APPENDIX G

Geotechnical Report

REVISED GEOTECHNICAL INVESTIGATION
VILLAGE 8 WEST
OTAY RANCH
CHULA VISTA, CA

For:
OTAY LAND COMPANY

October 22, 2010

P/W 1009-05
Report No. 1009-05-B-2

ADVANCED GEOTECHNICAL SOLUTIONS, INC.

TABLE OF CONTENTS

1.0 INTRODUCTION 2
1.1 Background and Purpose 2
1.2 Scope of Study 2
1.3 Project Location and Description 3
1.4 Land Use 3
1.5 Proposed Development 4
1.6 Previous Geotechnical Studies 4
2.0 GEOLOGIC SETTING 5
2.1 Regional. 5
2.2 Stratigraphy 5
2.2.1 Santiago Peak Volcanics (Map Symbol Jsp) 5
2.2.2 Unnamed Fanglomerate Deposits (Map Symbol Tfg) 6
2.2.3 Otay Formation (Map Symbol OO) 6
2.2.4 Terrace Deposits (Map Symbol Qt) 7
2.2.5 Alluvium (Map Symbol Qal) 7
2.2.6 Topsoil 8
2.2.7 Artificial Fills (Map Symbol af) 8
2.3 Geologic Structure/Tectonic Setting 8
2.3.1 Tectonic Framework 8
2.3.2 Regional Faulting 8
2.3.3 Site Geologic Structure 9
2.4 Groundwater 9
2.5 Mass Wasting 10
2.6 Seismic Hazards 10
2.6.1 Surface Fault Rupture 10
TABLE 2-1 11
2.6.2 Ground Motion 11
TABLE 2-2 12
2.6.3 Liquefaction 13
2.6.4 Seismically-Induced Landsliding 13
2.6.5 Seiches and Tsunamis 14
3.0 ENGINEERING ANALYSES 14
3.1 Material Properties 14
3.1.1 Excavation Characteristics 14
3.1.2 Compressibility 15
3.1.3 Expansion Potential 15
3.1.4 Earthwork Adjustments 16

TABLE 3-1 16
3.1.5 Chemical Analyses 16
3.2 Slope Stability 17
4.0 GEOTECHNICAL CONCLUSIONS AND RECOMMENDATIONS 17
4.1 Site Preparation and Removals 17
TABLE 4-1 18
4.2 Slope Stability Remediation 19
4.2.1 Cut Slopes 19
4.2.2 Fill Slopes 19
4.2.3 Terrace Drains 20
4.2.4 Natural Slopes 20
4.3 Overexcavation of Building Pads and Streets 20
4.4 Subsurface Drainage 21
4.5 Construction Staking and Survey 22
4.6 Settlement Monitoring 22
4.7 Earthwork Considerations 23
4.7.1 Compaction Standards 23
4.7.2 Documentation of Removals and Drains 23
4.7.3 Treatment of Removal Bottoms 23
4.7.4 Fill Placement 23
4.7.5 Benching 24
4.7.6 Mixing 24
4.7.7 Fill Slope Construction 24
4.7.8 Oversized Materials 25
4.7.8.1 Rock Blankets 25
4.7.8.2 Rock Windrows 26
4.7.8.3 Individual Rock Burial 27
4.7.8.4 Rock Disposal Logistics 27
4.8 Haul Roads 27
4.9 Import Materials 27
5.0 DESIGN RECOMMENDATIONS 28
5.1 Structural Design - Residential 28
5 .1.1 Foundation Design 29
5.l.2 Post- Tensioned Slab Foundation System Design Recommendations 29
5.1.3 Conventional Slab Recommendations 30
5.l.4 Total & Differential Settlement.. 30
5.1.5 Deepened Footings and Structural Setbacks 31
FIGURE 1 31
5.1.6 Backyard Improvements 32
5.1.7 Miscellaneous Foundation Recommendations 32
5.2 Retaining Wall Design 32
5.2.1 Earth Pressure Coefficients - Select Backfill.. 32

5.2.2 Other Design Considerations 33
5.2.3 Waterproofing and Drainage System 33
FIGURE 2 34
5.3 Other Design and Construction Recommendations 34
5.3.1 Site Drainage 34
5.3.2 Concrete Flatwork and Lot Improvements 34
5.3.3 Utility Trench Excavation 35
5.3.4 Utility Trench Backfill 35
5.4 Preliminary Pavement Design 36
TABLES-I 36
6.0 FUTURE STUDY NEEDS 37
7.0 LIMITATIONS 37

APPENDIX A - REFERENCES
APPENDIX B - SUBSURFACE INVESTIGATION
APPENDIX C - LABORATORY TESTING
APPENDIX D - SLOPE STABILITY CALCULATIONS
APPENDIX E - EARTHWORK SPECIFICATIONS AND GRADING DETAILS
APPENDIX F - HOMEOWNERS MAINTENANCE GUIDELINES

POCKET ENCLOSURES:
SHEETS 3 through 5 and 7
PLATE 1

ADVANCED GEOTECHNICAL SOLUTIONS, INC.
529 West 4th Street, Suite B
Escondido, California 92025
Telephone: (619) 850-3980 Fax: (714) 409-3287

OTAY LAND COMPANY
1903 Wright Place, Suite 220
Carlsbad, CA 92008-1420

October 22, 2010
P/W 1009-05
Report No. 1009-05-B-2

Attention: **Mr. Curt Noland**
Vice President

Subject: **Geotechnical Investigation, Otay Ranch, Village 8 West, Chula Vista, California**

References: Appendix A

Gentlemen:

Presented herein is Advanced Geotechnical Solutions, Inc. (AGS) revised Geotechnical Investigation for Otay Ranch, Village 8 West, Chula Vista, California. AGS has been retained by Otay Land Company to complete the geotechnical services supporting the EIR and Tentative Tract submittal and approval process for this project. Signatories on this report have previous experience on this project and have accepted the findings and recommendations from the reports prepared on the project by Pacific Soils Engineering, Inc. (PSE). Based upon this previous work, AGS will become the Geotechnical Engineer and Engineering Geologist of record for the project.

The purpose of this revision to the Geotechnical Investigation is to address outstanding review comments on the May 26, 2010 Geotechnical Investigation report prepared by PSE. An EIR level investigation was prepared by PSE (2006) based upon subsurface work compiled in 2004 (PSE). That information and data is included herein. In response to outstanding review comments, the May 26, 2010 document was published by PSE. Additional review comments have been provided addressing that submittal and this document has been produced to respond to those comments via a revised version of the May 26, 2010 report.

Presented in this transmittal is explanatory text and geotechnical maps and cross sections utilizing the most current Tentative Tract Map (dated August 11, 2010) prepared by Hale Engineering (Sheets 3 through 5, & 7 of 7).

AGS appreciates the opportunity to provide you with geotechnical consulting services on this project. If you have questions concerning this report, please do not hesitate to contact the undersigned at (619) 708-1649

Respectfully submitted,
Advanced Geotechnical Solutions, Inc.

JEFFREY A. CHANEY, Vice President	PAUL DE RISI, Vice President
RCE 46544/RGE 2314, Reg. Exp. 6-30-11	CEG 2536, Reg. Exp. 5-31-11

Distribution: (8) Addressee
(1) Hale Engineering, Attn: John Hayes (pdf)

1.0 INTRODUCTION

1.1 Background and Purpose

The purpose of this report is to provide a "Tentative Tract Level" (TTM) geotechnical study of Portions of Otay Ranch, Village 8 West, Chula Vista, California that may be utilized to support the EIR submittal. This report has been revised to geotechnically address the most current TTM design prepared by Hale Engineering and to integrate responses to outstanding City of Chula review comments. This report has been prepared in a manner consistent with City of Chula Vista geotechnical report guidelines and the current standard of practice. Geotechnical conclusions and recommendations are presented herein and items addressed include: 1.) Unsuitable soil removals; 2.) Cut, fill and natural slope stability and remedial grading, where necessary; 3.) Buttress/Stabilization fill requirements; 4.) Cut/fill pad over excavation criteria; 5.) Remedial and design grading recommendations; 6.) Handling and disposal of oversize hard earth materials and 6.) Foundations design recommendations based upon anticipated as graded soil conditions.

1.2 Scope of Study

This study is aimed at providing geotechnical/geologic conclusions and recommendations for development of TTM for residential uses, attendant streets, parks, school and open space areas. The scope of this study included the following tasks:

- Review of readily available maps, literature and aerial photographs (Appendix A).
- Review of site geologic mapping conducted by PSE and refinement by AGS for this report.
- Compilation of previous subsurface data from PSE (2004) including seventy-three (73) backhoe test pits and sixteen (16) bucket auger borings that were also included in the subsequent 2006 EIR study (Appendix B). This data has been plotted onto the current Tentative Tract map for Village 8 West (Sheets 3 through 5, and 7 of 7) prepared by Hale Engineering (dated August 11, 2010).
- Compilation of previous laboratory testing conducted by PSE (Appendix *C).*
- Preparation of geologic cross sections (Plate 1)
- Stability analysis of both the highest cut and fill slopes (Appendix D)
- Data analyses in relation to the site specific proposed improvement.
- Analysis of the excavation characteristics (i.e. rippability) of onsite bedrock materials.
- Discussion of pertinent geologic and geotechnical topics.
- Preparation of this report and accompanying exhibits.

1.3 Project Location and Description

The subject tentative map is part of the larger Otay Ranch Master Planned Community. Specifically, this report covers portions of Otay Ranch, Village 8 West. The 320-acre property is rectangular-shaped, and is located along the southern portions of the Otay Mesa, north of the Otay River (Figure 1). The site consists of two (2) bedrock controlled, topographic regimes. The north and east portions are underlain by Otay Formation and consist of gently rolling terrain that is punctuated by south flowing "V"-shaped drainages. Most drainages are broad and relatively shallow; however, locally along incised flow-lines, gradients on the order of 1.5: 1 (horizontal to vertical) or steeper exist. Low-relief river terraces superjacent to the Otay River occupy the southernmost portion of this terrain. The southwest portion of the parcel reflects of more rugged terrain underlain by Santiago Peak Volcanics. Surface outcrops and large in-place exposed boulders are common, reflecting the bedrocks resistant character.

Approximately 37.3 acres of slopes with gradients greater than 25% are present within the project limits. This area is referred to as Rock Mountain and relief over the volcanic area within project limits is over 300 feet (Sheet 4). The southerly extension of the offsite 30 foot access road for the proposed sewer, storm drain, and water mains extends approximately 4,000 feet traversing through relatively level Terrace deposits before it drops into the alluviated Otay River drainage.

1.4 Land Use

Current and past use includes light agriculture such as dry farming and pasture. A 19.6-acre City of San Diego reservoir occupies the central part of the site (Sheet 3). Reservoir-associated large-diameter aqueducts forming the *Coronado Wye* traverse the site at the approximate locations shown on Sheets 3, 4, 5 and 7. The aqueducts were conducted by cut and cover methods and in tunnels whose locations are within the easements shown on the accompanying plates. A rock quarry is located southwest of the project.

1.5 Proposed Development

It is AGS's understanding that the Otay Ranch, Village 8 West will be developed to include mixed use of residential, commercial, recreational and institutional components. The approximate 320-acre site is scheduled for 2050 living units with 21 acres allocated for a school site and 19.8 acres for three parks. Additionally, a sewer access road is proposed at the south project boundary and ties into the existing sewer that parallels the Otay Valley (Sheet 7). Dedicated open space totals 22.8 acres and public streets cover 28.6 acres. It is estimated that 4,676,000 cubic yard of excavation will be required to grade the project. Import or export of materials in not planned for the project.

The grading concept shown on Sheet 3 through 5 depicts 20 large pads located on the north and east portions of the property. Grade splits of several feet to as much as 30 feet separate the pads. The single-family neighborhoods flank these larger pads to the south and southwest. Cuts as deep as 150± feet are planned in the southwest portion of the site while fills up to about 50 feet deep are shown in the south portion of the site. The cut slopes onsite are designed at ratios of 2: 1 (horizontal to vertical) to vertical heights of 135 feet. Fill slopes are designed at ratios of 2:1 (horizontal to vertical) up to vertical heights of 70 feet. It is our understanding that the existing City of San Diego Reservoir will remain in-place and that the large-diameter aqueducts will be relocated.

1.6 Previous Geotechnical Studies

Pacific Soils Engineering, Inc. (2003) ~~has~~ completed a feasibility-level geotechnical report for Parcels "A", "B" and "C". Neblitt and Associates, Inc. (2003) undertook geologic mapping along a waterline trench excavation in Parcel "B". An EIR level report was prepared in June of 2006 utilizing data generated from a subsurface investigation (conducted in 2004). A revised Geotechnical Investigation was prepared by PSE in May of 2010. AGS has reviewed the PSE and NA reports and have incorporated those findings and revisions into this study.

2.0 GEOLOGIC SETTING

2.1 Regional

Otay Mesa in general and Village 8 West in particular are part of a broad, relatively undeformed, uplifted highland encompassing much of western and southern San Diego County. Elements of the Elsinore and Laguna Salada Faults bound the highlands in the east and the Rose Canyon and associated offshore fault to the west. Otay Mesa consists of Mesozoic metamorphic, volcanic and igneous rocks on which marine and non-marine Cretaceous through Holocene sediments have been deposited (Kennedy and Tan, 1977). These deposits have been only mildly deformed and are easily recognized as widespread, near-horizontal, sedimentary beds forming the broad tablelands and rolling hills of Otay Mesa.

2.2 Stratigraphy

The local stratigraphy reflects the regional, near-horizontal to gently southwest dipping Oligocene Otay Formation, and a Tertiary un-named fanglomerate. These mapped units non-conformably overlie volcanic and metavolcanic rocks of the Mesozoic Santiago Peak Volcanics. In turn, various Pleistocene and Holocene non-marine sediments mantle those formations, particularly in the south part of the site. Approximate geologic contacts are shown on Sheets 3 through 5 and

sheet 7 with subsurface relationships depicted on the geologic cross sections (Plate 1).

2.2.1 Santiago Peak Volcanics (Map Symbol Jsp)

The Santiago Peak Volcanics crop out in the southwest part of the property and represent the east flank of Rock Mountain. The contact between the Santiago Peak Volcanics and the overlying younger geologic units represents a significant geologic hiatus. This contact is irregular and reflects a relatively high relief Mesozoic landscape. Subsequent erosion has exhumed portions of this ancient landscape, creating modern topographic highs including Rock Mountain.

In addition, buried, near-surface Santiago Peak Volcanics were observed in the subsurface investigation generally along the west property line (BA-12, TP-43 and TP-46) of Sheet 3 and cross section A-A".

The Santiago Peak Volcanics are generally dense and mildly metamorphosed volcanic rocks. Large in-place surface boulders occur on natural slope areas in Neighborhoods P and N (Sheet 4). Composition of the volcanic rocks varies from basalt to rhyolite but is predominantly dacite and andesite (Kennedy and Tan, 1977). Typically the meta-volcanics display crude to moderate bedding and foliation. Fracturing is poorly to moderately well developed. In general, outside of boulder areas, a weathered halo of only a few feet thick exists. Below this the rock is very dense and will require blasting to excavate. Blasting operations have been widespread in the nearby quarry, where the formation has been mined for aggregate.

2.2.2 Unnamed Fanglomerate Deposits (Map Symbol Tfg)

A Tertiary fanglomerate initially mapped by Kennedy and Tan (1977) crops out in the lower-elevation slopes above the Otay River (Sheets 4, 5 and 7). This mapping unit either locally pinches out or is covered by river terrace deposits south of the property. Angular metamorphic boulders typify the clasts within the unit. The matrix is rubified, dense and moderately to well cemented. Crude horizontal to sub-horizontal stratification is identifiable in some outcrops. Rubification, cementation and presence of subrounded "meta-breccia" cobbles distinguish this formation from overlying Pleistocene terrace deposits.

2.2.3 Otay Formation (Map Symbol Oo)

The Oligocene Otay Formation underlies most of the study area. Brown to light gray sandstone/gritstone typifies the formation. It is generally poorly to moderately indurated and is locally cross-bedded. Infrequent to common gray bentonite beds occur throughout the section. Typically, these beds are one to several feet thick and have relatively sharp contact with the

interbedded sandstones. The clay beds are expansive and exhibit low shear strengths when wetted. Harder and more resistant "gritstone" sub-units are common within the Otay Formation and can range from a few feet to tens of feet thick. Breccia sub-units consisting of rounded to angular cobbles to boulder-sized clasts can also be found within the Otay Formation near the contact of the Santiago Peak Volcanics. These beds are likely equivalent to the Tertiary Fanglomerate (Kennedy and Tan, 1977). The Breccia subunits encountered in the subsurface explorations onsite consisted of gravel to cobble-sized clasts. The Otay Formation is less resistant than the Santiago Peak Volcanics and unnamed Fanglomerate and thus forms subdued, rolling topography exemplifying Otay Mesa. Its steepest slopes occur where young consequent tributaries to the Otay River are actively eroding headward and downward.

2.2.4 Terrace Deposits (Map Symbol Qt)

Veneers of Pleistocene cobbley to bouldery, well oxidized, dense sands have been mapped on surfaces 90 to 170 feet above the modern Otay River channel. These deposits are depicted as terrace deposits in Neighborhoods U and V (Sheet 5) and along the majority of the sewer access road alignment (sheet 7). These deposits vary from a few tens of feet thick to only a veneer of lag gravel composed of residual dense cobbles and boulders.

2.2.5 Alluvium (Map Symbol Qal)

Alluvium occupies the onsite drainages. The alluvium observed is porous, expansive, and exhibits low in-situ density. Typical these sediments vary from but a few to ten (10) feet in thickness with local variations.

2.2.6 Topsoil

A mantle of residual "topsoil" is present over much of the rolling hills underlain by Otay Formation. The soils are typically one (1) to five (5) feet thick, low density, organic-rich and porous. Generally, the areas underlain by Santiago Peak Volcanics have thinner soils and are locally absent as evidenced by the frequent occurrence of surface boulders.

2.2.7 Artificial Fills (Map Symbol af)

Significant deposits of artificial fill are associated with the reservoir and also exist over the aqueducts crossing the site. Sheets 2 through 5, and 7 depict the locations of the major, most recognizable artificial fill. Small prisms of fill that have not been mapped are primarily associated with unimproved Jeep trails.

2.3 Geologic Structure/Tectonic Setting

2.3.1 Tectonic Framework

The Otay Mesa is part of the Santa Ana sub-block of the Peninsular Ranges that extends from Baja California in the south and that terminates in the north against the Transverse Ranges east of Los Angeles (Jennings, 1994). The Santa Ana sub-block is a highland bounded by the Elsinore Fault Zone on the east and by the Rose Canyon Fault Zone on the west. Many areas, especially in the San Diego region, have remained relatively un-deformed. The Otay Mesa is such an example as indicated by the unfolded, nearly horizontal section of sedimentary rocks.

2.3.2 Regional Faulting

Regional faults in southernmost California typically trend northwest (Figure 2) and display major right lateral slip with common smaller scale vertical displacements (Jennings, 1994). Significant faults of this system displaying Holocene offset are the San Andreas, Elsinore, San Jacinto, Coronado Bank, Newport-Inglewood and Rose Canyon Faults. Of these, the Rose Canyon Fault is the closest, being approximately twelve (12) miles (19.3 km) west.

The closest mapped fault is the La Nacion (Kennedy and Tan, 1977) about two (2) miles to the west. Those authors show the fault separating Tertiary sedimentary rocks in the west from Mesozoic rocks in the east. A nearby subsurface investigation by PSE along that fault demonstrated that it is not active as evidenced by unbroken Pleistocene sediments overlying the fault. Jennings (1994) mapped a "pre-Quaternary" fault in and paralleling the Otay River. The "matching" of Mission Valley Formation outcroppings west of the study sites on either side of the Otay River (Kennedy and Tan, 1977) argue for limited displacement along this postulated fault, if it even exists.

2.3.3 Site Geologic Structure

The Santiago Peak Volcanics typically exhibit poorly to moderately well developed fracturing and display crude to moderate bedding/foliations. As exposed in the nearby quarry, joints and foliation/bedding dip steeply.

The Tertiary fanglomerate and Otay Formation are only slightly fractured and represent an essentially horizontal section of rocks. Local dips of less than 5 degrees to the south or southwest have been recognized in the region (Kennedy and Tan, 1977) although local undulations are possible. These dips may reflect broad up-warping of the region or, alternatively, they may

represent initial dips. Faults were not mapped within onsite outcrops or subsurface explorations.

2.4 Groundwater

Active springs or surface seeps were not observed during our geologic field mapping or subsurface investigation. It is possible that seasonal groundwater associated with precipitation intermittently occurs in onsite drainages. Owing to the depth of cut, it is possible that seasonal nuisance water trapped along joints or beds may be encountered during grading especially in the Santiago Peak Volcanics. Minor seeps or wet areas were observed in Borings BA-9, BA-11 and BA-12.

2.5 Non-Seismic Geologic Hazards

2.5.1 Mass Wasting

The Otay Formation is susceptible to erosion and slumping. Surficial slumps and bedrock landslides were observed within the Otay Formation west of the project but not onsite. These features often are associated with the La Nacion fault and/or bentonite beds exposed by erosion and baseline down cutting.

No indications of mass wasting was observed nor mapped within the Santiago Peak Volcanics. The absence of mass wasting and the existence of relatively stable, steep natural slopes is common is this erosion resistant unit.

Within the project significant landslides were not identified during site reconnaissance and subsurface investigation.

2.5.2 Flooding

According to FEMA, the site is not within a FEMA identified flood hazard.

2.5.3 Subsidence and Ground Fissuring

The Santiago Formation, Otay Formation and the Fanglomerate/Terrace deposits are not susceptible to subsidence and or ground fissuring. The surficial units on site (alluvium, undocumented fill and topsoil's) can be susceptible to minor amounts of subsidence and ground fissuring.

2.6 Seismic Hazards

The project is located in the tectonically active southern California, and will likely experience some effects from future earthquakes. Alquist-Priolo Fault Hazard Zones have not been imposed

within the subject property. The State of California Seismic Hazards Mapping program identifying areas of potential liquefaction and earthquake induced landsliding has not addressed the Otay Quadrangle as of this writing.

The type or severity of seismic hazards affecting the site is chiefly dependent upon the distance to and direction from causative faults, the intensity and duration of the seismic events, and the onsite soil characteristics. The seismic hazard may be primary, such as surface rupture and/or ground shaking, or secondary, such as liquefaction or landsliding. The following is a brief seismic hazards assessment for the project

2.6.1 Surface Fault Rupture

Active, potentially active and inactive faults are not known to exist at the site. According to the literature, the nearest known active fault is the Rose Canyon Fault, a Type "B" fault (UBC, 1997), located approximately twelve (12) miles (19 km) west. Accordingly, the potential for fault surface rupture within the project is not significant. A listing of active faults within about 100-kilometers (62 miles) of the site is presented in Table 2-1.

Table 2-1

Distance to Known Active Faults

Fault Name	Distance		Maximum Moment Magnitude (Mmax)*
	(mi)	(Km)	
Rose Canyon	12	19	6.9
Coronado Bank	28	28	7.4
Elsinore-Julian	43	69	7.1
Elsinore-Coyote Mountain	45	73	6.8
Earthquake Valley	46	75	6.5
Newport-Inglewood (Offshore)	47	75	6.5
Elsinore-Temecula	54	88	6.9
San Jacinto-Coyote Creek	63	105	6.8
San Jacinto-Borrego	63	105	6.6
Laguna Salada	66	106	7.0

* Petersen and others (1996) and Blake *(FRISKSP,* ver.4.0

2.6.2 Seismicity

Although no known active faults exist within the project limits, the site will experience ground motion and associated effects from earthquakes generated along regional active faults such as those listed in Table 2-1. Figures 2 and 3 are generalized maps showing the active faults considered in the assessment of ground motion. Figures 4 and 5 show regional historical earthquakes between 1800 to 1999.

To estimate potential ground shaking, PSE performed a probabilistic seismic hazard analysis (PSHA) that is consistent with the commonly accepted procedures outlined in Petersen and others (1996) and the UBC (ICBO, 1997). PSE used *FRISKSP,* developed from United States Geologic Survey software *(FRISK)* by Blake (2000); to derive hypothetical probabilistic peak horizontal accelerations using three commonly employed attenuation relationships of Boore and others (1997), Campbell (1997,1999 Revised) and Sadigh and others (1997). Subsoil types SB (shear wave velocity 1070 m/s) and SD (shear wave velocity 250 m/s) were used by *FRISKSP.* Based on limited information, soil type SB is representative of the Santiago Peak Volcanics and SD was preliminarily judged typical of all other soil/rock types. For a complete discussion of the software and probabilistic methods, the reader is referred to Blake (2000)

Table 2-2 presents the horizontal ground accelerations and the average of same, representing the UBC-consistent 10 percent probability of exceedance in 50-years (475-year return period) as calculated by *FRISKSP.* Figures 6 through 11 show the probability of exceedance curves for each attenuation relationship, using both subsoil types. Whereas the 10 percent probability of exceedance in 50 years is the Design Basis Earthquake generally applied to "normal" structures such as housing, the Upper Bound Earthquake (10 % chance of exceedance in 100 years) is required for design of critical structures such as schools and emergency facilities. The Upper Bound numbers can be deduced by inspection of Figures 6 through 11.

Table 2-2

Horizontal Ground Accelerations

Investigators	Volcanics	Other Geologic Units (onsite)
Boore and others 1997	0.17g	0.25g
Campbell, 1997	0.17g	0.21g
Sadigh and others, 1997	0.2g	0.2g
Average	***0.18g***	***0.22g***

It should be noted that these hypothetical numbers are based on recent standards of practice (for example, Martin and Lew, 1999, Petersen, 1996) and thus differ from numbers derived from past standards of practice.

In sum, these results are based on many unavoidable geological and statistical uncertainties, yet are consistent with current standard of practice. As engineering seismology evolves and as more fault-specific geological data are gathered, more certainty and different methodologies may also evolve.

2.6.3 Liquefaction

Seismic agitation of relatively loose saturated sands and silty sands can result in a buildup of pore pressure. If the pore pressure exceeds the overburden stresses, a temporary quick condition known as liquefaction may occur. The effects of liquefaction at a site can manifest in several ways, and may include: 1) ground oscillations; 2) loss of bearing; 3) lateral spread; 4) dynamic settlement; and 5) flow failure.

Within the vast majority of the project, the potential for liquefaction in both the pre- and post-development condition is very low due to the lack of liquefaction susceptible earth materials and the dense nature of the onsite geologic units.

2.6.4 Seismically-Induced Landsliding

No landslides, including shallow surficial failures, have been mapped onsite. This indicates the lack of any seismically activated land sliding during past historic and ancient seismic events. Seismically induced land sliding is not considerate a significant concern in both the pre- and post-development site condition.

2.6.5 Seiches and Tsunamis

Seismically induced hazards such as tsunamis and earthquake-induced flooding are not considered significant hazards. If at full capacity, it is possible that during a strong seismic event with a long duration of shaking, minor localized overtopping of the City of San Diego reservoir could occur. It appears that adequate freeboard exists for nearly the entire reservoir with the possible exception at the low point where the paved access road meets the reservoir. At this location, any overtopping would be directed onto the proposed paved access road and down to Street " storm drain improvements. Given the likelihood, volume of the reservoir, and area of

potential overtopping, it is likely that this event would not be a significant hazard.

3.0 ENGINEERING ANALYSES

Presented herein is a discussion of the geotechnical properties of the various soil types and earth materials that have been developed from our site-specific analyses of the design as shown on Sheets 2 through 5 and 7, PSE's subsurface investigation, and the referenced reports.

3.1 Material Properties

3.1.1 Excavation Characteristics

The excavation characteristics of the onsite materials are highly variable. The meta-volcanic rock, which occurs in the southwest portion of the site, will require blasting at or near the natural ground surface for efficient excavation in order to achieve design grade as well as the undercuts to accommodate footings, utilities and other subsurface improvements. It is likely that the blasting and excavation operations will generate oversized rock fragments requiring specialized techniques.

The other onsite materials, including Otay Formation, Tertiary Fanglomerate, terrace deposits, topsoil and artificial fill can be excavated with conventional techniques (scrapers) assisted by minor to moderate ripping. Oversize material can be expected in the Fanglomerate. Heavy ripping and possible local blasting should be anticipated in some localized areas of the Otay Formation. In most cases this would be due to highly cemented sandstone, gritstone and/or the presence of cobbles, boulders and concretions. Excavations into this formation can possibly generate oversize material that may require special handling and placement within selected fill areas (See Section 4.7.8). Discussion of undercut recommendations is contained in Section 4.3 of this report.

3.1.2 Compressibility

Onsite materials that are significantly compressible include slope wash, topsoil and the undocumented artificial fill, and the highly weathered portions of older alluvium, terrace, Tertiary Fanglomerate, Otay Formation and metavolcanic rock. Mitigation measures addressing potentially compressible soils are presented in Section 4.1

3.1.3 Expansion Potential

It is anticipated that the expansion potential of the majority of onsite materials will vary from "low" to "very high". The majority of earth materials to be used in grading will possess an expansion index in this range with some of the bentonite clays possibly in the "Very high" category (UBC Table 18-1). Review of the grading design and boring information preliminarily

indicates a paucity of thick and common bentonite sub-units with the Otay section. Mitigation for this condition is further discussed in sections 5.1.

3.1.4 Earthwork Adjustments

In consideration of the proposed mass grading to develop the project as currently proposed on the *Preliminary Tentative Tract* maps the following average earthwork adjustment factors presented in Table 3-1 have been formulated for use in the earthwork design of the project.

.

Table 3-1
Earthwork Adjustments

Geologic Unit (map symbol)	Adjustment Factor
Undocumented Artificial Fill (afu)	6%-10% Shrink
Alluvium (Qal)	8%-12% Shrink
Terrace/Fanglomerate (Qt/Tfg)	0%- 2% Bulk
Otay Formation (Oo)	0%- 5% Bulk
Santiago Peak Volcanics (Jsp)	15%- 25% Bulk

3.1.5 Chemical Analyses

The results of chemical/resistivity tests, presented in Appendix C (Plates C-l through C-13) indicate that the soluble sulfate potential for the majority of the site can be classified as "negligible" in accordance with ACI 318-05 per the 2007 CBC. Test results for chloride and pH indicate a potential for corrosive attack on metal portions of the proposed structures. We recommend that a corrosion engineer be consulted for additional testing and design/construction recommendations. Testing should be conducted on the near-surface soils after grading completion Mitigation for this condition is further discussed in section 5.1.

3.2 Slope Stability

Typically, the Santiago Peak Volcanics are grossly stable in cut and natural slopes owing to their induration. Local wedge-type failures are not likely, but should be assessed by geologic mapping during grading. The Otay Formation in many places possesses only moderate to weak shear strengths, particularly where bentonite beds are present. The wetting of the bentonite can lead to further reduction in shear strengths both along and across bedding. Review of the subsurface data and proposed design indicates that bentonitic claystone beds could possibly daylight on the face

of proposed cut slopes. The Fanglomerate and the Terrace deposits are anticipated to be grossly and surficially stable in cut and natural slopes owing to their lack of defined bedding and the granular nature of these deposits.

