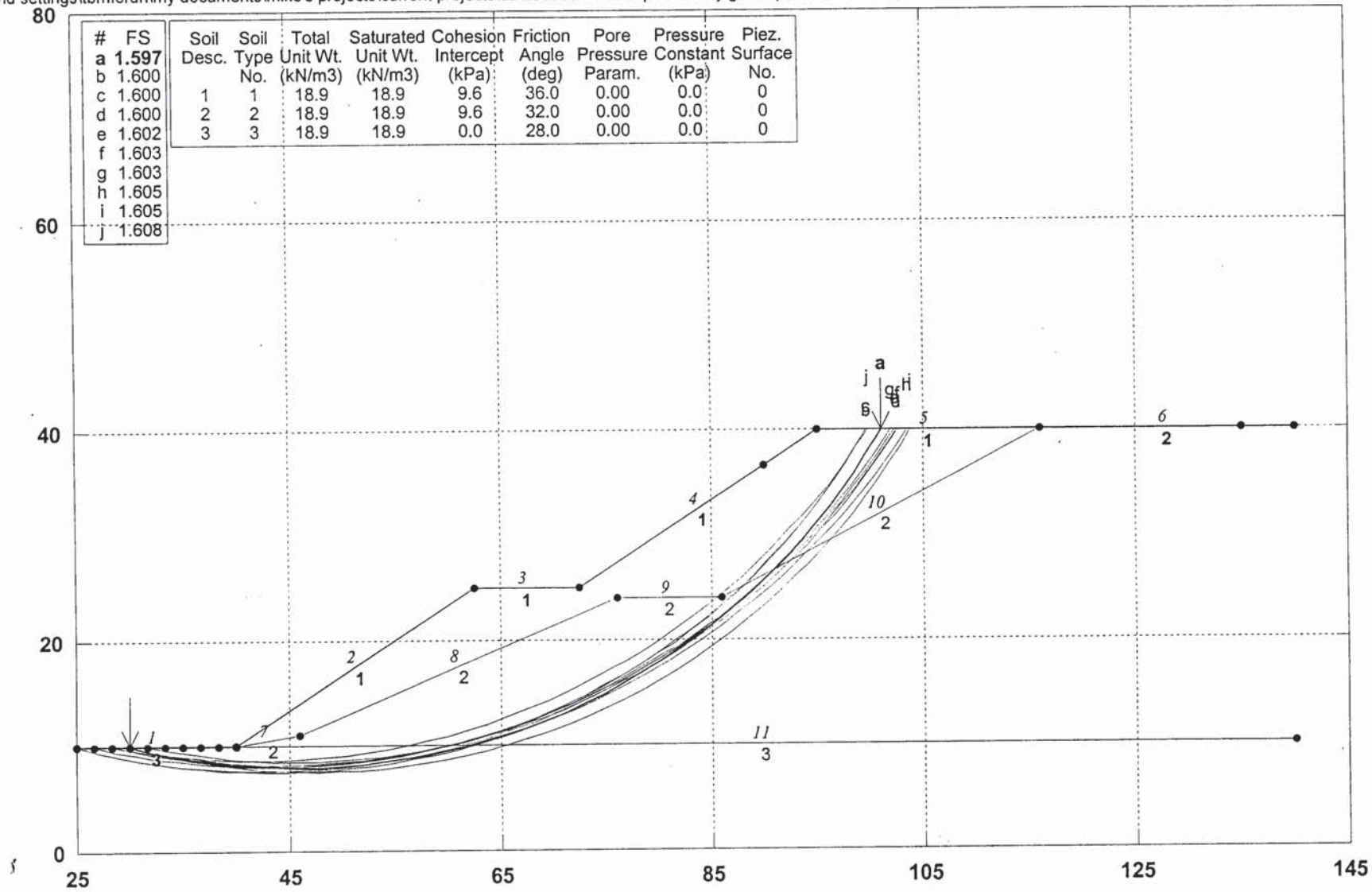
GSTABL7

I-5 Preliminary Geotechnical Report Fill Slope SD Lagoon (1:1.5)30M C

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 580+00 1-1,5 30m.pl2 Run By: mike fordham 11/10/2004 1

#	FS
a	**1.597**
b	1.600
c	1.600
d	1.600
e	1.602
f	1.603
g	1.603
h	1.605
i	1.605
j	1.608

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	0
2	2	18.9	18.9	9.6	32.0	0.00	0.0	0
3	3	18.9	18.9	0.0	28.0	0.00	0.0	0



GSTABL7 v.2 FSmin=1.597

Safety Factors Are Calculated By The Modified Bishop Method

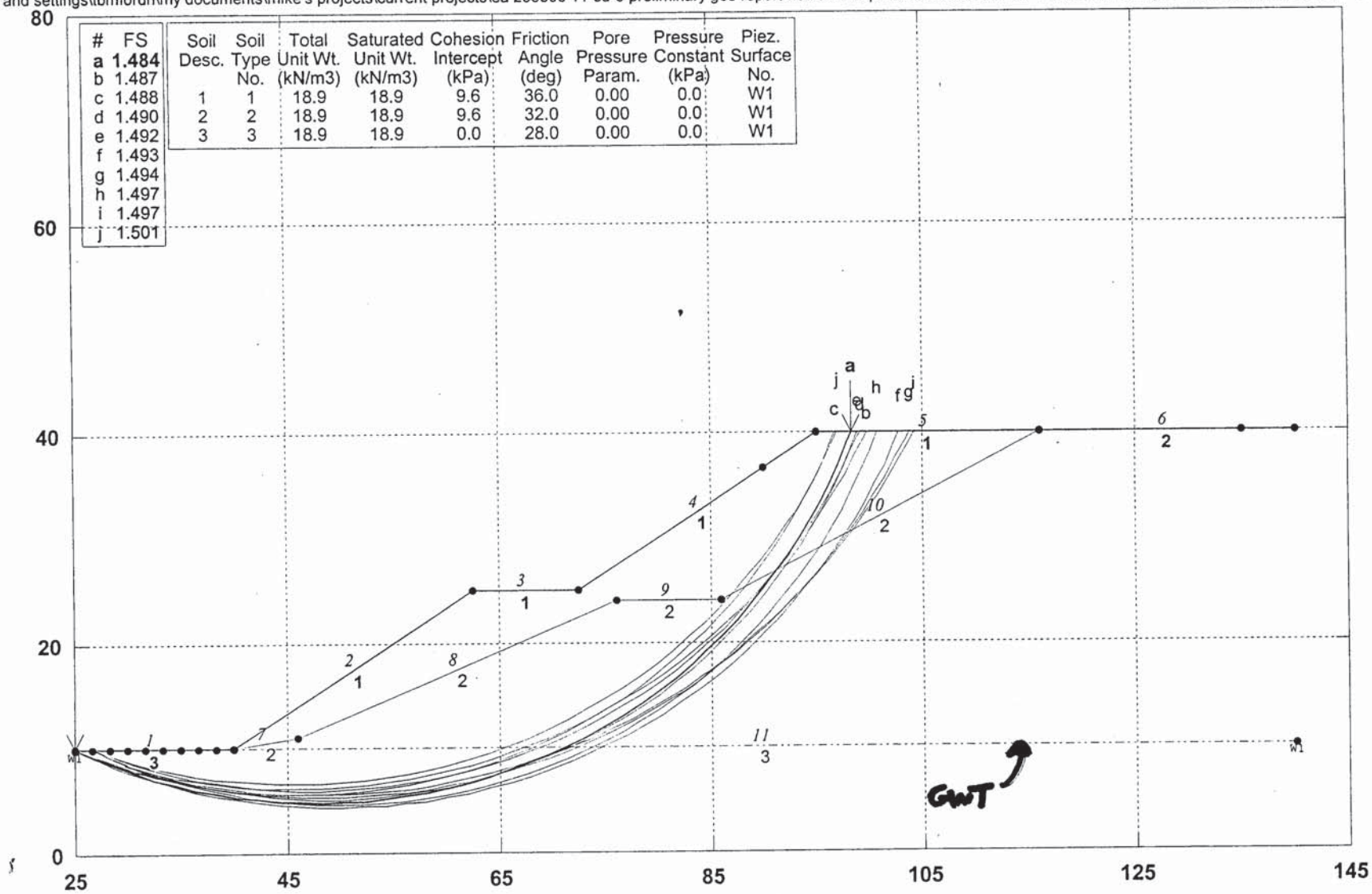
GSTABL7

I-5 Preliminary Geotechnical Report Fill Slope SD Lagoon (1:1.5)30M C

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 580+00 1-1,5 30m water.pl2 Run By: mike fordham 9/12/2005 11:5

#	FS
a	**1.484**
b	1.487
c	1.488
d	1.490
e	1.492
f	1.493
g	1.494
h	1.497
i	1.497
j	1.501

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	W1
2	2	18.9	18.9	9.6	32.0	0.00	0.0	W1
3	3	18.9	18.9	0.0	28.0	0.00	0.0	W1



GSTABL7 v.2 FSmin=1.484

Safety Factors Are Calculated By The Modified Bishop Method

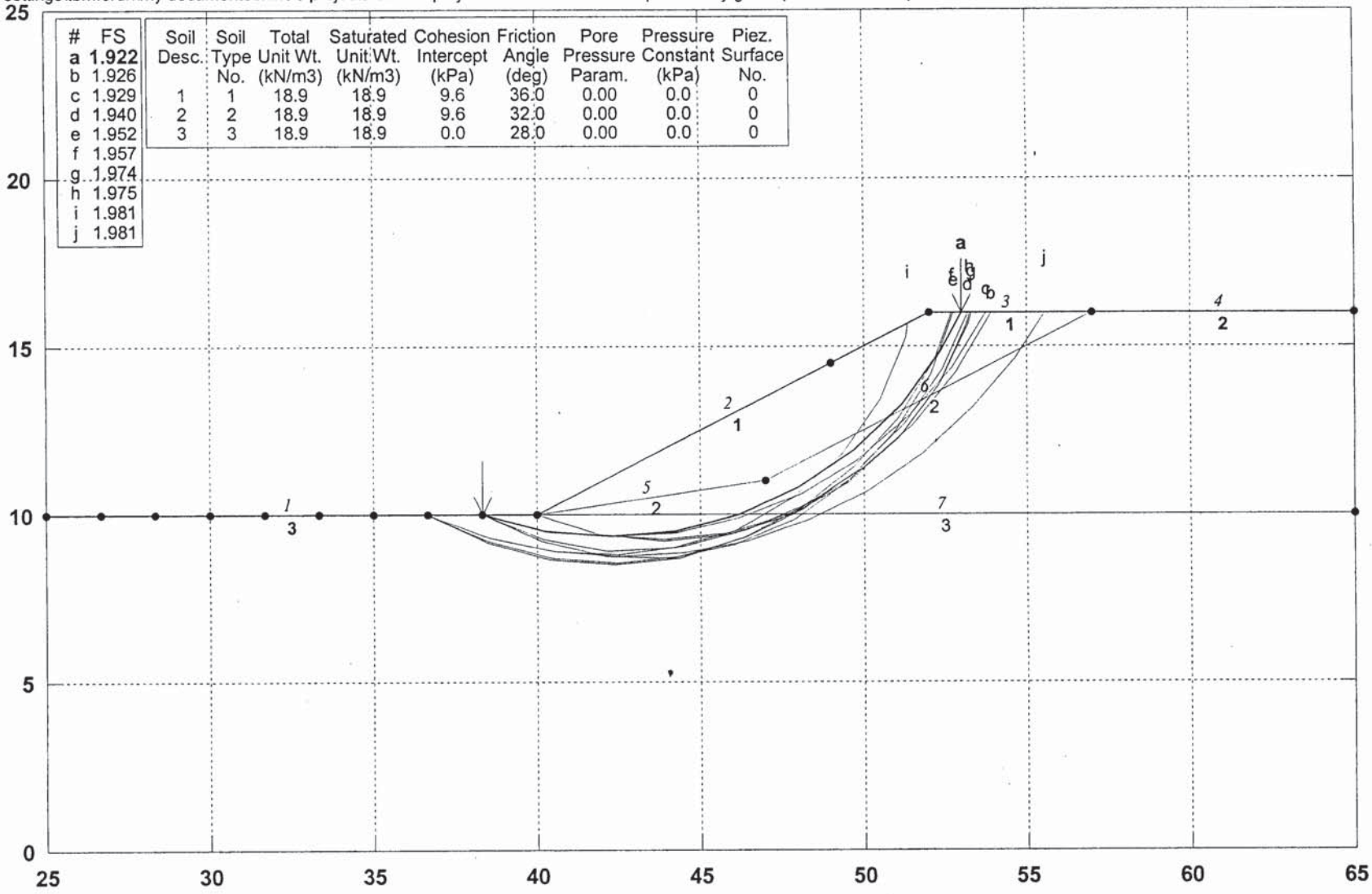
GSTABL7

I-5 Preliminary Geotechnical Report Fill Slope SD Lagoon 580+00 (1:2)6M C

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 580+00 1-2 6m.pl2 Run By: mike fordham 11/10/2004 12

#	FS
a	**1.922**
b	1.926
c	1.929
d	1.940
e	1.952
f	1.957
g	1.974
h	1.975
i	1.981
j	1.981

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	0
2	2	18.9	18.9	9.6	32.0	0.00	0.0	0
3	3	18.9	18.9	0.0	28.0	0.00	0.0	0



GSTABL7 v.2 FSmin=1.922

Safety Factors Are Calculated By The Modified Bishop Method

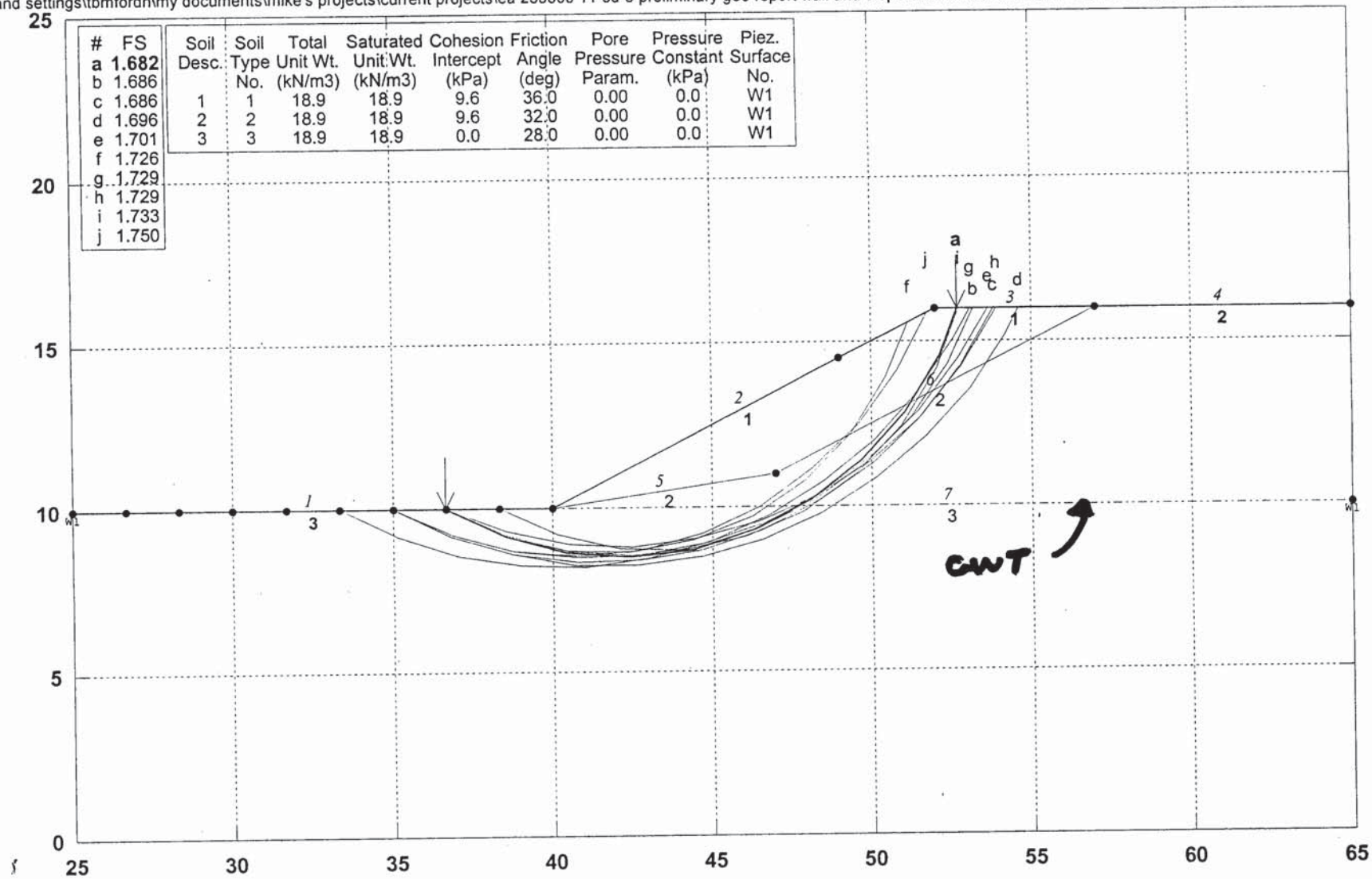
GSTABL7

I-5 Preliminary Geotechnical Report Fill Slope SD Lagoon 580+00 (1:2)6M C

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 580+00 1-2 6m water.pl2 Run By: mike fordham 9/12/2005 12

#	FS
a	**1.682**
b	1.686
c	1.686
d	1.696
e	1.701
f	1.726
g	1.729
h	1.729
i	1.733
j	1.750

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	W1
2	2	18.9	18.9	9.6	32.0	0.00	0.0	W1
3	3	18.9	18.9	0.0	28.0	0.00	0.0	W1



GSTABL7 v.2 FSmin=1.682

Safety Factors Are Calculated By The Modified Bishop Method

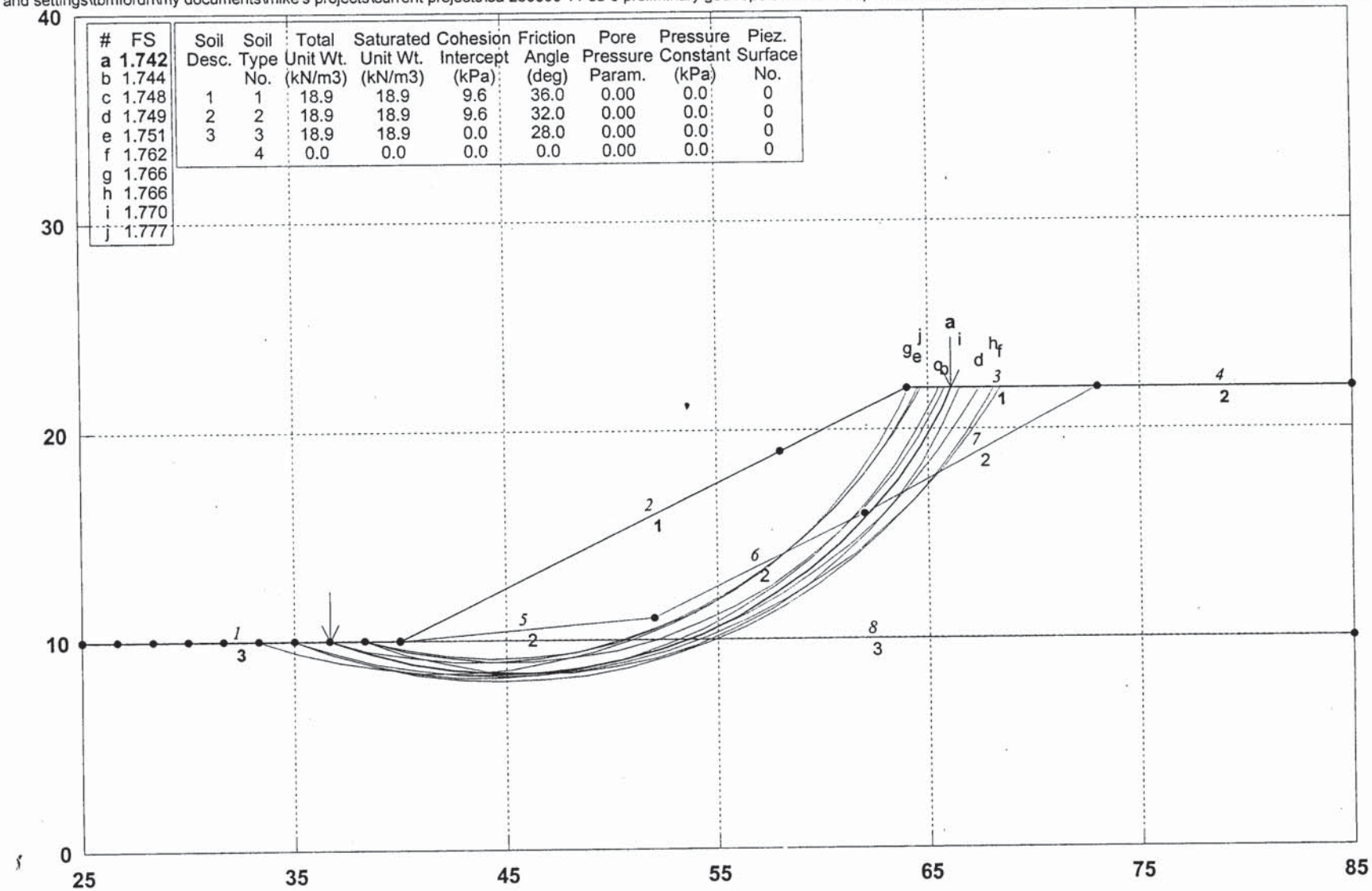
GSTABL7

I-5 Preliminary Geotechnical Report Fill Slope SD Lagoon (1:2)12M no bench C

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 580+00 1-2 12m no bench.pl2 Run By: mike fordham 11/10/2004 11:

#	FS
a	**1.742**
b	1.744
c	1.748
d	1.749
e	1.751
f	1.762
g	1.766
h	1.766
i	1.770
j	1.777

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	0
2	2	18.9	18.9	9.6	32.0	0.00	0.0	0
3	3	18.9	18.9	0.0	28.0	0.00	0.0	0
	4	0.0	0.0	0.0	0.0	0.00	0.0	0



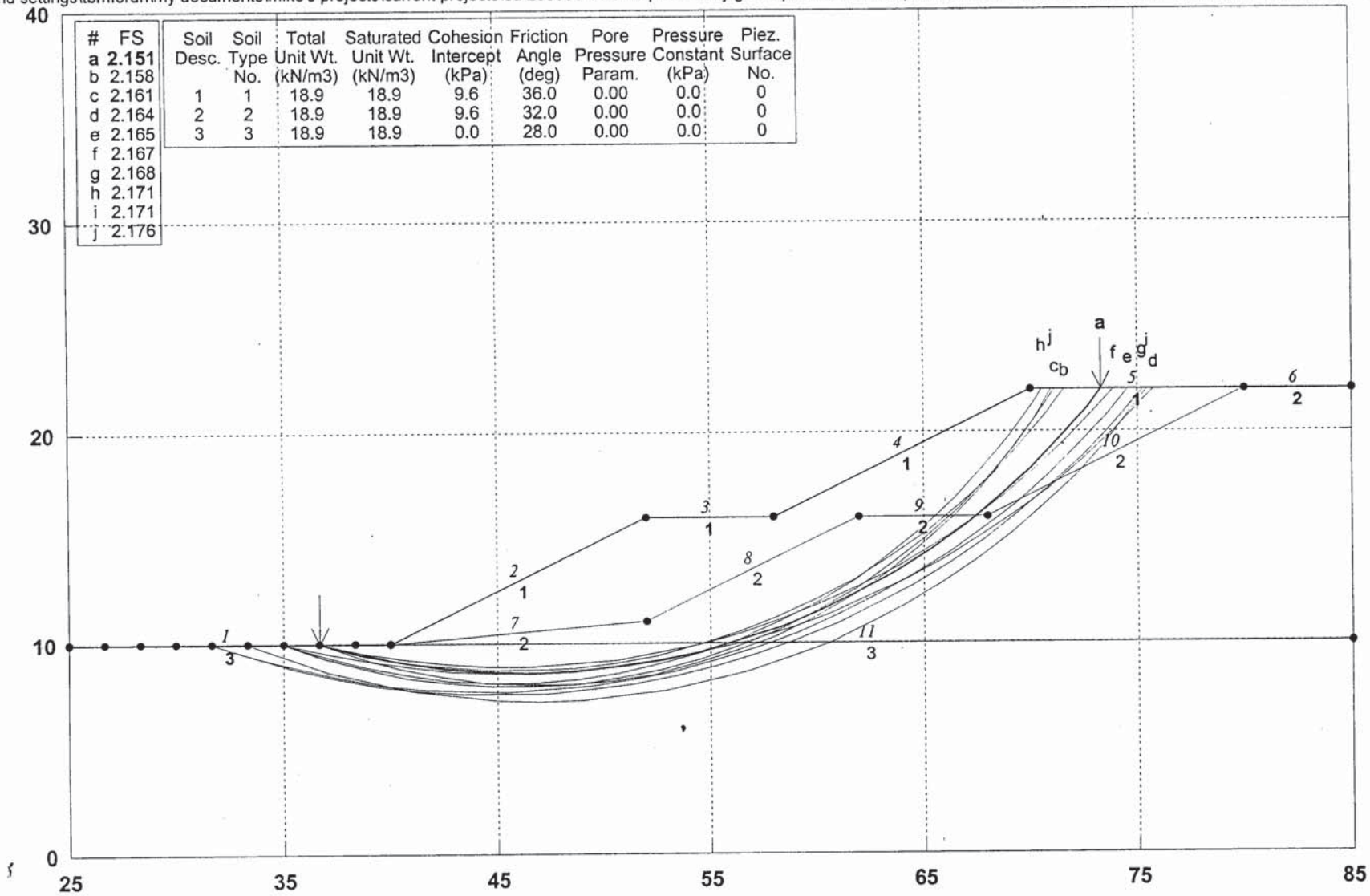
GSTABL7 v.2 FSmin=1.742

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

I-5 Preliminary Geotechnical Report Fill Slope SD Lagoon (1:2)12M C

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 580+00 1-2 12m.pl2 Run By: mike fordham 11/10/2004 11



#	FS
a	2.151
b	2.158
c	2.161
d	2.164
e	2.165
f	2.167
g	2.168
h	2.171
i	2.171
j	2.176

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	0
2	2	18.9	18.9	9.6	32.0	0.00	0.0	0
3	3	18.9	18.9	0.0	28.0	0.00	0.0	0

GSTABL7 v.2 FSmin=2.151

Safety Factors Are Calculated By The Modified Bishop Method

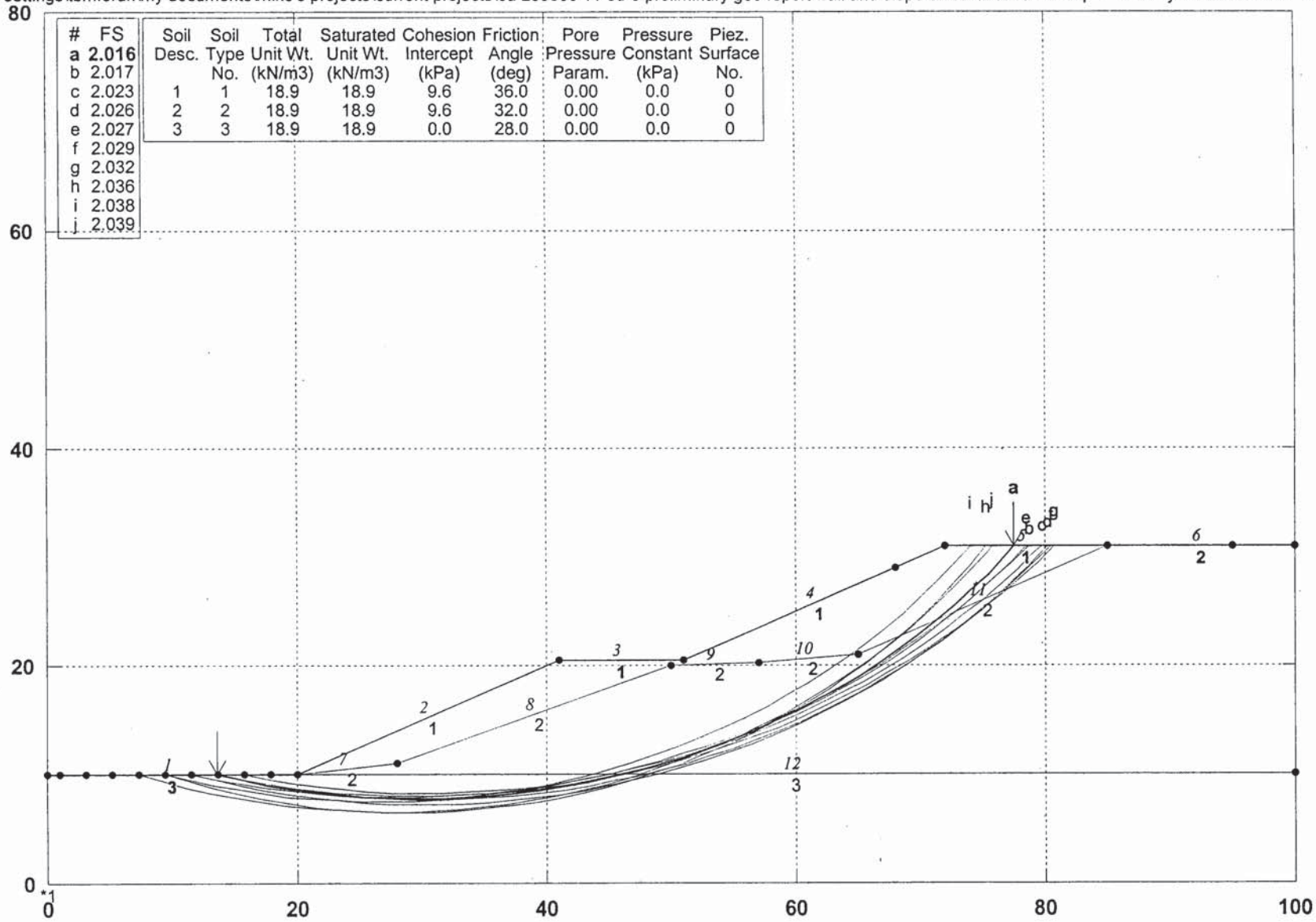
GSTABL7

I-5 Preliminary Geotechnical Report Fill Slope SD Lagoon 580+00 (1:2)20M C

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 580+00.pl2 Run By: mike fordham 11/10/2004 0

#	FS
a	**2.016**
b	2.017
c	2.023
d	2.026
e	2.027
f	2.029
g	2.032
h	2.036
i	2.038
j	2.039

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	0
2	2	18.9	18.9	9.6	32.0	0.00	0.0	0
3	3	18.9	18.9	0.0	28.0	0.00	0.0	0