Slope stability analyses were performed using the Modified Bishop Method for circular and non-circular failure surfaces. Stability calculations were compiled using *STEDwin* in conjunction with *GSTABL7* computer code. The results of our analyses is presented on Plates D-l through D-4 in Appendix D. Additionally, a surficial slope stability analysis was conducted on Plate D-5.

4.0 GEOTECHNICAL CONCLUSIONS AND RECOMMENDATIONS

Development of the subject property as proposed is considered feasible, from a geotechnical standpoint, provided that the conclusions and recommendations presented herein are incorporated into the design and construction of the project. Presented below are issues identified by this study or previous studies as possibly impacting site development. They are further summarized and described in Sections 2.0 and 3.0. Recommendations to mitigate these issues and geotechnical recommendations for use in planning and design are presented in the following sections of this report.

4.1 Site Preparation and Removals

Grading should be accomplished under the observation and testing of the project soils engineer and engineering geologist or their authorized representative in accordance with the recommendations contained herein, the current Municipal Code of the City of Chula Vista, and PSE's *Earthwork Specifications* (Appendix E). Existing vegetation, trash, debris and other deleterious materials should be removed and wasted from the site prior to removal of unsuitable soils and placement of compacted fill. Artificial fill, topsoil, alluvium, highly weathered terrace deposits and highly weathered Otay Formation, Tertiary Fanglomerate and Santiago Peak Volcanics should be removed in areas planned to receive fill or where exposed at final grade. The resulting undercuts should be replaced with engineered fill. Estimated depths of removals based upon the geologic unit are presented in Table 4-1, it should be noted that local variations can be expected requiring an increase in the depth of removal for unsuitable and weathered deposits. The extent of removals can best be determined in the field during grading when observation and evaluation can be performed by the soil engineer and/or engineering geologist. Removals should expose competent Terrace deposits, Otay Formation, Tertiary Fanglomerate or Santiago Peak Volcanics and be observed and mapped by the engineering geologist prior to fill placement. In general, soils removed during remedial grading will be suitable for reuse in compacted fills

provided they are properly moisture conditioned and do not contain deleterious materials.

The northwest-trending tunnels that currently contain the large-diameter aqueduct should be properly mitigated prior to improvement construction. Mitigation methods include excavation to expose the tunnel and then infill with engineered, compacted fill or infill with lightweight sand/cement grout. A combination of these methodologies may be employed depending upon the depth of the tunnel below the design ground surface.

Table 4-1
Estimated Depth of Removal

Geologic Unit (map symbol)	Estimated Removal Depth
Undocumented Artificial Fill (afu)	3-15 feet
Topsoil (No Map Symbol)	2-5 feet
Alluvium (Qal)	4-10 feet
Terrace Deposits (Qt)	1-4 feet
Otay Formation (Oo)	3-6 feet
Tertiary Fanglomerate (Tfg)	1-3 feet
Santiago Peak Volcanics (Jsp)	1-3 feet

4.2 Slope Stability Remediation

4.2.1 Cut Slopes

Cut slopes have been designed at slope ratios of 2: 1 (horizontal to vertical) to heights of one hundred thirty five feet. Stability calculations are presented on Plates D-1 through D- 2. The engineering geologist should observe all cut slopes during grading. Based on our analysis of the subsurface data and review of the proposed design, it is possible that flat lying bentonitic claystone beds may be exposed on finished slope faces. Additional evaluation for this condition should be conducted once 40-scale plans become available. At that time more detailed recommendations can be presented. A skin fill slope and a fill over cut slope-requiring stabilization fills have been identified on Sheet 4.

Upon completion of 40-scale grading plans, these areas should be evaluated for the appropriate

remedial measure. At that time a more detailed analysis can be provided that can be based on detailed slope dimensions and allow for accurate keyway determinations. Ultimately, all final remedial cut slope recommendations should be based upon conditions exposed during grading to confirm that assumptions developed during this and future grading plan reviews are consistent with those observed in the field.

All buttress and stabilization fills will require backdrain systems as shown on Detail-3 (Appendix E). Upper tier backdrains are recommended in stabilization and buttress fills where geologic contacts and/or claystones daylight in the backcut or where backcut heights exceed thirty (30) feet.

4.2.2 Fill Slopes

Fill slopes are designed at ratios of 2: 1 (horizontal to vertical) or flatter up to heights approaching seventy (70) feet. Fill slopes, when properly constructed with onsite materials, are expected to be grossly stable as designed. Stability calculations are presented on Plates D-3 through D- 5.

4.2.3 Natural Slopes

Within the project limits, natural slopes are either very low relief or present below propose developed areas consisting of relatively stable Santiago Peak Volcanic terrain. An example is at the south end of the project south of Neighborhoods P and V. Accordingly, natural slopes are considered relatively stable.

4.3 Overexcavation of Building Pads and Streets

4.3.1 Building Pads

It is recommended that overexcavation of "cut" lots in hard rock, well cemented sandstones and/or cemented breccia (Tertiary Fanglomerate) be performed. The cut and any shallow fill portions of these lots should be overexcavated a minimum of three (3) feet and replaced to design grade with select compacted fill. The undercut should be excavated such that a gradient of at least one percent be maintained toward the front of the pad. Replacement fill should be eight inch minus in particle size and compacted to project specifications. Preliminarily, anticipated rock undercuts are indicated by a "circled R" (see legend, Sheet 3). Final determination of pad undercut for hard rock at grade should be determined when more detailed plans are available. It is possible that relatively thin (i.e. less than one (1) foot) bentonitic claystone beds may be exposed at pad grade. Review of the data and design indicate that most of the recognized beds will not be

exposed at pad grades. This includes the single family lots and larger pads areas. Accordingly, no undercuts to mitigate the effects of claystone beds are formulated at this time; however should such beds occur in the near-surface, undercutting to depths of 5 to 10 feet and replacement with compacted fill may be warranted. When grading plans are available, a thorough evaluation should be performed for this condition.

Where design or remedial grading activities create a cut/fill transition in areas of the Otay or other formations that do not require blasting, excavation of the cut or shallow fill portion should be performed such that at least three (3) feet of compacted fill exits over the pad. The undercut overexcavation should maintain a minimum one (1) percent gradient to the front of the lot. In addition, where steep cut/fill transitions are created, additional overexcavation and flattening of the transitions are recommended.

Undercuts for the larger sheet graded pads should be deferred until actual product types and finished grades are determined.

4.3.2 Streets

Street undercuts in hard rock areas should be based on depth of utilities within "public right of way". The depth of undercut for streets should be at least one (1) feet below the deepest utility. Final determination of undercut depths should be dependent upon review of more detailed plans once they become available.

4.4 Subsurface Drainage

Six- (6) and eight- (8) inch canyon subdrains are recommended onsite in canyon areas that will receive compacted fill. The drains should be placed along the lowest alignment of canyon removals. Final locations of subdrains should be assessed during preliminary investigations and plan analyses. Preliminary subdrain locations are depicted on Plates 3 through 5 and 7. Final determination of drain locations will be made in the field, based on exposed conditions. All drains should be constructed in accordance with the details shown on Detail 1 and 2 (Appendix E).

In some instances post-grading irrigation practices and rainfall patterns can create seepage in cut and fill slopes. This seepage is more prevalent in cut slopes excavated in Santiago Peak Volcanics or fill slopes constructed out of shot rock. Where nuisance seepage is observed, drains are typically installed to collect this water and outlet it into suitable surface or subsurface drainage devices. These drains, if required, should be installed on a case by case basis per the geotechnical consultant’s recommendations.

The infiltration of standing water into all BMP's could potentially be detrimental to improvements such as slopes, foundations, utility trenches, retaining walls and pavement sections. Geotechnical

review of grading plans should be performed when available to determine which storm drain infiltration devices may require mitigation such as collecting and discharging accumulated subsurface water away from improvements.

4.5 Construction Staking and Survey

Removal bottoms, keyways, sub drains and backdrains should be surveyed by the civil engineer after observation by the geotechnical engineer/engineering geologist and prior to the placement of fill. Toe stakes should be provided by the civil engineer in order to verify required key dimensions and locations. Survey support will also be required to monitor settlement as discussed in Section 4.6.

4.6 Settlement Monitoring

Fills are subject to post-grading settlement it is recommended that all fills greater than fifty (50) feet in thickness be monitored prior to release for construction. The monitoring can be accomplished by installation of surface monuments as detailed on Detail 12 (Appendix E). Tentative settlement monument locations should be determined once more detailed 40-scale plans become available.

Surface monuments should be surveyed every two (2) weeks for two (2) months and monthly thereafter until data warrants release of the area for utility or residential construction. It is likely that infrastructure development can be initiated in advance of completion of the primary settlement process, depending upon the sensitivity of improvements to the anticipated settlement.

4.7 Earthwork Considerations

4.7.1 Compaction Standards

Fill and processed natural ground shall be compacted to a minimum relative compaction of 90 percent as determined by ASTM Test Method: D 1557. All fill to be placed below fifty (50) feet from ultimate grade and/or below subdrains should be compacted to at least 93 percent of maximum density. Care should be taken that the ultimate grade be considered when determining the compaction requirements for disposal fill and "super pad" areas. Compaction shall be achieved at slightly above the optimum moisture content, and as generally discussed in the attached Earthwork Specifications (Appendix E).

4.7.2 Documentation of Removals and Drains

Removal bottoms, canyon subdrains, fill keys, backcuts, backdrains and their outlets should be observed by the engineering geologist and/or geotechnical engineer and documented by the civil

engineer prior to fill placement.

4.7.3 Treatment of Removal Bottoms

At the completion of removals, the exposed bottom should be scarified to a depth of approximately 8 to 12 inches, moisture conditioned to above optimum conditions, and compacted in-place to the standards set forth in this report.

4.7.4 Fill Placement

After removals, scarification, and compaction of in-place materials are completed, additional fill may be placed. Fill should be placed in thin lifts [eight- (8) inch bulk], moisture conditioned to slightly above the optimum moisture content, mixed, compacted, and tested as grading progresses until final grades are attained.

4.7.5 Benching

Where the natural slope is steeper than 5-horizontal to 1-vertical, and where designed by the project geotechnical engineer or geologist, compacted fill material should be keyed and benched into competent bedrock or firm natural soil.

4.7.6 Mixing

In order to provide thorough moisture conditioning and proper compaction, processing (mixing) of materials is necessary. Mixing should be accomplished prior to, and as part of the compaction of each fill lift.

4.7.7 Fill Slope Construction

Fill slopes shall be overfilled to an extent determined by the contractor, but not less than two (2) feet measured perpendicular to the slope face, so that when trimmed back to the compacted core, the required compaction is achieved.

Compaction of each fill lift should extend out to the temporary slope face. Backrolling during mass filling at intervals not exceeding four (4) feet in height is recommended unless more extensive overfill is undertaken.

As an alternative to overfilling, fill slopes may be built to the finish slope face in accordance with the following recommendations:

- Compaction of each fill lift shall extend to the face of the slopes.
- Backrolling during mass grading shall be undertaken at intervals not exceeding four (4) feet in height. Backrolling at more frequent intervals may be required.

- Care should be taken to avoid spillage of loose materials down the face of the slopes during grading.
- At completion of mass filling, the slope surface shall be watered, shaped and compacted first with a sheepsfoot roller, then with a grid roller operated from a side boom Cat, or equivalent, such that compaction to project standards is achieved to the slope face.

Proper seeding and planting of the slopes should follow as soon as practical, to inhibit erosion and deterioration of the slope surfaces. Proper moisture control will enhance the long-term stability of the finished slope surface.

4.7.8 Oversized Materials

Oversized rock material [i.e., rock fragments greater than eight (8) inches] will be produced during the excavation of the design cuts and undercuts. Provided that the procedure is acceptable to the developer and governing agency, this rock may be incorporated into the compacted fill section to within three (3) feet of finish grade within residential areas and to two (2) foot below the deepest utility in street and house utility connection areas. Maximum rock size in the upper portion of the hold-down zone is restricted to eight (8) inches. Disclosure of the above rock hold-down zone should be made to prospective homebuyers explaining that excavations to accommodate swimming pools, spas, and other appurtenances will likely encounter oversize rock [i.e., rocks greater than eight (8) inches] below three (3) feet. Rock disposal details are presented on Detail-10, Appendix E. Rocks in excess of eight (8) inches in maximum dimension may be placed within the deeper fills, provided rock fills are handled in a manner described below. In order to separate oversized materials from the rock hold-down zones, the use of a rock rake may be necessary

4.7.8.1 Rock Blankets

Rock blankets consisting of a mixture of gravel, sand and rock to a maximum dimension of two (2) feet may be constructed. The rocks should be placed on prepared grade, mixed with sand and gravel, watered and worked forward with bulldozers and pneumatic compaction equipment such that the resulting fill is comprised of a mixture of the various particle sizes, contains no significant voids, and forms a dense, compact, fill matrix. Rock blankets may be extended to the slope face provided the following additional conditions are met: 1) no rocks greater than twelve (12) inches in diameter are allowed within six (6) horizontal feet of the slope face; 2) 50 percent (by volume) of the material is three-quarter- (3/4) inch minus; and 3) backrolling of the slope face is conducted at

four- (4) foot verticals and satisfies project compaction specifications (See Section 5.9.7).

4.7.8.2 Rock Windrows

Rocks to maximum dimension of four (4) feet may be placed in windrows in deeper fill areas in accordance with the details on Detail 10 (Appendix E). The base of the windrow should be excavated an equipment-width into the compacted fill core with rocks placed in single file within the excavation. Sands and gravels should be added and thoroughly flooded and tracked until voids are filled. Windrows should be separated horizontally by at least fifteen (15) feet of compacted fill, be staggered vertically, and separated by at least four (4) vertical feet of compacted fill. Windrows should not be placed within ten (10) feet of finish grade, within two (2) vertical feet of the lowest buried utility conduit in structural fills, or within fifteen (15) feet of the finish slope surface unless specifically approved by the developer, geotechnical consultant, and governing agency.

4.7.8.3 Individual Rock Burial

Rocks in excess of four (4) feet, but no greater than eight (8) feet may be buried in the compacted fill mass on an individual basis. Rocks of this size may be buried separately within the compacted fill by excavating a trench and covering the rock with sand/gravel, and compacting the fines surrounding the rock. Distances from slope face, utilities, and building pad areas (i.e., hold-down depth) should be the same as windrows.

4.7.8.4 Rock Disposal Logistics

The grading contractor should consider the amount of available rock disposal volume afforded by the design when excavation techniques and grading logistics are formulated. Rock disposal techniques should be discussed and approved by the geotechnical consultant and developer prior to implementation.

4.8 Haul Roads

Haul roads, ramp fills, and tailing areas should be removed prior to placement of fill.

4.9 Import Materials

Import materials, if required, should have similar engineering characteristics as the onsite soils and should be approved by the soil engineer at the source prior to importation to the site.

5.0 DESIGN RECOMMENDATIONS

5.1 Structural Design – Residential

It's our understanding that the site will be graded and lots will be ultimately sold to merchant builders; thus precise building products, loading conditions, and locations are not currently available. It is expected that for typical one to three story residential products and loading conditions (1 to 3 ksf for spread and continuous footings), conventional shallow slab-on-grade foundations will be utilized in areas with low expansive and shallow fill areas (<50 feet) and where the as-grade differential fill depth meets h/3 criteria (where h is the maximum depth of fill). Post-tensioned slab/foundations may also be used for all of the residential lots. Typically post-tensioned slab/foundations will be used for lots which exhibit expansion potentials ranging from "moderate" to "very high", for lots in a areas where the fill depth exceed fifty (50) feet in depth, and where the as-grade differential fill depth exceeds h/3 criteria (where h is the maximum depth of fill).

Upon the completion of rough grading, finish grade samples should be collected and tested to develop specific recommendations as they relate to final foundation design recommendations for individual lots. These test results and corresponding design recommendations should be presented in a Final Rough Grading Report.

It is anticipated that the as-graded near-surface soils could from "low" to "very high" in expansion potential when tested in accordance with UBC Table 18-1- B. For preliminary budgeting purposes and procedures can be anticipated, subject to confirmation of assumptions and as-graded conditions.

5.1.1 Foundation Design

Residential structures can be supported on conventional shallow foundations and slab-on-grade or post-tensioned slab/foundations systems, as discussed above. The design of foundation systems should be based on as-graded conditions as determined after grading completion. The following values may be used in preliminary foundation design:

Allowable Bearing:	2000 psf.
Lateral Bearing:	250 psf. per foot of depth to a maximum of 2000 psf. for level conditions. Reduced values may be appropriate for descending slope conditions.
Sliding Coefficient:	0.35

The above values may be increased as allowed by Code to resist transient loads such as wind or seismic. Building code and structural design considerations may govern. Depth and reinforcement

requirements and should be evaluated by a qualified engineer.

5.1.2 Post-Tensioned Slab Foundation System Design Recommendations

Preliminary geotechnical engineering design and construction parameters for post-tensioned slab foundations are as follows:

- Post-tensioned slabs should incorporate a perimeter-thickened edge to reduce the potential for moisture infiltration, seasonal moisture fluctuation and associated differential movement around the slab perimeter. Deeper embedment will be required for "very high" expansion conditions, if existent. The minimum depth of the thickened edge could vary from 12-inches for "low" expansion to 24-inches for "high" expansion potential.
- Design and construction of the post-tensioned foundations should be undertaken by firms experienced in the field. It is the responsibility of the foundation design engineer to select the design methodology and properly design the foundation system for the onsite soils conditions. The slab designer should provide deflection potential to the project architect/structural engineer for incorporation into the design of the structure.
- The project foundation design engineer should use the Post-Tensioning Institute (PTI) foundation design procedures as described in UBC, based upon appropriate soil design parameters relating to edge moisture variation and differential swell provided by the geotechnical consultant at the completion of rough grading operations.
- A vapor/moisture barrier is recommended below all moisture sensitive areas.

5.1.3 Conventional Slab Recommendations

Conventional foundations and slabs-on grade can be considered for very low and low expansion conditions on shallow fill areas (<50 feet). Final foundation design should be provided by the project geotechnical engineer.

5.1.4 Total & Differential Settlement

In addition to the potential effects of expansive soils, the proposed residential structures should be designed in anticipation of total and differential settlements. The following lot categories are presented based upon anticipated settlement, fill thickness and expansion potential

Category I

"Very low to low" expansion potential and fill depths less than 50 feet. Minimum fill depth meets h/3 criteria where h is the maximum fill thickness.

Total = 3/4 inch

Differential = 3/8 inch in 20 feet

Category II

"Medium" expansion potential and/or fill depths less than 50 feet. Minimum fill depth meets h/5 criteria where h is the maximum fill thickness.

Total = 3/4 inch

Differential = 1/2 inch in 20 feet

Category III

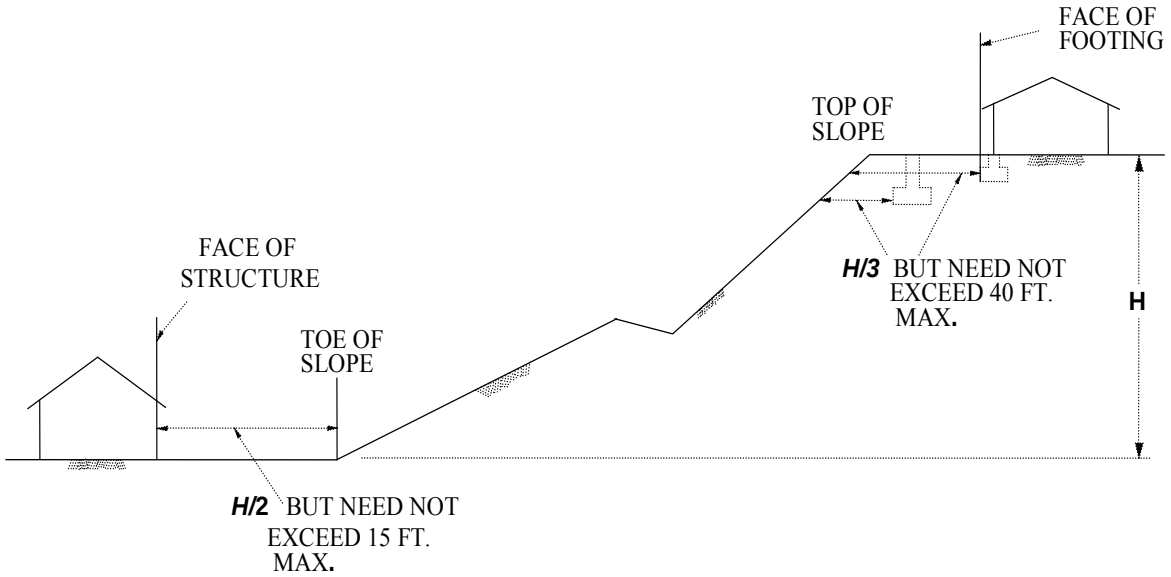
High expansion potential and/or fill depths greater than 50 feet.

Total = 1 inch

Differential = 1/2 inch in 20 feet

5.1.5 Deepened Footings and Structural Setbacks

It is generally recognized that improvements constructed in proximity to natural slopes or properly-constructed, manufactured slopes can, over a period of time, be affected by natural processes including gravity forces, weathering of surficial soils, and long-term (secondary) settlement. Most building codes, including the Uniform Building Code (UBC), require that structures be set back or footings deepened, where subject to the influence of these natural processes.



5.1.6 Miscellaneous Foundation Recommendations

Soils from the footing excavations should not be placed in slab-on-grade areas unless properly compacted and tested. The excavations should be cleaned of all loose/sloughed materials and be neatly trimmed at the time of concrete placement.

5.2 Retaining Wall Design

For preliminary design of retaining walls the values presented in section 5.1.1 and the following recommendations can be utilized:

5.2.1 Earth Pressure Coefficients - Select Backfill

Level Backfill	2:1 Sloping Backfill
Ka = 0.31	Ka = 0.47
Kp = 3.25	$K_p^{(+)} = 8.61$
Ko = 0.47	$K_p^{(+)} = 1.24$ (Ascending Slope)
	$K_o^{(-)} = 0.85$ (Descending Slope)

Equivalent fluid pressure can be calculated utilizing a soil unit weight (γ) of 130 pcf. Restrained retaining walls should be designed for "at-rest" conditions, utilizing Ko'

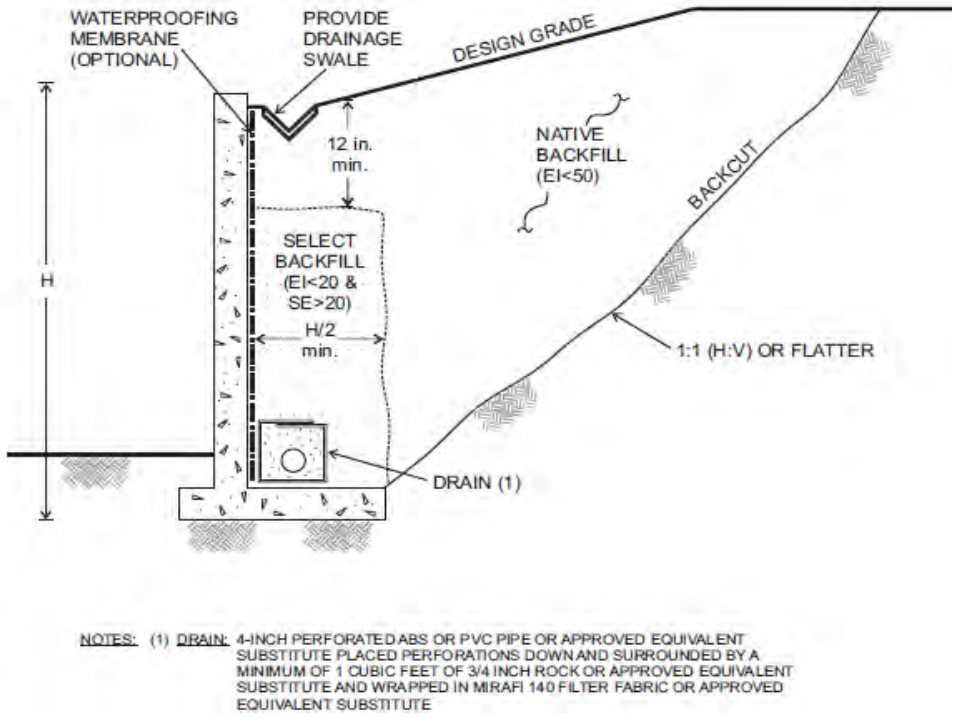
5.2.2 Other Design Considerations

Passive earth pressure coefficients used in the design of retaining walls should consider descending slopes as presented in section 5.2.1 as Kp () when retaining walls are positioned at the top of slopes and/or on the face of slopes. Retaining wall design should consider the additional surcharge loads for superjacent slopes and/or footings, where appropriate.

5.2.3 Waterproofing and Drainage System

Retaining walls should be waterproofed to minimize water staining. The walls should be backfilled with free draining material (SE$\geq$20) to within twelve (12) inches of grade extending horizontally one-half (1/2) the wall height compacted to project specifications. Native soils shall be utilized in the upper eighteen (18) inches. Drainage systems including, as a minimum, a four- (4) inch diameter perforated drain line surrounded by four (4) cubic feet per lineal foot of three-quarters- (3/4) inch to one (1) inch crushed rock wrapped with a suitable filter fabric, should be provided to cantilever and restrained retaining walls to relieve hydrostatic pressure (see Figure 2).

FIGURE 2



5.3 Other Design and Construction Recommendations

5.3.1 Site Drainage

Positive drainage away from structures should be provided and maintained.

5.3.2 Concrete Flatwork and Lot Improvements

- **In** an effort to minimize shrinkage cracking, concrete flatwork should be constructed of uniformly cured, low-slump concrete and should contain sufficient control/contraction joints (typically spaced at 8 to 10 feet, maximum).
- Additional provisions need to be incorporated into the design and construction of all improvements exterior to the proposed structures (pools, spas, walls, patios, walkways, planters, etc.) to account for the hillside nature of the project, as well as being designed to

account for potential expansive soil conditions. Design considerations on any given lot may need to include provisions for differential bearing materials (bedrock vs. compacted fill), ascending/descending slope conditions, bedrock structure, perched (irrigation) water, special surcharge loading conditions, potential expansive soil pressure, and differential settlement/heave.

- All exterior improvements should be designed and constructed by qualified professionals using appropriate design methodologies that account for the onsite soils and geologic conditions. The aforementioned considerations should be used when designing, constructing, and evaluating long-term performance of the exterior improvements on the lots.
- The homeowners should be advised of their maintenance responsibilities as well as geotechnical issues that could affect design and construction of future homeowner improvements. The information presented in Appendix F should be considered for inclusion in homeowner packages in order to inform the homeowner of issues relative to drainage, expansive soils, landscaping, irrigation, sulfate exposure, and slope maintenance.

5.3.3 Utility Trench Excavation

All utility trenches should be shored or laid back in accordance with applicable OSHA standards. Excavations in bedrock areas should be made in consideration of underlying geologic structure. The project geotechnical consultant should be consulted on these issues during construction.

5.3.4 Utility Trench Backfill

Mainline and lateral utility trench backfill should be compacted to at least 90 percent of maximum dry density as determined by ASTM D- 1557. Onsite soils will not be suitable for use as bedding material but will be suitable for use in backfill, provided oversized materials are removed. No surcharge loads should be imposed above excavations. This includes spoil piles, lumber, concrete trucks, or other construction materials and equipment. Drainage above excavations should be directed away from the banks. Care should be taken to avoid saturation of the soils.

Compaction should be accomplished by mechanical means. Jetting of native soils will not be acceptable. Under-slab trenches should also be compacted to project specifications. If native soils are used, mechanical compaction is recommended. If select granular backfill (SE> 30) is used, compaction by flooding will be acceptable. The soil engineer should be notified for inspection prior to placement of the membrane and slab reinforcement.

5.4 Preliminary Pavement Design

Final pavement design should be made based upon sampling and testing of post-grading conditions. For preliminary design and estimating purposes the pavement structural sections presented in Table 5-1 can be used for the range of likely traffic indices. The structural sections

are based upon an assumed R - Value of 30.

Table 5-1

Preliminary Pavement Sections

Traffic Index (TI)	Asphaltic Concrete (AC) Inches	Aggregate Base (AB) Inches
5.0	3	6
6.0	4	9
7.0	4	10
8.0	5	13

Sub grade soils should be compacted to at least 95 percent of maximum density as determined by ASTM D-1557. Aggregate base materials should be compacted to at least 95 percent of maximum density as determined by California Test 216. Final determination of pavement sections will be provided by the City of Chula Vista based upon sampling and testing of the subgrade soils.

6.0 FUTURE STUDY NEEDS

This report represents a "Tentative Tract" map level review of Otay Land Company- Village 8 West. As the project design progresses, additional site specific geologic and geotechnical issues will need to be considered in the ultimate design and construction of the project. Consequently, future geotechnical reviews are necessary. These reviews may include reviews of:

- Rough grading plans.
- Precise grading plans.
- Foundation plans.
- Retaining wall plans.

These plans should be forwarded to the project geotechnical engineer/geologist for evaluation and comment, as necessary.

7.0 LIMITATIONS

This report is based on the project as described and the information obtained from referenced reports. The findings are based on the review of the field and laboratory data provided combined with an interpolation and extrapolation of conditions between and beyond the reviewed exploratory excavations. The results reflect an interpretation of the direct evidence obtained. Services performed by AGS have been conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. No other representation, either expressed or implied, and no warranty or guarantee is included or intended.

The recommendations presented in this report are based on the assumption that an appropriate level of field review will be provided by geotechnical engineers and engineering geologists who are familiar with the design and site geologic conditions. That field review shall be sufficient to confirm that geotechnical and geologic conditions exposed during grading are consistent with the geologic representations and corresponding recommendations presented in this report. AGS should be notified of any pertinent changes in the project plans or if subsurface conditions are found to vary from those described herein. Such changes or variations may require a re-evaluation of the recommendations contained in this report.

The data, opinions, and recommendations of this report are applicable to the specific design of this project as discussed in this report. They have no applicability to any other project or to any other location, and any and all subsequent users accept any and all liability resulting from any use or reuse of the data, opinions, and recommendations without the prior written consent of AGS.

AGS has no responsibility for construction means, methods, techniques, sequences, or procedures, or for safety precautions or programs in connection with the construction, for the acts or omissions of the CONTRACTOR, or any other person performing any of the construction, or for the failure of any of them to carry out the construction in accordance with the final design drawings and specifications.

APPENDIX A

REFERENCES

REFERENCES

Anderson, lC., Rockwell, T.K., and Agnew, D.C., 1989, Past and possible future earthquakes of significance to the San Diego region: Earthquake Spectra, vol. 5, no. 2, p. 299-335.

Blake, T.F., 2000, *FRISKSP:* A computer program for the probabilistic estimation of peak acceleration and uniform hazard spectra using 3-D faults as earthquake sources, v.4.00: Thomas F. Blake, Newbury Park, California, 199 p.

Boore, D.M., Joyner, W.B., and Fumal, T.E., 1997, Equations for estimating horizontal response spectra and peak acceleration from western North American earthquakes: A summary of recent work: Seis. Res. Let. v. 68, n. 1, p. 128-153.

California Department of Conservation, Division of Mines and Geology, 1998, Maps of known active fault near source zones in California and adjacent portions of Nevada, published by ICBO February 1998.