GSTABL7 v.2 FSmin=2.016

Safety Factors Are Calculated By The Modified Bishop Method

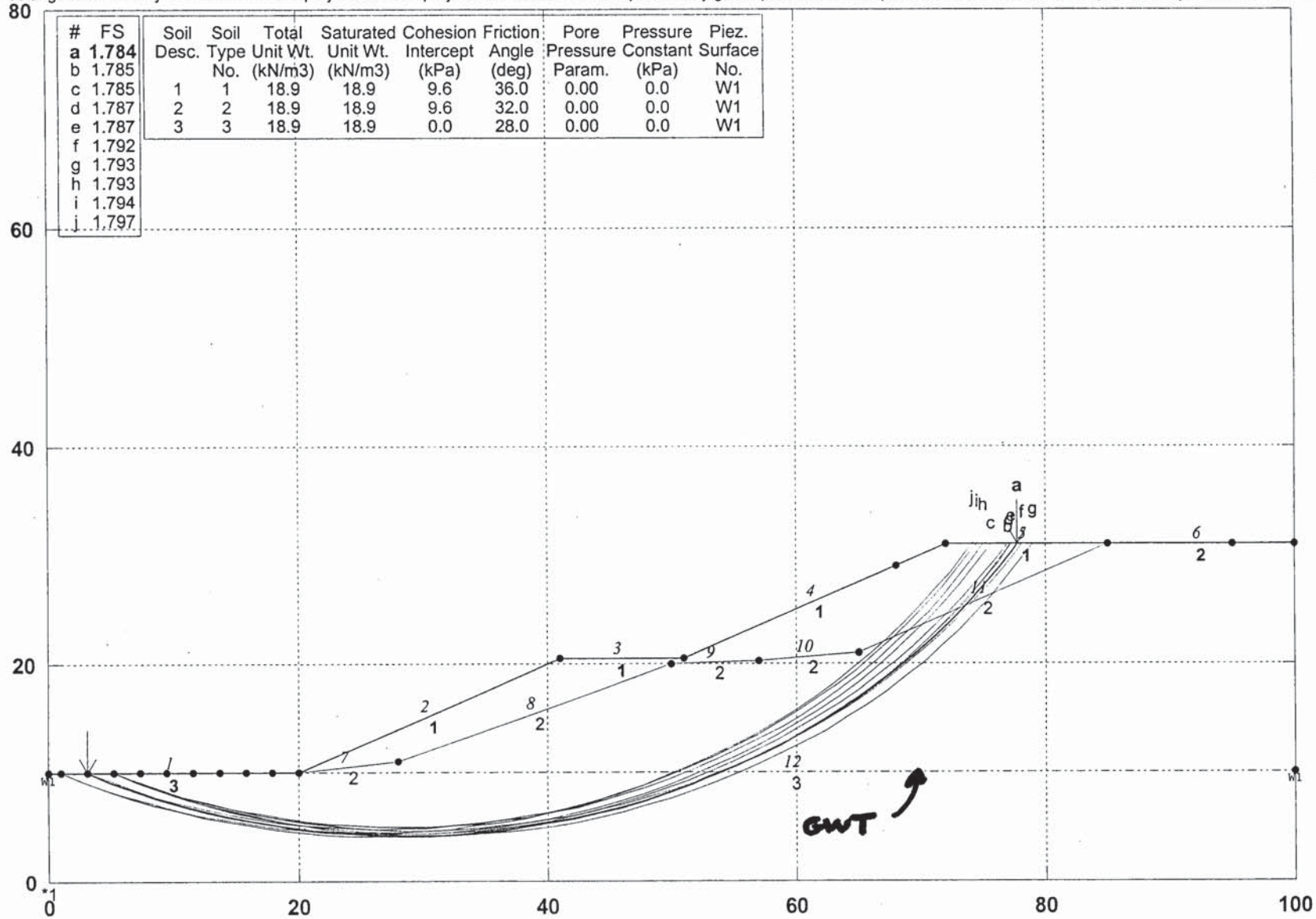
GSTABL7

I-5 Preliminary Geotechnical Report Fill Slope SD Lagoon 580+00 (1:2)20M C

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 580+00 water.pl2 Run By: mike fordham 9/12/2005 12

#	FS
a	**1.784**
b	1.785
c	1.785
d	1.787
e	1.787
f	1.792
g	1.793
h	1.793
i	1.794
j	1.797

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	W1
2	2	18.9	18.9	9.6	32.0	0.00	0.0	W1
3	3	18.9	18.9	0.0	28.0	0.00	0.0	W1



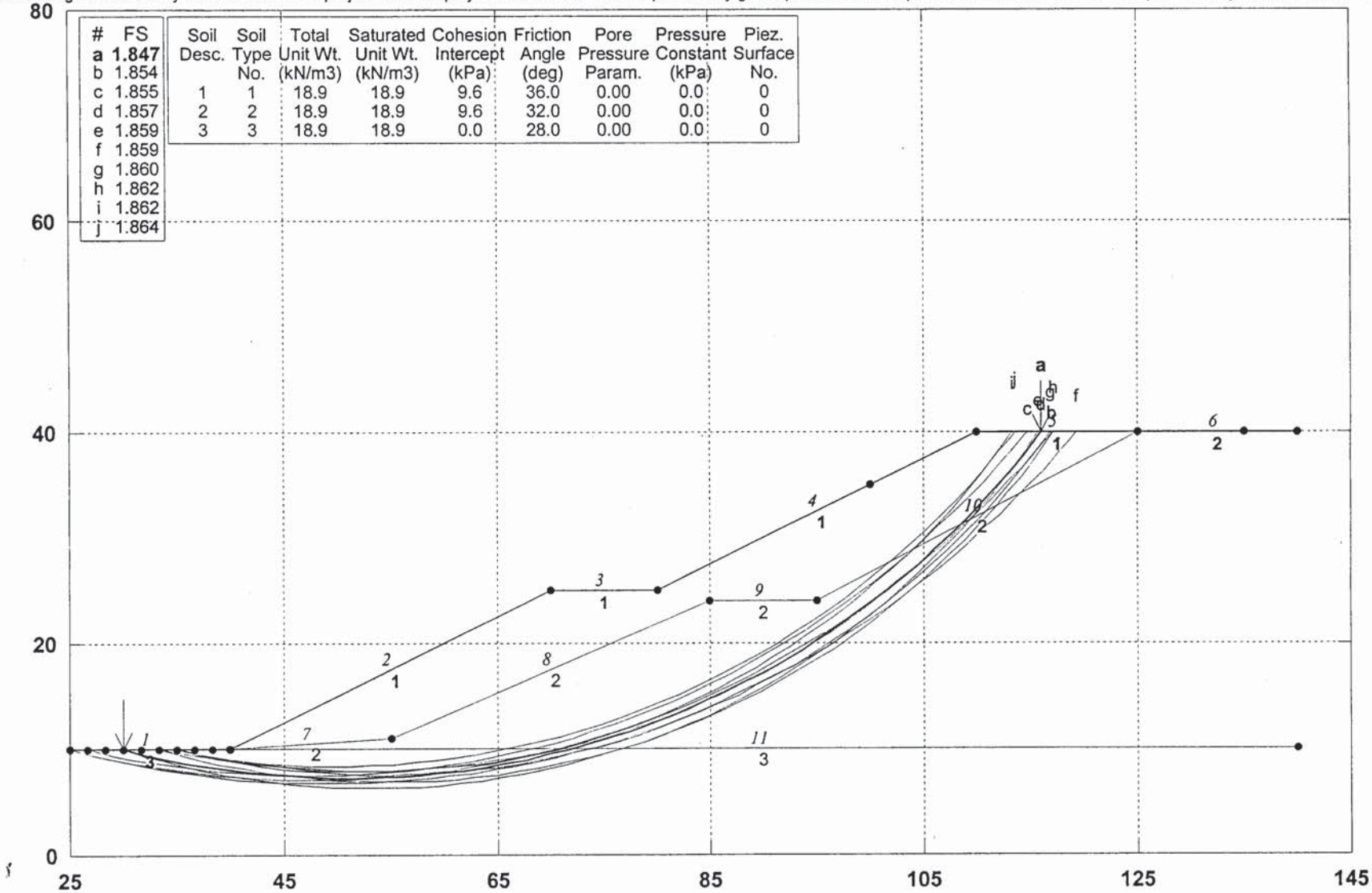
GSTABL7 v.2 FSmin=1.784

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

I-5 Preliminary Geotechnical Report Fill Slope SD Lagoon (1:2)30M C

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\fill sdl 580+00 1-2 30m.pl2 Run By: mike fordham 11/10/2004 01



#	FS
a	**1.847**
b	1.854
c	1.855
d	1.857
e	1.859
f	1.859
g	1.860
h	1.862
i	1.862
j	1.864

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	0
2	2	18.9	18.9	9.6	32.0	0.00	0.0	0
3	3	18.9	18.9	0.0	28.0	0.00	0.0	0

GSTABL7 v.2 FSmin=1.847

Safety Factors Are Calculated By The Modified Bishop Method

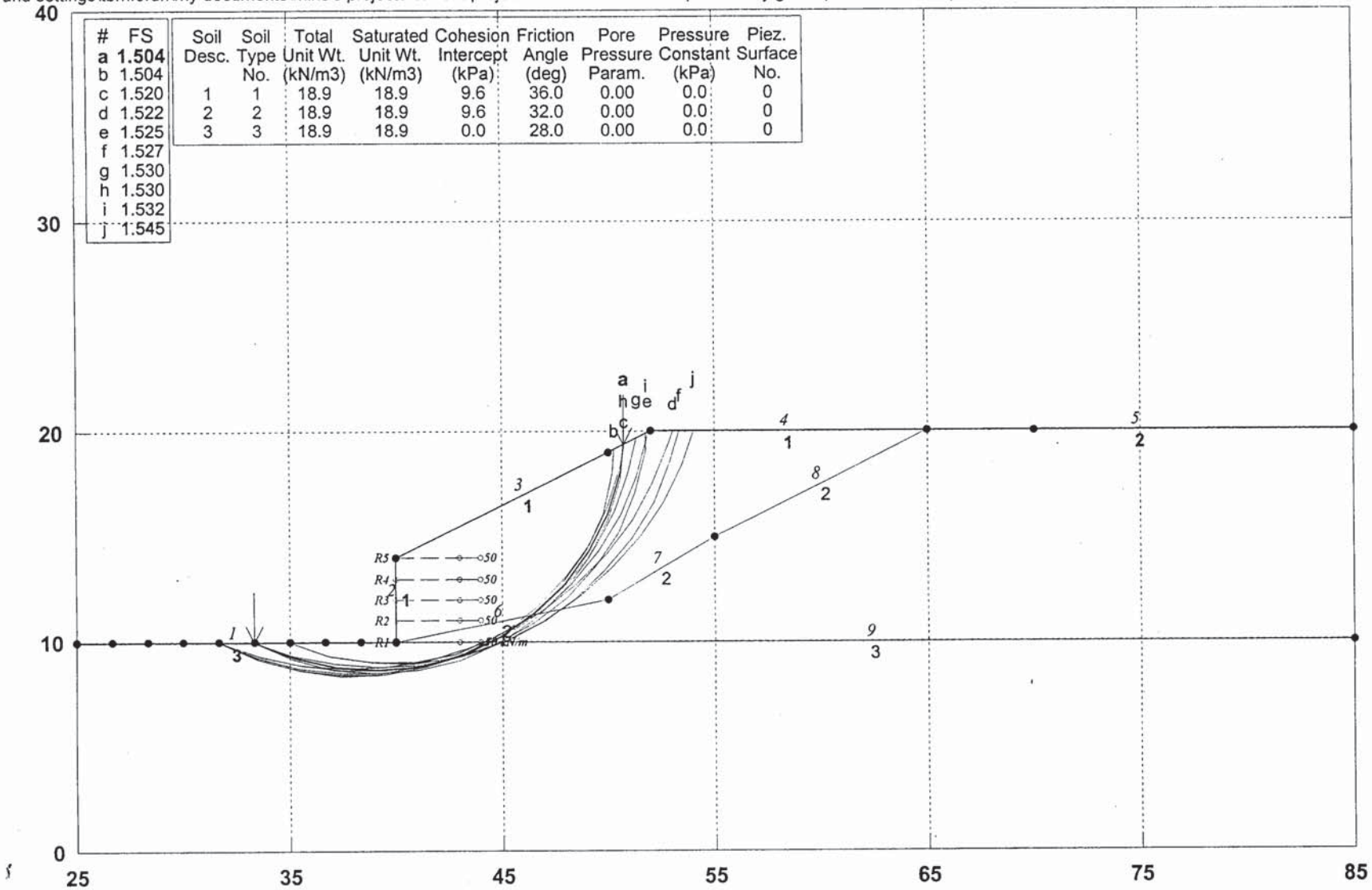
GSTABL7

I-5 Preliminary Geotechnical Report mse wall 4m with 1:2 c, 10m total height

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\mse 4m w 1-2.pl2 Run By: mike fordham 11/10/2004 01

#	FS
a	**1.504**
b	1.504
c	1.520
d	1.522
e	1.525
f	1.527
g	1.530
h	1.530
i	1.532
j	1.545

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	0
2	2	18.9	18.9	9.6	32.0	0.00	0.0	0
3	3	18.9	18.9	0.0	28.0	0.00	0.0	0



GSTABL7 v.2 FSmin=1.504

Safety Factors Are Calculated By The Modified Bishop Method

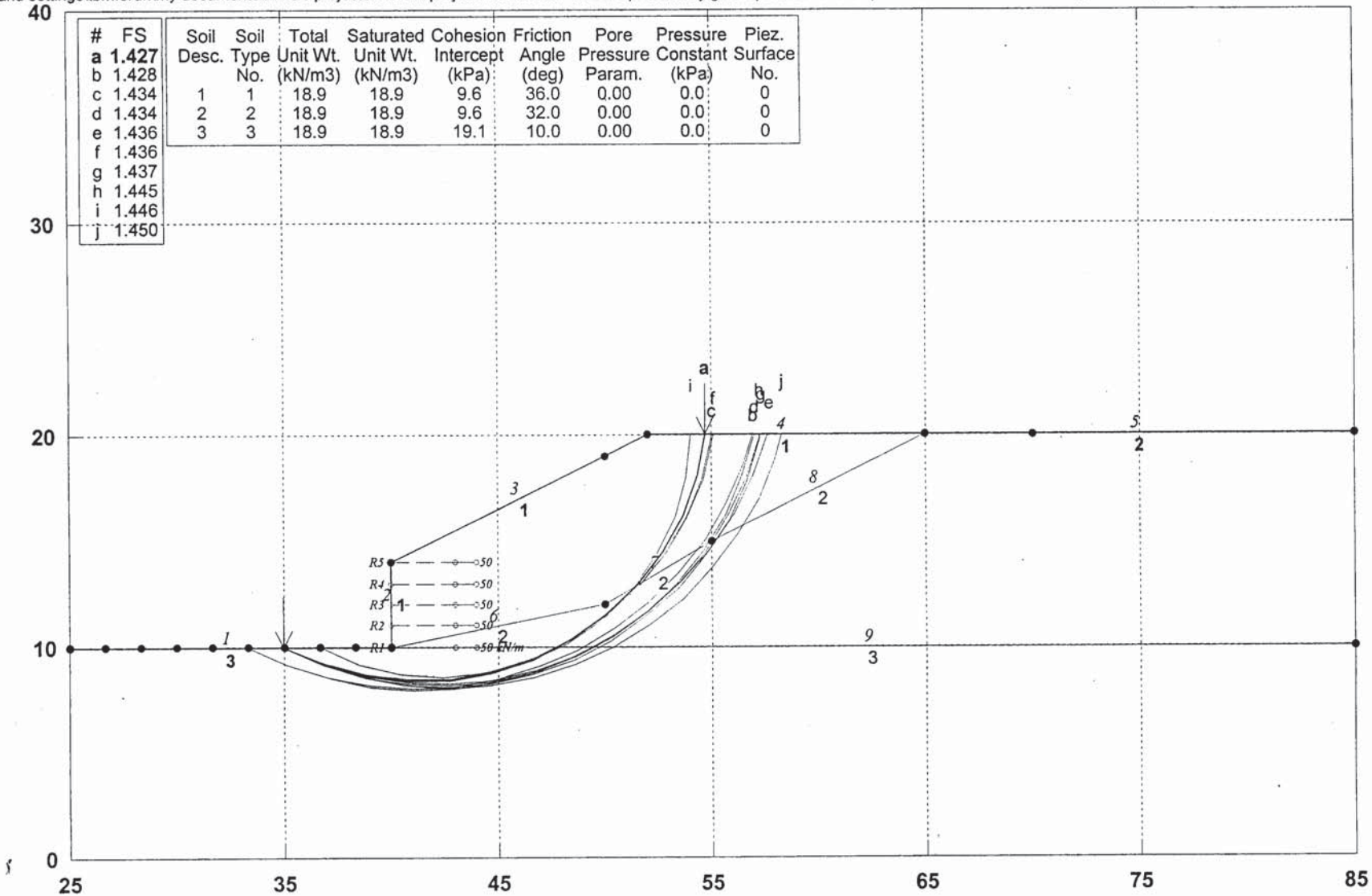
GSTABL7

I-5 Preliminary Geotechnical Report mse wall 4m with 1:2 c, 10m total height

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\mse 4m w 1-2.in long term c-d.pl2 Run By: mike fordham 11/17/2004 11:

#	FS
a	**1.427**
b	1.428
c	1.434
d	1.434
e	1.436
f	1.436
g	1.437
h	1.445
i	1.446
j	1.450

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	0
2	2	18.9	18.9	9.6	32.0	0.00	0.0	0
3	3	18.9	18.9	19.1	10.0	0.00	0.0	0



GSTABL7 v.2 FSmin=1.427

Safety Factors Are Calculated By The Modified Bishop Method

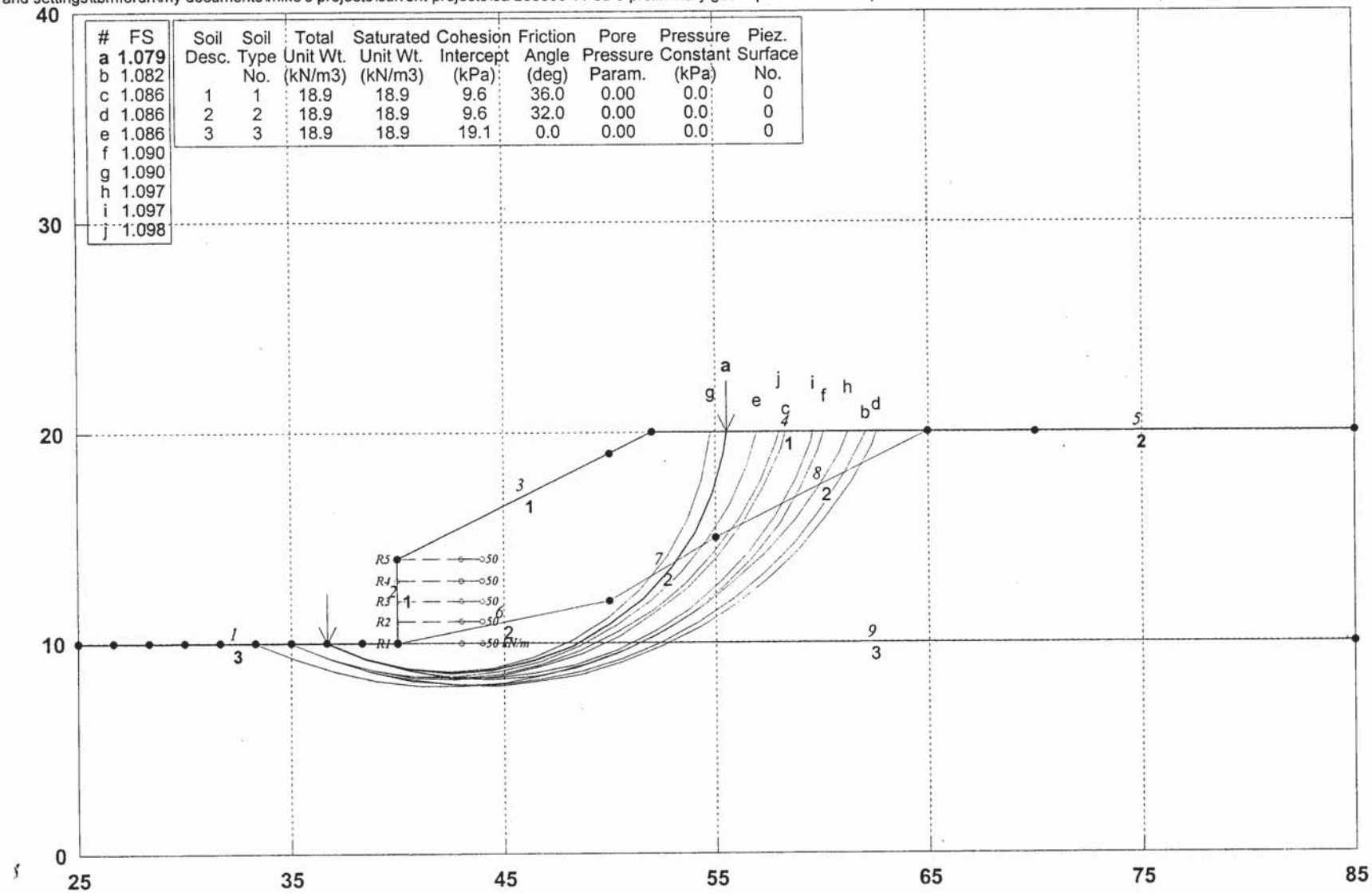
GSTABL7

I-5 Preliminary Geotechnical Report mse wall 4m with 1:2 c, 10m total height

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\mse 4m w 1-2.in short term u-u.pl2 Run By: mike fordham 11/17/2004 11:

#	FS
a	1.079
b	1.082
c	1.086
d	1.086
e	1.086
f	1.090
g	1.090
h	1.097
i	1.097
j	1.098

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	0
2	2	18.9	18.9	9.6	32.0	0.00	0.0	0
3	3	18.9	18.9	19.1	0.0	0.00	0.0	0



GSTABL7 v.2 FSmin=1.079

Safety Factors Are Calculated By The Modified Bishop Method

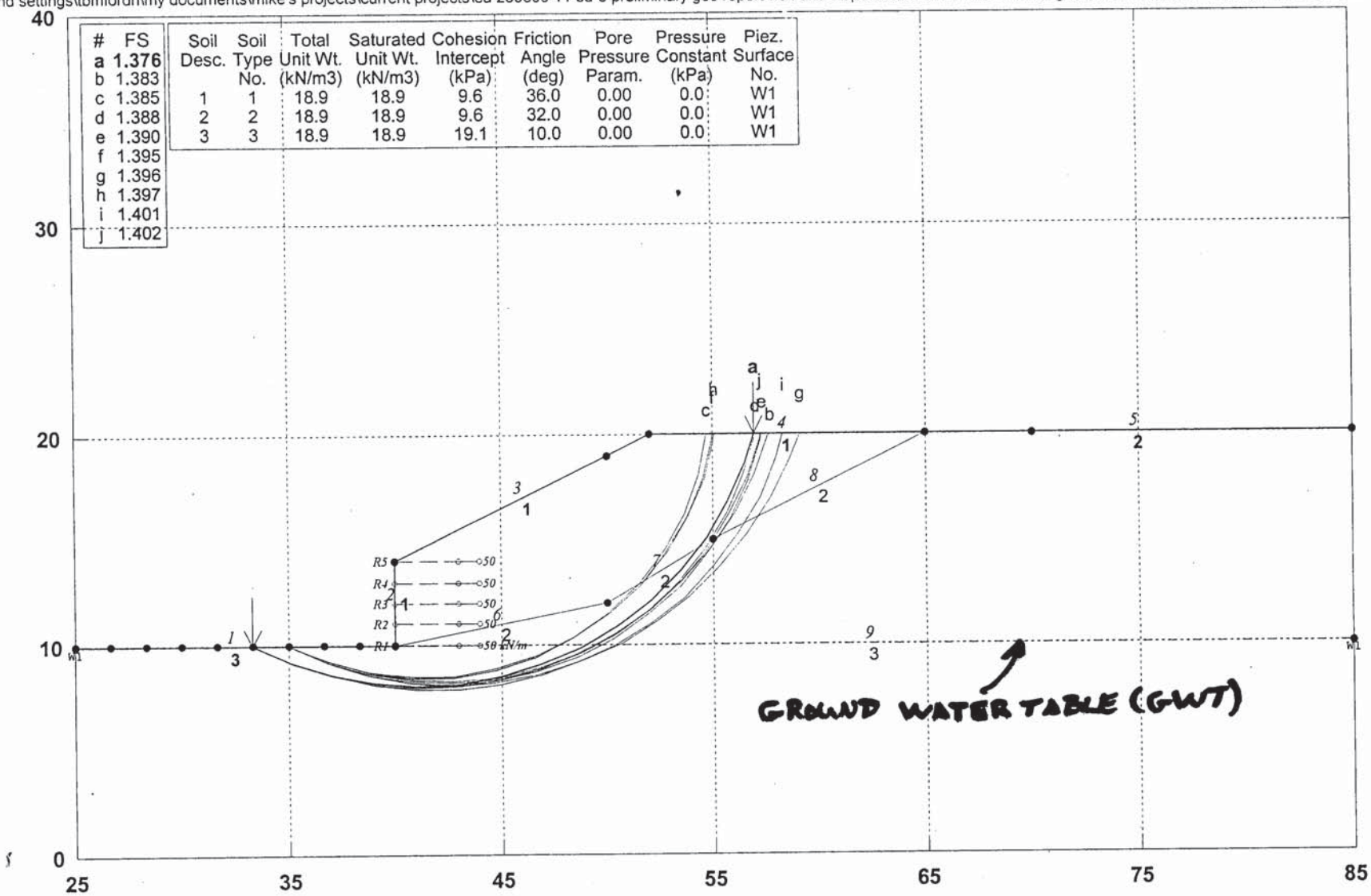
GSTABL7

I-5 Preliminary Geotechnical Report mse wall 4m with 1:2 c, 10m total height

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\mse 4m w 1-2.in long term c-d water.pl2 Run By: mike fordham 9/12/2005 1:

#	FS
a	1.376
b	1.383
c	1.385
d	1.388
e	1.390
f	1.395
g	1.396
h	1.397
i	1.401
j	1.402

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	W1
2	2	18.9	18.9	9.6	32.0	0.00	0.0	W1
3	3	18.9	18.9	19.1	10.0	0.00	0.0	W1



GSTABL7 v.2 FSmin=1.376

Safety Factors Are Calculated By The Modified Bishop Method

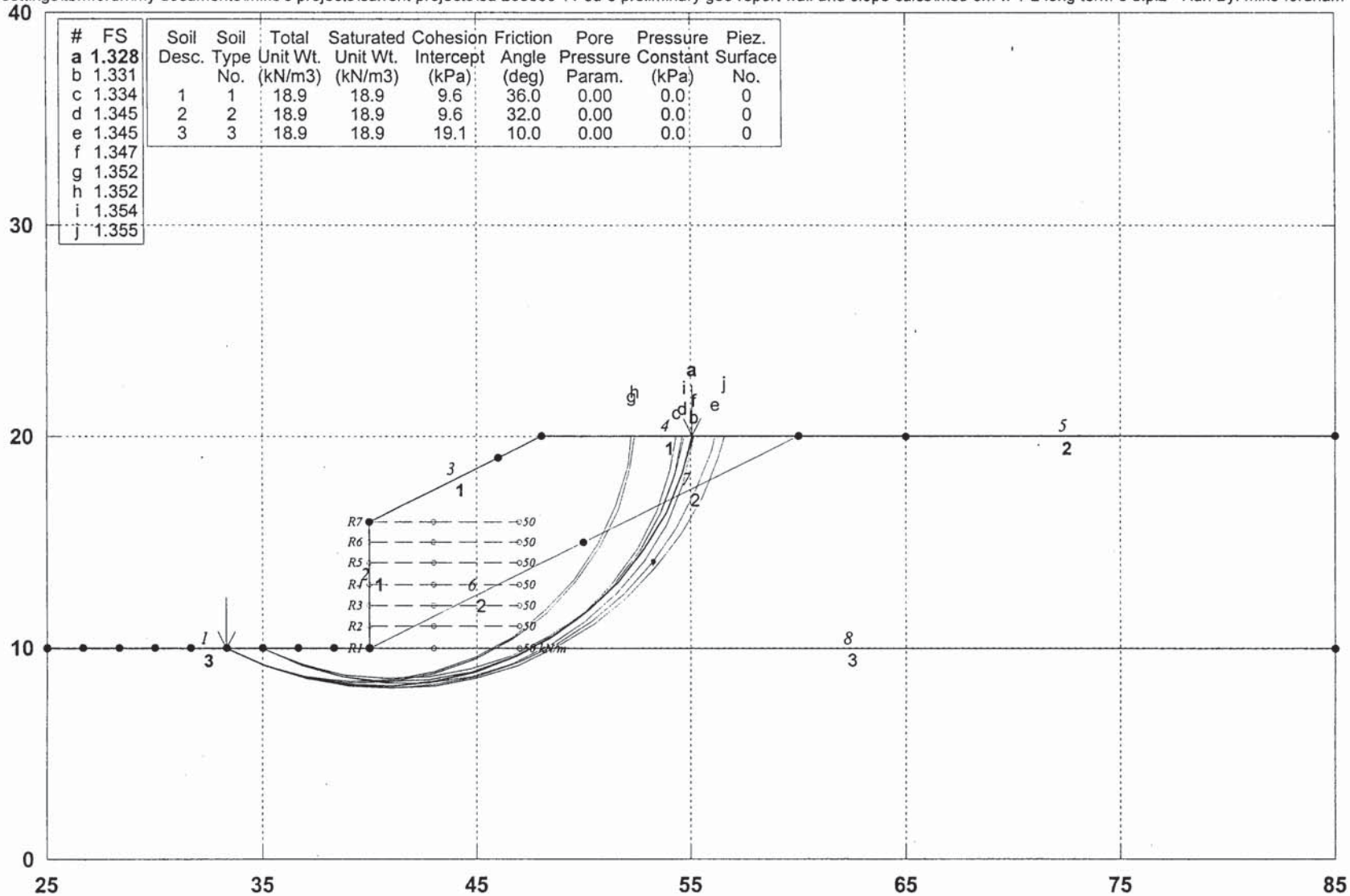
GSTABL7

I-5 Preliminary Geotechnical Report mse wall 6m with 1:2 c, 10m total height

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\mse 6m w 1-2 long term c-d.pl2 Run By: mike fordham 6/28/2005 08

#	FS
a	1.328
b	1.331
c	1.334
d	1.345
e	1.345
f	1.347
g	1.352
h	1.352
i	1.354
j	1.355

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	0
2	2	18.9	18.9	9.6	32.0	0.00	0.0	0
3	3	18.9	18.9	19.1	10.0	0.00	0.0	0



GSTABL7 v.2 FSmin=1.328

Safety Factors Are Calculated By The Modified Bishop Method

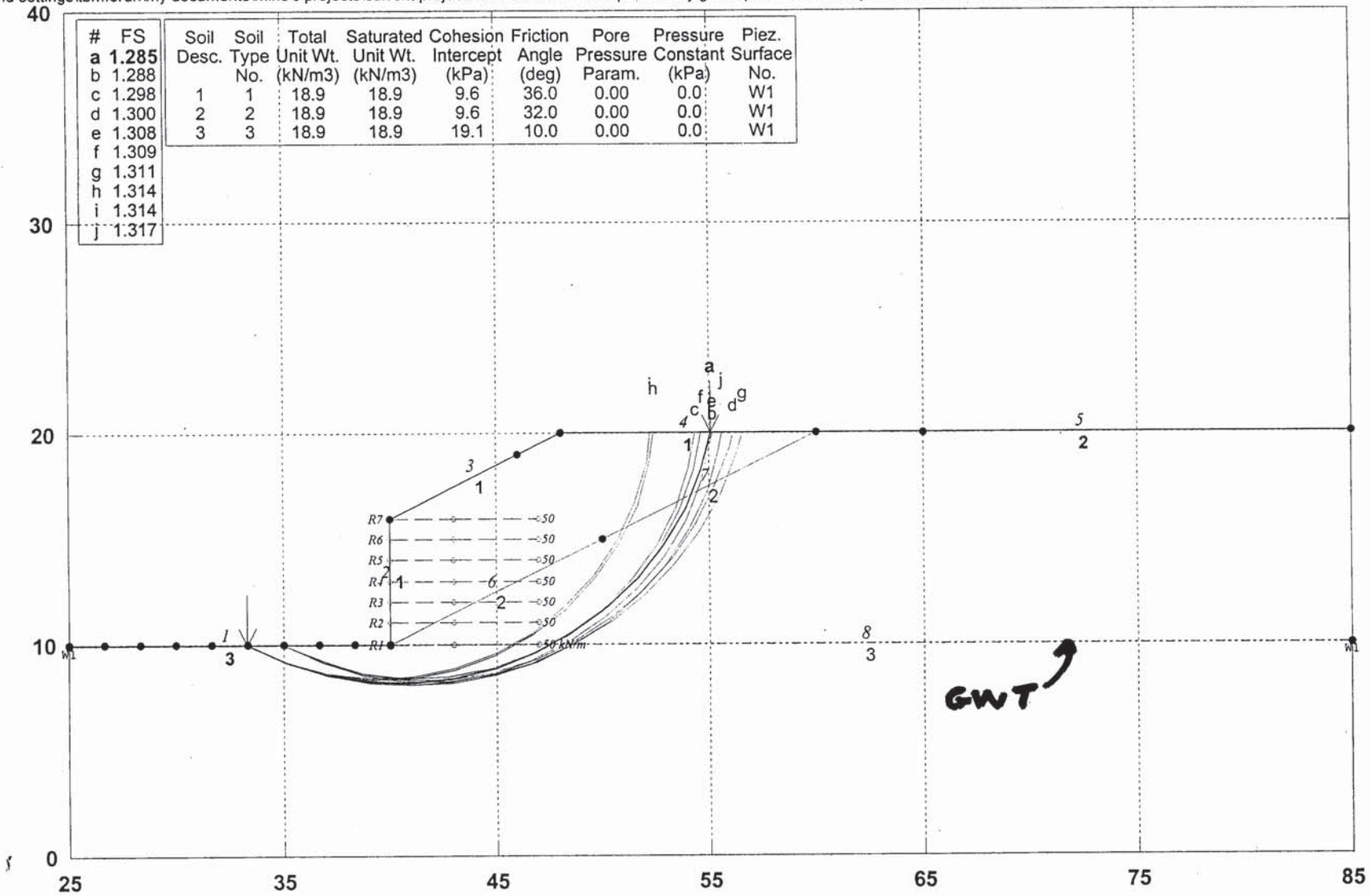
GSTABL7

I-5 Preliminary Geotechnical Report mse wall 6m with 1:2 c, 10m total height

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\mse 6m w 1-2 long term c-d water.pl2 Run By: mike fordham 9/12/2005 12