California Division of Mines and Geology, 1999, Fault rupture hazard zones in California: Special Publication 42.

California Division of Mines and Geology, 1997, Guidelines for evaluating and mitigating seismic hazards in California: Department of Conservation, special publication 117, 74 p.

California Division of Mines and Geology, 1993, The Rose Canyon Fault Zone, southern California: Department of Conservation, Open File Report 93-02, 45 pp.

California Division of Mines and Geology, 1962, Geologic Map of California, San Diego-El Centro Sheet, California Department of Conservation, Scale 1 :250,000.

Campbell, K.W., 1997, Empirical near-source attenuation relationships for horizontal and vertical components of peak ground acceleration, peak ground velocity, and pseudo-absolute acceleration response spectra: Seis. Res. Let. v. 68, n. 1, p. 154-179.

Hart, E. W., 1994, Fault-rupture hazard zones in California: California Division of Mines and Geology, special publication 42, 1992 revised edition, 34 p.

Jennings, C. W., 1994, Fault activity map of California and adjacent areas: California Division of Mines and Geology, California geologic map data series, map no. 6, scale 1:750,000.

Jennings, C. W., 1994, An explanatory text to accompany the fault activity map of California and adjacent areas: California Division of Mines and Geology, 92 p.

Kennedy, M. P., and Tan, S.S., 1977, Geology of National City, Imperial Beach and Otay Mesa Quadrangles, southern San Diego metropolitan area, California: California Division of Mines and Geology, Map Sheet 29.

REFERENCES continued

Kennedy, M.P., 1975, Character and Recency of Faulting, San Diego Metropolitan Area, California: California Division of Mines and Geology, Special Report 123, 33p.

Legg, M. R., 1989, Faulting and seismotectonics ofthe inner continental borderland west of San Diego: in Roquemore, G. (ed.), Proceedings workshop on the Seismic Risk in the San Diego Region: Special Focus on the Rose Canyon Fault System, p. 50-70.

Martin, G.R. and Lew, M., 1999, Recommended procedures for implementing of DMG special publication 117, Guidelines for analyzing and mitigating liquefaction hazards in California: Southern California Earthquake Center, University of Southern California, March, 1999.

Neblitt and Associates, Inc., 2003, Results of Geologic Field Mapping, Portions of Otay Ranch Parcel B, Along 48" Diameter Water Line Trench Excavation, City of Chula Vista, County of San Diego, California dated October 16, 2003 (Proj. No. 328001-03) .

Pacific Soils Engineering, Inc 2010, Revised Geotechnical Investigation for Village 8 West, Otay Ranch, Chula Vista, California, dated May 26, 2010 (Work Order 400948B4).

Pacific Soils Engineering, Inc 2006, Geotechnical Investigation for EIR Purposes, Parcel "B" Otay Ranch, Chula Vista, California, dated June 2, 2006 (Work Order 400948B4).

Pacific Soils Engineering, Inc., 2003, Feasibility-Level Geotechnical Report, Parcels A, B and C, Otay Ranch, Chula Vista, California, dated August 22, 2003 (Work Order 400948).

Petersen, M. D., Bryant, W. A., Cramer, C. H., Cao, T., Reichle, M. S., Frankel, A. D., Lienkaemper, J. J., McCrory, P. A., and Schwartz, D. P., 1996, Probabilistic seismic hazard assessment for the State of California: California Division of Mines and Geology, open file report 96-08,59 p.

Sadigh, K., Chang, Y., Egan, J.A., Makdisi, F., and Youngs, R.R., 1997, Attenuation relationships for shallow crustal earthquakes based on California strong motion data: Seis. Res. Let. v. 68, n.l.

Tan, S. S., 1995, Landslide hazards in the southern part of the San Diego metropolitan area, San Diego, California, landslide identification map no. 33: California Department of Conservation, Division of Mines and Geology, open file report 95-03.

REFERENCES continued

United States Department of Agriculture, 1953, Vertical black and white aerial photographs (photo nos. AXN-9M-162, -163, -164, -165, and AXM 10M-4, -5) scale 1 :20,000; dated April 14, 1953.

Uniform Building Code, 1997, International Conference of Building Officials (lCBO), Volume 2, structural engineering design provisions: p. 2-30-2-35.

Walsh, S.L., and Derriere, T.A., 1991, Age and stratigraphy of the Sweetwater and Otay Formations, San Diego County, California, in Abbott, P.L. and May, J.A. (eds.), Eocene geologic history of the San Diego region: Society of Economic Paleontologists and Mineralogists, Pacific Section, v. 68, p. 131-148.

APPENDIX B

SUBSURFACE INVESTIGATION

DESCRIPTION OF PSE's SUBSURFACE INVESTIGATION

Pacific Soils Engineering, Inc. performed a subsurface field investigation for Otay Ranch Parcel "B" in June of2004. Sixteen (16) borings were excavated utilizing a bucket auger drill rig (Plates A-1 through A-16). In addition, seventy-three (73) backhoe test pits were excavated (Table I). Boring and test pit excavations ranged from three (3) to eighty (80) feet below existing grades. All excavations were logged and sampled by representatives of PSE.

Representative bulk and "undisturbed" samples were obtained from the exploratory excavations and delivered to PSE's laboratory for testing and analysis.

Undisturbed samples were obtained from the bucket auger borings by driving a sampling spoon into the material. A split barrel type spoon, having an inside diameter of 2.50 inches, with a tapered cutting tip at the lower end, was used. The barrel is lined with thin brass rings, each 1 inch in height. The spoons penetrated into the soil approximately 12 inches. The lower portion of the sample (6 inches) was retained for testing. All samples in the natural field condition were sealed in airtight containers and transported to PSE's laboratory.

Blow counts were noted for each "undisturbed" sample and are presented in the logs of the borings (Plates A-1 through A-16).

The approximate locations of all exploratory excavations are shown on the enclosed plans (Sheets 3 through 5 and 7).

APPENDIX C

LABORATORY TESTING

DESCRIPTION OF PSE's LABORATORY ANALYSES

Moisture Density Determinations

Moisture and density determinations were made by direct measurements on undisturbed samples to provide in-situ information of the various materials. The results of these tests are shown on the logs of borings [Plates A-1 through A-16 (Appendix B)] and Table II.

Compaction Characteristics

Maximum densities and optimum moistures were determined for selected samples in accordance with ASTM: D-1557. Results are presented in Table II.

Hydrometer Analyses

Hydrometer grain size analyses were performed on the minus No. 10 sieve portion of selected samples. These tests were used as an aid in soil classification. The results of these tests are shown on Table II.

Expansion Index Testing

Expansion index testing was performed on selected samples in accordance with the expansion index UBC Standard No. 18-2. Results are presented in Table II.

Direct Shear Tests

Direct shear tests were performed on samples, which were remolded to 90 percent of the laboratory maximum density, and on undisturbed specimens. Samples were tested after inundation and confinement for 24 hours. Tests were made under various normal loads at a constant rate of strain of 0.01 or 0.05 inches per minute. Shear test data are presented in Table II and on Plates B-1 through B-14.

Chemica/Resistivity

Chemical/resistivity testing was conducted by others and is presented on Plates C-1 through C-13.

APPENDIX D

SLOPE STABILITY ANALYSIS

APPENDIX E

GENERAL EARTHWORK SPECIFICATIONS AND GRADING DETAILS

GENERAL EARTHWORK SPECIFICATIONS

I. General

A. General procedures and requirements for earthwork and grading are presented herein. The earthwork and grading recommendations provided in the geotechnical report are considered part of these specifications, and where the general specifications provided herein conflict with those provided in the geotechnical report, the recommendations in the geotechnical report shall govern. Recommendations provided herein and in the geotechnical report may need to be modified depending on the conditions encountered during grading.

B. The contractor is responsible for the satisfactory completion of all earthwork in accordance with the project plans, specifications, applicable building codes, and local governing agency requirements. Where these requirements conflict, the stricter requirements shall govern.

C. It is the contractor's responsibility to read and understand the guidelines presented herein and in the geotechnical report as well as the project plans and specifications. Information presented in the geotechnical report is subject to verification during grading. The information presented on the exploration logs depict conditions at the particular time of excavation and at the location of the excavation. Subsurface conditions present at other locations may differ, and the passage of time may result in different subsurface conditions being encountered at the locations of the exploratory excavations. The contractor shall perform an independent investigation and evaluate the nature of the surface and subsurface conditions to be encountered and the procedures and equipment to be used in performing his work.

D. The contractor shall have the responsibility to provide adequate equipment and procedures to accomplish the earthwork in accordance with applicable requirements. When the quality of work is less than that required, the Geotechnical Consultant may reject the work and may recommend that the operations be suspended until the conditions are corrected.

E. Prior to the start of grading, a qualified Geotechnical Consultant should be employed to observe grading procedures and provide testing of the fills for conformance with the project specifications, approved grading plan, and guidelines presented herein. All clearing and grubbing, remedial removals, clean-outs, removal bottoms, keyways, and subdrain installations should be observed and documented by the Geotechnical Consultant prior to placing fill. It is the contractor's responsibility to apprise the Geotechnical Consultant of their schedules and notify the Geotechnical Consultant when those areas are ready for observation.

F. The contractor is responsible for providing a safe environment for the Geotechnical Consultant to observe grading and conduct tests.

II. Site Preparation

A. Clearing and Grubbing: Excessive vegetation and other deleterious material shall be sufficiently removed as required by the Geotechnical Consultant, and such materials shall be

properly disposed of offsite in a method acceptable to the owner and governing agencies. Where applicable, the contractor may obtain permission from the Geotechnical Consultant, owner, and governing agencies to dispose of vegetation and other deleterious materials in designated areas onsite.

B. Unsuitable Soils Removals: Earth materials that are deemed unsuitable for the support of fill shall be removed as necessary to the satisfaction of the Geotechnical Consultant.

C. Any underground structures such as cesspools', cisterns, mining shafts, tunnels, septic tanks, wells, pipelines, other utilities, or other structures located within the limits of grading shall be removed and/or abandoned in accordance with the requirements of the governing agency and to the satisfaction of the Geotechnical Consultant. Environmental evaluation of existing conditions is not the responsibility of the Geotechnical Consultant.

D. Preparation of Areas to Receive Fill: After removals are completed, the exposed surfaces shall be processed or scarified to a depth of approximately 8 inches, watered or dried, as needed, to achieve a generally uniform moisture content that is at or near optimum moisture content. The scarified materials shall then be compacted to the project requirements and tested as specified.

E. All areas receiving fill shall be observed and approved by the Geotechnical Consultant prior to the placement of fill. A licensed surveyor shall provide survey control for determining elevations of processed areas and keyways.

III. Placement of Fill

A. Suitability of fill materials: Any materials, derived onsite or imported, may be utilized as fill provided that the materials have been determined to be suitable by the Geotechnical Consultant. Such materials shall be essentially free of organic matter and other deleterious materials, and be of a gradation, expansion potential, and/or strength that is acceptable to the Geotechnical Consultant. Fill materials shall be tested in a laboratory approved by the Geotechnical Consultant, and import materials shall be tested and approved prior to being imported.

B. Generally, different fill materials shall be thoroughly mixed to provide a relatively uniform blend of materials and prevent abrupt changes in material type. Fill materials derived from benching should be dispersed throughout the fill area instead of placing the materials within only an equipment-width from the cut/fill contact.

C. Oversize Materials: Rocks greater than 12 inches in largest dimension shall be disposed of offsite or be placed in accordance with the recommendations by the Geotechnical Consultant in the areas that are designated as suitable for oversize rock placement. Rocks that are smaller than 8 inches in largest dimension may be utilized in the fill provided that they are not nested and are their quantity and distribution are acceptable to the Geotechnical Consultant and do not inhibit the ability to properly compact fill materials.

D. The fill materials shall be placed in thin, horizontal layers such that, when compacted, shall not exceed 6 inches. Each layer shall be spread evenly and shall be thoroughly mixed to obtain a near uniform moisture content and uniform blend of materials.

E. Moisture Content: Fill materials shall be placed at or above the optimum moisture content or as recommended by the geotechnical report. Where the moisture content of the engineered fill is less than recommended, water shall be added, and the fill materials shall be blended so that a near uniform moisture content is achieved. If the moisture content is above the limits specified by the Geotechnical Consultant, the fill materials shall be aerated by discing, blading, or other methods until the moisture content is acceptable.

F. Each layer of fill shall be compacted to the project standards in accordance to the project specifications and recommendations of the Geotechnical Consultant. Unless otherwise specified by the Geotechnical Consultant, the fill shall be compacted to a minimum of 90 percent of the maximum dry density as determined by ASTM Test Method: D1557-09.

G. Benching: Where placing fill on a slope exceeding a ratio of 5 to 1 (horizontal to vertical), the ground should be keyed or benched. The keyways and benches shall extend through all unsuitable materials into suitable materials such as firm materials or sound bedrock or as recommended by the Geotechnical Consultant. The minimum keyway width shall be 15 feet and extend into suitable materials, or as recommended by the geotechnical report and approved by the Geotechnical Consultant. The minimum keyway width for fill over cut slopes is also 15 feet, or as recommended by the geotechnical report and approved by the Geotechnical Consultant. As a general rule, unless otherwise recommended by the Geotechnical Consultant, the minimum width of the keyway shall be equal to ½ the height of the fill slope.

H. Slope Face: The specified minimum relative compaction shall be maintained out to the finish face of fill and stabilization fill slopes. Generally, this may be achieved by overbuilding the slope and cutting back to the compacted core. The actual amount of overbuilding may vary as field conditions dictate. Alternately, this may be achieved by backrolling the slope face with suitable equipment or other methods that produce the designated result. Loose soil should not be allowed to build up on the slope face. If present, loose soils shall be trimmed to expose the compacted slope face.

I. Slope Ratio: Unless otherwise approved by the Geotechnical Consultant and governing agencies, permanent fill slopes shall be designed and constructed no steeper than 2 to 1 (horizontal to vertical).

J. Natural Ground and Cut Areas: Design grades that are in natural ground or in cuts should be evaluated by the Geotechnical Consultant to determine whether scarification and processing of the ground and/or overexcavation is needed.

K. Fill materials shall not be placed, spread, or compacted during unfavorable weather conditions. When grading is interrupted by rain, filing operations shall not resume until the Geotechnical Consultant approves the moisture and density of the previously placed compacted fill.

IV. Cut Slopes

A. The Geotechnical Consultant shall observe all cut slopes, including fill over cut slopes, and shall be notified by the contractor when cut slopes are started.

B. If adverse or potentially adverse conditions are encountered during grading, the Geotechnical Consultant shall investigate, evaluate, and make recommendations to mitigate the adverse conditions.

C. Unless otherwise stated in the geotechnical report, cut slopes shall not be excavated higher or steeper than the requirements of the local governing agencies. Short-term stability of the cut slopes and other excavations is the contractor's responsibility.

V. Drainage

A. Backdrains and Subdrains: Backdrains and subdrains shall be provided in fill as recommended by the Geotechnical Consultant and shall be constructed in accordance with the governing agency and/or recommendations of the Geotechnical Consultant. The location of subdrains, especially outlets, shall be surveyed and recorded by the Civil Engineer.

B. Top-of-slope Drainage: Positive drainage shall be established away from the top of slope. Site drainage shall not be permitted to flow over the tops of slopes.

C. Drainage terraces shall be constructed in compliance with the governing agency requirements and/or in accordance with the recommendations of the Civil Engineer.

D. Non-erodible interceptor swales shall be placed at the top of cut slopes that face the same direction as the prevailing drainage.

VI. Erosion Control

A. All finish cut and fill slopes shall be protected from erosion and/or planted in accordance with the project specifications and/or landscape architect's recommendations. Such measures to protect the slope face shall be undertaken as soon as practical after completion of grading.

B. During construction, the contractor shall maintain proper drainage and prevent the ponding of water. The contractor shall take remedial measures to prevent the erosion of graded areas until permanent drainage and erosion control measures have been installed.

VII. Trench Excavation and Backfill

A. Safety: The contractor shall follow all OSHA requirements for safety of trench excavations. Knowing and following these requirements is the contractor's responsibility. All trench excavations or open cuts in excess of 5 feet in depth shall be shored or laid back. Trench excavations and open cuts exposing adverse geologic conditions may require further evaluation

by the Geotechnical Consultant. If a contractor fails to provide safe access for compaction testing, backfill not tested due to safety concerns may be subject to removal.

B. Bedding: Bedding materials shall be non-expansive and have a Sand Equivalent greater than 30. Where permitted by the Geotechnical Consultant, the bedding materials can be densified by jetting.

C. Backfill: Jetting of backfill materials to achieve compaction is generally not acceptable. Where permitted by the Geotechnical Consultant, the bedding materials can be densified by jetting provided the backfill materials are granular, free-draining and have a Sand Equivalent greater than 30.

VIII. Geotechnical Observation and Testing During Grading

A. Compaction Testing: Fill will be tested and evaluated by the Geotechnical Consultant for evaluation of general compliance with the recommended compaction and moisture conditions. The tests shall be taken in the compacted soils beneath the surface if the surficial materials are disturbed. The contractor shall assist the Geotechnical Consultant by excavating suitable test pits for testing of compacted fill.

B. Where tests indicate that the density of a layer of fill is less than required, or the moisture content is not within specifications, the Geotechnical Consultant shall notify the contractor of the unsatisfactory conditions of the fill. The portions of the fill that are not within specifications shall be reworked until the required density and/or moisture content has been attained. No additional fill shall be placed until the last lift of fill is tested and found to meet the project specifications and approved by the Geotechnical Consultant.

C. If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as adverse weather, excessive rock or deleterious materials being placed in the fill, insufficient equipment, excessive rate of fill placement, results in a quality of work that is unacceptable, the consultant shall notify the contractor, and the contractor shall rectify the conditions, and if necessary, stop work until conditions are satisfactory.

D. Frequency of Compaction Testing: The location and frequency of tests shall be at the Geotechnical Consultant's discretion. Generally, compaction tests shall be taken at intervals approximately two feet in fill height.

E. Compaction Test Locations: The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of the compaction test locations. The contractor shall coordinate with the surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations. Alternately, the test locations can be surveyed and the results provided to the Geotechnical Consultant.

F. Areas of fill that have not been observed or tested by the Geotechnical Consultant may have to be removed and recompacted at the contractor's expense. The depth and extent of removals will be determined by the Geotechnical Consultant.

G. Observation and testing by the Geotechnical Consultant shall be conducted during grading in order for the Geotechnical Consultant to state that, in his opinion, grading has been completed in accordance with the approved geotechnical report and project specifications.

H. Reporting of Test Results: After completion of grading operations, the Geotechnical Consultant shall submit reports documenting their observations during construction and test results. These reports may be subject to review by the local governing agencies.

APPENDIX F

HOMEOWNERS MAINTENANCE GUIDELINES

HOMEOWNERS MAINTENANCE GUIDELINES

Homeowners are accustomed to maintaining their homes. They expect to paint their houses periodically, replace wiring, clean out clogged plumbing, and repair roofs. Maintenance of the home site, particularly on hillsides, should be considered on the same basis, or even on a more serious basis because neglect can result in serious consequences. In most cases, lot and site maintenance can be taken care of along with landscaping, and can be carried out more economically than repair after neglect.

Most slope and hillside lot problems are associated with water. Uncontrolled water from a broken pipe, cesspool, or wet weather causes most damage. Wet weather is the largest cause of slope problems, particularly in California where rain is intermittent, but may be torrential. Therefore, drainage and erosion control are the most important aspects of home site stability; these provisions must not be altered without competent professional advice. Further, maintenance must be carried out to assure their continued operation.

As geotechnical engineers concerned with the problems of building sites in hillside developments, we offer the following list of recommended home protection measures as a guide to homeowners.

Expansive Soils

Some of the earth materials on site have been identified as being expansive in nature. As such, these materials are susceptible to volume changes with variations in their moisture content. These soils will swell upon the introduction of water and shrink upon drying. The forces associated with these volume changes can have significant negative impacts (in the form of differential movement) on foundations, walkways, patios, and other lot improvements. In recognition of this, the project developer has constructed homes on these lots on post-tensioned or mat slabs with pier and grade beam foundation systems, intended to help reduce the potential adverse effects of these expansive materials on the residential structures within the project. Such foundation systems are not intended to offset the forces (and associated movement) related to expansive soil, but are intended to help soften their effects on the structures constructed thereon.

Homeowners purchasing property and living in an area containing expansive soils must assume a certain degree of responsibility for homeowner improvements as well as for maintaining conditions around their home. Provisions should be incorporated into the design and construction of homeowner improvements to account for the expansive nature of the onsite soils material. Lot maintenance and landscaping should also be conducted in consideration of the expansive soil characteristics. Of primary importance is minimizing the moisture variation below all lot improvements. Such design, construction and homeowner maintenance provisions should include:

- Employing contractors for homeowner improvements who design and build in recognition of local building code and site specific soils conditions.
- Establishing and maintaining positive drainage away from all foundations, walkways, driveways, patios, and other hardscape improvements.

- Avoiding the construction of planters adjacent to structural improvements. Alternatively, planter sides/bottoms can be sealed with an impermeable membrane and drained away from the improvements via subdrains into approved disposal areas.
- Sealing and maintaining construction/control joints within concrete slabs and walkways to reduce the potential for moisture infiltration into the subgrade soils.
- Utilizing landscaping schemes with vegetation that requires minimal watering. Alternatively, watering should be done in a uniform manner as equally as possible on all sides of the foundation, keeping the soil "moist" but not allowing the soil to become saturated.
- Maintaining positive drainage away from structures and providing roof gutters on all structures with downspouts installed to carry roof runoff directly into area drains or discharged well away from the structures.
- Avoiding the placement of trees closer to the proposed structures than a distance of one-half the mature height of the tree.
- Observation of the soil conditions around the perimeter of the structure during extremely hot/dry or unusually wet weather conditions so that modifications can be made in irrigation programs to maintain relatively constant moisture conditions.

Sulfates

On site soils were tested for the presence of soluble sulfates. Based on the results of that testing, the soluble sulfate exposure level was determined to be “negligible” to “moderate” when classified in accordance with the ACI 318-05 Table 4.3.1 (per 2007 CBC). As such, a concrete mix design should be based on a “moderate” sulfate exposure (4,000 psi concrete with a water to cement ratio of 0.50).

Homeowners should be cautioned against the import and use of certain fertilizers, soil amendments, and/or other soils from offsite sources in the absence of specific information relating to their chemical composition. Some fertilizers have been known to leach sulfate compounds into soils otherwise containing "negligible" sulfate concentrations and increase the sulfate concentrations in near-surface soils to "moderate" or "severe" levels. In some cases, concrete improvements constructed in soils containing high levels of soluble sulfates may be affected by deterioration and loss of strength.

Water - Natural and Man Induced

Water in concert with the reaction of various natural and man-made elements, can cause detrimental effects to your structure and surrounding property. Rain water and flowing water erodes and saturates the ground and changes the engineering characteristics of the underlying earth materials upon saturation. Excessive irrigation in concert with a rainy period is commonly associated with shallow slope failures and deep seated landslides, saturation of near structure soils, local ponding of water, and transportation of water soluble substances that are deleterious to building materials including concrete, steel, wood, and stucco.

Water interacting with the near surface and subsurface soils can initiate several other potentially detrimental phenomena other then slope stability issues. These may include expansion/contraction

cycles, liquefaction potential increase, hydro-collapse of soils, ground surface settlement, earth material consolidation, and introduction of deleterious substances.

The homeowners should be made aware of the potential problems which may develop when drainage is altered through construction of retaining walls, swimming pools, paved walkways and patios. Ponded water, drainage over the slope face, leaking irrigation systems, over-watering or other conditions which could lead to ground saturation must be avoided.

- Before the rainy season arrives, check and clear roof drains, gutters and down spouts of all accumulated debris. Roof gutters are an important element in your arsenal against rain damage. If you do not have roof gutters and down spouts, you may elect to install them. Roofs, with their, wide, flat area can shed tremendous quantities of water. Without gutters or other adequate drainage, water falling from the eaves collects against foundation and basement walls.
- Make sure to clear surface and terrace drainage ditches, and check them frequently during the rainy season. This task is a community responsibility.
- Test all drainage ditches for functioning outlet drains. This should be tested with a hose and done before the rainy season. All blockages should be removed.
- Check all drains at top of slopes to be sure they are clear and that water will not overflow the slope itself, causing erosion.
- Keep subsurface drain openings (weep-holes) clear of debris and other material which could block them in a storm.
- Check for loose fill above and below your property if you live on a slope or terrace.
- Monitor hoses and sprinklers. During the rainy season, little, if any, irrigation is required. Oversaturation of the ground is unnecessary, increases watering costs, and can cause subsurface drainage.
- Watch for water backup of drains inside the house and toilets during the rainy season, as this may indicate drain or sewer blockage.
- Never block terrace drains and brow ditches on slopes or at the tops of cut or fill slopes. These are designed to carry away runoff to a place where it can be safely distributed.
- Maintain the ground surface upslope of lined ditches to ensure that surface water is collected in the ditch and is not permitted to be trapped behind or under the lining.
- Do not permit water to collect or pond on your home site. Water gathering here will tend to either seep into the ground (loosening or expanding fill or natural ground), or will overflow into the slope and begin erosion. Once erosion is started, it is difficult to control and severe damage may result rather quickly.
- Never connect roof drains, gutters, or down spouts to subsurface drains. Rather, arrange them so that water either flows off your property in a specially designed pipe or flows out into a paved driveway or street. The water then may be dissipated over a wide surface or, preferably, may be carried away in a paved gutter or storm drain. Subdrains are constructed to take care of ordinary subsurface water and cannot handle the overload from roofs during a heavy rain.

- Never permit water to spill over slopes, even where this may seem to be a good way to prevent ponding. This tends to cause erosion and, in the case of fill slopes, can eat away carefully designed and constructed sites.
- Do not cast loose soil or debris over slopes. Loose soil soaks up water more readily than compacted fill. It is not compacted to the same strength as the slope itself and will tend to slide when laden with water; this may even affect the soil beneath the loose soil. The sliding may clog terrace drains below or may cause additional damage in weakening the slope. If you live below a slope, try to be sure that loose fill is not dumped above your property.
- Never discharge water into subsurface blanket drains close to slopes. Trench drains are sometimes used to get rid of excess water when other means of disposing of water are not readily available. Overloading these drains saturates the ground and, if located close to slopes, may cause slope failure in their vicinity.
- Do not discharge surface water into septic tanks or leaching fields. Not only are septic tanks constructed for a different purpose, but they will tend, because of their construction, to naturally accumulate additional water from the ground during a heavy rain. Overloading them artificially during the rainy season is bad for the same reason as subsurface subdrains, and is doubly dangerous since their overflow can pose a serious health hazard. In many areas, the use of septic tanks should be discontinued as soon as sewers are made available.
- Practice responsible irrigation practices and do not over-irrigate slopes. Naturally, ground cover of ice plant and other vegetation will require some moisture during the hot summer months, but during the wet season, irrigation can cause ice plant and other heavy ground cover to pull loose. This not only destroys the cover, but also starts serious erosion. In some areas, ice plant and other heavy cover can cause surface sloughing when saturated due to the increase in weight and weakening of the near-surface soil. Planted slopes should be planned where possible to acquire sufficient moisture when it rains.
- Do not let water gather against foundations, retaining walls, and basement walls. These walls are built to withstand the ordinary moisture in the ground and are, where necessary, accompanied by subdrains to carry off the excess. If water is permitted to pond against them, it may seep through the wall, causing dampness and leakage inside the basement. Further, it may cause the foundation to swell up, or the water pressure could cause structural damage to walls.
- Do not try to compact soil behind walls or in trenches by flooding with water. Not only is flooding the least efficient way of compacting fine-grained soil, but it could damage the wall foundation or saturate the subsoil.
- Never leave a hose and sprinkler running on or near a slope, particularly during the rainy season. This will enhance ground saturation which may cause damage.
- Never block ditches which have been graded around your house or the lot pad. These shallow ditches have been put there for the purpose of quickly removing water toward the driveway, street or other positive outlet. By all means, do not let water become ponded above slopes by blocked ditches.

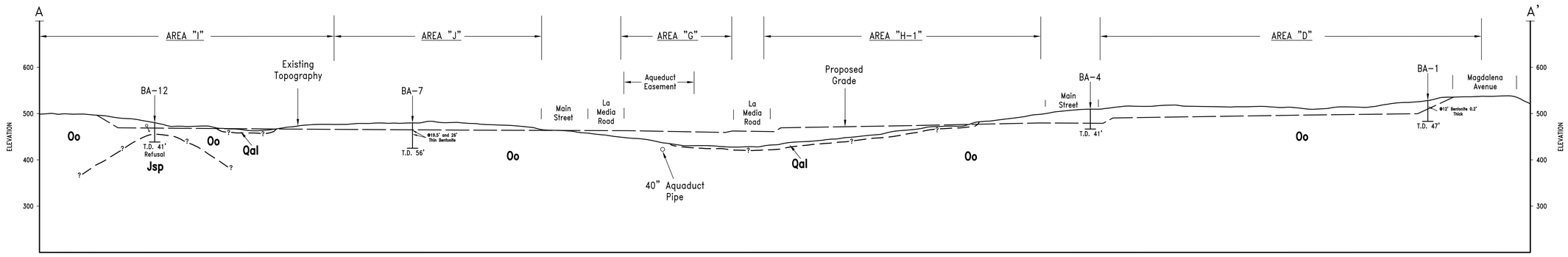
- Seeding and planting of the slopes should be planned to achieve, as rapidly as possible, a well-established and deep-rooted vegetal cover requiring minimal watering.
- It should be the responsibility of the landscape architect to provide such plants initially and of the residents to maintain such planting. Alteration of such a planting scheme is at the resident's risk.
- The resident is responsible for proper irrigation and for maintenance and repair of properly installed irrigation systems. Leaks should be fixed immediately. Residents must undertake a program to eliminate burrowing animals. This must be an ongoing program in order to promote slope stability. The burrowing animal control program should be conducted by a licensed exterminator and/or landscape professional with expertise in hill side maintenance.