#	FS
a	1.285
b	1.288
c	1.298
d	1.300
e	1.308
f	1.309
g	1.311
h	1.314
i	1.314
j	1.317

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	W1
2	2	18.9	18.9	9.6	32.0	0.00	0.0	W1
3	3	18.9	18.9	19.1	10.0	0.00	0.0	W1



GSTABL7 v.2 FSmin=1.285

Safety Factors Are Calculated By The Modified Bishop Method

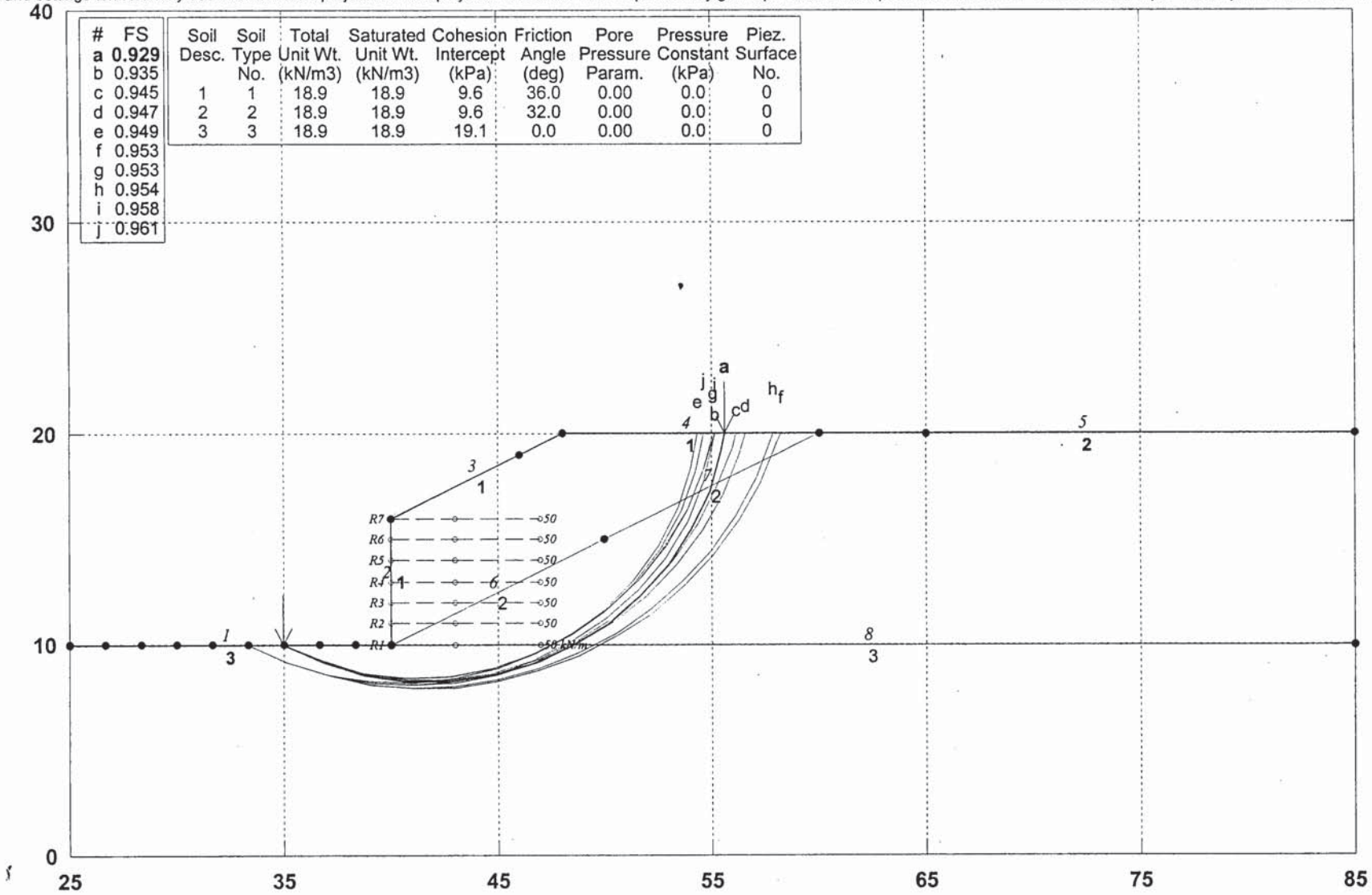
GSTABL7

I-5 Preliminary Geotechnical Report mse wall 6m with 1:2 c, 10m total height

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\mse 6m w 1-2 short term u-u.pl2 Run By: mike fordham 11/17/2004 11:3

#	FS
a	0.929
b	0.935
c	0.945
d	0.947
e	0.949
f	0.953
g	0.953
h	0.954
i	0.958
j	0.961

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	0
2	2	18.9	18.9	9.6	32.0	0.00	0.0	0
3	3	18.9	18.9	19.1	0.0	0.00	0.0	0



GSTABL7 v.2 FSmin=0.929

Safety Factors Are Calculated By The Modified Bishop Method

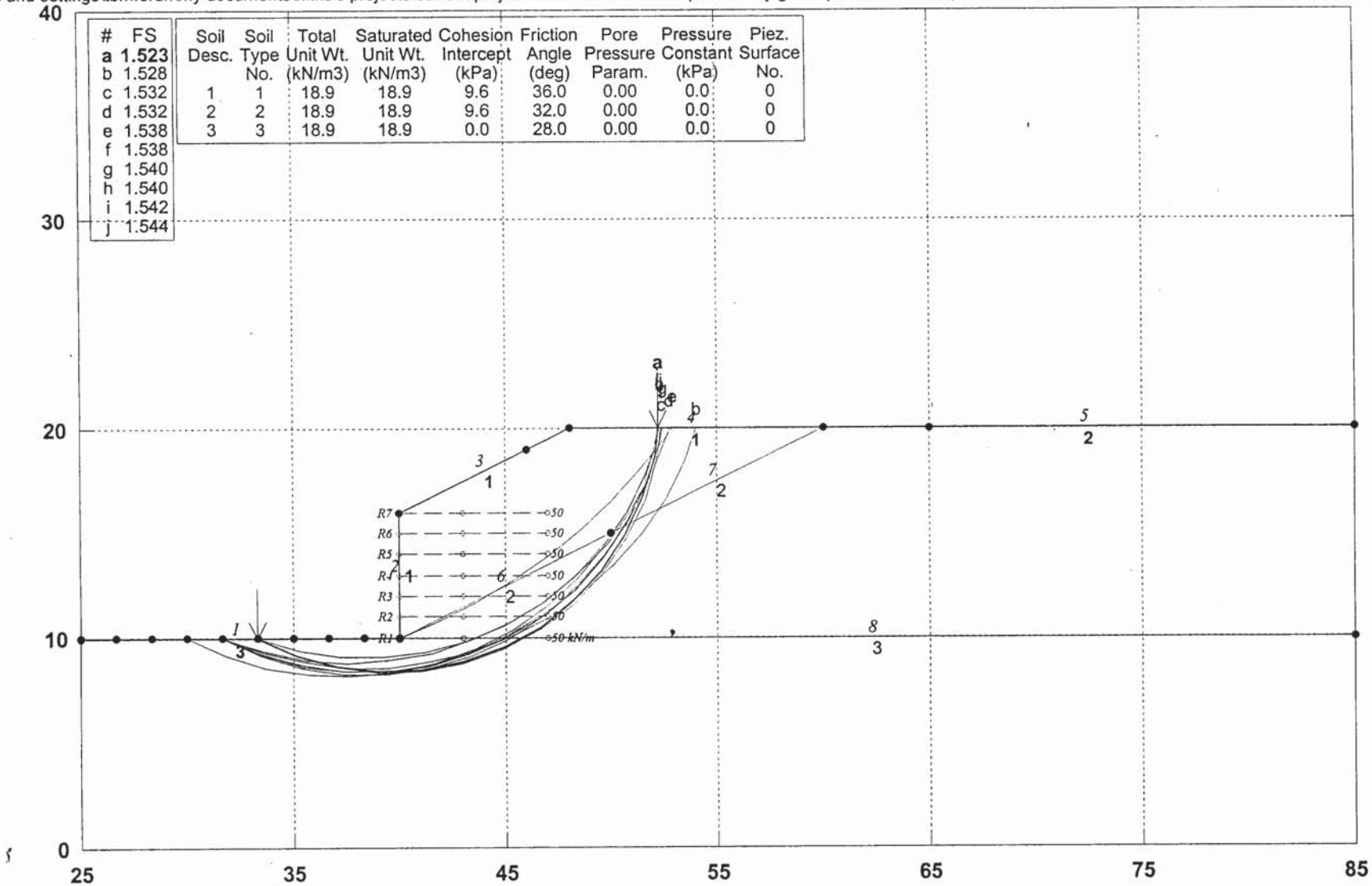
GSTABL7

I-5 Preliminary Geotechnical Report mse wall 6m with 1:2 c, 10m total height

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\mse 6m w 1-2.pl2 Run By: mike fordham 11/10/2004 0

#	FS
a	**1.523**
b	1.528
c	1.532
d	1.532
e	1.538
f	1.538
g	1.540
h	1.540
i	1.542
j	1.544

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	0
2	2	18.9	18.9	9.6	32.0	0.00	0.0	0
3	3	18.9	18.9	0.0	28.0	0.00	0.0	0



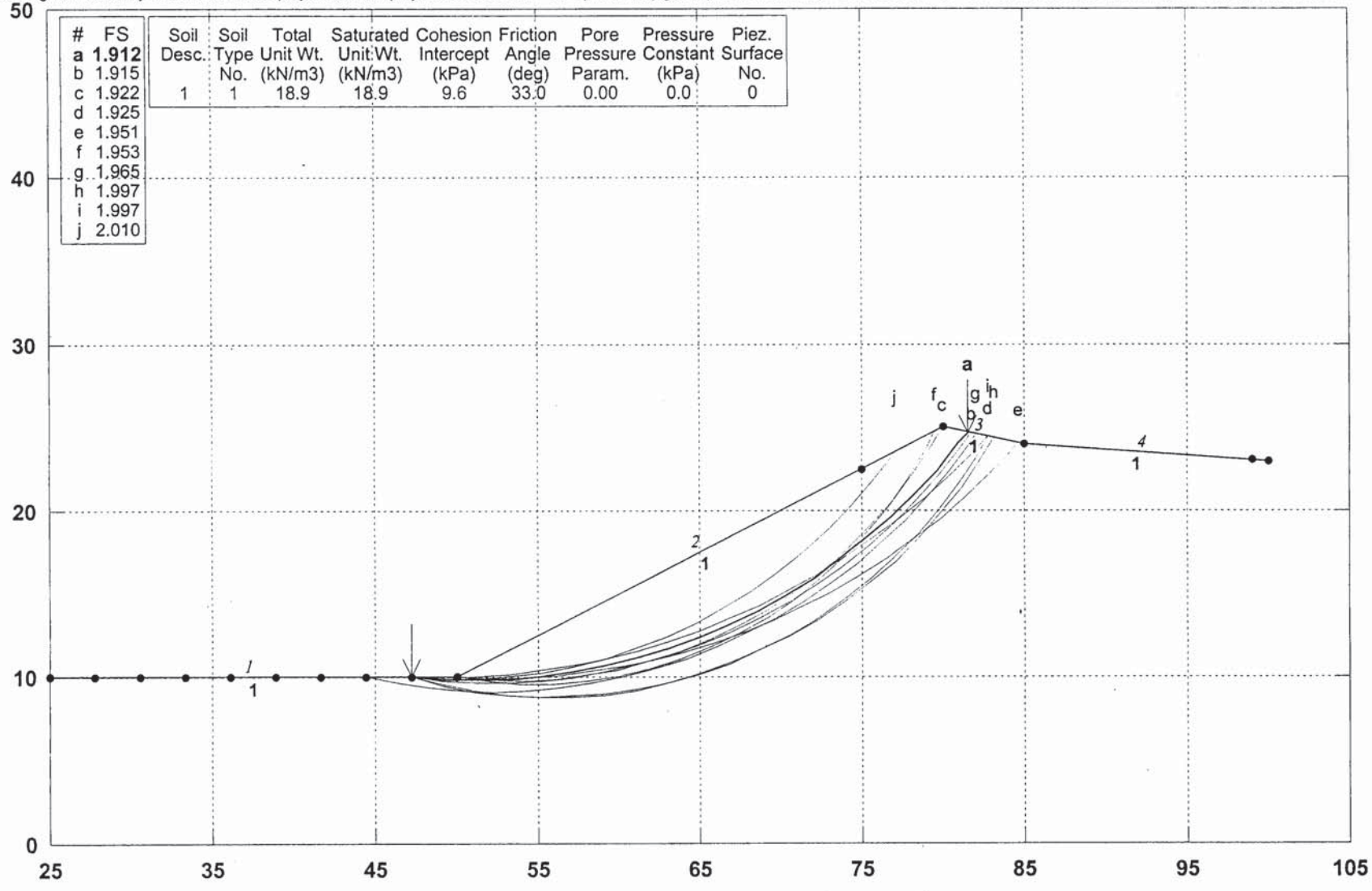
GSTABL7 v.2 FSmin=1.523

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

I-5 Preliminary Geotechnical Report Cut Slope 828+00 (1:2) 15 m sandstone

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\cut 828+20 1-2 15m no bench sandstone.pl2 Run By: mike fordham 11/10/2004 0