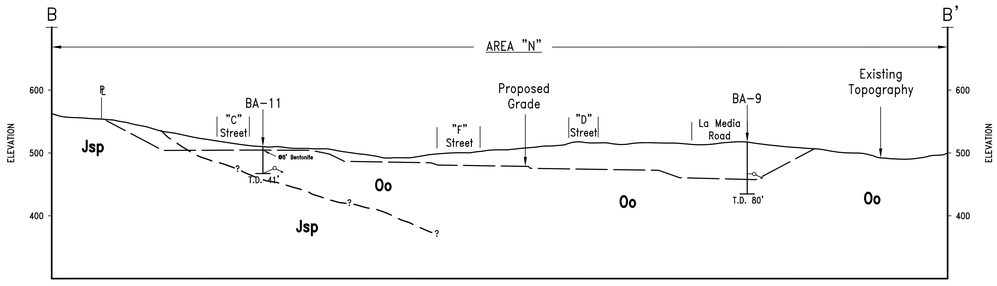
Geotechnical Review

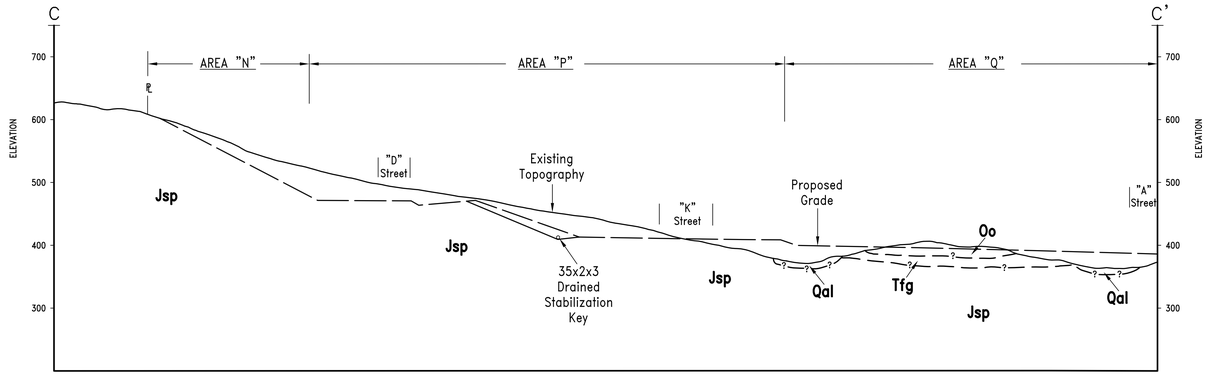
Due to the presence of expansive soils on site and the fact that soil types may vary with depth, it is recommended that plans for the construction of rear yard improvements (swimming pools, spas, barbecue pits, patios, etc.), be reviewed by a geotechnical engineer who is familiar with local conditions and the current standard of practice in the vicinity of your home.

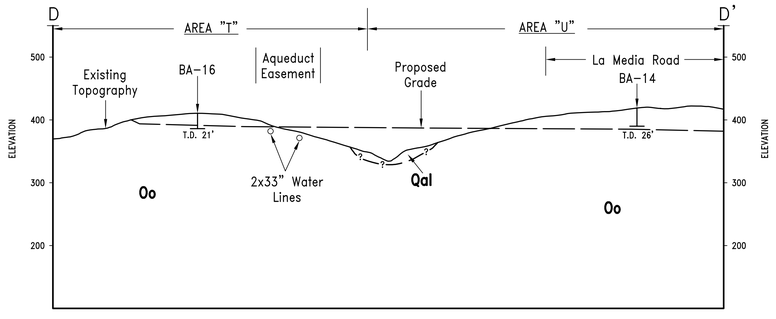
In conclusion, your neighbor's slope, above or below your property, is as important to you as the slope that is within your property lines. For this reason, it is desirable to develop a cooperative attitude regarding hillside maintenance, and we recommend developing a "good neighbor" policy. Should conditions develop off your property, which are undesirable from indications given above, necessary action should be taken by you to insure that prompt remedial measures are taken. Landscaping of your property is important to enhance slope and foundation stability and to prevent erosion of the near surface soils. In addition, landscape improvements should provide for efficient drainage to a controlled discharge location downhill of residential improvements and soil slopes.

Additionally, recommendations contained in the Geotechnical Engineering Study report apply to all future residential site improvements, and we advise that you include consultation with a qualified professional in planning, design, and construction of any improvements. Such improvements include patios, swimming pools, decks, etc., as well as building structures and all changes in the site configuration requiring earth cut or fill construction.









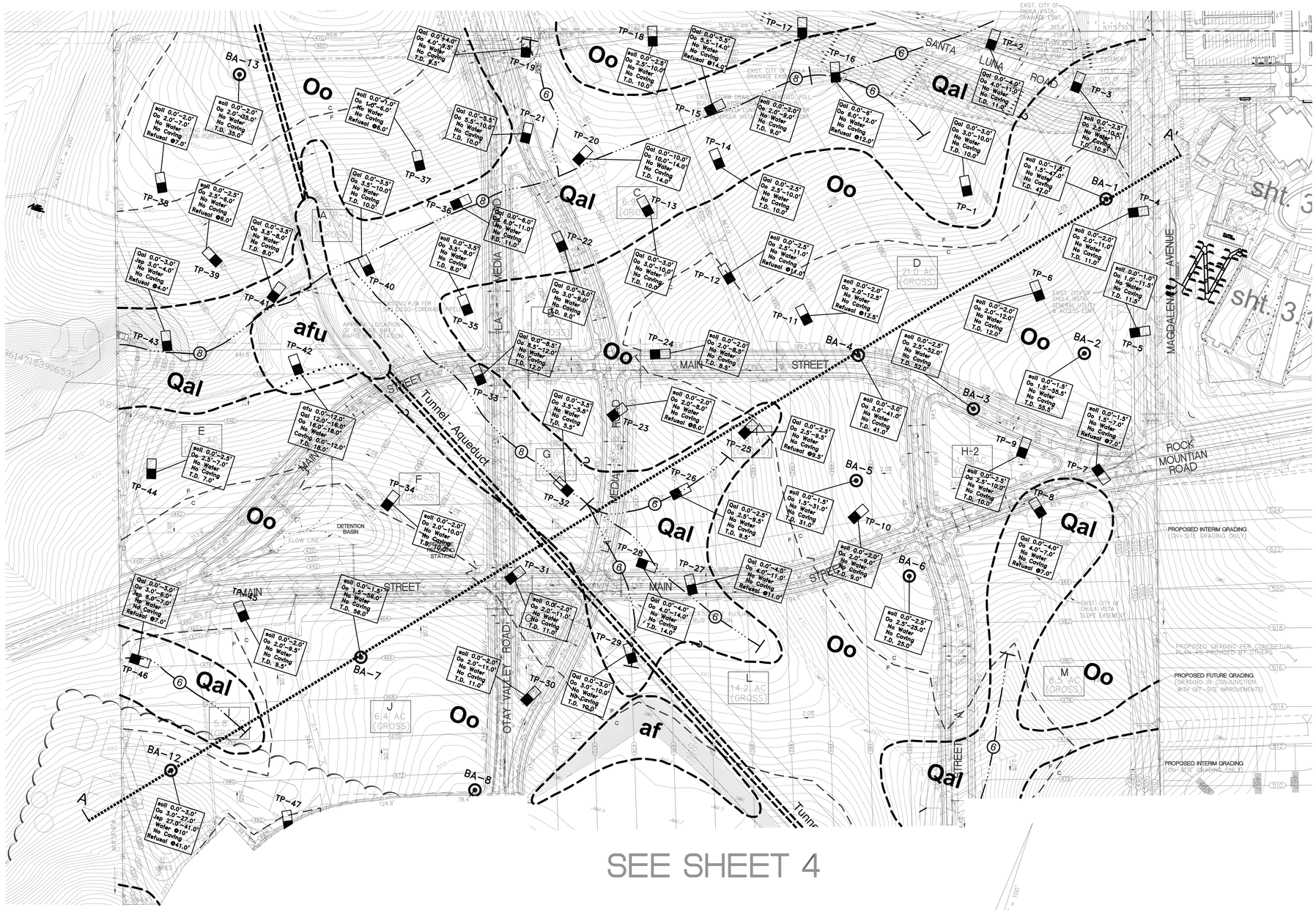
SCALE: 1"=40'

PLATE 1

CROSS-SECTIONS A-A', B-B', C-C' AND D-D'

AGS ADVANCED GEOTECHNICAL SOLUTIONS, INC.
27431 Enterprise Circle West, Suite 200,
Temecula, California 92606
Telephone: (714) 786-5661 Fax: (714) 409-3287

Project: P/W 1009-05-B-2 | Date: October 22, 2010



SEE SHEET 4

SEE SHEET 4

LEGEND

afu	ARTIFICIAL FILL, UNDOCUMENTED
af	ARTIFICIAL FILL, ENGINEERED
Qal	ALLUVIUM
Qt	TERRACE DEPOSITS
Oo	OTAY FORMATION
Tfg	FANGLOMERATE
Jsp	SANTIAGO PEAK VOLCANICS
	GEOLOGIC CONTACT; DOTTED WHERE BURIED, QUERIED WHERE UNCERTAIN
BA-1	APPROXIMATE LOCATION OF BUCKET AUGER BORING LOCATION
TP-2	APPROXIMATE LOCATION OF BACKHOE TEST PIT
A A'	CROSS-SECTION LOCATION
6	PROPOSED CANYON SUBDRAIN WITH PIPE DIAMETER IN INCHES
	PROPOSED STABILIZATION KEYWAY WITH WIDTH X TOE X HEEL DIMENTIONS AND BACKDRAIN SIZE IN INCHES

100 0 100 200 300
SCALE 1" = 100'

PARKS

PARCEL NO	GROSS AREA (AC)	NET AREA (AC)
A (P-1)	17.4	17.7*
G (P-2)	3.1	3.8*

*NET AREA INCLUDES AREA TO FACE OF CURB CREDITED BY THE CITY

SCHOOLS

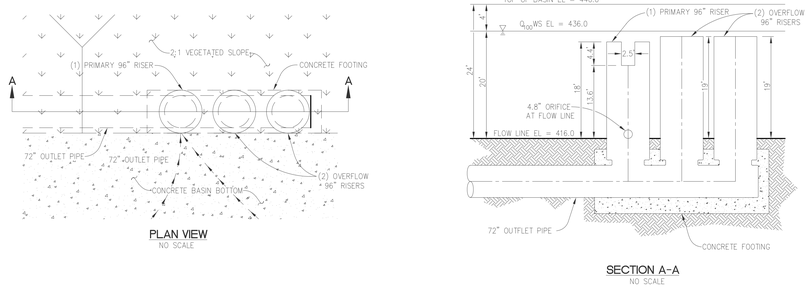
PARCEL NO	AREA (AC)
D	21.0

TC PARCELS

PARCEL NO	AREA (AC)
B	1.4
C	6.9
F	5.4
H-1	7.8
H-2	1.3
J	5.4
L	14.2

MH PARCELS

PARCEL NO	AREA (AC)
E	5.3
I	6.8
M	8.5



PLAN VIEW
NO SCALE

SECTION A-A
NO SCALE

DETENTION RISER DETAIL

AGS ADVANCED GEOTECHNICAL SOLUTIONS, INC.
27431 Enterprise Circle West, Suite 200, Temecula, California 92590
Telephone: (714) 786-5661 Fax: (714) 409-3287

PREPARED BY:
7910 CONVOY COURT
SAN DIEGO, CA 92111
TEL: (858) 715-1420 FAX: (858) 715-1424

Project: P/W 1009-05-B-2 | Date: October 22, 2010

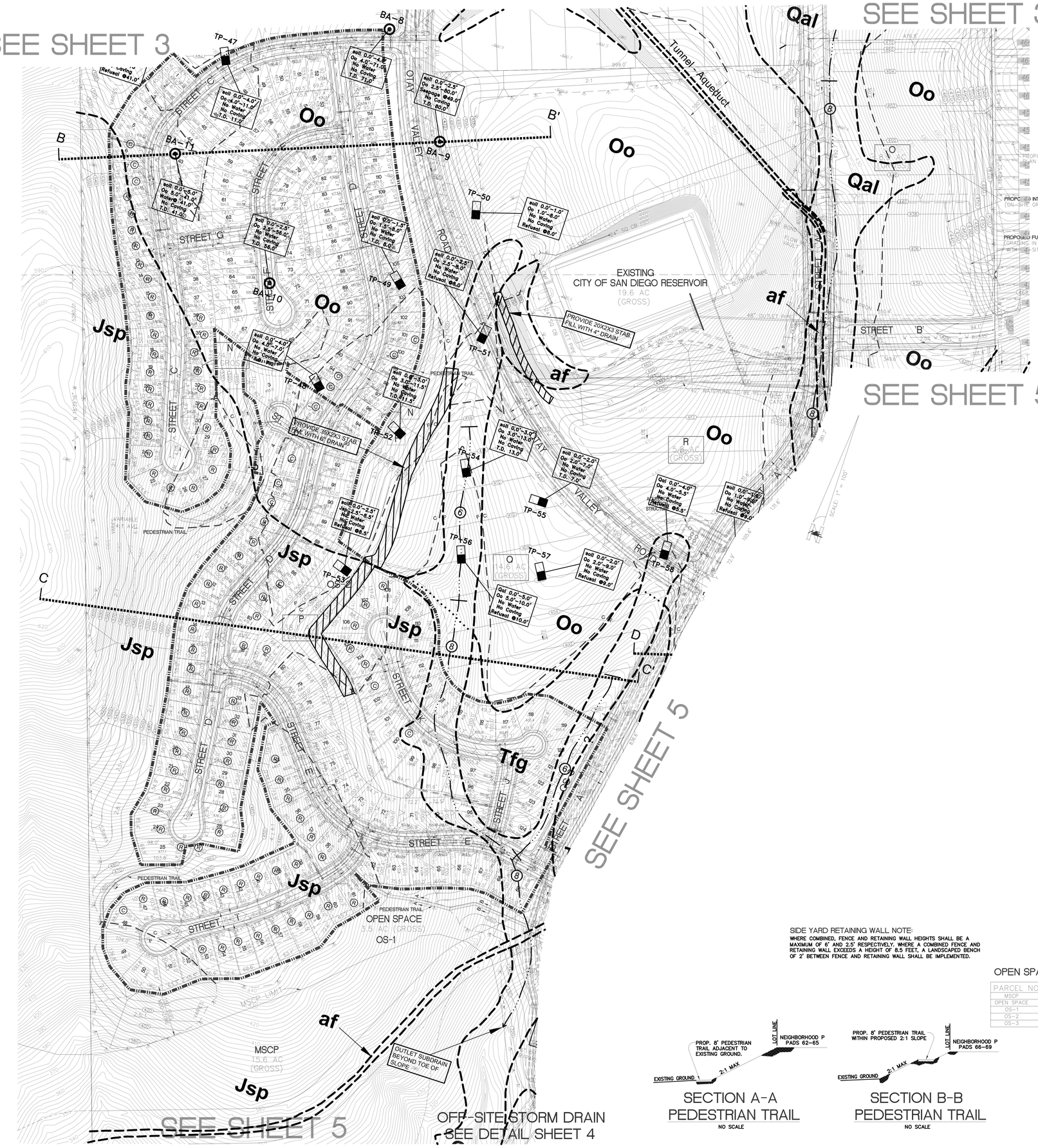
ORIGINAL: 12/23/08

REVISIONS	DATE	BY
TM 1ST SUBMITTAL	7/30/09	
TM 2ND SUBMITTAL	5/12/10	
TM 3RD SUBMITTAL	8/11/10	

PRELIMINARY TENTATIVE MAP
OTAY RANCH, VILLAGE 8 WEST
CHULA VISTA TRACT NO. 09-XX
CITY OF CHULA VISTA, CALIFORNIA

SHEET 3 OF 7

JOB NO. 08020 09/02/2010



ALTERNATE STREET 'I' CUL-DE-SAC

SCALE: 1"=100'

PARCEL N LOTS

LOT NO.	LOT SQ. FT.	LOT NO.	LOT SQ. FT.	LOT NO.	LOT SQ. FT.
1	4770	51	5320	101	4590
2	4270	52	7050	102	4980
3	4910	53	5640	103	4980
4	5290	54	5540	104	4420
5	5600	55	5640	105	4750
6	6450	56	6000	106	4750
7	4300	57	6620	107	4750
8	4050	58	7360	108	4750
9	4210	59	8460	109	4340
10	4230	60	8430	110	4500
11	4710	61	8330	111	4430
12	4720	62	7720	112	4280
13	4720	63	9100	113	4280
14	4720	64	6230	114	4280
15	7080	65	6090	115	4280
16	5270	66	6680	116	4280
17	5520	67	8600	117	7740
18	4650	68	6500		
19	5380	69	6200		
20	5430	70	5720		
21	4300	71	4800		
22	4050	72	4120		
23	4050	73	5040		
24	6910	74	4060		
25	7830	75	4030		
26	6960	76	4050		
27	6940	77	4700		
28	4050	78	5130		
29	4710	79	5140		
30	4970	80	5160		
31	5330	81	4430		
32	4580	82	5230		
33	4560	83	6390		
34	4620	84	6260		
35	4620	85	6440		
36	4620	86	6700		
37	4640	87	6840		
38	4500	88	6260		
39	6290	89	6120		
40	7120	90	6710		
41	4290	91	6850		
42	5370	92	6840		
43	7490	93	6460		
44	7810	94	6770		
45	5840	95	7020		
46	5950	96	4320		
47	6410	97	4280		
48	6410	98	4510		
49	6370	99	4590		
50	6070	100	4590		

PARCEL P LOTS

LOT NO.	LOT SQ. FT.	LOT NO.	LOT SQ. FT.	LOT NO.	LOT SQ. FT.
1	5690	51	5880	101	7910
2	6420	52	6000	102	6330
3	14960	53	6470	103	5750
4	8250	54	7200	104	6690
5	6010	55	7730	105	7400
6	6630	56	7640	106	7010
7	6570	57	7660	107	7590
8	6480	58	7940	108	7970
9	5500	59	7190	109	6980
10	5500	60	6170	110	5700
11	5500	61	6060	111	6560
12	6520	62	7130	112	6120
13	6610	63	6620	113	6430
14	6090	64	6000	114	6430
15	5500	65	6060	115	6430
16	5500	66	7010	116	6430
17	5660	67	6630	117	6810
18	5620	68	5500	118	7390
19	5500	69	5500	119	11200
20	5500	70	7250	120	7480
21	5500	71	8020	121	6620
22	5630	72	7150	122	6800
23	6220	73	7150	123	5920
24	7220	74	7150	124	8740
25	7780	75	6560		
26	5700	76	6100		
27	5810	77	6100		
28	5620	78	6490		
29	5500	79	6730		
30	5500	80	6850		
31	5500	81	7440		
32	5680	82	7120		
33	7550	83	6930		
34	11390	84	5500		
35	7000	85	5500		
36	7250	86	5520		
37	7130	87	5830		
38	9180	88	5830		
39	6210	89	5830		
40	6020	90	5800		
41	6220	91	5500		
42	5730	92	5690		
43	5610	93	6510		
44	5500	94	6160		
45	5700	95	8910		
46	5850	96	7940		
47	7680	97	8440		
48	6410	98	8740		
49	8820	99	10600		
50	8440	100	10270		

MH PARCELS

PARCEL NO	AREA (AC)
O	8.9
Q	14.6

CPF PARCELS

PARCEL NO	GROSS AREA	NET AREA (AC)
R	5.8	4.4

EXISTING PARCELS

PARCEL NO	AREA (AC)
RESERVOIR	19.6

SIDE YARD RETAINING WALL NOTE:
WHERE COMBINED, FENCE AND RETAINING WALL HEIGHTS SHALL BE A MAXIMUM OF 6' AND 2.5' RESPECTIVELY. WHERE A COMBINED FENCE AND RETAINING WALL EXCEEDS A HEIGHT OF 8.5 FEET, A LANDSCAPED BENCH OF 2' BETWEEN FENCE AND RETAINING WALL SHALL BE IMPLEMENTED.

100 0 100 200 300
SCALE 1" = 100'

OPEN SPACE/MSCP

PARCEL NO.	AREA (AC)
MSCP	15.6
OPEN SPACE	
OS-1	3.5
OS-2	1.9
OS-3	0.3

SECTION A-A
PEDESTRIAN TRAIL
NO SCALE

SECTION B-B
PEDESTRIAN TRAIL
NO SCALE

NOTE:
1: THE 150' FUEL MODIFICATION ZONE ADJACENT TO THE MSCP IS SHOWN HEREON. FOR LOCATIONS AND DETAILS OF ALL OTHER FUEL MODIFICATION ZONES REFER TO THE "FIRE PROTECTION PLAN FOR OTAY RANCH VILLAGE 8 WEST".

SEE SHEET 3 FOR LEGEND

AGS ADVANCED GEOTECHNICAL SOLUTIONS, INC.
27431 Enterprise Circle West, Suite 200,
Temecula, California 92606
Telephone: (714) 786-5661 Fax: (714) 409-3287

Project: P/W 1009-05-B-2 | Date: October 22, 2010

ORIGINAL: 12/23/08

PREPARED BY:
.\LOGO.bmp
7910 CONVOY COURT
SAN DIEGO, CA 92111
TEL: (858) 715-1420 FAX: (858) 715-1424

REVISIONS	DATE	BY
TM 1ST SUBMITTAL	7/30/09	
TM 2ND SUBMITTAL	5/12/10	
TM 3RD SUBMITTAL	8/11/10	

PRELIMINARY TENTATIVE MAP
OTAY RANCH, VILLAGE 8 WEST
CHULA VISTA TRACT NO. 09-XX
CITY OF CHULA VISTA, CALIFORNIA

SHEET 4 OF 7

JOB NO. 09020 09/02/2010

PARCEL P LOTS

LOT NO.	LOT SQ. FT.	LOT NO.	LOT SQ. FT.
1	7560	51	7650
2	7020	52	7310
3	7020	53	8850
4	6570	54	8650
5	6150	55	6700
6	7140	56	6000
7	6150	57	6460
8	6300	58	6560
9	6490	59	6010
10	6810	60	8180
11	6660	61	7650
12	6860	62	10970
13	6660	63	23460
14	6510	64	13240
15	6000	65	8460
16	6000	66	6430
17	6000	67	13680
18	6000	68	13650
19	6540	69	11700
20	6000	70	9370
21	6000	71	8190
22	6000	72	7450
23	6020	73	7400
24	6220	74	7920
25	6180	75	9930
26	6220	76	7530
27	6000	77	6000
28	6000	78	7030
29	6130	79	6620
30	8120	80	6000
31	7600	81	6000
32	7540	82	6260
33	7110	83	6250
34	10810	84	6140
35	26040	85	6000
36	10790	86	6000
37	12080	87	6040
38	10380	88	6000
39	9760	89	6000
40	10020	90	6000
41	10020		
42	9650		
43	9080		
44	8430		
45	8290		
46	8430		
47	8200		
48	8030		
49	8120		
50	8080		

SCHOOLS

PARCEL NO	AREA (AC)
S	11.4

OPEN SPACE/MSCP

PARCEL NO.	AREA (AC)
MSCP	15.6
OPEN SPACE	
OS-1	3.5

PARKS

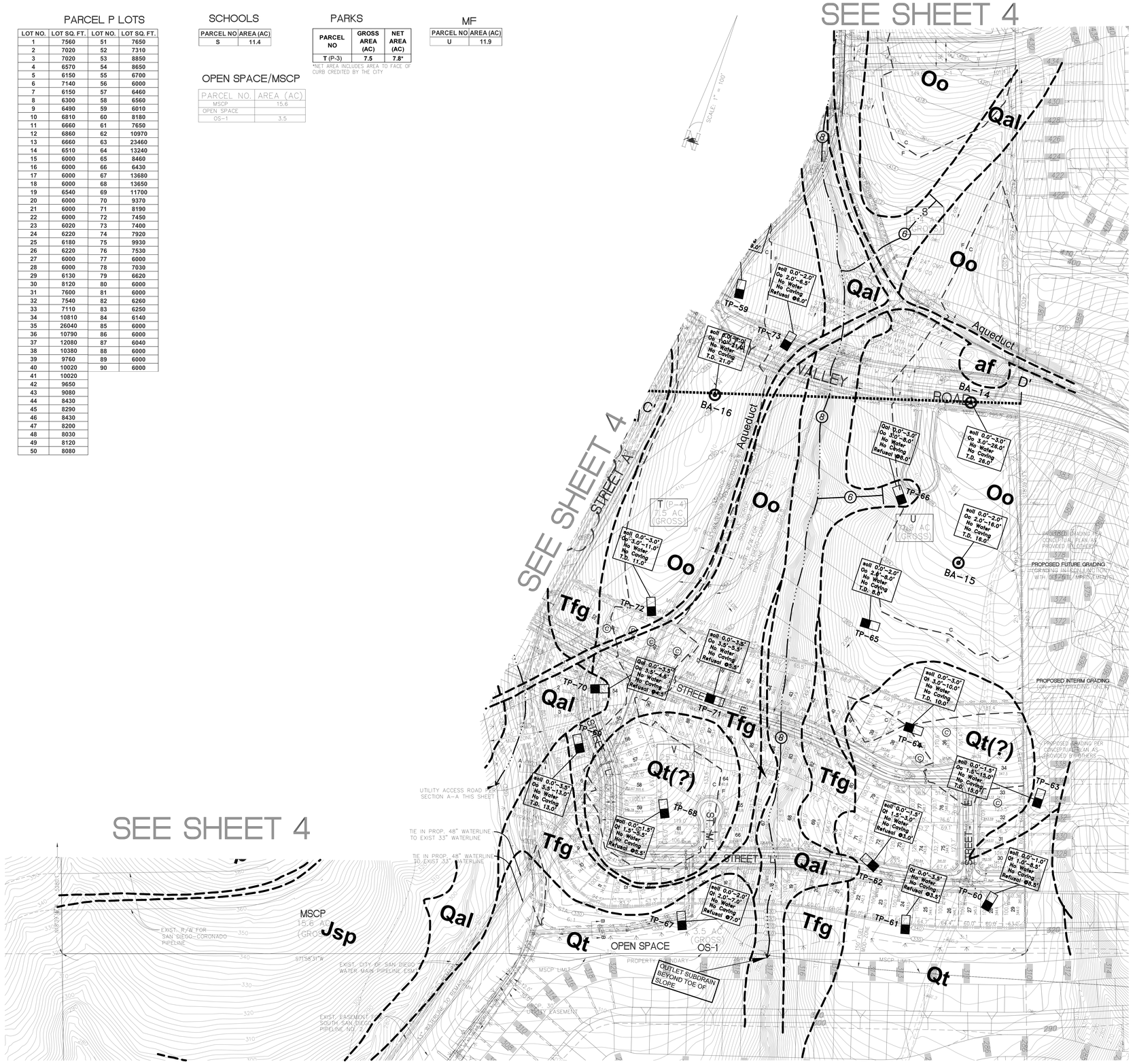
PARCEL NO	GROSS AREA (AC)	NET AREA (AC)
T (P-3)	7.5	7.8*

*NET AREA INCLUDES AREA TO FACE OF CURB CREDITED BY THE CITY

MF

PARCEL NO	AREA (AC)
U	11.9

SEE SHEET 4



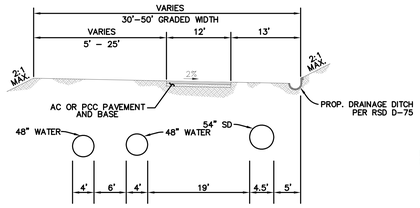
SEE SHEET 4

SEE SHEET 4

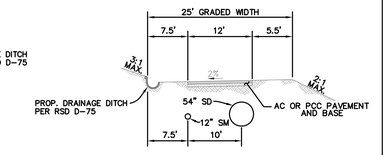
OFF-SITE SEWER AND STORM DRAIN
SEE DETAIL THIS SHEET

OFF-SITE SEWER AND STORM DRAIN DETAIL

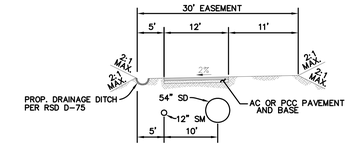
SCALE 1" = 100'



SECTION A-A
UTILITY ACCESS ROAD
NO SCALE



SECTION B-B
UTILITY ACCESS ROAD
NO SCALE



SECTION C-C
30' EASEMENT AND UTILITY ACCESS ROAD
NO SCALE

UTILITY ACCESS ROAD NOTE:

ALL PORTIONS OF THE UTILITY ACCESS ROAD WITH GRADES OF 5 PERCENT OR GREATER SHALL BE CONSTRUCTED OF 6" PCC WITH #4 BARS AT 18" O.C. (EACH WAY) AND A HEAVY BROOM FINISH.

ALL PORTIONS OF THE UTILITY ACCESS ROAD WITH GRADES OF LESS THAN 5 PERCENT SHALL BE CONSTRUCTED OF AC MEETING H20 LOADING STANDARDS.

NOTE:

1: THE 150' FUEL MODIFICATION ZONE ADJACENT TO THE MSCP IS SHOWN HEREON. FOR LOCATIONS AND DETAILS OF ALL OTHER FUEL MODIFICATION ZONES REFER TO THE "FIRE PROTECTION PLAN FOR OTAY RANCH VILLAGE 8 WEST".