#	FS
a	**1.912**
b	1.915
c	1.922
d	1.925
e	1.951
f	1.953
g	1.965
h	1.997
i	1.997
j	2.010

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	33.0	0.00	0.0	0

GSTABL7 v.2 FSmin=1.912

Safety Factors Are Calculated By The Modified Bishop Method

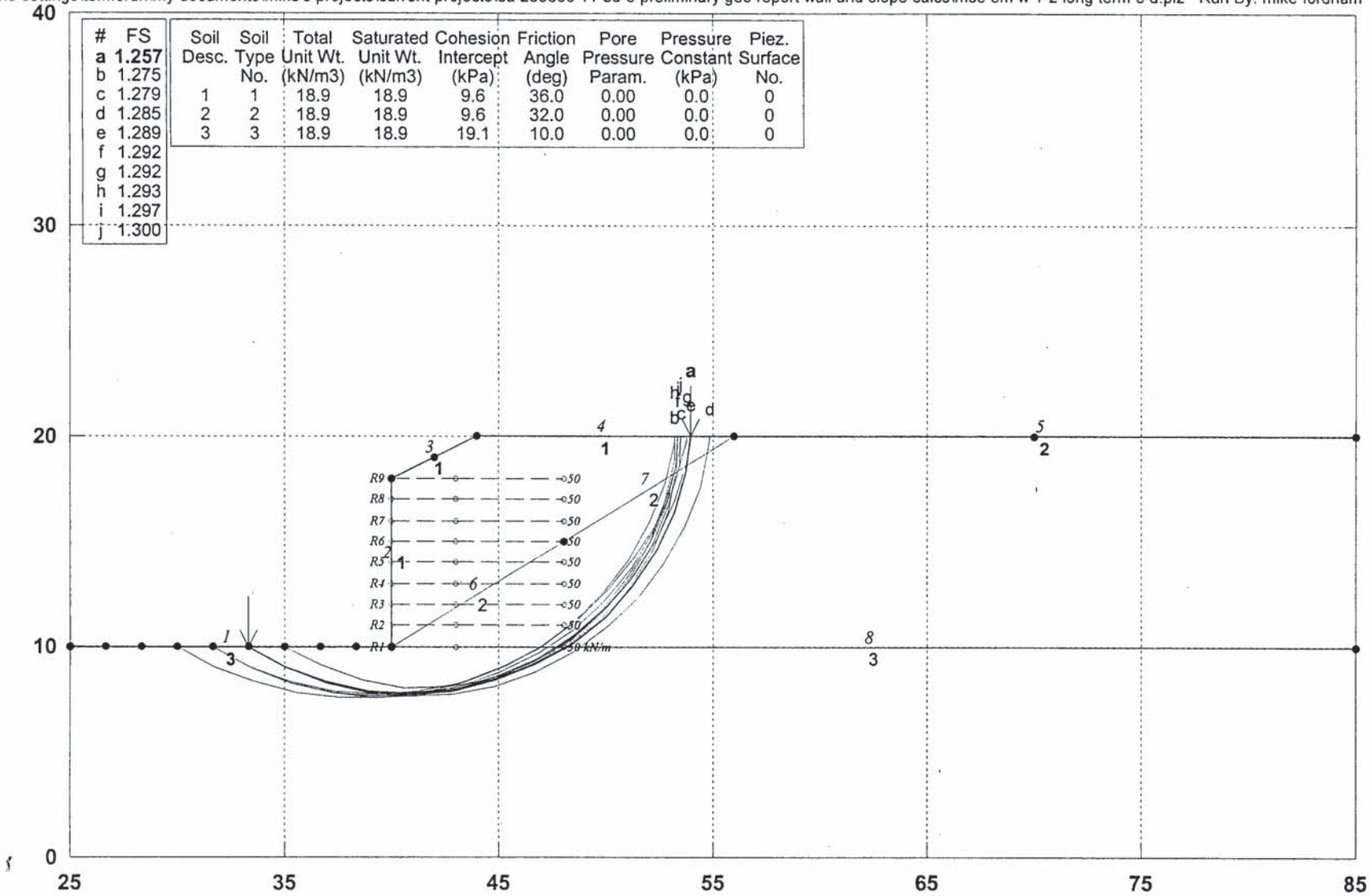
GSTABL7

I-5 Preliminary Geotechnical Report mse wall 8m with 1:2 c, 10m total height

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\mse 8m w 1-2 long term c-d.pl2 Run By: mike fordham 11/17/2004 1

#	FS
a	**1.257**
b	1.275
c	1.279
d	1.285
e	1.289
f	1.292
g	1.292
h	1.293
i	1.297
j	1.300

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	0
2	2	18.9	18.9	9.6	32.0	0.00	0.0	0
3	3	18.9	18.9	19.1	10.0	0.00	0.0	0



GSTABL7 v.2 FSmin=1.257

Safety Factors Are Calculated By The Modified Bishop Method

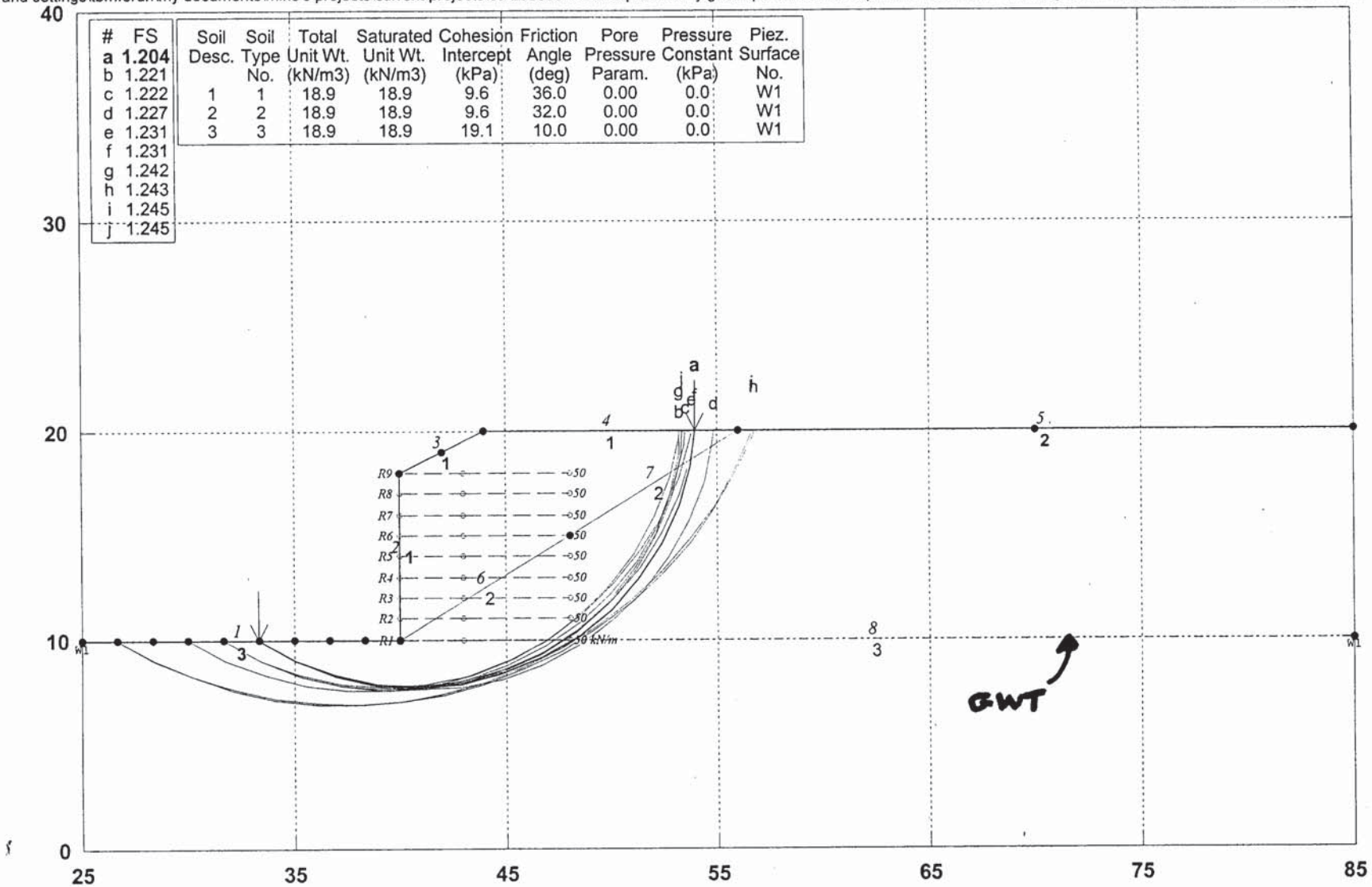
GSTABL7

I-5 Preliminary Geotechnical Report mse wall 8m with 1:2 c, 10m total height

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\mse 8m w 1-2 long term c-d water.pl2 Run By: mike fordham 9/12/2005 1:

#	FS
a	**1.204**
b	1.221
c	1.222
d	1.227
e	1.231
f	1.231
g	1.242
h	1.243
i	1.245
j	1.245

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	W1
2	2	18.9	18.9	9.6	32.0	0.00	0.0	W1
3	3	18.9	18.9	19.1	10.0	0.00	0.0	W1



GSTABL7 v.2 FSmin=1.204

Safety Factors Are Calculated By The Modified Bishop Method

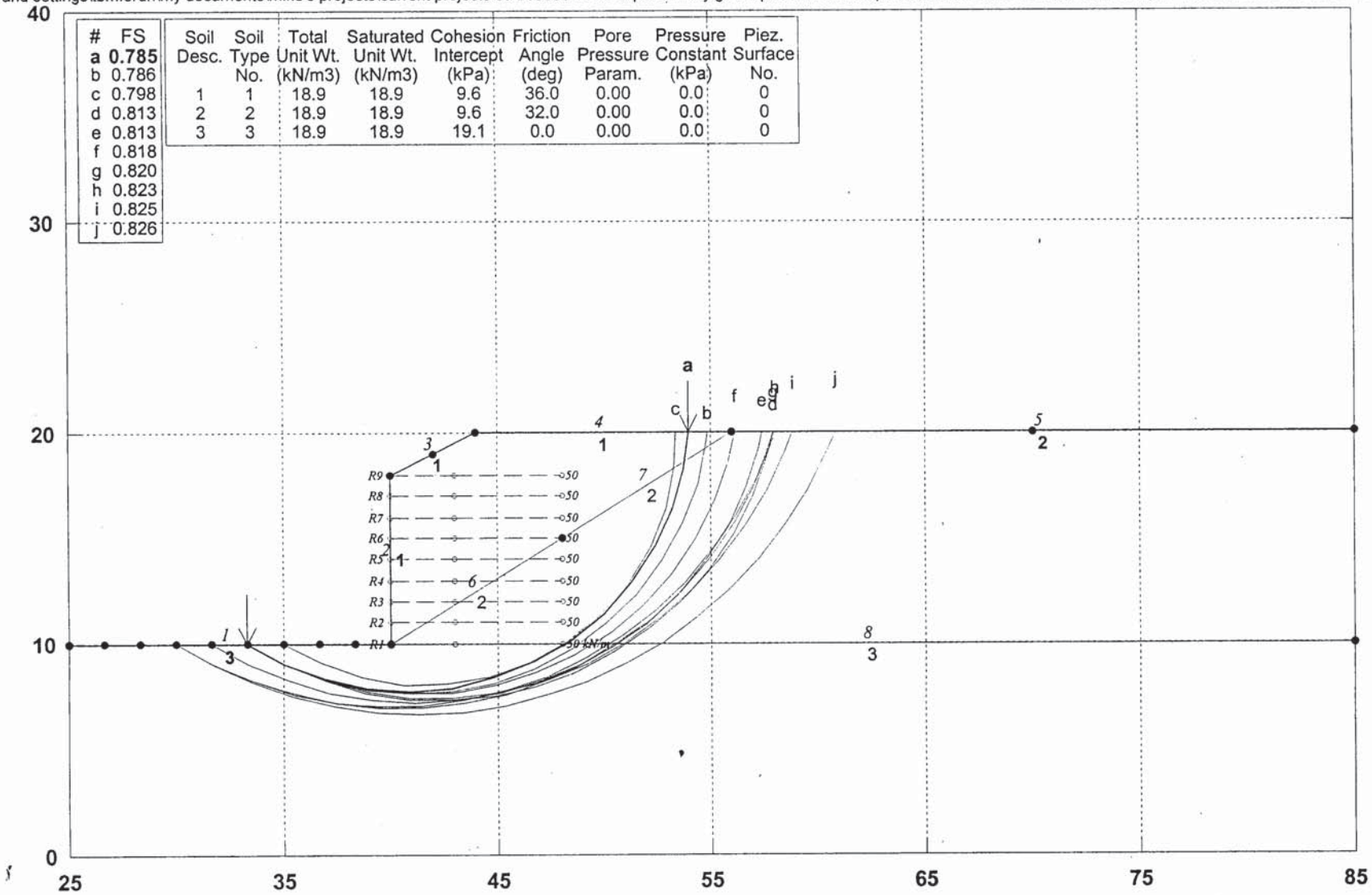
GSTABL7

I-5 Preliminary Geotechnical Report mse wall 8m with 1:2 c, 10m total height

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\mse 8m w 1-2 short term u-u.pl2 Run By: mike fordham 11/17/2004 11:4

#	FS
a	0.785
b	0.786
c	0.798
d	0.813
e	0.813
f	0.818
g	0.820
h	0.823
i	0.825
j	0.826

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	0
2	2	18.9	18.9	9.6	32.0	0.00	0.0	0
3	3	18.9	18.9	19.1	0.0	0.00	0.0	0



GSTABL7 v.2 FSmin=0.785

Safety Factors Are Calculated By The Modified Bishop Method

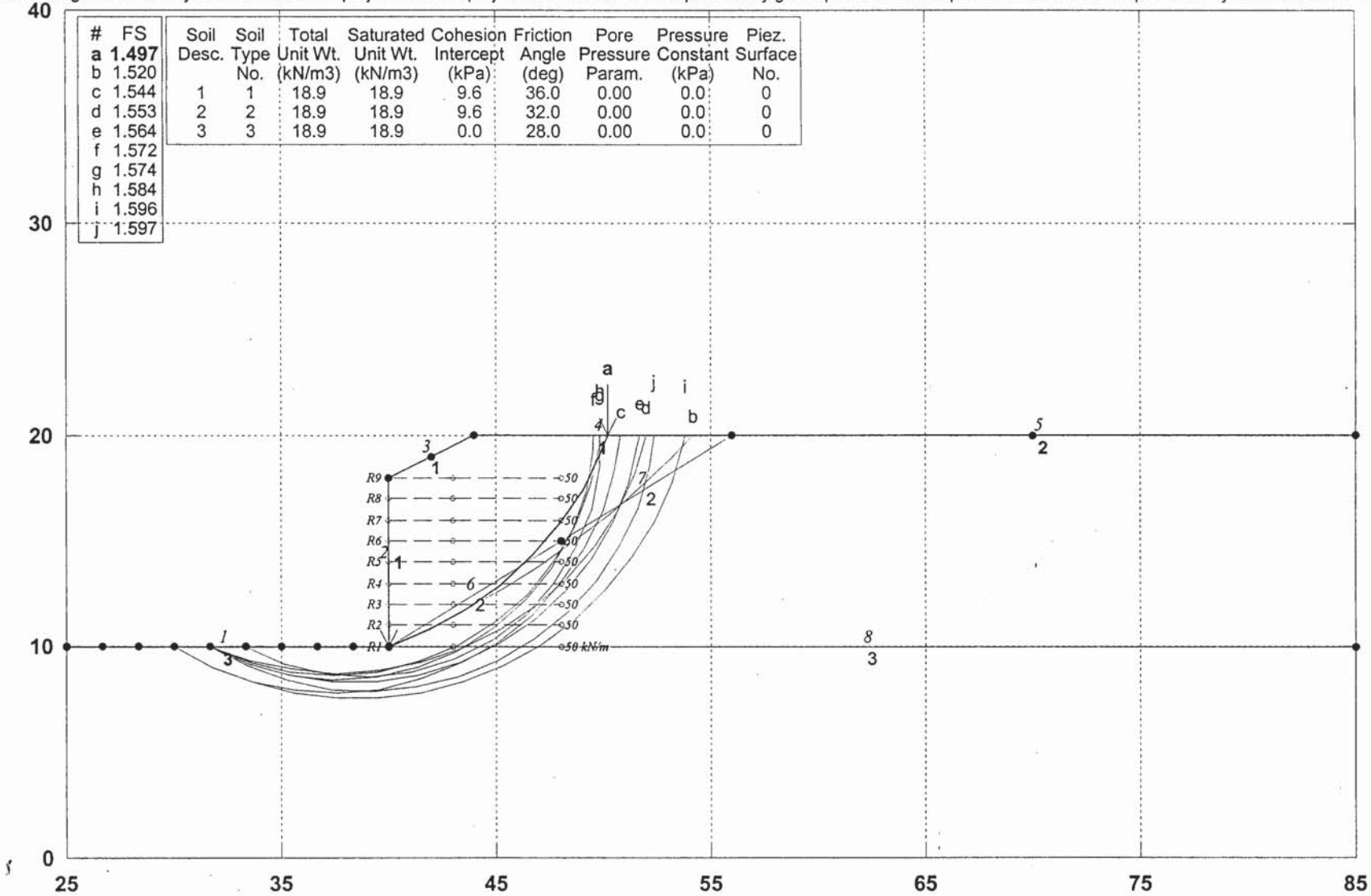
GSTABL7

I-5 Preliminary Geotechnical Report mse wall 8m with 1:2 c, 10m total height

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\mse 8m w 1-2.pl2 Run By: mike fordham 11/10/2004 01

#	FS
a	**1.497**
b	1.520
c	1.544
d	1.553
e	1.564
f	1.572
g	1.574
h	1.584
i	1.596
j	1.597

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	36.0	0.00	0.0	0
2	2	18.9	18.9	9.6	32.0	0.00	0.0	0
3	3	18.9	18.9	0.0	28.0	0.00	0.0	0