100 0 100 200 300
SCALE 1" = 100'

SEE SHEET 3 FOR LEGEND

AGS ADVANCED GEOTECHNICAL SOLUTIONS, INC.
27411 Enterprise Circle West, Suite 200,
Temecula, California 92606
Telephone: (714) 786-5661 Fax: (714) 409-3287

Project: P/W 1009-05-B-2 | Date: October 22, 2010

ORIGINAL: 12/23/08

PREPARED BY:

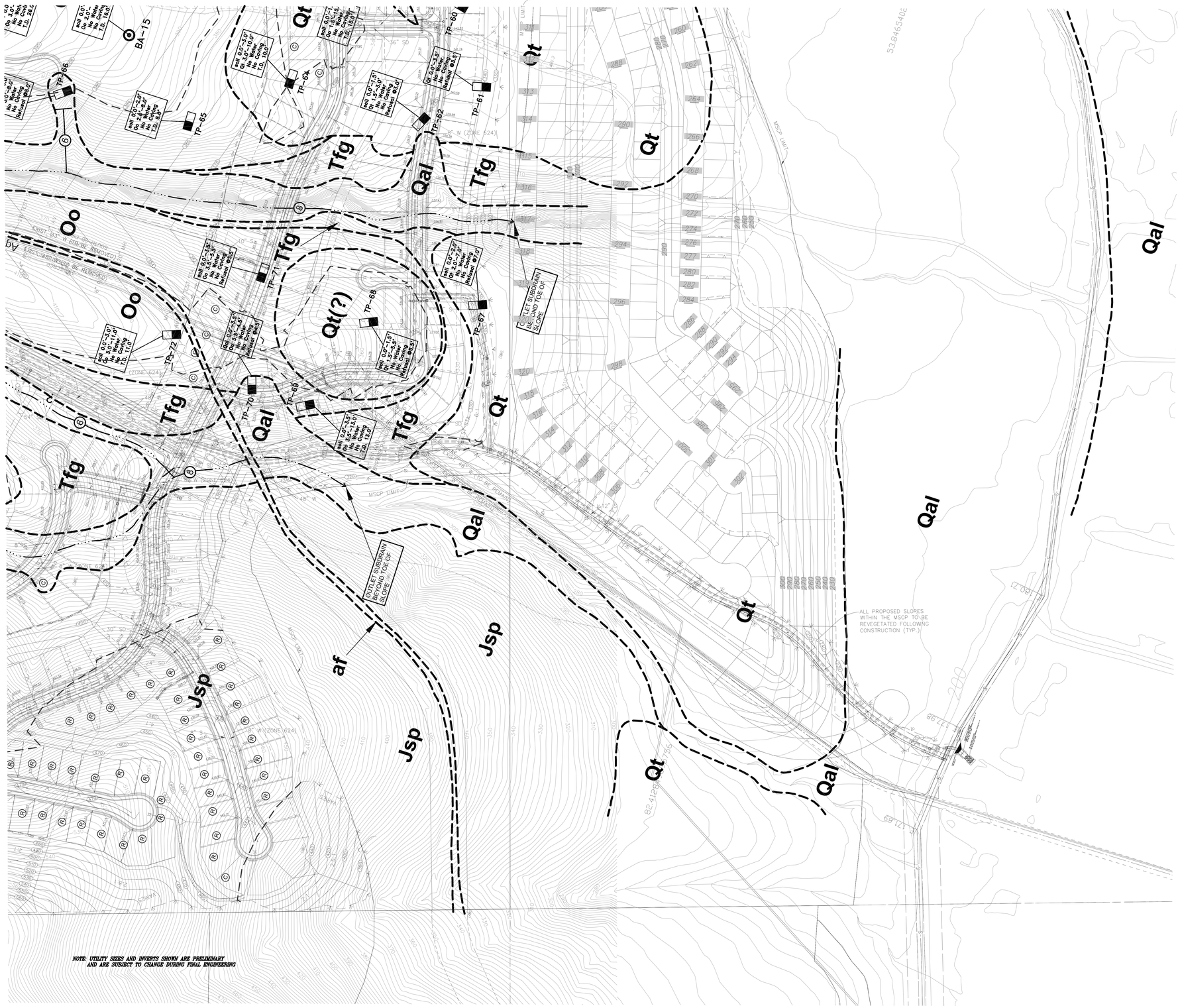
7910 CONVOY COURT
SAN DIEGO, CA 92111
TEL. (858) 715-1420 FAX (858) 715-1424

REVISIONS	DATE	BY
TM 1ST SUBMITTAL	7/30/09	
TM 2ND SUBMITTAL	5/12/10	
TM 3RD SUBMITTAL	8/11/10	

PRELIMINARY TENTATIVE MAP
OTAY RANCH, VILLAGE 8 WEST
CHULA VISTA TRACT NO. 09-XX
CITY OF CHULA VISTA, CALIFORNIA

SHEET 5 OF 7

JOB NO. 08200 09/02/2010



SEE SHEET 3 FOR LEGEND

ADVANCED GEOTECHNICAL SOLUTIONS, INC.
27431 Enterprise Circle West, Suite 200,
Temecula, California 92606
Telephone: (714) 786-5661 Fax: (714) 409-3287

Project: P/W 1009-05-B-2 | Date: October 22, 2010

ORIGINAL: 12/23/08

REVISIONS	DATE	BY
TM 1ST SUBMITTAL	7/30/09	
TM 2ND SUBMITTAL	5/12/10	
TM 3RD SUBMITTAL	8/11/10	

PREPARED BY:
7910 CONVOY COURT
SAN DIEGO, CA 92111
TEL: (858) 715-1420 FAX: (858) 715-1424

SCALE: 1" = 100'

100 0 100 200 300
SCALE 1" = 300'

PRELIMINARY TENTATIVE MAP
OTAY RANCH, VILLAGE 8 WEST
CHULA VISTA TRACT NO. 09-XX
CITY OF CHULA VISTA, CALIFORNIA

SHEET 7 OF 7

JOB NO. 08020 09/02/2010

APPENDIX H1

Global Climate Change Analysis

Global Climate Change Analysis for the Otay Land Company General Plan Amendment and Otay Ranch General Development Plan Amendment, Chula Vista, California

Prepared for

City of Chula Vista
Public Services Building 200
276 Fourth Avenue
Chula Vista, CA 92010
Contact: Stephen Power, AICP

Prepared by

RECON Environmental, Inc.
1927 Fifth Avenue
San Diego, CA 92101-2358
P 619.308.9333 F 619.308.9334
RECON Number 4829

May 10, 2012



Karen Bowling, Senior Environmental Analyst

TABLE OF CONTENTS

Executive Summary 1

1.0 Introduction 2

1.1 Understanding Global Climate Change 2

1.2 Greenhouse Gases of Primary Concern 3

2.0 Project Description 4

2.1 Development Summary 4

2.2 Green Building/Energy Efficiency Standards 8

2.2.1 Energy Efficiency 8
2.2.2 Water Conservation 8
2.2.3 Materials Use and Waste Reduction 9
2.2.4 Pollutant Control and Heat Island Reduction 9

3.0 Existing Conditions 9

3.1 Environmental Setting 9

3.1.1 Regional Climate 9
3.1.2 State and Regional GHG Inventories 10
3.1.3 Consequences of Global Climate Change 12

3.2 Regulatory Background 13

3.2.1 International 13
3.2.2 National 16
3.2.3 State 18
3.2.4 Local 29

4.0 Significance Criteria and Analysis Methodologies 36

4.1 Determining Significance 36

4.1.1 Business-as-Usual 2020 Emissions 36
4.1.2 Scoping Plan Reduction Measures 37
4.1.3 Significance Thresholds 38

4.2 Methodology and Assumptions 39

4.2.1 Estimating Vehicle Emissions 40
4.2.2 Estimating Construction Emissions 41
4.2.3 Estimating Building Use Emissions 41
4.2.4 General Assumptions 44

TABLE OF CONTENTS (cont.)

5.0 Impact Analysis 45

5.1 Project Emissions Relative to BAU 45

5.1.1 Impacts 45
5.1.2 Significance of Impacts 55

5.2 Project Consistency with Adopted Plans, Policies, and Regulations 58

5.2.1 Impacts 58
5.2.2 Significance of Impacts 59

6.0 Conclusions and Recommendations 60

7.0 References Cited 60

FIGURES

1: Regional Location 5
2: Aerial Photograph of Project 6
3: Proposed Land Uses 7
4: City Climate Zones 35

TABLES

1: Global Warming Potentials and Atmospheric Lifetimes 3
2: California GHG Emissions in 1990 and 2004 10
3: San Diego County GHG Emissions in 2006 11
4: CARB Scoping Plan Recommended GHG Reduction Measures 21
5: California BAU 2020 GHG Emissions Forecast 37
6: CARB Scoping Plan Recommended GHG Reduction Measures within City's Control 38
7: Future (Year 2020) Modeled Land Uses 40
8: GHG Emission Factors 44
9: Summary of Estimated GHG Emissions and Project Reductions from Non-Transportation Sources 57

ATTACHMENTS

1: Understanding Global Climate Change
2: Chula Vista Green Building Standards and Increased Energy Efficiency Standards Ordinances
3: GHG Emissions Calculations

Executive Summary

The proposed Otay Ranch General Development Plan (Proposed Project) is located south of Olympic Parkway, west and east of State Route 125 (SR-125) in the Otay Ranch community in the city of Chula Vista (City). The Proposed Project comprises a General Plan Amendment (GPA) and General Development Plan Amendment (GDPA) to allow the ultimate buildout of 6,050 residential units, 1.8 million square feet of commercial uses, 51.4 acres of schools, 10.8 acres of community purpose facilities, 55.4 acres of park, and 2.2 million square feet of industrial uses. The purpose of this report is to evaluate the significance of the Proposed Project's GHG emissions that would occur from the construction and ongoing operation of the maximum allowable land uses under the proposed plan. The operational GHG emissions evaluated include emissions from vehicle use, electricity consumption, natural gas combustion, water use, and solid waste disposal. Significance was determined based on the City's threshold requiring a 20 percent reduction in the Proposed Project's overall GHG emissions compared to a business-as-usual (BAU) scenario.

This report concludes that the Proposed Project's contribution to cumulative greenhouse gas (GHG) emissions would be less than significant. A total of 197,220.66 metric tons of carbon dioxide equivalent ($MTCO_2E$) of GHG emissions would be emitted by the Proposed Project each year above existing conditions. This estimate represents a nearly 29-percent reduction in total GHG emissions compared to the BAU condition, which would emit 275,971.62 $MTCO_2E$ of GHG emissions per year above existing conditions. This reduction is due to the Proposed Project's incorporation of key vehicle emission reduction measures as well as increased energy- and water-saving design. Accounting for statewide regulations being imposed on the auto and fuel industries to reduce vehicle GHG emissions statewide, and project-specific design that reduces average vehicle trip lengths, transportation-related BAU emissions would be reduced nearly 40 percent by the Proposed Project. The Proposed Project's average local daily trip length would be 4.62 miles for Village 8 West and 5.08 miles for Village 9. This trip length is less than the regional average trip length of 5.8 miles, and yields a substantially lesser VMT and total vehicle fuel consumption compared to BAU.

Accounting for the Proposed Project's increased energy- and water-saving design requirements, the non-transportation-related BAU emissions (i.e., emissions from energy and water use, solid waste disposal and construction activities) would be reduced 21 percent by the Proposed Project. This reduction results from substantially reduced BAU energy and water use as required in the proposed new General Plan (GP) Policy E 7.8 and in existing City ordinances.

Given its vehicle, energy and water use GHG reduction features, the Proposed Project would generate total GHG emissions 29 percent lower than the total emissions projected

for BAU. The Proposed Project is therefore consistent with the City's threshold and with the Scoping Plan and AB 32 year 2020 goals upon which it is based. The Proposed Project's Climate Change impacts would be less than significant.

1.0 Introduction

This report evaluates the significance of the Proposed Project's contribution of GHG emissions to statewide GHG emissions and GHG emissions reduction targets. To evaluate the incremental effect of Proposed Project development on statewide and global climate change, it is important to have a basic understanding of the nature of the global climate change problem.

1.1 Understanding Global Climate Change

Global climate change is a change in the average weather of the earth, which can be measured by wind patterns, storms, precipitation, and temperature. The earth's climate is in a state of constant flux with periodic warming and cooling cycles. Extreme periods of cooling are termed "ice ages," which may then be followed by extended periods of warmth. For most of the earth's geologic history, these periods of warming and cooling have been the result of many complicated, interacting natural factors that include volcanic eruptions which spew gases and particles (dust) into the atmosphere, the amount of water, vegetation, and ice covering the earth's surface, subtle changes in the earth's orbit, and the amount of energy released by the sun (sun cycles). However, since the beginning of the Industrial Revolution around 1750, the average temperature of the earth has been increasing at a rate that is faster than can be explained by natural climate cycles alone.

With the Industrial Revolution came an increase in the combustion of carbon-based fuels such as wood, coal, oil, natural gas, and biomass. Industrial processes have also created emissions of substances that are not found in nature. This in turn has led to a marked increase in the emissions of gases that have been shown to influence the world's climate. These gases, termed "greenhouse" gases, influence the amount of heat that is trapped in the earth's atmosphere. Because recently observed increased concentrations of GHGs in the atmosphere are related to increased emissions resulting from human activity, the current cycle of "global warming" is generally believed to be largely due to human activity. Of late, the issue of global warming or global climate change has arguably become the most important and widely debated environmental issue in the United States and the world. Because climate change is caused by the collective of human actions taking place throughout the world, it is quintessentially a cumulative issue.

1.2 Greenhouse Gases of Primary Concern

There are numerous GHGs, both naturally occurring and manmade. Table 1 summarizes some of the most common. Each GHG has variable atmospheric lifetime and global warming potential.

The atmospheric lifetime of the GHG is the average time the molecule stays stable in the atmosphere. Most GHGs have long atmospheric lifetimes, staying in the atmosphere hundreds or thousands of years. The potential of a gas to trap heat and warm the atmosphere is measured by its global warming potential or GWP. Specifically, GWP is defined as the cumulative radiative forcing effects of a gas, both direct and indirect, integrated over a specified period of time resulting from the emission of a unit mass of gas relative to some reference gas (U.S. EPA 2002). The reference gas for GWP is carbon dioxide which, as shown in Table 1, thus has a GWP of 1. The GHGs with higher GWPs have a greater global warming effect than carbon dioxide on a molecule by molecule basis.

TABLE 1
GLOBAL WARMING POTENTIALS (GWPs) AND ATMOSPHERIC LIFETIMES (YEARS)

Gas	Atmospheric Lifetime	100-year GWP	20-year GWP	500-year GWP
Carbon Dioxide (CO_2)	50-200	1	1	1
Methane (CH_4)[a]	12±3	21	56	6.5
Nitrous oxide (N_20)	120	310	280	170
HFC-23	264	11,700	9,100	9,800
HFC-125	32.6	2,800	4,600	920
HFC-134a	14.6	1,300	3,400	420
HFC-143a	48.3	3,800	5,000	1,400
HFC-152a	1.5	140	460	42
HFC-227ea	36.5	2,900	4,300	950
HFC-236fa	209	6,300	5,100	4,700
HFC-4310mee	17.1	1,300	3,000	400
CF_4	50,000	6,500	4,400	10,000
C_2F_6	10,000	9,200	6,200	14,000
C_4F_{10}	2,600	7,000	4,800	10,100
C_6F_{14}	3,200	7,400	5,000	10,700
SF_6	3,200	23,900	16,300	34,900

SOURCE: U.S. EPA 2002.
[a] The methane GWP includes the direct effects and those indirect effects due to the production of tropospheric ozone and stratospheric water vapor. The indirect effect due to the production of CO_2 is not included.

Of the gases listed in Table 1, carbon dioxide (CO_2), methane (CH_4), and nitrous oxide(N_20) are produced by both biogenic (natural) and anthropogenic (human) sources. The remaining gases occur solely as the result of human processes. Hydrofluorocarbons (HFCs) are synthetic, made-made chemicals used as substitutes for ozone-depleting chloroflourocarbons in automobile air conditioners and refrigerants. Perfluorocarbons (PFCs) such as CF_4 are used primarily in aluminum production and

semiconductor manufacture. Sulfur hexafluoride (SF_6) is used for insulation in electric power transmission and distribution equipment. These remaining gases are not of primary concern to the Proposed Project.

CO_2, CH_4 and N_20 are the GHGs of primary concern in this analysis. Carbon dioxide would be emitted by uses allowed under the Proposed Project during the combustion of fossil fuels in vehicles, from electricity generation and natural gas consumption, and from solid waste disposal. Smaller amounts of methane and nitrous oxide would be emitted from the same Project operations.

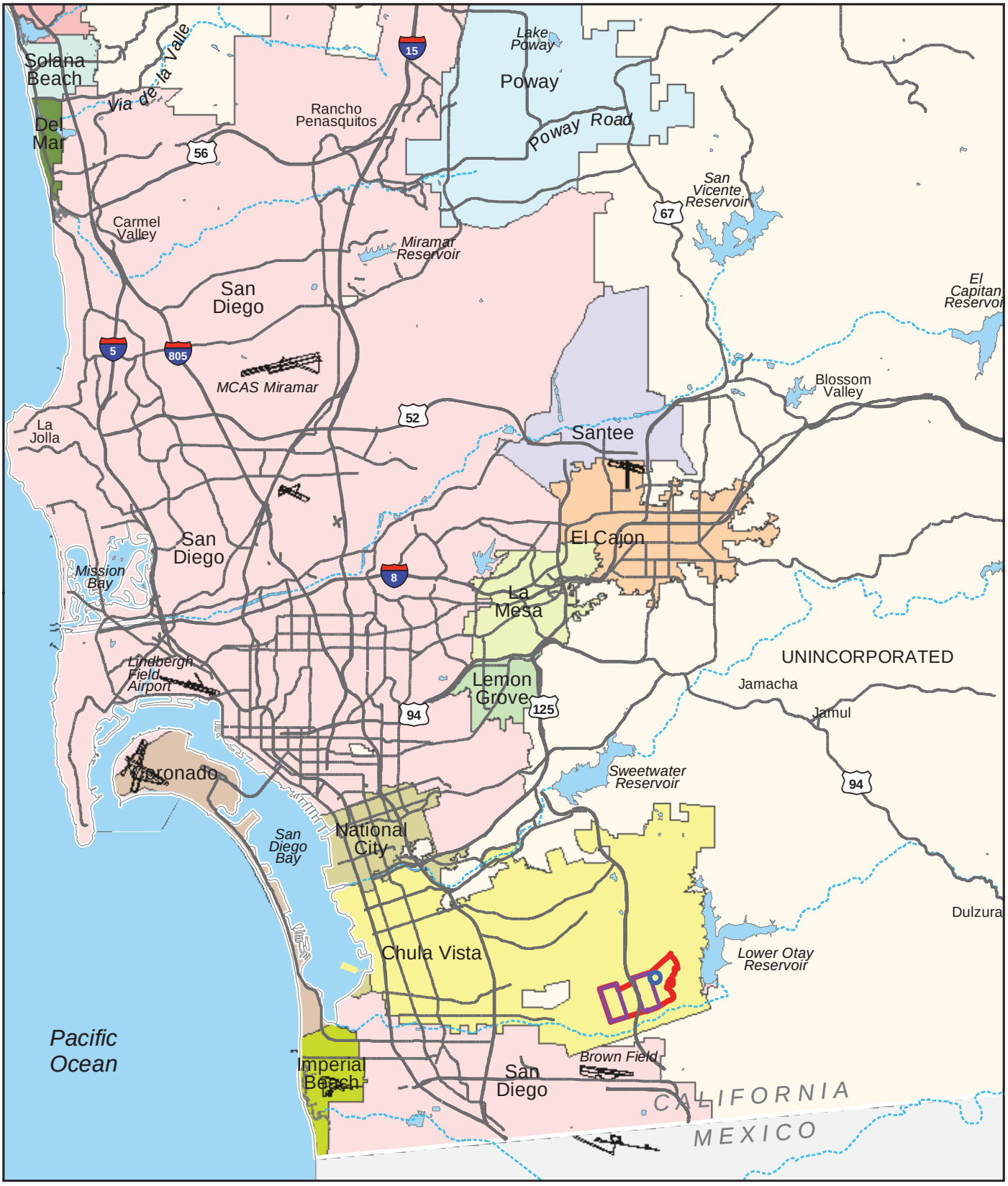
More information on the background of global warming and GHGs can be found in Attachment 1, Understanding Global Climate Change.

2.0 Project Description

2.1 Development Summary

The Otay Ranch GPA and GDPA (collectively known as the Proposed Project) is composed of two parcels of land (Village 8 West and Village 9) located within the Otay Ranch villages planning area. The intent of the Proposed Project is to redefine village boundaries to create Village 8 West and Village 9 as cohesive and integrated village areas which correspond to the City's General Plan. The Proposed Project also includes an 85-acre Regional Technology Park (RTP) within the Planning Area 10/University Site. The discretionary actions required to implement the Proposed Project include a GPA and Otay Ranch GDPA.

The Proposed Project is located south of Olympic Parkway, west and east of State Route 125 (SR-125) in the Otay Ranch community in the eastern part of the City (Figure 1). The proposed GPA and GDPA would revise text and graphics relevant to the subject village areas in these plans to allow the ultimate buildout of 6,050 residential units, 1.8 million square feet of commercial and 2.2 million square feet of industrial uses, 10.8 acres of community purpose use, 51.4 acres of schools, and 55.4 acres of park use on currently vacant land (Figure 2). Figure 3 shows the land use plan of the Proposed Project. The Proposed Project's plan of land uses have been guided by principles that encourage walkability, mixed-use, alternative modes of transportation, and preservation of a large amount of open space.



Project Area

Village 8 West and Village 9

RTP

FIGURE 1

Regional Location

M:\JOBS3\4829\common_gis\fig1_tech.mxd 11/1/2011

Image source: Copyright 2010 AerialsExpress, All Rights Reserved (flown Feb 2010)



Project Area
Village 8 West and Village 9
RTP

0 Feet 4,000

FIGURE 2

Aerial Photograph of Project Area

M:\JOBS3\4829\common_gis\fig2_tech.mxd 11/1/2011



FIGURE 3

Proposed Land Uses

\\server04\gis\JOBS3\4829\common_gis\fig3_air.mxd 1/24/2012

2.2 Green Building/Energy Efficiency Standards

The proposed GPA includes the addition of a new energy-related Policy E 7.8 into the existing General Plan's Environmental Element to "ensure that residential and non-residential construction complies with all applicable City of Chula Vista energy efficiency measures that are in effect at the time of discretionary permit review and approval or building permit issuance, whichever is applicable." The residential and non-residential construction that would be allowed by the Proposed Project would thus be subject to compliance with all relevant City energy efficiency and green building measures. The City currently has two key Municipal Code ordinances that require advanced water conservation, energy efficiency and other measures that would reduce the emission of GHGs. These ordinances are discussed later in Section 3.2.4.5 and Section 3.2.4.6 and are attached in their entirety as Attachment 2. An overview of the major GHG reducing benefits of these existing ordinances is described below.

2.2.1 Energy Efficiency

In accordance with the City's current energy code and Increased Energy Efficiency Standards (Municipal Code Chapter 15.26, Section 15.26.030), the Proposed Project development shall exceed the current 2008 California Energy Code's residential energy efficiency standards by 15 percent. Projects would accomplish this through improved Heating, Ventilation, & Air Conditioning (HVAC) systems and duct seals; enhanced ceiling, attic and wall insulation; EnergyStar appliances; high-efficiency water heaters; energy-efficient three-coat stucco exteriors; energy-efficient lighting; and high-efficiency window glazing. These energy features would undergo independent third party inspection and diagnostics as part of the City's verification and commissioning process.

2.2.2 Water Conservation

In accordance with the City's current Green Building Standards (Municipal Code Chapter 15.12), residential and commercial buildings would be required to be designed to use at least 20 percent less water per unit than buildings compliant with the existing plumbing code. This would be achieved through advanced plumbing systems such as parallel hot water piping or hot water recirculation systems, and fixtures such as ultra-low flow toilets, water-saving showerheads and kitchen faucets, and buyer-optional high-efficiency clothes washers. As required by the Standards, the 20-percent reduction in potable water use shall be demonstrated by verifying each plumbing fixture and fitting meets the 20 percent reduced flow rate or by calculating a 20-percent reduction in the building water use baseline.

In addition to these indoor water use conservation features, projects would be required to design outdoor landscaping that minimizes turf, maximizes drought-tolerant plants, and incorporates weather-based irrigation controllers, multi-programmable irrigation

clocks, and a high-efficiency drip irrigation system. Also at the time of final inspection, a manual shall be placed in each building that includes, among other things, information about water conservation.

2.2.3 Materials Use and Waste Reduction

In accordance with the Green Building Standards and state and local laws, at least 50 percent of on-site construction waste and ongoing operational waste would be diverted from landfills through reuse and recycling. To further minimize waste, the Standards require projects to incorporate recycled materials for such things as flooring, and to use certified sustainable wood products and other recycled or rapidly renewable building materials where possible. Areas for storage and collection of recyclables and yard waste are also required to be provided for each residence.

2.2.4 Pollutant Control and Heat Island Reduction

To maximize shade and reduce heat island effects, the landscape plans of subsequent projects would be required to include strategic location of deciduous trees and other vegetation, as well as the possible use of cool or green roofs. Impervious surfaces, including paved parking areas, are required to be minimized and pervious pavers and materials used instead where practical. No CFC-based refrigerants are allowed, and interior finishes, adhesives, sealants, paints and coatings, and carpet systems would be required to be low in VOCs (volatile organic compounds), and meet the testing and product requirements of one or more nationally recognized green product labeling programs. Compliance with these requirements shall be verified through documentation.

3.0 Existing Conditions

3.1 Environmental Setting

3.1.1 Regional Climate

The climate of the region which encompasses the City of Chula Vista is identified as Mediterranean, which is characterized by warm, dry summers and mild, wet winters. Clear skies predominate for much of the year due to a semi-permanent high-pressure cell located over the Pacific Ocean. This high-pressure cell also drives the dominant onshore circulation and helps to create subsidence and radiation temperature inversions. Subsidence inversions occur during the warmer months when descending air associated with the high-pressure cell comes in contact with cool marine air.

Radiation inversions typically occur on winter nights when air near the ground cools by radiation and the air aloft remains warm.

An average of 10 inches of rain falls each year from November to early April, while the remainder of the year is typically dry. Typically, measurable rain falls on 20 days per year, with only six of these days experiencing moderate (0.5 inch in 24 hours) rainfall.

3.1.2 State and Regional GHG Inventories

3.1.2.1 California GHG Inventory

The CARB performs statewide inventories. The inventory is divided into nine broad sectors of economic activity: agriculture, commercial, electricity generation, forestry, high GWP emitters, industrial, recycling and waste, residential, and transportation. Emissions are quantified in million $MTCO_2E$. Table 2 shows the estimated statewide GHG emissions for the years 1990, 2000, 2004, and 2008.

TABLE 2
CALIFORNIA GHG EMISSIONS BY SECTOR IN 1990, 2000, 2004, AND 2008

Sector	1990 Emissions in $MMTCO_2E$ (% total)[1]	2000 Emissions in $MMTCO_2E$ (% total)[1]	2004 Emissions in $MMTCO_2E$ (% total)[1]	2008 Emissions in $MMTCO_2E$ (% total)[1]
Sources				
Agriculture	23.4 (5%)	25.44 (6%)	28.82 (6%)	28.06 (6%)
Commercial	14.4 (3%)	12.80 (3%)	13.20 (3%)	14.68 (3%)
Electricity Generation	110.6 (26%)	103.92 (23%)	119.96 (25%)	116.35 (24%)
Forestry (excluding sinks)	0.2 (<1%)	0.19 (<1%)	0.19 (<1%)	0.19 (<1%)
High GWP	--	10.95 (2%)	13.57 (3%)	15.65 (3%)
Industrial	103.0 (24%)	97.27 (21%)	90.87 (19%)	92.66 (19%)
Recycling and Waste	--	6.20 (1%)	6.23 (1%)	6.71 (1%)
Residential	29.7 (7%)	30.13 (7%)	29.34 (6%)	28.45 (6%)
Transportation	150.7 (35%)	171.13 (37%)	181.71 (38%)	174.99 (37%)
Unspecified Remaining[2]	1.3 (<1%)	--	--	--
Subtotal	433.3	458.03	483.89	477.74
Sinks				
Forestry Sinks	-6.7 (--)	-4.72 (--)	-4.32 (--)	-3.98 (--)
TOTAL	**426.6**	**453.31**	**479.57**	**473.76**

SOURCE: CARB 2007, 2010a.
[1]Percents may not total 100 due to rounding.
[2]The remaining are from unspecified fuel combustion and ozone depleting substance (ODS) substitute use which could not be attributed to an individual sector.

As shown in Table 2, statewide GHG emissions totaled 433 $MMTCO_2E$ in 1990, 458 $MMTCO_2E$ in 2000, 484 $MMTCO_2E$ in 2004, and 478 $MMTCO_2E$ in 2008. According to data from the CARB, it appears that statewide GHG emissions peaked in 2004 and are now beginning to decrease (CARB 2010a). Transportation-related emissions consistently contribute the most GHG emissions, followed by electricity generation and industrial emissions.

The forestry sector is unique because it not only includes emissions associated with harvest, fire, and land use conversion, but also includes removals of atmospheric CO_2 by photosynthesis, which is then bound (sequestered) in plant tissues. As seen in Table 2, the forestry sector consistently removes more CO_2 from the atmosphere statewide than it emits. As a result, although decreasing over time, this sector represents a net sink, removing a net 6.7 $MMTCO_2E$ from the atmosphere in 1990, a net 4.7 $MMTCO_2E$ in 2000, a net 4.3 $MMTCO_2E$ in 2004, and a net 4.0 $MMTCO_2E$ in 2008.

3.1.2.2 San Diego County GHG Inventory

A San Diego County regional emissions inventory was prepared by the University of San Diego that took into account the unique characteristics of the region. The 2006 emissions inventory for San Diego County is duplicated below in Table 3. The sectors included in this inventory are somewhat different than those in the statewide inventory.

TABLE 3
SAN DIEGO COUNTY GHG EMISSIONS BY SECTOR IN 2006

Sector	2006 Emissions in $MMTCO_2E$ (% total) [1]
Agriculture/Forestry/Land Use	0.7 (2%)
Waste	0.7 (2%)
Electricity	9 (25%)
Natural Gas Consumption	3 (8%)
Industrial Processes & Products	1.6 (5%)
On-Road Transportation	16 (45%)
Off-Road Equipment & Vehicles	1.3 (4%)
Civil Aviation	1.7 (5%)
Rail	0.3 (<1%)
Water-Borne Navigation	0.127 (<0.5%)
Other Fuels/Other	1.1 (3%)
Total	**35.5**

SOURCE: San Diego County Greenhouse Gas Inventory: An Analysis of Regional Emissions and Strategies to Achieve AB 32 Targets. Prepared by the University of San Diego School of Law, Energy Policy Initiative Center (EPIC), and available online at http://www.sandiego.edu/ epic/ghginventory/.
[1]Percents may not total 100 due to rounding.

Similar to the statewide emissions, transportation-related GHG emissions contributed the most countywide, followed by emissions associated with energy use.

3.1.2.3 City of Chula Vista GHG Inventory

As part of monitoring its progress in attaining the goals of its CO_2 Reduction Plan (see Section 3.2.4.2 below), the City of Chula Vista inventoried citywide GHG emissions in 2005 and 2008. The *2005 GHG Emissions Inventory* was the first formal evaluation of

the City's progress in reaching its emissions goals, and the *2008 GHG Emissions Inventory* was the second formal evaluation (City of Chula Vista 2005, 2008a).

The *2008 GHG Emissions Inventory* separates emissions into two major categories, community and municipal. The community analysis represents the quantity of GHG emissions produced throughout the entire City in both public and private sectors. The municipal analysis represents emissions only from City facilities and operations.

In 2008, community GHG emissions in the City totaled 934,630 $MTCO_2E$. Transportation and mobile sources accounted for approximately 44 percent of this total. This is 29 percent higher than 1990 levels and 17 percent higher than 2005 levels citywide and is attributed to population growth.

In 2008, municipal GHG emissions in the City totaled 16,817 $MTCO_2E$. Transportation and mobiles sources accounted for approximately 46 percent of this total. Emissions from municipal buildings and the municipal vehicle fleet increased from 1990 levels but decreased 17 percent from the 2005 levels.

3.1.2.4 Project Site GHG Emissions

The Proposed Project site is located in the south central portion of the Otay Ranch GDP area. The Otay Ranch GDP area is former agricultural ranch land historically used for ranching, grazing, and dry farming. It is currently vacant of development and is thus not a source of anthropogenic GHGs.

Disturbed and undisturbed natural vegetation comprise the site's dominant land cover. Natural vegetation and soils temporarily store and release carbon as part of the terrestrial carbon cycle. Plants absorb carbon dioxide through photosynthesis as they grow, store it in solid form during the life of the plant, and release it again as a gas when they die and decompose. Soil carbon accumulates from inputs of plants and animal matter, roots, and other living components of the soil ecosystem (e.g. bacteria, worms). Soil carbon is released through biological respiration, or through soil erosion and other forms of soil disturbance. These emissions of carbon dioxide from the Project site are not readily quantifiable, but are likely small from a regional perspective. Negligible emissions of methane and nitrous oxides may also be occurring due to on-site decomposition of wood, or any vegetative matter or waste, or to residue oxidation.

3.1.3 Consequences of Global Climate Change

CARB projects a future statewide GHG emissions increase of over 23 percent (from 2004) by 2020 given current trends (CARB 2008c). The 2008 EPIC study predicts a countywide increase to 43 $MMTCO_2E$ or roughly 20 percent (from 2006) by 2020, given

a BAU trajectory. Global GHG emissions forecasts also predict similar substantial increases, given a BAU trajectory.

The potential consequences of global climate change on the San Diego region are far reaching. The Climate Scenarios report, published in 2006 by the California Climate Change Center, uses a range of emissions scenarios to project a series of potential warming ranges (low, medium or high temperature increases) that may occur in California during the 21st century. Throughout the state and the region, global climate and local microclimate changes could cause an increase in extreme heat days; higher concentrations, frequency and duration of air pollutants; an increase in wildfires; more intense coastal storms; sea level rise; impacts to water supply and water quality through reduced snowpack and saltwater influx; public health impacts; impacts to near-shore marine ecosystems; reduced quantity and quality of agricultural products; pest population increases; and altered natural ecosystems and biodiversity.

3.2 Regulatory Background

In response to rising concern associated with increasing GHG emissions and global climate change impacts, numerous plans, policies and regulations have been adopted at the international, national, state and local levels with the aim of reducing GHG emissions.

3.2.1 International

3.2.1.1 Montreal Protocol on Substances that Deplete the Ozone Layer

Human caused effects on the global atmosphere first became widely known to the public at large in the mid-1970s when it was discovered that a number of substances, particularly chlorofluorocarbons (CFCs) used in refrigeration, when released into the atmosphere could cause the breakdown of significant quantities of the earth's protective ozone (O_3) in the stratosphere (i.e., the "ozone layer"). Somewhat concurrent with this was the discovery of the now well documented "ozone hole" over Antarctica. The ozone layer filters out most of the ultraviolet-B (UV-B) radiation reaching the earth. Therefore, destruction of the ozone layer would allow more UV-B radiation to reach the earth's surface potentially leading to increases in skin cancer and other effects such as crop damage and adverse effects on marine phytoplankton.

In response to these concerns, the Coordinating Committee on the Ozone Layer was established by the United Nations Environment Program (UNEP) in 1977, and UNEP's Governing Council adopted the World Plan of Action on the Ozone Layer. Continuing efforts led to the signing in 1985 of the Vienna Convention on the Protection of the

Ozone Layer. This led to the creation of the Montreal Protocol on Substances That Deplete the Ozone Layer (Montreal Protocol), an international treaty designed to protect the stratospheric ozone layer by phasing out production of ozone depleting substances. The Montreal Protocol was adopted on September 16, 1987 and was enacted on January 1, 1989. The Protocol has been revised five times since 1989, most recently in 1999.

This treaty is considered one of the most successful international treaties on environmental protection in the world, with ratification by 191 countries including the United States. By the end of 2006, the 191 parties to the treaty had phased out over 95 percent of ozone depleting substances (UNEP 2007). Because of this success, scientists are now predicting that the ozone hole will "heal" later this century.

The elimination of these ozone-depleting substances also has benefits relative to global climate change because most of these substances are also potent GHGs with very high GWPs, ranging from 4,680 to 10,720 (UNEP 2007, Australian Government 2007). However, the phasing out of ozone depleting substances has led to an increase in the use of non-ozone depleting substances such as hydrofluorocarbons (HFCs) which, although not detrimental to the ozone layer, are also potent GHGs. As shown in Table 1, these substances have GWPs ranging from 140 to 11,700.

3.2.1.2 Intergovernmental Panel on Climate Change

In response to growing concern about pollutants in the upper atmosphere and the potential problem of climate change, the World Meteorological Organization and the UNEP established the Intergovernmental Panel on Climate Change (IPCC) in 1988. The IPCC was tasked with assessing the scientific, technical, and socioeconomic information relevant to understanding the scientific basis for human-induced climate change, its potential impacts, and options for adaptation and mitigation. The most recent reports of the IPCC have emphasized the scientific consensus that real and measurable changes to the climate are occurring, that they are caused by human activity, and that significant adverse impacts on the environment, the economy, and human health and welfare are unavoidable.

3.2.1.3 United Nations Framework Convention on Climate Change

In 1994, the Unites States joined a number of other nations in signing an international treaty known as the United Nations Framework Convention on Climate Change (UNFCCC). The UNFCCC recognized that global climate is a shared resource that can be affected by industrial and other emissions of greenhouses gases, and set an overall framework for intergovernmental efforts to tackle the challenges posed by global climate

change. As with the Montreal Protocol, this treaty was ratified by 191 countries including the United States. Under this treaty, governments were to (UNFCCC 2007a):

- Gather and share information on GHG emissions, national policies and best practices;
- Launch national strategies for addressing GHG emissions and adapting to expected impacts; and
- Cooperate with other nations in preparing for adaptation to the impacts of climate change.

The UNFCCC divided countries into three main groups according to differing commitments based on economic strength, vulnerability to adverse climate change impacts, and capacity to respond or adapt to climate change effects. The stronger economic nations, including the United States, were to provide financial and technological support to developing countries to enable them to undertake emissions reduction activities and to help them adapt to adverse effects of climate change.

The UNFCCC was enacted in March 1994; however, it generally lacked powerful, legally binding measures. This led to the development of the Kyoto Protocol.

3.2.1.4 Kyoto Protocol to the UNFCCC

Knowing that the UNFCCC did not contain the legally binding measures that would be required to meaningfully address global climate change, a conference of the UNFCCC signatory nations was held in Berlin in 1995 that launched a new round of discussions to determine more detailed and stronger commitments for industrialized countries (the Berlin Mandate). After two and a half years of negotiations, the Kyoto Protocol was adopted in December 1997 (UNFCCC 2007c). While the 1997 Kyoto Protocol shared the UNFCCC's objectives, it committed signatories to individual, legally binding targets to limit or reduce their GHG emissions. By March 1999, 84 countries, including the United States, had signed the Kyoto Protocol (UNFCCC 2009).

Only Parties to the UNFCCC that have also become Parties to the Kyoto Protocol are bound by the Kyoto Protocol's commitments. Governments become Parties to the Protocol by ratifying, accepting, approving, or acceding to it. Because of the complexity of the negotiations and uncertainty associated with the rules or how they would operate, several of the signing countries, including the United States, were reluctant to actually ratify the Protocol. Therefore a new round of negotiations was undertaken to flesh out the Kyoto Protocol's rulebook. These negotiations concluded with the adoption of the Marrakesh Accords in 2001. With the adoption of the Marrakesh Accords, the Protocol was enacted in February 2005, and by July 2009, 184 governments had become Parties to the Protocol (UNFCCC 2007c, 2009). In December 2009, a Copenhagen Accord was held to address global climate change issues in the future; however, no further

measures were adopted. Another Accord is planned for December 2010 in Cancun, Mexico.

Although a signer to the Kyoto Protocol, to date the U.S. has not ratified the Kyoto Protocol, because it does not mandate emissions reductions from all countries, including several developing countries whose GHG emissions are expected to exceed emissions from developed countries within the next 25 years (U.S. EPA 2007a).

3.2.2 National

3.2.2.1 Clean Air Act, Title VI - Stratospheric Ozone Protection

Similar to the Montreal Protocol discussed above, Title VI of the Clean Air Act was established to protect stratospheric ozone by phasing out the manufacture of ozone-depleting substances, and by restricting their use and distribution (U.S. EPA 2007b). Also similar to the Montreal Protocol, while successful in phasing out ozone depleting substances, Title VI has inadvertently led to an increase in the production and use of non-ozone depleting substitutes such as HFCs that are global warming gases with high GWPs and relatively long atmospheric lifetimes.

3.2.2.2 Climate Change Action Plan

Adopted in 1993, the U.S. Climate Change Action Plan (CCAP) consists of voluntary actions to reduce all significant GHGs from all economic sectors. Backed by federal funding, the CCAP supports cooperative partnerships between the government and the private sector in establishing flexible and cost-effective ways to reduce GHG emissions. The CCAP encourages investments in new technologies, but also relies on previous actions and programs focused on saving energy, reducing transportation emissions, improving forestry management, and reducing waste. With respect to energy and transportation-related GHG emissions reductions, the CCAP includes the following (U.S. Global Change Research Information Office 1993).

- Energy Demand Actions to accelerate the use of existing energy saving technologies and encourage the development of more advanced technologies. Commercial actions focus on installing efficient heating and cooling systems in commercial buildings and upgrading to energy-efficient lighting systems (the *Green Lights* program). The *State Buildings Energy Incentive Fund* provides funding to states for the development of public building energy management programs. Residential actions focus on developing new residential energy standards and building codes and providing money-saving energy efficient options to homeowners.

- Energy Supply Actions to reduce emissions from energy supply. These actions focus on increasing the use of natural gas, which emits less CO_2 than coal or oil, and

investing in renewable energy sources, such as solar and wind power, which result in zero net CO_2 emissions. Energy supply strategies also focus on reducing the amount of energy lost during distribution from power plants to consumers.

- Transportation Actions to reduce transportation related emissions are focused on investing in cleaner fuels and more efficient technologies and reducing vehicle miles traveled (VMT). Also, the U.S. EPA and Department of Transportation (DOT) are to draft guidance documents for reducing VMTs for us in developing local clean air programs.

3.2.2.3 GHG Emissions Intensity Reduction Programs

The GHG Emissions Intensity is the ratio of GHG emissions to economic output. In 2002, the U.S. GHG Emissions Intensity was 183 metric tons per million dollars of Gross Domestic Product (U.S. EPA 2007c). In February 2002, the U.S. set a goal to reduce this GHG Emissions Intensity by 18 percent by 2012 through various reduction programs. A number of ongoing voluntary programs have thus been instituted to reduce nationwide GHG emissions. These include (U.S. EPA 2007c):

- **Climate VISION Partnership:** In 2003, this program established a partnership between 12 major industries and the U.S. Department of Energy (U.S. DOE), the U.S. EPA, the DOT and the U.S. Department of Agriculture. The involved industries include electric utilities; petroleum refiners and natural gas producers; automobile, iron and steel, chemical and magnesium manufacturers; forest and paper producers; railroads; and cement, mining, aluminum, and semiconductor industries. These industries are working with the four agencies to reduce their GHG emissions by developing cost-effective solutions, measuring and reporting emissions, developing strategies for the adoption of advanced technologies, and implementing voluntary mitigation actions.

- **Cleaner Energy-Environment State Partnership:** This program established a partnership between federal and state agencies to support states in implementing strategies and policies to promote renewable energy, energy efficiency, and other cost-effective clean energies. States receive technical assistance from the U.S. EPA.

- **Climate Leaders:** Climate Leaders is a U.S. EPA voluntary program that establishes partnerships with individual companies. Together they establish individual corporate goals for GHG emissions reduction and monitor their emissions to measure progress. More than 100 corporations that represent 8 percent of U.S. GHG emissions are involved in Climate Leaders. More than half have reached their emissions goals so far.

- **Energy Star:** Energy Star was established in 1992 by the U.S. EPA and became a joint program with the U.S. DOE in 1996. Energy Star is a program that labels energy

efficient products with the Energy Star label. Energy Star enables consumers to choose energy efficient and cost saving products. More than 1,400 manufacturers use Energy Star labels on their energy efficient products.

- **Green Power Partnership:** This program establishes partnerships between the U.S. EPA and companies and organizations that have bought or are considering buying green power, which is power generated from renewable energy sources. The U.S. EPA offers recognition and promotion to organizations that replace electricity consumption with green power.

3.2.2.4 Corporate Average Fuel Economy Standards

The federal Corporate Average Fuel Economy (CAFE) standards determine the fuel efficiency of certain vehicle classes in the U.S. While the standards had not changed since 1990, in 2007, as part of the Energy and Security Act of 2007, the CAFE standards were increased for new light-duty vehicles to 35 miles per gallon (mpg) by 2020. In May 2009, President Obama announced further plans to increase CAFE standards to require light duty vehicles to meet an average fuel economy of 35.5 mpg by 2016. With improved gas mileage, fewer gallons of transportation fuel would be combusted to travel the same distance, thereby reducing nationwide GHG emissions associated with vehicle travel.

3.2.2.5 Mandatory Reporting of GHGs Rule

Starting January 1, 2010, large emitters of heat-trapping gases are to begin collecting GHG data and reporting their annual GHG emissions to the U.S. EPA. Under this reporting Rule, approximately 10,000 facilities would be covered, accounting for nearly 85 percent of the nation's GHG emissions. This mandatory reporting applies to fossil fuel and industrial GHG suppliers, motor vehicle and engine manufacturers, and facilities that emit 25,000 $MTCO_2E$ or more per year. Vehicle and engine manufacturers outside of the light-duty sector are required to begin phasing in their GHG reporting starting with engine/vehicle model year 2011.

3.2.3 State

The State of California has adopted a number of plans and regulations aimed at identifying statewide and regional GHG emissions caps, GHG emissions reduction targets, and actions and timelines to achieve the target GHG reductions.

3.2.3.1 EO S-3-05 – Statewide GHG Emission Targets

This executive order (EO) signed by Governor Schwarzenegger on June 1, 2005, established the following GHG emission reduction targets for the state of California:

- By 2010, reduce GHG emissions to 2000 levels;
- By 2020 reduce GHG emissions to 1990 levels;
- By 2050 reduce GHG emissions to 80 percent below 1990 levels.

This executive order also directs the secretary of the CalEPA to oversee the efforts made to reach these targets, and to prepare biannual reports on the progress made toward meeting the targets and on the impacts to California related to global warming, including impacts to water supply, public health, agriculture, the coastline, and forestry. With regard to impacts, the report shall also prepare and report on mitigation and adaptation plans to combat the impacts. The first Climate Action Team Assessment Report was produced in March 2006 and has been updated biennially.

3.2.3.2 AB 32 – California Global Warming Solutions Act

In response to Executive Order S-3-05, the California legislature passed Assembly Bill (AB) 32 (Nuñez), the "California Global Warming Solutions Act of 2006", which was signed by the governor on September 27, 2006. It requires the CARB to adopt rules and regulations that would reduce GHG emissions to 1990 levels by 2020. The CARB is also required to publish a list of discrete GHG emission reduction measures.

Specifically, AB 32, the California Global Warming Solutions Act of 2006, requires CARB to (State of California 2006):

- Establish a statewide GHG emissions cap for 2020, based on 1990 emissions by January 1, 2008.
  - ✓ In December 2007, CARB approved a 2020 emission limit of 427 million metric tons of CO_2 equivalent.
- Adopt mandatory reporting rules for significant sources of GHGs by January 1, 2009.
  - ✓ In December 2007, CARB adopted regulations requiring the largest industrial sources to report and verify their GHG emissions. Facilities began tracking emissions in 2008 and reports were due June 1, 2009. Emissions reporting for 2008 was allowed to be based on best available data. Beginning in 2010, emissions reports are to be more rigorous and subject to third-party verification.

    This action builds on the earlier SB 177 (Sher) enacted in 2000 which established a nonprofit California Climate Action Registry for the purpose of administering a voluntary GHG emissions registry.

- Adopt a plan by January 1, 2009 indicating how emission reductions will be achieved from significant GHG sources via regulations, market mechanisms and other actions.

  ✓ A Climate Change Scoping Plan (Scoping Plan) was approved on December 12, 2008. The Scoping Plan contains the main strategies California will implement to achieve a reduction of 174 million $MTCO_2E$ GHG emissions, or approximately 29 percent from the state's projected 2020 emission level of 596 million $MTCO_2E$ under a BAU scenario. The Scoping Plan is discussed in greater detail in Section 3.2.3.3 below.

- Adopt regulations by January 1, 2011 to achieve the maximum technologically feasible and cost-effective reductions in GHG, including provisions for using both market mechanisms and alternative compliance mechanisms.

- Convene an Environmental Justice Advisory Committee and an Economic and Technology Advancement Advisory Committee to advise CARB.

  ✓ In January 2007, the CARB appointed a ten member Environmental Justice Advisory Committee and appointed members to the Economic and Technology Advancement Advisory Committee.

- Ensure public notice and opportunity for comment for all CARB actions.

  ✓ A number of CARB documents, including the 2020 Emissions Forecast, the Scoping Plan, and the Draft Recommended Approaches for Setting Interim Significance Thresholds, have been circulated for public review and comment.

- Prior to imposing any mandates or authorizing market mechanisms, CARB must evaluate several factors, including but not limited to impacts on California's economy, the environment and public health; equity between regulated entities; electricity reliability; conformance with other environmental laws; and ensure that the rules do not disproportionately impact low-income communities.

3.2.3.3 Climate Change Scoping Plan

As directed by AB 32, the Climate Change Scoping Plan prepared by CARB in December 2008 includes the measures in Table 4 to reduce statewide GHG emissions to 1990 levels by 2020. CARB identified these reductions as necessary to reduce forecasted BAU 2020 emissions by approximately 174 $MMTCO_2E$. CARB will update the Scoping Plan at least once every five years to allow evaluation of progress made and to correct the Plan's course where necessary.

As shown in Table 4, the majority of the reductions are to come from the two sectors that generate the most GHG emissions statewide—transportation and electricity generation. Transportation-related GHG emissions account for approximately 38 percent of the

TABLE 4
CARB SCOPING PLAN RECOMMENDED GHG REDUCTION MEASURES

Recommended Reduction Measures	Reductions Counted Towards 2020 Target In $MMTCO_2E$ (% subtotal)((% total))[2]
ESTIMATED REDUCTIONS RESULTING FROM THE COMBINATION OF CAPPED SECTORS AND COMPLEMENTARY MEASURES	**146.7**
California Light-Duty Vehicle Greenhouse Gas Standards • Implement Pavley Standards • Develop Pavley II light-duty vehicle standards	31.7 (22%)((18%))
Energy Efficiency • Building/appliance efficiency, new programs, etc. • Increase CHP generation by 30,000 GWh • Solar Water Heating (AB 1470 goal)	26.3 (18%)((15%))
Renewables Portfolio Standard (33% by 2020)	21.3 (14%)((12%))
Low Carbon Fuel Standard	15 (10%)((9%))
Regional Transportation-Related GHG Targets[1]	5 (4%)((3%))
Vehicle Efficiency Measures	4.5 (3%)((3%))
Goods Movement • Ship Electrification at Ports • System-Wide Efficiency Improvements	3.7 (3%)((2%))
Million Solar Roofs	2.1 (2%)((1%))
Medium/Heavy Duty Trucks • Heavy-Duty Vehicle Greenhouse Gas Emissions Reduction (Aerodynamic Efficiency) • Medium- and Heavy-Duty Vehicle Hybridization	1.4 (<1%)((<1%))
High Speed Rail	1.0 (<1%)((<1%))
Industrial Measures (for sources covered under cap&trade program) • Refinery Measures • Energy Efficiency and Co-Benefits Audits	0.3 (<.5%)((<.5%))
Additional Reductions Necessary to Achieve the Cap	34.4 (23%)((20%))
ESTIMATED REDUCTIONS RESULTING FROM UNCAPPED SECTORS	**27.3**
Industrial Measures (for sources not covered under cap&trade program) • Oil and Gas Extraction and Transmission	1.1 ((<1%))
High Global Warming Potential Gas Measures	20.2 ((12%))
Sustainable Forests	5.0 ((3%))
Recycling and Waste (landfill methane capture)	1.0 ((.6%))
TOTAL REDUCTIONS COUNTED TOWARDS 2020 TARGET	**174**[3]

SOURCE: Table 2 of the Climate Change Scoping Plan: A Framework for Change. Prepared by the California Air Resources Board, pursuant to AB 32 the California Global Warming Solution Act of 2006. December 2008.

[1] This number represents an estimate of what may be achieved from local land use changes. It is not the SB 375 regional target. CARB will establish regional targets for each Metropolitan Planning Organization following input of the Regional Targets Advisory Committee and a public stakeholders consultation process per SB 375.

[2] (Percentages) are relative to the capped sector subtotal of 146.7 $MMTCO_2E$, and ((percentages)) are relative to the total target reduction of 174 $MMTCO_2E$, and may not total 100 due to rounding.

[3] The total reduction for the recommended measures slightly exceeds the 169 $MMTCO_2E$ of reductions estimated in the BAU 2020 Emissions Forecast. This is the net effect of adding several measures and adjusting the emissions reduction estimates for some other measures.

forecasted BAU 2020 emissions and over 36 percent of the targeted total reductions. Energy-related emissions (including those from electric power generation, commercial and residential energy use, and industrial oil and natural gas refineries) account for approximately 48 percent of the forecasted BAU 2020 emissions and more than 29 percent of the targeted total reductions.

As indicated in Table 4 and described in greater detail in the following sections, the majority of these reductions in transportation-related and energy-related GHG emissions are to be achieved through statewide regulatory mandates affecting vehicle and fuel manufacture, public transit, and public energy utilities. The remaining reductions are to be achieved through direct regulation and price incentive measures affecting oil and gas extraction industries, forestry practices (including increased tree planting programs), landfill methane capture, and restrictions on high GWP gases (used in select industries). The three measures most applicable to the City's control over land use planning and development are the Regional Transportation-Related GHG Targets, the Energy Efficiency, and the Million Solar Roofs measures. Implementing these three measures accounts for a reduction of 33.4 $MMTCO_2E$ emissions, or approximately 20 percent, of the total statewide GHG emissions reductions.

CARB also lists several other recommended measures which will contribute toward achieving the 2020 statewide reduction goal, but whose reductions are not (for various reasons, including the potential for double counting) additive with the measures listed in Table 4. These include state and local government operations measures, green building, mandatory commercial recycling and other additional waste and recycling measures, water sector measures, and methane capture at large dairies.

The Scoping Plan reduction measures and complementary regulations are described further in the following sections, and are grouped under the two headings of Transportation-Related Emissions Reductions and Non-Transportation-Related Emissions Reductions as representative of the sectors to which they apply.

Transportation-Related Emissions Reductions

Transportation accounts for the largest share of the state's GHG emissions. Accordingly, a large share of the reduction of GHG emissions from the recommended measures comes from this sector. To address emissions from vehicles, CARB is proposing a comprehensive three-prong strategy: reducing GHG emissions from vehicles, reducing the carbon content of the fuel these vehicles burn, and reducing the miles these vehicles travel.

3.2.3.4 AB 1493 – Pavley Greenhouse Gas Vehicle Standards

AB 1493 (Pavley) enacted July 2002, directed CARB to adopt vehicle standards that lowered GHG emissions from passenger vehicles and light duty trucks to the maximum

extent technologically feasible, beginning with the 2009 model year. CARB adopted regulations in 2004 and applied to the U.S. EPA for a waiver under the federal Clean Air Act to implement them.

Under federal law, California is the only state allowed to adopt its own vehicle standards, but it cannot implement them until the U.S. EPA grants an administrative waiver. In December 2004 the Alliance of Automobile Manufacturers sued CARB to block implementation of the new regulations and ultimately, in December 2007, a federal judge decided the case in favor of the CARB (Sacramento Bee 2007). Despite this ruling, the U.S. EPA denied CARB's waiver request in February 2008. In January 2008, the State of California sued the U.S. EPA in an attempt to overturn the U.S. EPA's denial (Marten Law Group 2008).

CARB adopted amendments to its new regulations in September 2009 that would enforce AB 1493 but provide vehicle manufacturers with new compliance flexibility. On June 30, 2009, the U.S. EPA rejected its earlier waiver denial reasoning and granted California the authority to implement these GHG emissions reduction standards for new passenger cars, pickup trucks, and sport utility vehicles. With this action, it is expected that the new regulations will reduce GHG emissions from California passenger vehicles by about 22 percent in 2012 and about 30 percent in 2016 (CARB 2010b) for a total reduction of 31.7 $MMTCO_2E$ counted toward the total statewide reduction target (CARB 2008b) (see Table 4). These reductions are to come from improved vehicle technologies such as small engines with superchargers, continuously variable transmissions, and hybrid electric drives.

3.2.3.5 EO S-01-07 – Low Carbon Fuel Standard

This executive order signed by Governor Schwarzenegger in January 2007, directed that a statewide goal be established to reduce the carbon intensity of California's transportation fuels by at least 10 percent by 2020 through a Low Carbon Fuel Standard (LCFS). CARB adopted the LCFS as a discrete early action measure pursuant to AB 32 in April 2009 and includes it as a reduction measure in its Scoping Plan (see Table 4).

The LCFS is a performance standard with flexible compliance mechanisms intended to incentivize the development of a diverse set of clean, low-carbon transportation fuel options. Its aim is to accelerate the availability and diversity of low-carbon fuels such as biofuels, electricity and hydrogen, by taking into consideration the full life-cycle of GHG emissions. A 10 percent reduction in the intensity of transportation fuels is expected to equate to a reduction of 16.5 $MMTCO_2E$ in 2020. However, in order to account for possible overlap of benefits between LCFS and the Pavley GHG standards, CARB has discounted the contribution of LCFS to 15 $MMTCO_2E$ (CARB 2008b).

3.2.3.6 Regional Transportation-Related GHG Targets

The Regional Transportation-Related GHG Targets measure included in the Scoping Plan identifies policies to reduce transportation emissions through changes in future land use patterns and community design, as well as through improvements in public transportation, that reduce VMT. By reducing the miles vehicles travel, vehicle emissions will be reduced. Improved planning and the resulting development are seen as essential for meeting the 2050 emissions target (CARB 2008b p. 20). CARB expects that this measure will reduce transportation-related GHG emissions by about 5 $MMTCO_2E$ or 4 percent of the total statewide reductions attributed to the capped sectors (Table 4). Specific regional reduction targets established through SB-375 will determine more accurately what reductions can be achieved through this measure.

3.2.3.7 SB 375 – Regional Emissions Targets

SB 375 was signed in September 2008 and requires CARB to set regional targets for reducing passenger vehicle GHG emissions in accordance with the Scoping Plan measure described above. Its purpose is to align regional transportation planning efforts, regional GHG reduction targets, and land use and housing allocation to reduce GHG emissions by promoting high-density, mixed-use developments around mass transit hubs.

CARB, in consultation with statewide Metropolitan Planning Organizations (MPOs), is to provide each affected region with passenger vehicle GHG emissions reduction targets for 2020 and 2035 by September 30, 2010. The San Diego Association of Governments (SANDAG) is the San Diego region's MPO. On August 9, 2010 CARB released the staff report on the proposed reduction target for San Diego County, which was subsequently approved by CARB on September 23, 2010. The San Diego region will be required to reduce greenhouse gas emissions from cars and light trucks 7 percent per capita by 2020 and 13 percent by 2035 (SANDAG 2010a). The reduction targets are to be updated every 8 years, but can be updated every 4 years if advancements in emissions technologies affect the reduction strategies to achieve the targets.

Once reduction targets are established, SB 375 requires MPOs in California to prepare and adopt a Sustainable Communities Strategy (SCS) that demonstrates how the region will meet its greenhouse gas reduction targets through integrated land use, housing, and transportation planning. Enhanced public transit service combined with incentives for land use development that provides a better market for public transit will play an important role in the SCS. After the SCS is adopted by the MPO, the SCS will be incorporated into that region's federally enforceable RTP. SANDAG has completed work on the 2050 RTP, the first such plan in the state that will include an SCS (CARB 2010c; SANDAG 2010a). CARB is also required to review each final SCS to determine whether it would, if implemented, achieve the greenhouse gas emission reduction target

for its region. If the combination of measures in the SCS will not meet the region's target, the MPO must prepare a separate Alternative Planning Strategy (APS) to meet the target. The APS is not a part of the RTP.

As an incentive to encourage implementation of the SCS and APS, developers can obtain relief from certain requirements under the California Environmental Quality Act (CEQA) for those projects that are consistent with either the SCS or APS (CARB 2010c).

3.2.3.8 EO S-7-04/SB 1505 – California Hydrogen Highway Network

This executive order signed in 2004 designated California's 21 interstate freeways as the "California Hydrogen Highway Network", and directed the California Environmental Protection Agency (CalEPA) and all other relevant state agencies to plan and build a network of hydrogen fueling stations along these roadways and in the urban centers. This EO also called for the rapid transition to a hydrogen economy in California by January 1, 2005.

In response to this EO, SB 1505 (Lowenthal) was passed a year later requiring the CARB to adopt regulations to ensure that the production and use of hydrogen for transportation purposes contributes to the reduction of GHGs and other air contaminants (Union of Concerned Scientists 2007).

a. Non-Transportation-Related Emissions Reductions

In the energy sector, Scoping Plan measures aim to provide better information and overcome institutional barriers that slow the adoption of cost-effective energy efficiency technologies. They include enhanced energy efficiency programs to provide incentives for customers to purchase and install more efficient products and processes; and building and appliance standards to ensure that manufacturers and builders bring improved products to market. Over the long term, the recommended measures will increase the amount of electricity from renewable energy sources and improve the energy efficiency of industries, homes and buildings. While energy efficiency gains the largest emissions reductions from this sector, other land development applicable measures such as water conservation, materials use and waste reduction, and green building design and development practices, achieve additional emissions reduction.

3.2.3.9 Renewables Portfolio Standard

The Renewables Portfolio Standard (RPS) promotes diversification of the state's electricity supply. Its purpose is to achieve 33 percent renewable energy mix statewide; providing 33 percent of the state's electricity needs met by renewable resources by 2020 (CARB 2008b). The RPS is included in CARB's Scoping Plan list of reduction measures (see Table 4). Increasing the RPS to 33 percent is designed to accelerate the

transformation of the electricity sector, including investment in the transmission infrastructure and systems changes to allow integration of large quantities of intermittent wind and solar generation. Renewable energy includes (but is not limited to) wind, solar, geothermal, small hydroelectric, biomass, anaerobic digestion, and landfill gas. Increased use of renewables would decrease California's reliance on fossil fuels, thus reducing emissions of GHGs from the electricity sector. CARB estimates that full achievement of the RPS would decrease statewide GHG emissions by 21.3 $MMTCO_2E$ (CARB 2008b).

3.2.3.10 Million Solar Roofs Program

The Million Solar Roofs Program was created by SB 1 in 2006 and includes the CPUC's California Solar Initiative and California Energy Commission's (CEC) New Solar Homes Partnership. It requires publicly owned utilities to adopt, implement and finance solar incentive programs to lower the cost of solar systems and help achieve the goal of installing 3,000 MW of new solar capacity by 2020. The Million Solar Roofs Program is one of CARB's GHG reduction measures identified in the 2008 Scoping Plan (see Table 4). Achievement of the program's goal is expected to equate to a reduction of 2.1 $MMTCO_2E$ in 2020 statewide BAU emissions, as counted toward the total statewide reduction of 173 $MMTCO_2E$ (CARB 2008b).

3.2.3.11 SB 1368 – Public Utility Emission Standards

SB 1368 (Parata), passed in 2006, requires the CEC to set GHG emission standards for entities providing electricity in the state. The bill further requires that the California Public Utilities Commission (CPUC) prohibit electricity providers and corporations from entering into long-term contracts if those providers and corporations do not meet the CEC's standards (Union of Concerned Scientists 2007).

3.2.3.12 Title 24, Part 6 - California Energy Code

The California Code of Regulations, Title 24, Part 6 is the California Energy Code. This code, originally enacted in 1978 in response to legislative mandates, establishes energy efficiency standards for residential and non-residential buildings in order to reduce California's energy consumption. The Code is updated periodically to incorporate and consider new energy efficiency technologies and methodologies as they become available. The most recent amendments to the Code, known as Title 24 2008, or the 2008 Energy Code, became effective January 1, 2010. Title 24 2008 requires energy savings of 15–35 percent above the former Title 24 2005 energy code. At a minimum, residential buildings must achieve a 15 percent reduction in their combined space heating, cooling and water heating energy compared to the Title 24 2005 standards. Incentives in the form of rebates and tax breaks are provided on a sliding scale for buildings achieving energy efficiency above the minimum 15 percent reduction over

Title 24 2005. The reference to Title 24 2005 is relevant in that many of the State's long-term energy and GHG reduction goals identify energy saving targets relative to Title 24 2005. By reducing California's energy consumption, emissions of statewide GHGs may also be reduced.