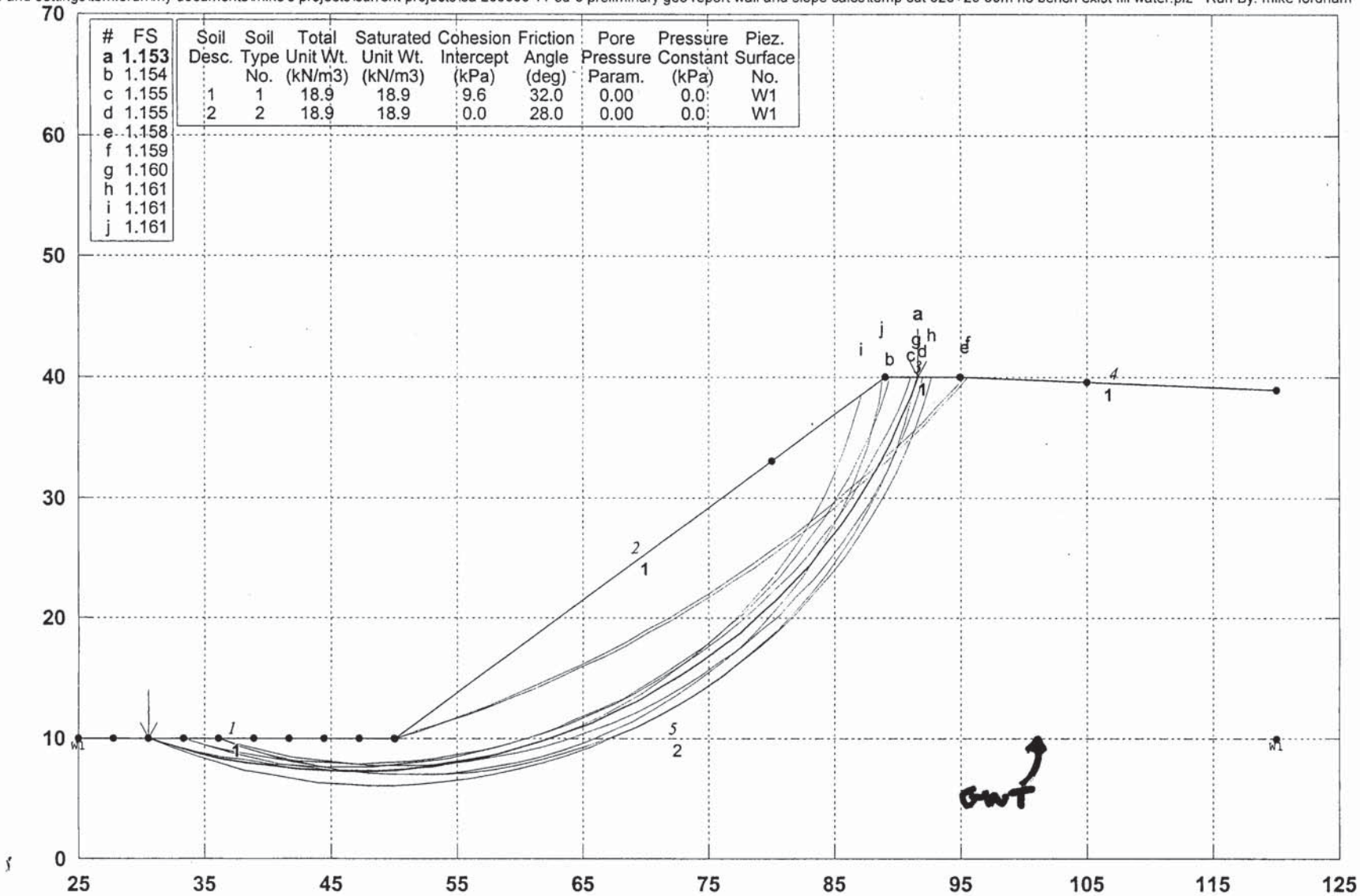
GSTABL7 v.2 FSmin=1.497

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

I-5 Preliminary Geotechnical Report temp Cut Slope 828+00 30m exist fill

c:\documents and settings\tbmfordh\my documents\mike's projects\current projects\ea 235800 11-sd-5 preliminary geo report wall and slope calcs\temp cut 828+20 30m no bench exist fill water.pl2 Run By: mike fordham 9/12/2005 12



#	FS
a	**1.153**
b	1.154
c	1.155
d	1.155
e	1.158
f	1.159
g	1.160
h	1.161
i	1.161
j	1.161

Soil Desc.	Soil Type No.	Total Unit Wt. (kN/m3)	Saturated Unit Wt. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (kPa)	Piez. Surface No.
1	1	18.9	18.9	9.6	32.0	0.00	0.0	W1
2	2	18.9	18.9	0.0	28.0	0.00	0.0	W1

GSTABL7 v.2 FSmin=1.153

Safety Factors Are Calculated By The Modified Bishop Method

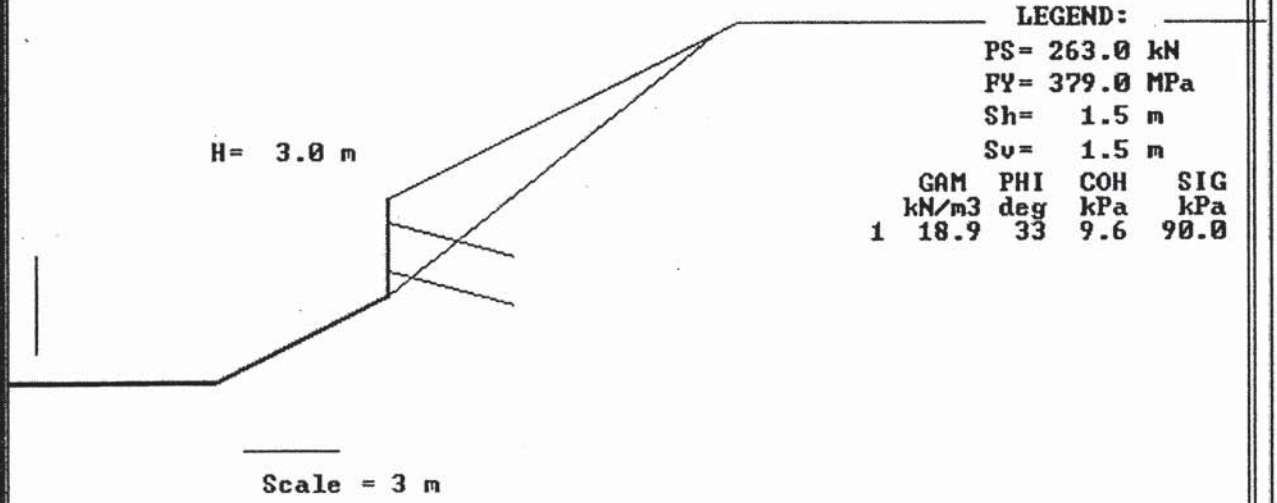
GSTABL7

ROJECT TITLE: 3m wall I-5 PGR mid slope sandstone 6m bottom 12m top

te: 06-28-2005 SnailWin 3.10 ile: i-5 pgr 3m wall 6-12

Minimum Factor of Safety = 2.19

10.0 m Behind Wall Crest
0.0 m Below Wall Toe



LEGEND:
PS= 263.0 kN
FY= 379.0 MPa
Sh= 1.5 m
Sv= 1.5 m

	GAM kN/m3	PHI deg	COH kPa	SIG kPa
1	18.9	33	9.6	90.0

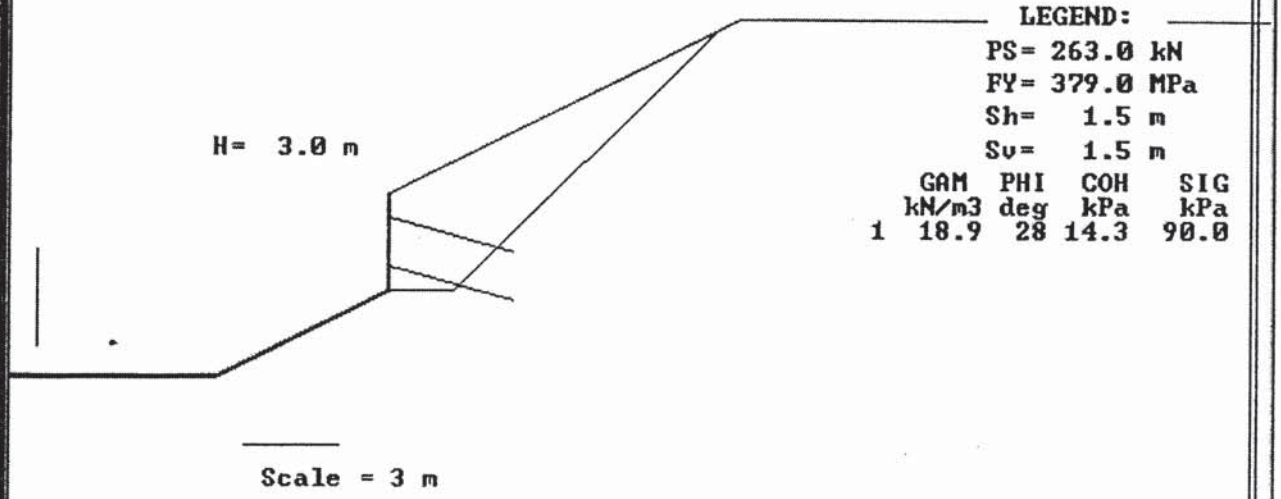
ROJECT TITLE: 3m wall I-5 PGR mid slope sandstone 6m bottom 12m top

te: 06-28-2005

SnailWin 3.10 File: i-5 pgr 3m wall shale 6-12

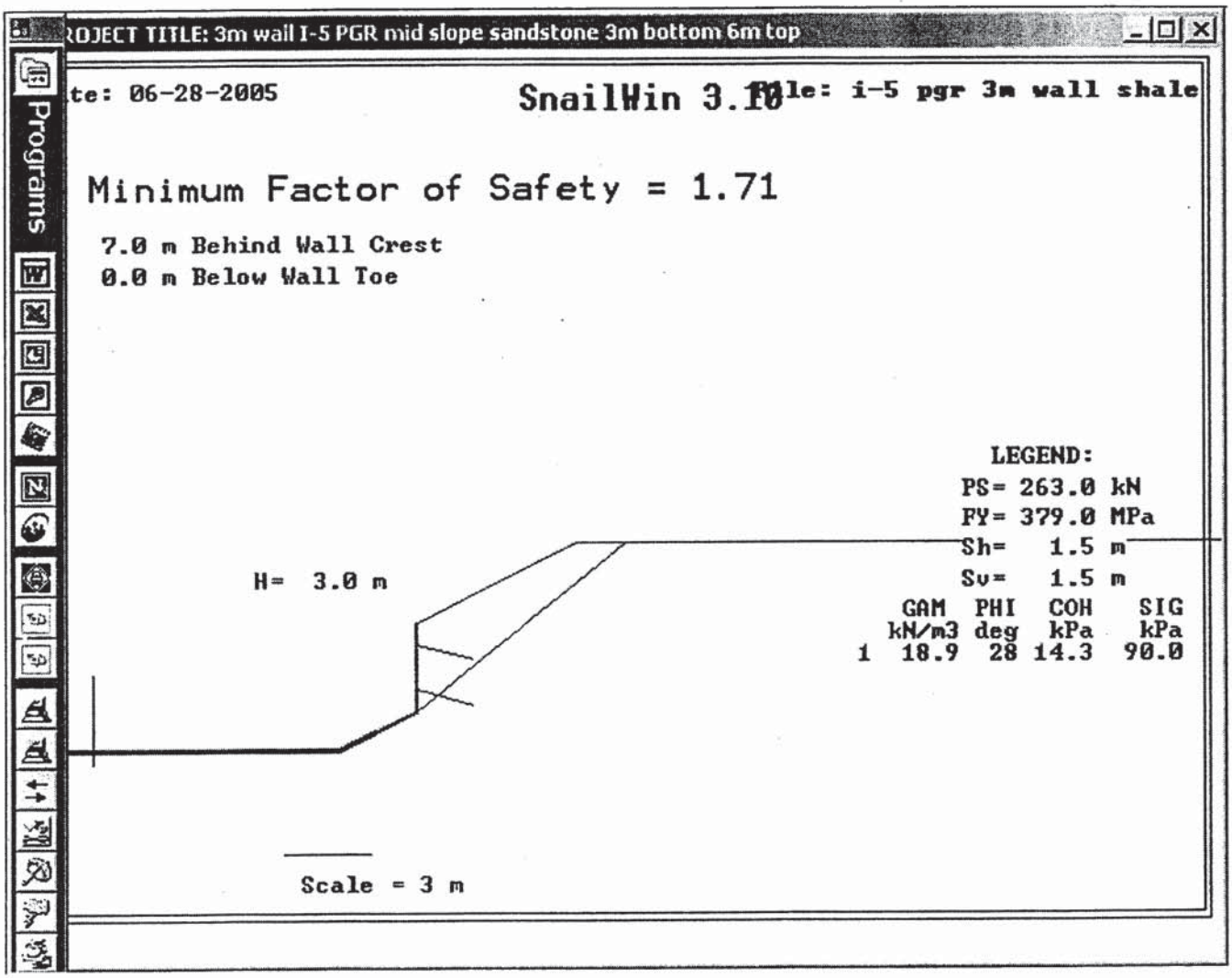
Minimum Factor of Safety = 2.25

10.0 m Behind Wall Crest
0.0 m Below Wall Toe



LEGEND:
PS= 263.0 kN
FY= 379.0 MPa
Sh= 1.5 m
Sv= 1.5 m

	GAM kN/m3	PHI deg	COH kPa	SIG kPa
1	18.9	28	14.3	90.0


ROJECT TITLE: 3m wall I-5 PGR mid slope sandstone 3m bottom 6m top
Programs
te: 06-28-2005
SnailWin 3.10
le: i-5 pgr 3m wall shale
Minimum Factor of Safety = 1.71
7.0 m Behind Wall Crest
0.0 m Below Wall Toe
LEGEND:
PS= 263.0 kN
FY= 379.0 MPa
Sh= 1.5 m
Sv= 1.5 m
GAM PHI COH SIG
kN/m3 deg kPa kPa
1 18.9 28 14.3 90.0
H= 3.0 m
Scale = 3 m