New construction and major renovations must demonstrate their compliance with the current Energy Code through submission and approval of a Title 24 Compliance Report to the local building permit review authority and the CEC. The compliance reports must demonstrate a building's energy performance through use of CEC-approved energy performance software that shows iterative increases in energy efficiency given selection of various HVAC, sealing, glazing, insulation, and other components related to the building envelope. Title 24 governs energy consumed by the built environment and by the major building envelope systems such as space heating, space cooling, water heating, some aspects of the fixed lighting system, and ventilation. Non-building energy use or "plug-in" energy use (such as appliances, equipment, electronics, plug-in lighting) is independent of building design and not subject to Title 24.

3.2.3.13 Title 24, Part 11 – California Green Building Standards

In 2007, Governor Schwarzenegger directed the California Building Standards Commission to work with state agencies on the adoption of green building standards for residential, commercial and public building construction for the 2010 code adoption process. A voluntary version of this California Green Building Standards Code, referred to as CALGreen, was added to Title 24 as Part 11 in 2009. The 2010 version of CALGreen took effect January 2011 and instituted mandatory minimum environmental performance standards for all ground-up new construction of commercial, low-rise residential, and state-owned buildings; as well as schools and hospitals. It also includes voluntary tiers (I and II) with stricter environmental performance standards. Local jurisdictions must enforce the minimum mandatory requirements and may also adopt the Green Building Standards with amendments for stricter requirements.

The mandatory standards require:

- 20 percent mandatory reduction in indoor water use relative to specified baseline levels;
- 50 percent construction/demolition waste must be diverted from landfills;
- Mandatory inspections of energy systems to ensure optimal working efficiency; and
- Low-pollutant emitting exterior and interior finish materials such as paints, carpets, vinyl flooring and particle boards.

The voluntary standards require:

- Tier I – 15 percent improvement in energy requirements, stricter water conservation requirements for specific fixtures, 65 percent reduction in construction waste, 10 percent recycled content, 20 percent permeable paving, 20 percent cement reduction, cool/solar reflective roof.
- Tier II – 30 percent improvement in energy requirements, stricter water conservation requirements for specific fixtures, 75 percent reduction in construction waste, 15 percent recycled content, 30 percent permeable paving, 30 percent cement reduction, cool/solar reflective roof.

Similar to the compliance reporting procedure described above for demonstrating energy code compliance, compliance with the CALGreen water reduction requirements must be demonstrated through completion of water use reporting forms for both commercial and low-rise residential buildings. The water use compliance form must demonstrate a minimum 20 percent reduction in indoor water use by either showing a 20 percent reduction in the overall baseline water use as identified in CALGreen or a reduced per-plumbing-fixture water use rate.

Related to CALGreen are the earlier Sustainable Building Goal (EO D-16-00) and Green Building Initiative (EO S-20-04). The 2000 Sustainable Building Goal instructed that all state buildings be constructed or renovated and maintained as models of energy, water and materials efficiency. The 2004 Green Building Initiative recognized further that significant reductions in GHG emissions can be achieved through the design and construction of new green buildings as well as the sustainable operation, retrofitting, and renovation of existing buildings.

The CARB Scoping Plan includes a Green Building Strategy with the goal of expanding the use of green building practices to reduce the carbon footprint of new and existing buildings. Consistent with CALGreen, the Scoping Plan recognized that GHG reductions would be achieved through buildings that exceed minimum energy efficiency standards, decrease consumption of potable water, reduce solid waste during construction and operation, and incorporate sustainable materials. Green building is thus a vehicle to achieve the Scoping Plan's statewide electricity and natural gas efficiency targets and to lower GHG emissions from waste and water transport sectors.

In the Scoping Plan, CARB projects that an additional 26 $MMTCO_2E$ could be reduced through expanded green building (CARB 2008b, p.17). However, this reduction is not counted toward the BAU 2020 reduction goal to avoid any double counting, as most of these reductions are accounted for in the electricity, waste, and water sectors. Because of this, CARB has assigned all emissions reductions that occur as a result of green building strategies to other sectors for the purpose of meeting AB 32 requirements, but will continue to evaluate and refine the emissions from this sector.

3.2.3.14 SB 97 – CEQA GHG Amendments

SB 97 (Dutton) passed by the legislature and signed by the governor on August 24, 2007 required the office of Planning and Research (OPR) on or before July 1, 2009, to prepare, develop, and transmit to the Resources Agency amendments to the CEQA guidelines to assist public agencies in the mitigation of GHGs or the effects of GHGs as required under CEQA, including the effects associated with transportation and energy consumption, and required the Resources Agency to certify and adopt those guidelines by January 1, 2010. Proposed amendments to the state CEQA Guidelines for GHG emissions were submitted on April 13, 2009, adopted on December 30, 2009, and became effect March 18, 2010.

Section 15064.4 of the amended Guidelines includes the following requirements for determining the significance of impacts from greenhouse gas emissions. While the amendments require calculation of a project's contribution they clearly do not establish a standard by which to judge a significant effect or a means to establish such a standard.

> (a) The determination of the significance of greenhouse gas emissions calls for a careful judgment by the lead agency consistent with the provisions in section 15064. A lead agency should make a good-faith effort, based to the extent possible on scientific and factual data, to describe, calculate or estimate the amount of GHG emissions resulting from a project. A lead agency shall have discretion to determine, in the context of a particular project, whether to:
>
> > (1) Use a model or methodology to quantify greenhouse gas emissions resulting from a project, and which model or methodology to use. The lead agency has discretion to select the model or methodology it considers most appropriate provided it supports its decision with substantial evidence. The lead agency should explain the limitations of the particular model or methodology selected for use; and/or
> >
> > (2) Rely on a qualitative analysis or performance based standards.

3.2.4 Local

Since the early 1990s, Chula Vista has been engaged in multiple climate change forums including the UNFCCC, the International Cities for Climate Protection campaign and the U.S. Conference of Mayor's Climate Protection Agreement. The key plans and ordinances that the City has adopted and implemented to achieve citywide GHG emissions reductions are summarized below.

3.2.4.1 ICLEI Cities for Climate Protection

In 1992, the City participated in a program aimed at developing municipal action plans for the reduction of GHGs. This program—the Cities for Climate Protection Program—was sponsored by the International Council of Environmental Initiatives (ICLEI) and the UNEP. This program was developed by ICLEI and the UNEP in response to the UNFCCC, and in recognition that all local planning and development have direct consequences on energy consumption and cities exercise key powers over urban infrastructure, including neighborhood design and over transportation infrastructure such as roads, streets, pedestrian areas, bicycle lanes and public transport.

3.2.4.2 Chula Vista CO_2 Reduction Plan

Each participant in the ICLEI program was to create local policy measures to ensure multiple benefits to the city and at the same time identify a carbon reduction goal through the implementation of those measures. The carbon reduction goal was to fit within the realm of international climate treaty reduction goals. In its CO_2 Reduction Plan developed in 1996 and officially adopted in 2000, Chula Vista committed to lowering its CO_2 emissions by diversifying its transportation system and using energy more efficiently in all sectors. To focus efforts in this direction, the City adopted the international CO_2 reduction goal of returning to pre-1990 levels (i.e. 20 percent below) by 2010. In order to achieve this goal, eight actions were identified, which when fully implemented, were anticipated to save 100,000 tons of CO_2 each year.

As a result of the 2005 GHG Emissions Inventory Report, in May 2007 staff reported to City Council that citywide greenhouse gas emissions had increased by 35 percent (mainly due to residential growth) from 1990 to 2005, while emissions on a per capita basis and from municipal operations decreased by 17 percent and 18 percent, respectively. As a result, the City Council directed staff to convene a Climate Change Working Group (CCWG) to develop recommendations to reduce the community's GHGs in order to meet the City's 2010 GHG emissions reduction targets.

3.2.4.3 Climate Change Working Group

The CCWG, which is composed of residents, businesses, and community organization representatives, helps the City in developing climate-related programs and policies. In 2008, the CCWG reviewed over 90 carbon reduction measures and ultimately chose seven measures to recommend to City Council, which the Council subsequently adopted. The measures were designed to reduce or mitigate climate change impacts by reducing GHG emissions within Chula Vista to 20 percent below 1990 levels in keeping with its CO_2 Reduction Plan and UNFCCC goals, but the horizon date was delayed to 2012 instead of 2010. The measures are described below in the following section.

In October 2009, the City Council directed the CCWG to evaluate how the City could "adapt" to potential climate change impacts. The group will be meeting throughout 2010 to develop recommendations based on the City's vulnerabilities and risks to climate change.

3.2.4.4 Chula Vista Climate Protection Measures

On July 10, 2008, the City Council adopted implementation plans for seven climate protection measures to reduce GHG emissions to 20 percent below 1990 levels by 2012. Since the adoption of these measures, the CARB published its BAU 2020 forecast and Scoping Plan described in Section 3.2.3.3, which established statewide reduction measures necessary to achieve the AB 32 goal of reducing GHG emissions to 1990 levels by 2020. This goal is reflected in the City's adopted GHG significance thresholds for project-specific analysis under CEQA (see Section 4.1)

Nonetheless, the implementation plans outline the detailed strategy for initiating, funding, and tracking the following measures (City of Chula Vista 2008b):

1. *Clean Vehicle Replacement Policy for City Fleet:* When City fleet vehicles are retired, they will be replaced through the purchase or lease of alternative fuel or hybrid substitutes. In addition, the City fleet will begin to pursue installing new fuel tanks to allow heavy-duty vehicles to convert to biodiesel fuel immediately.

2. *Clean Vehicle Replacement Policy for City-Contracted Fleets:* As contracts for City-contracted fleet services (such as transit buses, trash haulers and street sweeper trucks) are renewed, the City will encourage contractors to replace their vehicles with alternative fuel or hybrid substitutes through the contract bid process. In addition, the City will pursue implementing two hydrogen vehicle demonstration projects.

3. *Business Energy Assessments:* Although not mandatory, businesses will be encouraged to participate in a no cost energy assessment of their facilities to help identify opportunities for them to reduce monthly energy costs. The business assessment will be integrated into the existing business licensing process and codified through a new municipal ordinance.

4. *Green Building Standard:* Chula Vista will implement a citywide, mandatory green building standard for new construction and major renovations. The new standard will have 3 main components: (1) a minimum energy efficiency (carbon equivalent) requirement of 15 percent above the 2005 Title 24, (2) the early adoption of the new California Green Building Codes for all residential and commercial projects, and (3) a Carbon Offset Fee available for projects not meeting the 15 percent above Title 24 threshold.

5. *Solar and Energy Efficiency Conversion Program:* The City will create a community program to provide residents and businesses a streamlined, cost-effective opportunity to implement energy efficiency improvements and to install solar/renewable energy systems on their properties. The City will develop a funding mechanism to allow program participants to voluntarily choose to place the improvement costs on their property's tax rolls, thereby avoiding large upfront capital costs. In addition, the program will promote vocational training, local manufacturing, and retail sales opportunities for environmental products and services. To help stimulate the private-sector renewable market and lower the cost for installing renewable energy systems on new homes, the City will require all new residential buildings to include pre-wiring and pre-plumbing for solar photovoltaic and solar hot water systems, respectively.

6. *Smart-Growth Around Trolley Stations:* The City will continue to implement the "Smart-Growth" design principles, which promote mixed-use and walkable and transit-friendly development, particularly in and around the E, H, and Palomar trolley stations. These principles were emphasized in the revised Chula Vista General Plan and the Urban Core Specific Plan. In particular, the City will initiate site planning, design studies and Specific Area Plan development to further support "Smart-Growth" development that complements greenhouse gas reductions.

7. *Turf Lawn Conversion Program:* The City will create a community program to provide residents and businesses a streamlined, cost-effective opportunity to replace their turf lawns with water-saving landscaping and irrigation systems. Some municipal turf lawn areas (such as medians, fire stations and non-recreational park areas) will also be converted to act as public demonstration sites and to reduce monthly water costs. The City will establish the model for water-wise landscaping for new development through an update of its Municipal Landscape Ordinance and Water Conservation Plan Guidelines.

An Implementation Progress Report, published in February 2010, reports the implementation status and milestones for each measure. Most measures are meeting milestones outlined in their original implementation plans (City of Chula Vista 2010).

3.2.4.5 Chula Vista Green Building Standards

Consistent with measure 4 above (Section 3.2.4.4), the City Council adopted the Green Building Standards ordinance (GBS ordinance) (Ordinance No. 3140) on October 6, 2009, which became effective November 5, 2009. This represents early adoption of the California Green Building Standards discussed in Section 3.2.3.13, with amendments to include major remodels (not just ground-up new construction) and all residential (not just low-rise single-family residential). Permit applications for all new/remodel residential and

non-residential projects submitted on or after November 5, 2009 are required to comply with the GBS ordinance. Through adherence to the GBS ordinance, new residential and non-residential construction, additions, remodels and improvements will benefit from enhanced energy efficiency, pollutant controls, interior moisture control, improved indoor air quality and exhaust, indoor water conservation, storm water management, and construction waste reduction and recycling. The complete Green Building Standards and Ordinance are included in Attachment 2.

As required by the GBS ordinance, as part of the application for a building permit, construction plans and specifications shall indicate in the general notes or individual detail drawings the Green Building Standards and product specifications and methods of construction that are required. The Building Official may require the applicant to retain the services of a consultant having expertise in Green Building and or energy efficiency techniques to review and evaluate complex systems and/or alternate methods or materials of construction and provide recommendations as to compliance with the requirements of the ordinance. No building permit shall be issued for any project subject to the Standards until the Building Official has determined that the plans and specifications submitted for the building permit are in compliance with the requirements. Compliance verification shall be performed by the Building Official, who shall verify that the green building measures and specifications indicated on the permitted plans and construction documents are being implemented at foundation, framing, electrical, plumbing, mechanical, and any other required inspections, and prior to issuance of a final certificate of occupancy. Additional inspections may be conducted as needed to ensure compliance, and during the course of construction and following completion of the project, the City may require the applicant to provide information and documents showing use of products, equipment and materials specified on the permitted plans and documents.

If at any stage of construction the Building Official determines that the project is not being constructed in accordance with the permitted plans and documents, a Stop Order may be issued pursuant to CVMC Section 15 06 060 D. At the discretion of the Building Official, the stop work order may apply to the portion of the project impacted by noncompliance or to the entire project. The stop work order shall remain in effect until the Building Official determines that the project will be brought into compliance with the permitted plans and documents.

Prior to final building approval or issuance of a certificate of occupancy the Building Official shall review the information submitted by the applicant and determine whether the applicant has constructed the project in accordance with the permitted plans and documents. If the Building Official determines that the applicant has failed to construct the project in accordance with the permitted plans and documents, then the final building approval and final certificate of occupancy may be withheld until the Building Official determines that the project is in compliance with the GBS ordinance.

3.2.4.6 Chula Vista Increased Energy Efficiency Standards

On January 26, 2010, the City Council adopted the Increased Energy Efficiency Standards ordinance (Ordinance No. 3149). This ordinance became effective February 26, 2010 as section 15.26 of the Municipal Code, and permit applications submitted on or after this date are required to comply with these new energy efficiency standards. The ordinance is included in Attachment 2.

Section 15.26.030 of the Municipal Code requires permit applications to comply with increased energy efficiency standards that achieve 15 to 20 percent greater efficiency than the requirements of the 2008 California Energy Code, Building Energy Efficiency Standards (Title 24, Part 6), depending on climate zone. As shown in Figure 4, the City falls within two climate zones, zone 7 and zone 10.

For climate zone 7, the Code requires:

- All new low-rise residential building or additions, remodels or alterations to existing low-rise residential buildings where the additions, remodels or alterations are greater than 1,000 square feet of conditional floor area, shall use at least 15 percent less energy than the 2008 Title 24 Building Energy Efficiency Standards allow; and

- All new non-residential, high-rise residential or hotel/motel buildings, or additions, remodels or alterations to existing non-residential, high-rise residential or hotel/motel buildings where the additions, remodels or alterations are greater than 10,000 square feet of conditioned floor area, shall use at least 15 percent less energy than the 2008 Title 24 Building Energy Efficiency Standards.

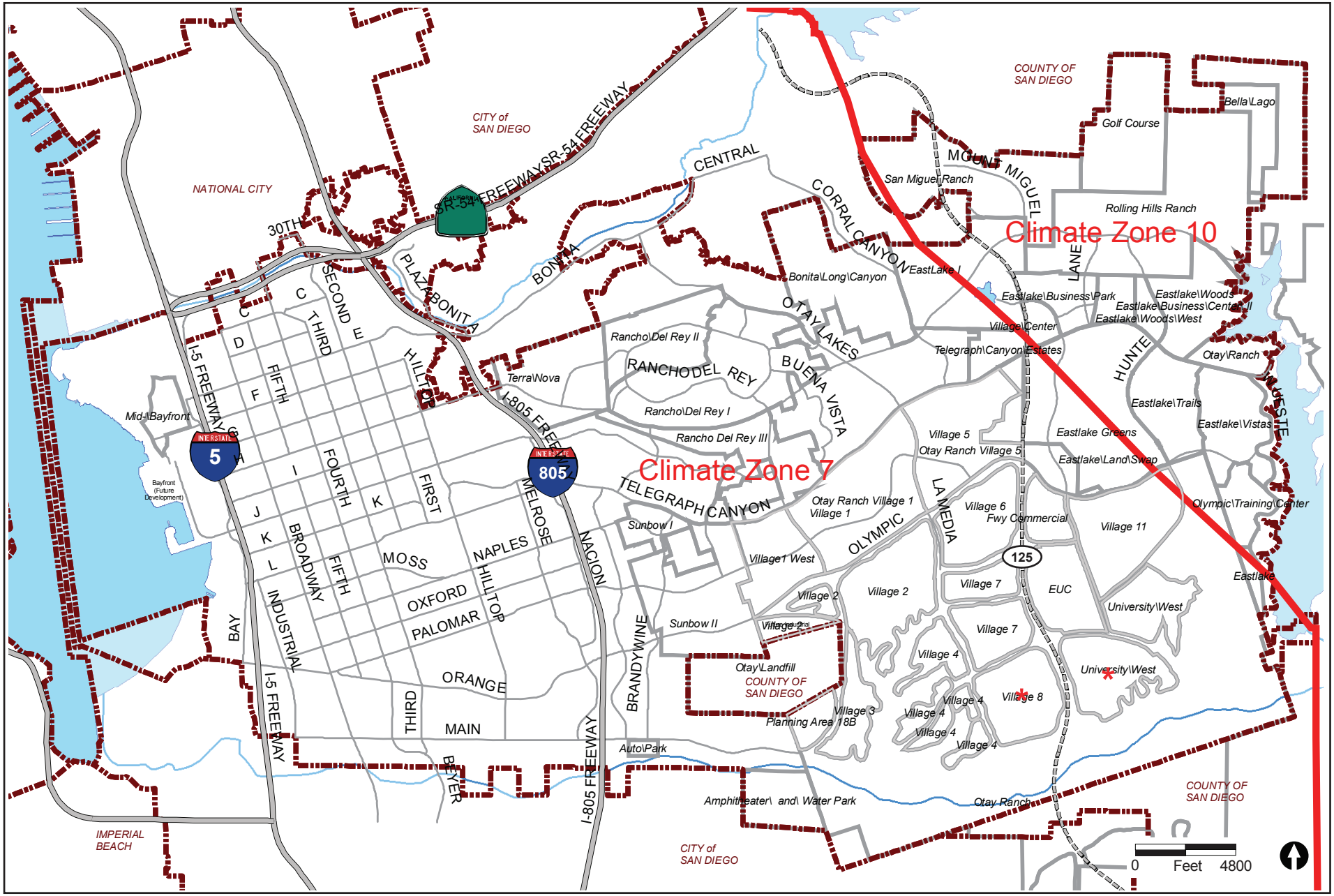
Most of the City lies within climate zone 7 (including the Proposed Project), as shown in Figure 4. For areas further east in climate zone 10, the Municipal Code requires projects to use 20 percent less energy than the 2008 Title 24 Building Energy Efficiency Standards allow. This is to address the higher energy demands typically associated with warmer, inland locations that use more cooling and air conditioning systems.

No City building permit shall be issued unless the permit application demonstrates to the Building Official compliance with the requirements of Section 15.26.030. Compliance is to be demonstrated based on a performance approach, using a CEC-approved energy compliance software program, as specified in the Title 24 2008 Building Energy Efficiency Standards.

3.2.4.7 Regional Climate Action Plan

The SANDAG Regional Climate Action Plan (RCAP) is a long-range policy (year 2030) that focuses on transportation, electricity and natural gas sectors. It complements the Regional Energy Strategy 2030 Update and feeds into the SANDAG Regional

Map Source: City of Chula Vista Geographic Information System, February 2006



Climate Zone Boundary

* Project Location

RECON

M:\JOBS3\4829\GCC\graphics\fig4.ai 10/18/10

FIGURE 4

City Climate Zones

Transportation Plan (RTP) and Regional Comprehensive Plan (RCP). It is currently in process of being prepared and no regional GHG emissions caps or reduction targets have been identified.

4.0 Significance Criteria and Analysis Methodologies

4.1 Determining Significance

To date, there have been no regional, state, or federal regulations establishing a threshold of significance to determine project-specific impacts of GHG emissions. As allowed by the CEQA Guidelines, after considering the thresholds of significance adopted or recommended by other public agencies and experts, including those adopted by the Bay Area and San Joaquin Air Quality Management Districts and the various options reviewed by the CARB, the City has developed its own significance thresholds. The City's thresholds are grounded in statute (AB 32) and executive order (EO S-3-05) and offer a way to achieve the 2020 goal of AB 32. The 2020 goal of AB 32 is to return statewide GHG emissions to 1990 levels by 2020. The City's threshold was established based on this goal of AB 32 and the reduction measures needed to achieve it as identified in the CARB Scoping Plan and as shaped by the assumptions of the business-as-usual (BAU) 2020 statewide forecast.

4.1.1 Business-as-Usual 2020 Emissions

As described above in Section 3.2.3.2, AB 32 directed the CARB to develop a Scoping Plan that identified the reduction measures needed to achieve the targets established in AB 32/EO S-3-05. In order to assess the scope of the needed reductions, CARB first estimated BAU 2020 GHG emissions, as shown below in Table 5.

TABLE 5
CALIFORNIA BAU 2020 GHG EMISSIONS FORECAST

Sector	Projected 2020 Emissions in $MMTCO_2E$ (% total)
Transportation	225.4 (38%)
Electric Power	139.2 (23%)
Commercial and Residential	46.7 (8%)
Industry	100.5 (17%)
Recycling and Waste	7.7 (1%)
High GWP	46.9 (8%)
Agriculture	29.8 (5%)
Forest Net Emissions	0.0
TOTAL	**596.4**

SOURCE: California 2020 GHG Emissions Forecast. Prepared by the CARB. Last updated October 2008; last reviewed May 28, 2010. Available at http://www.arb.ca.gov/cc/inventory/data/forecast.htm. Accessed May 28, 2010.

Table 5 represents the statewide GHG emissions that would be expected to occur in the absence of the GHG reduction measures identified in the Scoping Plan. This forecast also assumed energy efficiency in commercial and residential buildings in accordance with the 2005 Title 24 energy code, water conservation in accordance with the 2006 plumbing code, and waste diversion in accordance with the 1989 Integrated Waste Management Act. In its transportation-related emissions forecast, CARB assumed that total statewide VMT would increase based on growth in statewide population and fixed average trip lengths and vehicle fleet mix. Based on these assumptions, CARB estimated that statewide BAU 2020 GHG emissions will be 596.4 $MMTCO_2E$.

4.1.2 Scoping Plan Reduction Measures

As discussed in Section 3.2.3.3, the Scoping Plan identifies 16 measures that would provide reductions allowing the state to achieve a total GHG emissions reduction of 174 $MMTCO_2E$ by 2020 (see Table 4). Of these measures, three are measures that are, to some extent, within the control of the City. The Scoping Plan reduction measures the City has control over are listed in Table 6 below and include the Energy Efficiency, Regional Transportation-Related GHG Targets, and the Million Solar Roofs measures. Full statewide implementation of these three measures is projected to result in a 33.4 $MMTCO_2E$ reduction in GHG emissions by 2020, for a 19.2 percent reduction in forecasted BAU 2020 emissions.

TABLE 6
CARB SCOPING PLAN RECOMMENDED GHG REDUCTION MEASURES
WITHIN CITY'S CONTROL

Recommended Reduction Measures	Reductions Counted Towards 2020 Target in $MMTCO_2E$	Percentage of Total Reductions Counted Towards 2020 Target
REDUCTIONS COUNTED TOWARDS 2020 TARGET WITHIN CITY CONTROL	**33.4**	**19.2%**[1]
Energy Efficiency	26.3	
Regional Transportation-Related GHG Targets	5.0	
Million Solar Roofs	2.1	
REDUCTIONS COUNTED TOWARDS 2020 TARGET NOT WITHIN CITY CONTROL (see Table 4)	**140.6**	80.8%
TOTAL REDUCTIONS COUNTED TOWARDS 2020 TARGET	**174**	100**%**

Based on Table 2 of the Climate Change Scoping Plan: A Framework for Change. Prepared by the California Air Resources Board, pursuant to AB 32 the California Global Warming Solution Act of 2006. December 2008.
[1]19.2% is relative to the targeted total reduction of 174 $MMTCO_2E$. The BAU 2020 forecast initially projected a targeted reduction of 169 $MMTCO_2E$. The proportion of these three Scoping Plan measures would be 19.8 percent relative to that number.

To conform to the Scoping Plan, a proposed project would have to provide the same proportional reduction relative to BAU that the Scoping Plan identifies for these three measures. Rounding this number up to the nearest whole number results in a 20 percent proportion. As allowed in the Scoping Plan, project reductions could come from any one or combination of the three identified measures or complementary measures. For example, energy-related reductions could come from improved building energy efficiency, advanced water conservation measures, or solid waste reduction measures. Transportation-related reductions could come from project features that encourage alternate travel choices, such as through public transportation proximity, subsidized transit passes, preferential parking for carpool vehicles and low-carbon vehicles, bicycle facilities, walking paths; or shorter vehicle trip lengths, such as through the integration of housing proximate to employment, recreation, and community services. In this latter regard, vehicle trip lengths associated with a given project would have to alter the average regional trip length in order to be sufficient enough to change the statewide VMT assumptions in the BAU emissions forecast and associated Scoping Plan vehicle emissions reduction estimates.

4.1.3 Significance Thresholds

Based on the Scoping Plan and its associated BAU 2020 emissions forecast assumptions, the City has established the following City GHG thresholds of significance for land development projects. The City has determined that a project would have significant global climate change effects if it would:

- Conflict with or obstruct the achievement of the Scoping Plan reduction measures by not reducing its GHG emissions by at least 20 percent over that which would have been expected to occur in the BAU condition; or

- Conflict with any other applicable plan, policy or regulation adopted for the purpose of reducing the emissions of GHGs.

These thresholds are grounded in statute (AB 32) and executive order (S-3-05), and supported by substantial evidence in the CARB's BAU 2020 Forecast and Climate Change Scoping Plan. In addition, these thresholds are consistent with the amended CEQA Guidelines which state that cumulative impacts may be measured relative to a cumulative baseline that includes a

> …summary of projections contained in an adopted local, regional, or statewide plan, or related planning document, that describes or evaluates conditions contributing to the cumulative effect. Such plans may include: a general plan, regional transportation plan, or plans for the reduction of GHG emissions.

4.2 Methodology and Assumptions

Emission estimates were calculated for the three GHGs of primary concern (CO_2, CH_4, and N_2O) that would be emitted from the Proposed Project's construction and five sources of operational emissions: on-road vehicular traffic, electricity generation, natural gas consumption, water usage, and solid waste disposal. The method of quantifying GHG emissions in this analysis was based on methodologies recommended and used by several California air quality management districts (AQMD), including the South Coast and Bay Area AQMDs; as well as by the CARB.

To evaluate the Proposed Project relative to the BAU 2020 Forecast, emissions of each source of GHGs were estimated first for a project-equivalent under BAU conditions, assuming building energy efficiency in accordance with the 2005 Title 24 energy code, water conservation in accordance with the current plumbing code, and solid waste disposal quantities in accordance with current statewide legislation. A 20 percent reduction of this amount was then calculated in order to identify the targeted cap in GHG emissions attributable to the Proposed Project. Lastly, emissions of each source of GHGs were estimated for the Proposed Project assuming building energy and water efficiencies required in City ordinances and General Plan policy. This methodology allows for a comparison between the Proposed Project and BAU 2020 relative to the identified significance determination thresholds. These scenario analyses are included in Sections 5.1.1.1 and 5.1.1.2. Emissions calculations for all of these scenarios started with the following identical land use assumptions:

TABLE 7
FUTURE (YEAR 2020) MODELED LAND USES

Land Use	Quantity
Residential	6,050 dwelling units
Commercial	1,800,000 square feet
Industrial	2,200,000 square feet
Park	55.4 acres
School	51.4 acres
Community Purpose Facility	10.8 acres

The land use assumptions in Table 7 reflect the total allowable buildout as envisioned in the Proposed Project for Village 8 West, Village 9 and the 85-acre RTP. By multiplying the GHG emissions calculated for the Proposed Project by a factor of 1.5, an expanded cumulative projects area can be accounted for that includes the Village 8 East and the Planning Area 10/University Site projects. This analysis is provided in Section 5.1.1.3.

Complete emissions calculations are contained in Attachment 3.

4.2.1 Estimating Vehicle Emissions

Vehicle emissions were estimated using emission factors developed by the Bay Area AQMD and EPA in a fuel-based methodology using the following equation:

E = *EF* X *Fuel* X *C* X *GWP*

Where *E* is emission in metric tons per year; *EF* is an emission factor normalized for engine fuel consumption and expressed in units of pounds of GHG per gallon of transportation fuel; *Fuel* is the total quantity of fuel consumed per year; *C* is a constant reflecting the conversion of pounds to metric tons; and *GWP* is the global warming potential of each GHG. This fuel-based method is based on the equation used in CARB's OFFROAD2007 and EMFAC2007 models to estimate off- and on-road vehicle emissions:

E = *EF* X *Pop* X *AvgHp* X *Load* X *Activity*

where *E* is emission in tons per day; *EF* is an emission factor expressed in units of work done by the engine (e.g., g/bhp-hr); *Pop* is the engine population (number of engines in use); *AvgHp* is the average rated power of these engines; *Load* is the load on the engines relative to their average rated power; and *Activity* is the average annual hours of use per engine. However the fuel-based method simplifies the equation by using emission factors normalized for fuel consumption and allows the use of readily available and accurate regional fuel sales data. This method of calculating vehicle emissions also has the advantage of being able to estimate emissions for all three primary GHGs, while some computer models such as URBEMIS2007 can only directly estimate CO_2

emissions. The fuel-based calculation is thus commonly used to estimate regional emissions from the transportation sector (UCTC 1996, 2000), and is similar to the method CARB used in their BAU 2020 emissions forecast, which used statewide fuel sales data and statewide average VMT.