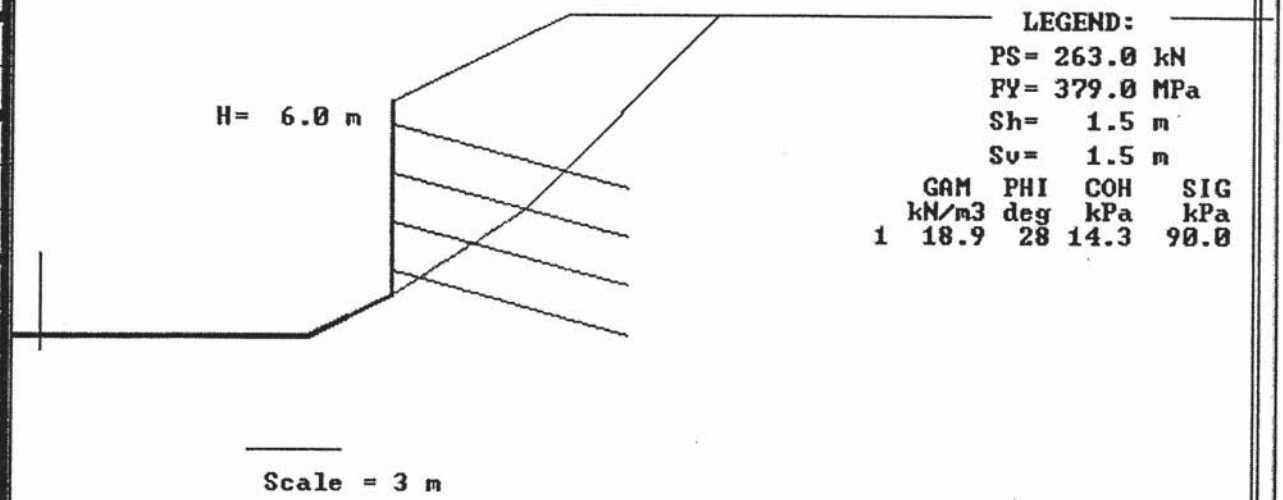
ROJECT TITLE: 6m wall I-5 PGR mid slope shale 3m 6m

te: 06-28-2005

SnailWin 3.10 File: i-5 pgr 6m wall shale

Minimum Factor of Safety = 1.89

10.0 m Behind Wall Crest
0.0 m Below Wall Toe



LEGEND:
PS= 263.0 kN
FY= 379.0 MPa
Sh= 1.5 m
Sv= 1.5 m

	GAM kN/m3	PHI deg	COH kPa	SIG kPa
1	18.9	28	14.3	90.0

ROJECT TITLE: 6m wall I-5 PGR mid slope sandstone

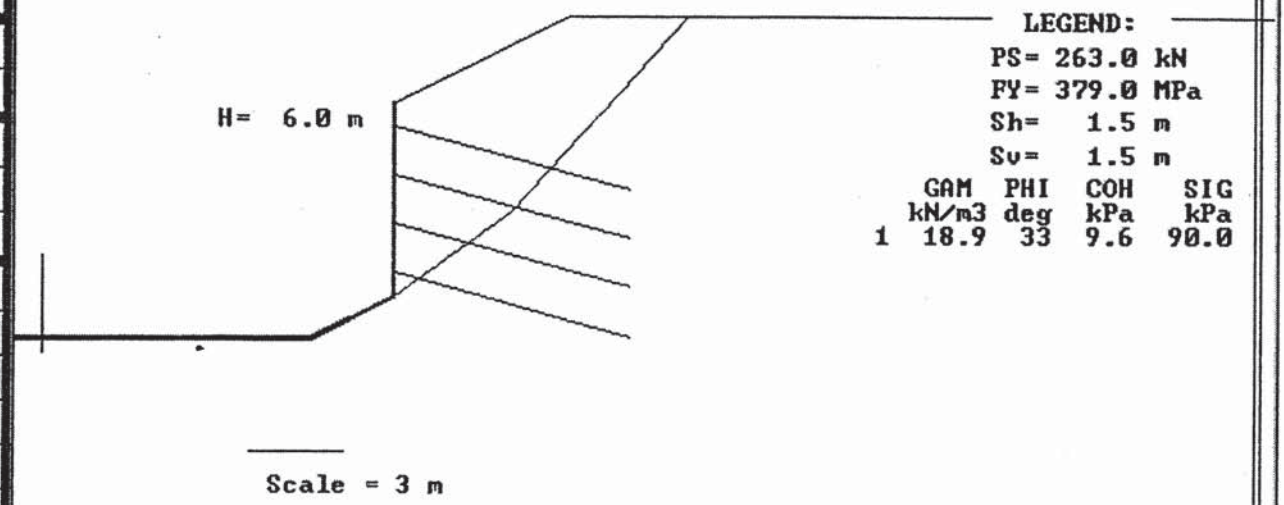
te: 06-28-2005

SnailWin 3.10

File: i-5 pgr 6m wall

Minimum Factor of Safety = 1.93

9.0 m Behind Wall Crest
0.0 m Below Wall Toe



LEGEND:

PS= 263.0 kN
FY= 379.0 MPa
Sh= 1.5 m
Sv= 1.5 m

	GAM kN/m3	PHI deg	COH kPa	SIG kPa
1	18.9	33	9.6	90.0

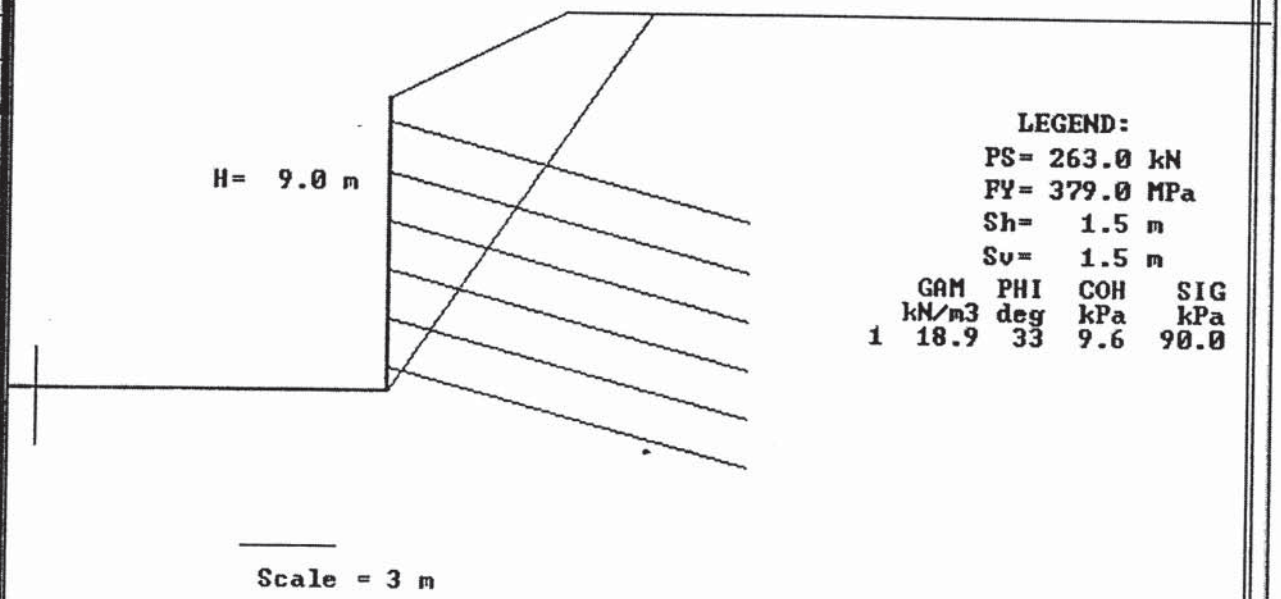
ROJECT TITLE: 9m wall I-5 PGR not mid slope sandstone 6m

te: 06-28-2005

SnailWin 9.10 File: I-5 pgr 9m wall not midslope

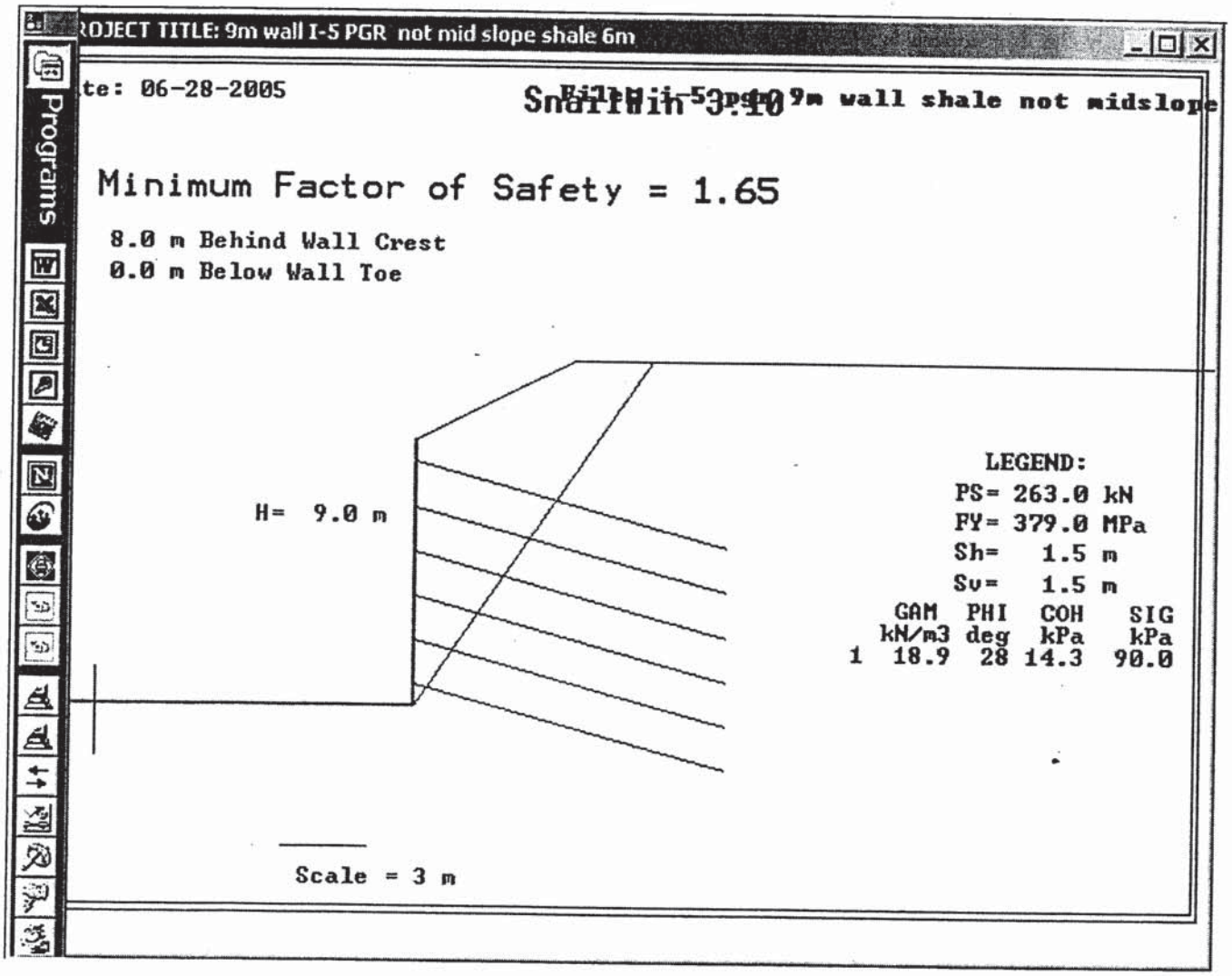
Minimum Factor of Safety = 1.71

8.0 m Behind Wall Crest
0.0 m Below Wall Toe



LEGEND:
PS= 263.0 kN
FY= 379.0 MPa
Sh= 1.5 m
Sv= 1.5 m

	GAM kN/m3	PHI deg	COH kPa	SIG kPa
1	18.9	33	9.6	90.0


ROJECT TITLE: 9m wall I-5 PGR not mid slope shale 6m
te: 06-28-2005
9m wall shale not midslope
Minimum Factor of Safety = 1.65
8.0 m Behind Wall Crest
0.0 m Below Wall Toe
H= 9.0 m
LEGEND:
PS= 263.0 kN
FY= 379.0 MPa
Sh= 1.5 m
Sv= 1.5 m
GAM PHI COH SIG
kN/m3 deg kPa kPa
1 18.9 28 14.3 90.0
Scale = 3 m
Programs

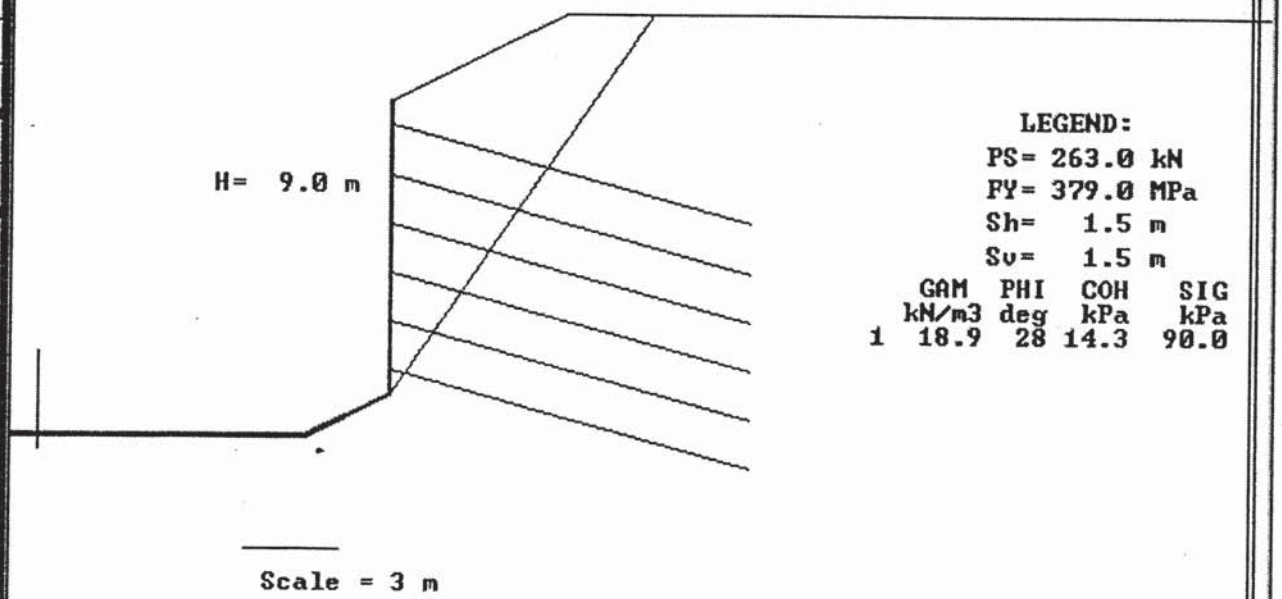
ROJECT TITLE: 9m wall I-5 PGR mid slope shale 3m 6m

te: 06-28-2005

SnailWin 3.10 ile: i-5 pgr 9m wall shale

Minimum Factor of Safety = 1.65

8.0 m Behind Wall Crest
0.0 m Below Wall Toe



LEGEND:
PS= 263.0 kN
FY= 379.0 MPa
Sh= 1.5 m
Sv= 1.5 m

	GAM kN/m3	PHI deg	COH kPa	SIG kPa
1	18.9	28	14.3	90.0

ROJECT TITLE: 9m wall I-5 PGR mid slope sandstone 3m 6m

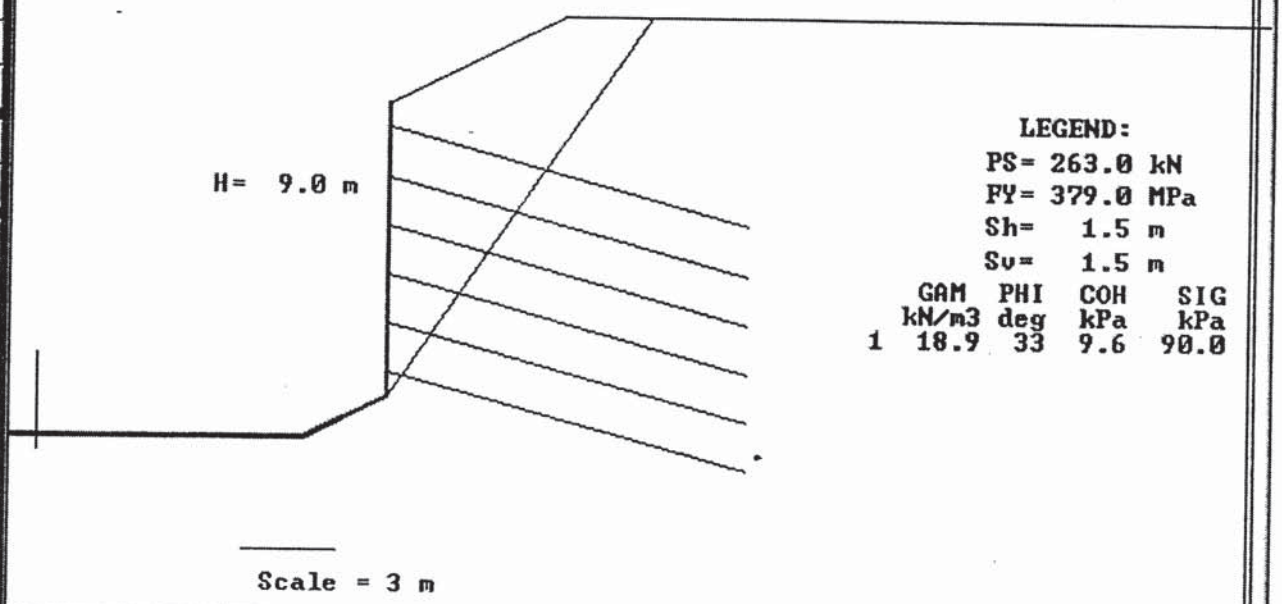
te: 06-28-2005

SnailWin 3.10

File: i-5 pgr 9m wall

Minimum Factor of Safety = 1.71

8.0 m Behind Wall Crest
0.0 m Below Wall Toe



LEGEND:
PS= 263.0 kN
FY= 379.0 MPa
Sh= 1.5 m
Sv= 1.5 m

	GAM kN/m3	PHI deg	COH kPa	SIG kPa
1	18.9	33	9.6	90.0

APPENDIX D

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