In this analysis, annual fuel consumption is obtained by multiplying the Proposed Project ADT obtained from the traffic study (LLG 2011) by the local (for the Proposed Project) and regional average (for BAU) trip lengths determined by SANDAG (2009, 20010b). The total VMT derived from this calculation is then multiplied by average vehicle mileage as identified by Caltrans to obtain total fuel consumption. This value is then multiplied by the emission factors in Table 8 to estimate GHG emissions.

4.2.2 Estimating Construction Emissions

Construction activities emit GHGs primarily though combustion of fossil fuels in the engines of off-road construction equipment (mostly diesel) and in the on-road vehicles of the construction workers. Smaller amounts of GHGs are also emitted through the energy use embodied in any water use (for fugitive dust control) and lighting for the construction activity. Construction emissions are not accounted for in the BAU 2020 forecast, and reductions in construction emissions are not specifically identified in the CARB Scoping Plan. However, the Association of Environmental Professionals (AEP) has recently recommended that total construction emissions be amortized over 30 years and added to operational emissions (AEP 2010).

Typically, project-level information is used to calculate construction emissions. In this analysis, given lack of project-specific information, construction emissions were estimated by multiplying the proposed land uses (Table 7, above) by annual construction emission rates of 0.077 $MTCO_2E$ per residential dwelling unit and 0.006 $MTCO_2E$ per square foot of non-residential use. These values were obtained through review of other project-level analyses (City of San Diego 2010a, 2010b).

4.2.3 Estimating Building Use Emissions

For estimates of non-transportation related operational emissions, total projected energy, water, and waste demands were multiplied by emission factors for each emission source and each GHG.

4.2.3.1 Electricity and Natural Gas Estimates

GHG emissions associated with electricity use were calculated by multiplying the total number of dwelling units, commercial and industrial square footage, and park, school, and community purpose facility acreages by the average electricity consumption rates used in CARB's 2011 California Emissions Estimator Model (CalEEMod) obtained from

the CEC end-use surveys for residential and non-residential uses (CEC; 2004 and 2006). These values were then multiplied by the electricity generation GHG emission factors contained in Table 8.

For the BAU calculations, 2006 statewide average electricity consumption rates of 590.88 kilowatt hours (kWh) per single-family residential unit per month, 360.39 kWh per multi-family residential unit per month, 14.10 kWh per commercial square foot per year, 17.60 kWH per industrial square foot per year, 6.35 kWh per school square foot per year, and 9.38 kWh per square foot per year of park and community purpose uses were used, consistent with the BAU 2020 forecast assumption of building energy efficiency in accordance with the Title 24, Year 2005 energy code.

For the Proposed Project calculations, a 30 percent improvement in residential and non-residential building energy efficiency was assumed based on the requirements of the Increased Energy Efficiency ordinance of the City's Municipal Code. This ordinance is described in Section 3.2.4.6 and would achieve a 15 percent reduction in building energy use compared to the existing 2008 Title 24 energy code and thus a 30 percent reduction in building energy use compared to BAU assumptions.

GHG emissions associated with natural gas were also calculated using rates obtained from CalEEMod/the CEC and the natural gas generation GHG emission factors shown in Table 8. Statewide monthly average natural gas consumption rates of 5,198.70 cubic feet per single-family residential unit, 3,128.97 cubic feet per multi-family residential unit, 2.90 cubic feet of natural gas per square foot of commercial space, 1.29 cubic feet per square foot of school space, 2.77 cubic feet per square foot of community purpose facility, 0.25 cubic feet per square foot of active park use, and 241,611 cubic feet per industrial consumer (assuming a minimum 2-acre lot size) were used to calculate BAU emissions.

For the Proposed Project calculations, a 30 percent improvement in building energy efficiency was assumed based on the requirements of the Municipal Code as described above. These values were then multiplied by the emission factors in Table 8 for natural gas consumption to obtain estimated quantities of GHG emissions.

4.2.3.2 Water Use Emissions Estimates

The GHG emissions associated with water use are calculated by multiplying the embodied energy in a gallon of potable water by the total number of gallons projected to be consumed by the project and then by the electricity generation GHG emission factors. For these estimates, it is assumed that water delivered to the Project site would have an embodied energy of 2,779 kWh/acre foot or 0.0085 kWh/gallon (Torcellini 2003).

To calculate the projected water demand of the Project and BAU, water demand rates by land use type were obtained from the October 2008 Otay Water District Water

Resources Master Plan Update (WRMP) and multiplied by the proposed quantities of residential units and non-residential square footage projected for buildout of the Proposed Project.

BAU water use assumptions based on the 2008 WRMP would be as follows: single-family residential units would consume 500 gallons per day (gpd) per unit; multi-family residential would consume 255[1] gpd per unit; schools would consume 1,785 gpd per acre, parks would consume approximately 2,155 gpd per acre, community purpose facilities would consume approximately 893 gpd per acre, commercial uses would consume 0.14 gpd per square foot; and industrial uses would consume 0.07 gpd per square foot.

Applying conservation measures required in the City's GBS Ordinance, described in Section 3.2.4.5, the Proposed Project's water use would achieve a 20 percent reduction in water consumption (and associated embodied energy) compared to BAU assumptions. Therefore, accounting for the advanced conservation measures of the Proposed Project, BAU/WRMP water consumption rates were adjusted as follows: single-family residential units would consume 400 gpd per unit; multi-family residential units would consume 204 gpd per unit; schools would consume 1,428 gpd per acre; parks would consume approximately 1,724 gpd per acre, community purpose facilities would consume 714.4 gpd per acre, commercial uses would consume 0.11 gpd per square foot; and industrial uses would consume 0.06 gpd per square foot.

4.2.3.3 Solid Waste Emissions Estimates

For both the BAU calculations and the Proposed Project calculations, a countywide average waste disposal rate was used and was obtained from the California Department of Resources Recycling and Recovery (CalRecycle) as included in CalEEMod. While the Proposed Project would implement lumber and other materials conservation in accordance with the City's Green Building Standards (see Section 3.2.4.5) and likely generate less landfill waste than average, these savings cannot be estimated at this time.

CalRecycle maintains a list of different waste generation rates for residential, commercial, and other uses. The multi-family residential waste generation rates range from 3.6 to 8.6 pounds per unit per day, the single-family residential waste generation rates ranged up to 11.4 pounds per unit per day, and the commercial generation rates range from 0.0025 to 0.046 pounds per square foot per day (CalRecycle 2009). To be conservative, the higher generation rates of 11.4 pounds daily per single-family dwelling unit, 8.6 pounds per unit per day for multi-family residential, 2.60 pounds per square foot

[1] Recommended rate of 300 gpd/unit reduced by 0.85 to account for reclaimed water use.

per day for schools, 11.4 pounds per square foot per day for community purpose facilities, 4.76 tons per acre per year for park uses, and 0.046 pounds per square foot per day for commercial and industrial uses were used to determine the total volume of waste by weight. These values were then multiplied by emissions factors used in the EPA Waste Reduction Model (WARM) for the different material classes (glass, metal, plastic, etc.) and two different waste streams (to landfill or to recycling). For the landfill estimates, landfill gas recovery for energy was assumed, and for both the landfill and recycling estimates, a truck haul distance of 20 miles and frequency of once per week. Local recycling and disposal (to landfill) percentages (of total waste generated) were also obtained from CalRecycle and reflect current waste disposal practice in accordance with the statutory 50 percent diversion mandate.

4.2.4 General Assumptions

The emission factors used to calculate vehicle, electricity and natural gas GHG emissions are shown below.

TABLE 8
GHG EMISSION FACTORS

Gas	Vehicle Emission Factors (pounds/gallon gas)[1]	Electricity Generation Emission Factors (pounds/MWh)[2, 3]	Natural Gas Combustion Emission Factors (pound/million ft^3)[4]
Carbon Dioxide	19.564	1,340	120,000
Methane	0.00055	0.0111	2.3
Nitrous Oxide	0.0002	0.0192	2.2

[1]SOURCE: BAAQMD 2006.
[2]SOURCE: U.S. DOE 2002.
[3]Emissions associated with water use are calculated from the embodied energy in a gallon of water multiplied by the same emissions factors for electricity generation. Waste emissions were similarly calculated using the U.S. EPA Waste Reduction model (WARM) emission factors specific to each waste type (e.g., glass, metal, plastic).
[4]SOURCE: U.S. EPA 1998.

Emissions estimated for each of the five emission sources are summed and expressed in terms of total metric tons carbon dioxide equivalent or $MTCO_2E$. CO_2-equivalent emissions are the preferred way to assess combined GHG emissions because they give weight to the GWP of a gas. The GWP, as described above in Section 1.1, is the potential of a gas to warm the global climate in the same amount as an equivalent amount of emissions of CO_2. CO_2 thus has a GWP factor of 1. Methane (CH_4) has a GWP factor of 21 and nitrous oxide (N_20) has a GWP of 310, which means they have a greater global warming effect than CO_2.

5.0 Impact Analysis

5.1 Project Emissions Relative to BAU

5.1.1 Impacts

To evaluate the significance of the Proposed Project's contribution of GHG emissions relative to statewide emissions and BAU reductions, GHG emissions from transportation, electricity, natural gas and water consumption, solid waste disposal, and construction activities, were estimated first for BAU, then for the Proposed Project. The Proposed Project calculations account for GHG emissions reductions from project-specific design features as well as applicable statewide emissions reduction programs.

5.1.1.1 BAU Emissions

a. Transportation-Related Emissions

Transportation-related GHG emissions comprise the largest contributor to existing and forecast GHG emissions, accounting for 38 percent of the total statewide forecasted BAU 2020 emissions (CARB 2008c). On-road vehicles alone account for 35 percent of the total forecasted BAU 2020 emissions. Transportation-related GHG emissions are generated from the combustion of fossil fuels (primarily gasoline and diesel) in vehicle engines. The quantity and type of transportation fuel consumed determines the amount of GHGs emitted from a vehicle. Therefore, not only are vehicle engine and fuel technologies of importance, but so too are the amount of vehicle trips and trip distances that motorists travel.

The traffic study projects that the proposed buildout of Villages 8 West, 9 and the 85-acre RTP would generate 113,073 ADT (LLG 2011). Based on the regional average trip length of 5.8 miles (SANDAG 2009) and an average fuel economy of 18.80 mpg for 2020 (Caltrans 2009), a total of 655,823 vehicle miles would be traveled each day and 34,884 gallons of vehicle fuel would be consumed each day under BAU conditions. Using the vehicle emissions factors contained in Table 8, the combustion of this fuel would result in the emission of 113,416.15 $MTCO_2E$ each year assuming BAU.

b. Electricity Emissions

Electric power generation accounted for the second largest sector contributing to existing and projected statewide GHG emissions, comprising 24 percent of the total statewide BAU 2020 emissions (CARB 2008c). Buildings use electricity for lighting, heating and cooling. Electricity generation entails the combustion of fossil fuels, including natural gas and coal, which are then stored and transported to end users. A

building's electricity use is thus associated with the off-site or indirect emission of GHGs at the source of electricity generation (i.e. the power plant).

Based on 887 single-family residences, 5,163 multi-family residences, 51.4 acres of schools, 10.8 acres of community purpose use, 1.8 million square feet of commercial, 2.2 million square feet of industrial space, and 55.4 acres of park space, buildout under BAU assumptions would annually consume 134,364 MWh of electricity. The residential uses would consume approximately 28,618 MWh, the school uses would consume approximately 14,218 MWh, the community purpose space would consume 4,413 MWh, the commercial uses would consume a maximum of 25,380 MWh, and the industrial uses would consume a maximum of 27,320 MWh each year. The park acreage could consume up to 15,845 MWh annually if developed into active recreational facilities such as a health or racquet club. Passive park space would consume less electricity. These estimates are based on average electricity consumption rates for southern California as identified by the CEC in the URBEMIS 2007 and 2011 CalEEMod air emissions models (CEC; 2004 and 2006). This quantity of electricity consumption equates to the emission of 17,474.49 $MTCO_2E$ each year from residential uses, 15,497.51 $MTCO_2E$ each year from commercial uses, 8,681.51 $MTCO_2E$ each year from schools, 2,694.54 $MTCO_2E$ each year from community purpose uses, 13,822 $MTCO_2E$ each year from active park uses, and 23,874.88 $MTCO_2E$ each year from industrial uses; totaling 82,044.93 $MTCO_2E$ each year.

c. Natural Gas Emissions

Buildings combust natural gas primarily for heating and cooking purposes, resulting in the emission of GHGs. GHG emissions associated with natural gas combustion are estimated by multiplying the total number of dwelling units by average residential natural gas consumption rates and then by their respective GHG emissions factors.

Based on 887 single-family residences, 5,163 multi-family residences, 1.8 million square feet of commercial space, 51.4 acres of schools, 10.8 acres of community purpose use, 55.4 acres of park space, and 2.2 million square feet of industrial space, buildout under BAU assumptions would annually consume 492.62 million cubic feet of natural gas. The residential uses would consume approximately 249.19 million cubic feet, the commercial uses would consume approximately 62.64 million cubic feet, the schools would consume approximately 34.70 million cubic feet, community purpose uses would consume approximately 15.62 million cubic feet, park uses would consume up to approximately 7.24 million cubic feet, and the industrial uses would consume approximately 123.22 million cubic feet each year. This equates to the emission of 13,646.41 $MTCO_2E$ GHG emissions each year from residential uses, 3,430.31 $MTCO_2E$ each year from commercial uses, 1,900.49 $MTCO_2E$ each year from schools, 855.33 $MTCO_2E$ each year from community purpose facilities, 396.46 $MTCO_2E$ each year from park uses, and 6,747.90 $MTCO_2E$ each year from industrial uses; totaling 29,976.90 $MTCO_2E$ GHG emissions each year.

d. Water Use Emissions

The provision of potable water consumes large amounts of energy associated with source and conveyance, treatment, distribution, end use, and wastewater treatment. This type of energy use is known as embodied energy. Water delivered to the site would have an embodied energy of 2,779 kWh/acre foot or 0.0085 kWh/gallon.

Multiplying the proposed 887 single-family residential units, 5,163 multi-family residential units, 51.4 acres of school use, 55.4 acres of parks, 10.8 acres of community purpose, 1.8 million square feet of commercial space, and 2.2 million square feet of industrial space, by the WRMP daily water demand rates of 500 gpd per single-family residential unit, 255 gpd per multi-family unit, 1,785 gpd per school acre, 2,155 gpd per park acre, 893 gpd per community purpose acre, 0.14 gpd per commercial square foot, and 0.07 gpd per industrial square foot, yields a total daily combined water demand of 2,388,355 gallons under BAU assumptions. Annual BAU water demand would total approximately 871,749,429 gallons. Of this annual total, approximately 642,423,725 gallons would be associated with residential uses, 33,488,385 gallons would be associated with school uses, 43,576,255 gallons would be associated with park uses, 3,520,206 gallons would be associated with community purpose uses, 91,980,000 gallons with commercial uses, and 56,760,858 gallons would be associated with industrial uses. The embodied energy demand associated with this total water use would equate to 7,409.87 MWh per year. Multiplying this value by the electricity emission factors for the three primary GHGs of concern in Table 8 yields an estimated annual emission associated with BAU water use of 4,524.61 $MTCO_2E$.

e. Solid Waste Emissions

The disposal of solid waste produces GHG emissions from anaerobic decomposition in landfills, incineration, and from the combustion of transportation fuel in the haul trucks that transport waste.

Based on 6,050 residential units, 1.8 million square feet of commercial space,2.2 million square feet of industrial space, 10.8 acres of community purpose facilities, 51.4 acres of schools, and 55.4 acres of park space, buildout under BAU assumptions would annually generate approximately 49,566 tons of solid waste each year. The residential uses would generate approximately 9,948 tons, the commercial uses would generate approximately 15,111 tons, the school uses would generate approximately 2,911 tons, the community purpose facility would generate approximately 2,682 tons, the park would generate approximately 264 tons, and the industrial uses would generate approximately 18,650 tons each year. GHG emissions associated with the disposal or diversion of this waste would equal approximately 7,918.07 $MTCO_2E$ per year.

f. Construction Emissions

Based on estimates of construction-related emissions for typical residential and non-residential projects, approximate annual emission rates of 0.077 $MTCO_2E$ per residential dwelling unit and 0.006 $MTCO_2E$ per non-residential square foot were determined. Multiplying these values by the proposed 6,050 residential units, 4 million square feet of commercial/industrial use, and 51.4 acres of schools (converted to 1.79 million square feet based on a conservative coverage ratio of 0.80:1), 10.8 acres of community purpose facility (converted to 376,358 square feet based on a conservative 0.80:1 coverage ratio) and 55.4 acres of park use (converted to 603,306 square feet of park structure space based on a conservative structure/park acre ratio of 0.25:1) results in annual construction emissions of 41,090.96 $MTCO_2E$.

5.1.1.2 Proposed Project Emissions

a. Transportation-Related Emissions

Proposed Project Average Trip Length Relative to Regional VMT

The BAU 2020 forecasted increase in transportation-related GHG emissions is dominated by an increase in emissions from on-road passenger vehicles; hence the emphasis in the CARB Scoping Plan on measures to reduce GHG emissions from on-road passenger vehicles (refer to Table 4).

CARB's estimated growth in vehicle emissions resulted from projected growth in statewide VMT due primarily to statewide population growth as projected by the Department of Finance. CARB's statewide VMT projections held average vehicle trip length and vehicle fleet mix constant. The BAU trip length for the San Diego region would thus be 5.8 miles, as currently reported by SANDAG (2009).

If a plan or project were to add motorists or to increase local trip lengths to such a degree that the regional average trip length was increased, regional and potentially statewide VMT could be increased. The project would thus be considered to generate vehicle GHG emissions in excess of those accounted for in the BAU 2020 Emissions Forecast. By extension, it would also be considered to generate vehicle emissions beyond those accounted for in the Scoping Plan reduction measures.

Patterns of development can increase, decrease, or have no effect at all on travel choices, depending on their location and design. For example, through provision of public transit, carpooling, and walking and biking amenities, and by bringing more people closer to more destinations, the City can increase low carbon travel and decrease on-road VMT. These are the types of strategies identified in the Scoping Plan's Regional Transportation-Related GHG Targets measure. CARB expects that this measure will

reduce transportation-related GHG emissions by about 5 million $MTCO_2E$, or 3 percent of the total statewide GHG reductions (see Table 4).

The Proposed Project is surrounded by existing or planned residential and mixed-use development to the north and west, with some neighborhood-serving commercial uses in the vicinity. Within the Proposed Project, a mix of residential, commercial, and recreational uses would be provided. These proximities would encourage walking and biking and relatively short local vehicle trips, as reflected in the shorter-than-regional-average trip lengths SANDAG identified for Villages 8 West and 9 (SANDAG 2010b). Compared to the regional average daily vehicle trip length of 5.8 miles, the average daily trip length for Village 8 would be 4.62 miles and the average daily trip length for Village 9 would be 5.08 miles. The average daily trip length for the RTP in the Planning Area 10/University Site was not determined but industrial park trip lengths are typically shorter than residential trip lengths and the same as commercial trip lengths (Institute of Transportation Engineers 2008). Because the Proposed Project would not increase the regional trip length, its projected vehicle-emissions would be consistent with forecasted vehicle emissions, and its cumulative contribution to statewide vehicle emissions would be less than significant.

According to the traffic analysis, the Proposed Project would generate 113,073 ADT at buildout (LLG 2011). Of this total ADT, 43,564 ADT would be associated with Village 8 West, 56,123 ADT would be associated with Village 9, and the remaining 13,386 ADT would be associated with the RTP in the Planning Area 10/University Site. Average local trip length data provided by SANDAG for the traffic analysis zones (TAZs) for Villages 8 West and 9 identify an average daily trip length of 4.62 miles for TAZ #4391 (i.e., Village 8 West) and 5.08 miles for TAZ #4373 (i.e., Village 9) (SANDAG 2010b). The RTP and Planning Area 10/University Site fall within TAZ #4353. This TAZ was not included in the SANDAG trip length model. Therefore, the SANDAG regional average trip length of 5.8 miles was used to estimate VMT for the RTP. Multiplying these trip length averages by their associated ADTs results in a daily VMT for the Proposed Project of 564,010; with 201,266 daily VMT resulting from Village 8 West, 285,105 daily VMT resulting from Village 9, and 77,639 daily VMT resulting from the RTP.

Overall Transportation Emissions

Using the same fuel economy figure used in the above paragraph to estimate BAU vehicle emissions, the projected daily VMT of 564,010 would result in an annual vehicle emissions generation of 97,538.09 $MTCO_2E$. However, as identified in the Section 3.2 Regulatory Background, there are several plans and regulations aimed at reducing transportation-related GHG emissions nationally and statewide by 2020, by increasing average vehicle fuel economy, decreasing average engine combustion emissions, and decreasing average VMT and trip length.

The key regulations affecting vehicle emissions include the national CAFE Standards which would increase average vehicle fuel economy to 35 mpg by 2020; the state Pavley GHG Vehicle Emissions Standards which set increasingly stringent emissions limits on vehicles, requiring improvement in vehicle engine technologies; and the state LCFS which reduces the carbon content of vehicle fuels. All of these actions have been approved by either the national or state legislatures and are coming into effect on a staggered timeline, with 2016 being the earliest vehicle model year affected. As shown in Table 4, CARB estimates that an approximate 46.7 $MMTCO_2E$ reduction, or 32 percent of the reduction target for capped sources and 27 percent of the total 174 $MMTCO_2E$ reduction target, would be achieved through full implementation of just the Pavley and LCFS transportation-related regulatory actions. A third action, the Vehicle Efficiency Measure, is estimated by CARB to add another 4.5 $MMTCO_2E$, or 2.5 percent, to the total statewide reductions. The national CAFE Standards, while not quantified in the CARB Scoping Plan, would likely contribute to further reductions in statewide vehicle GHG emissions.

It can be assumed that newer vehicles associated with the Proposed Project would benefit from these regulations, and estimated vehicle emissions would accordingly decrease. By accounting for the Scoping Plan measures already adopted, and the reduced vehicle trip lengths, the estimated vehicle emissions associated with the Proposed Project would decrease by 40 percent (with approximately 10 percent coming from the reduced vehicle trip lengths and nearly 30 percent from the state regulations), resulting in GHG emissions of 68,276.67 $MTCO_2E$ (compared to the 113,416.15 $MTCO_2E$ estimated for BAU).

In order to fully evaluate the significance of the Proposed Project's vehicle emissions reductions relative to the BAU 2020 vehicle emissions forecast and the Scoping Plan's vehicle emissions reductions, it is necessary to look at the Proposed Project in terms of its average trip length and effects on regional VMT.

b. Electricity Emissions

Buildout of the Proposed Project would be subject to the Chula Vista Green Building and Increased Energy Efficiency ordinances of the City's Municipal Code. These two ordinances are described in Section 3.2.4.5 and Section 3.2.4.6 and would achieve a 30 percent reduction in building energy (electricity and natural gas) use compared to BAU assumptions and a 20 percent reduction in potable water consumption (and associated embodied energy) compared to BAU assumptions.

Based on the energy savings required in the City's Increased Energy Efficiency ordinance, the proposed 6,050 residential units, 1.8 million cubic feet of commercial space, 10.8 acres of community purpose facility use, 51.4 acres of schools, 55.4 acres of park space, and 2.2 million square feet of industrial space would annually consume 94,054.45 MWh of electricity. The residential uses would consume approximately

28,617.65 MWh, the commercial uses would consume approximately 17,766 MWh, the school uses would consume approximately 9,952 MWh, the community purpose space would consume 3,089 MWh, active park uses would consume approximately maximum of 15,845 MWh, and the industrial uses would consume approximately 19,124 MWh each year. This equates to the emission of 12,232.14 $MTCO_2E$ each year from residential uses,10,848.26 $MTCO_2E$ each year from commercial uses, 6,077.06 $MTCO_2E$ each year from school uses, 9,675.40 $MTCO_2E$ each year from active park uses, 1,886.18 $MTCO_2E$ each year from community purpose facilities, and 16,712.41 $MTCO_2E$ each year from industrial uses; totaling 57,431.45 $MTCO_2E$ each year.

As shown in Table 4, the CARB Scoping Plan includes a Renewables Portfolio Standard which requires public utilities to acquire an increasing proportion of their energy supply from renewable energies. By 2020, 33 percent of all statewide electricity generation is to come from renewable energies. This would result in a statewide emissions reduction of 26.3 $MMTCO_2E$ and is a reduction that is counted toward the total 2020 emissions reduction target. As a result of implementation of the Renewables Portfolio Standard, GHG emissions from electricity generation needed to supply the Project would likely decline as energy supply shifts from fossil-fuel based energies to renewable energy. Renewable energies have zero to little carbon content and their use in electricity generation emits fewer GHGs.

c. Natural Gas Emissions

Buildout of the Proposed Project would be subject to the Increased Energy Efficiency ordinance of the City's Municipal Code. This ordinance is described in Section 3.2.4.6 and would achieve a 15 percent reduction in building energy use compared to the existing energy code (Title 24, Year 2008), which equates to a 30 percent reduction in building energy and natural gas use compared to BAU assumptions.

Based on the energy savings required in the City's Increased Energy Efficiency ordinance, the proposed 6,050 residential units, 1.8 million square feet of commercial space, 10.8 acres of community purpose facility, 51.4 acres of schools, 55.4 acres of parks, and 2.2 million square feet of industrial use would annually consume 344.83 million cubic feet of natural gas. The residential uses would consume approximately 174.44 million cubic feet, the commercial uses would consume approximately 43.85 million cubic feet, the community purpose facility would consume approximately 10.93 million cubic feet, the schools would consume approximately 24.29 million cubic feet, the park uses would consume approximately 5.07 million cubic feet, and the industrial uses would consume 86.25 million cubic feet each year. This equates to the emission of 9,552.49 $MTCO_2E$ of GHGs each year from residential uses, 2,401.22 $MTCO_2E$ each year from commercial uses, 598.73 $MTCO_2E$ each year from community purpose facilities, 1,330.34 $MTCO_2E$ each year from schools, 277.52 $MTCO_2E$ each year from park uses, and 4,723.53 $MTCO_2E$ each year from industrial uses; totaling 18,883.83 $MTCO_2E$ of GHG emissions each year.

d. Water Use Emissions

Buildout of the Proposed Project would be subject to the Green Building Standards in the City's Municipal Code. This ordinance is described in Section 3.2.4.5 and would achieve a 20 percent reduction in water use compared to the existing plumbing code (year 2006) and BAU assumptions. An adjustment to the WRMP daily water demand rates identified above for BAU were thus made to account for the City's more stringent water conservation design requirements. Multiplying the proposed 887 single-family residential units, 5,163 multi-family residential units, 51.4 acres of schools, 54.4 acres of park use, 10.8 acres of community purpose, 1.8 million square feet of commercial space, and 2.2 million square feet of industrial space, by adjusted WRMP daily water demand rates of 400 gallons per single-family residential unit, 204 gallons per multi-family unit, 1,428 gallons per school acre, 1,724 gallons per park acre, 714.4 gallons per community purpose acre, 0.11 gallon per commercial square foot, and 0.06 gallon per industrial square foot, yields a total daily combined water demand of 1,910,684 gallons for the Proposed Project. Annual project water demand would total approximately 697,399,543 gallons. Of this annual total, approximately 513,938,980 gallons would be associated with residential uses, 26,790,708 gallons would be associated with school uses, 34,861,004 gallons with park uses, 2,816,165 gallons would be associated with community purpose uses, 73,584,000 gallons with commercial uses, and 45,408,686 gallons would be associated with industrial uses. This water usage amounts to approximately 20 percent less than the average water use for residential and non-residential uses built to the current plumbing code. The embodied energy demand associated with the Proposed Project's total water use would equate to 5,927.90 MWh per year. Multiplying this value by the electricity emission factors for the three primary GHGs of concern in Table 8 yields an estimated annual emission associated with water use of 3,619.69 $MTCO_2E$.

While not shown in Table 4, the CARB Scoping Plan includes other reduction strategies not counted toward the 2020 target reduction of 174 $MMTCO_2E$ statewide. CARB estimates that their recommended water sector measures would reduce an additional 4.8 $MMTCO_2E$ by 2020. These are measures required of water suppliers that would improve energy and other efficiencies associated with water supply. Thus, it is possible that the embodied energy and resulting GHG emissions associated with supplying potable water to the Proposed Project would decrease somewhat by 2020.

e. Solid Waste Emissions

While the Proposed Project would implement lumber and other materials conservation in accordance with the City's Green Building Standards (see Section 3.2.4.5) and likely generate less landfill waste than average BAU, these savings cannot be estimated at this time. Therefore, for purposes of this program-level estimation, the Proposed Project is considered to generate the same amount of waste and associated GHG emissions as

that under BAU: 49,565.66 tons of solid waste each year, resulting in 7,918.07 $MTCO_2E$ of GHG emissions each year.

Future development in accordance with the Proposed Project would be required to implement lumber and other materials conservation in conformance with the Green Building Standards in effect at the time of project submittal that would likely exceed average or BAU practice. The importance of this action is revealed in CalRecycle's annual Statewide Waste Characterization Study (2008), which noted that inerts and other materials accounted for nearly one-third (29 percent) of the statewide waste stream, with lumber representing nearly 15 percent. The largest change in the overall waste stream was an increase, from 22 percent to 29 percent, in this materials class, largely due to an increase in lumber.

As shown in Table 4, the CARB Scoping Plan includes Recycling and Waste measures that would reduce statewide emissions by roughly 1.0 $MMTCO_2E$ by 2020. This is to be achieved through improved landfill methane capture. Also, while not shown in Table 4, the CARB Scoping Plan includes other waste sector reduction strategies not counted toward the statewide 2020 emissions reduction target. CARB estimates that these additional waste and recycling sector measures would provide up to an additional 10 $MMTCO_2E$ reduction by 2020. Thus, it is possible that the embodied energy and emissions resulting from disposing of the Proposed Project's solid waste may decrease somewhat by 2020 due to these measures.

f. Construction Emissions

The Proposed Project would generate the same approximate amount of construction emissions as BAU, 41,090.96 $MTCO_2E$ per year.

The Scoping Plan does not identify any measures specific to reducing GHG emissions from construction activities. However, the reduction measure affecting heavy-duty vehicle emissions would potentially encompass off-road construction equipment and reduce emissions through improved engine technology and conversion to non-diesel, low carbon fuels. Thus, as with the majority of the Scoping Plan's transportation-related reduction measures, reductions in construction emissions would have to come from emissions limits on construction equipment, redesign of construction equipment technology, and/or conversion to low carbon fuels. These measures are outside the control of the City or project-specific design.

5.1.1.3 Cumulative Projects GHG Emissions

While the GHG analysis for the Proposed Project is, in consideration of the global nature of climate change, a cumulative analysis, an additional detailed cumulative analysis is provided based on probable future projects (foreseeable) projects within the Project Area. These projects include Village 8 East and Planning Area 10/University Site. This

quantitative analysis of the potential cumulative impacts is based on the ratio of ADTs attributed to the foreseeable projects compared to ADTs from the Proposed Project. Specifically, total project generated ADTS (113,073) were divided into total ADT for the cumulative study area (174,700) resulting in a coefficient of 1.5. This coefficient is applied to all GHG emission factors to estimate cumulative emission levels.

a. Transportation-Related Emissions

The Cumulative Projects transportation-related GHG emissions would amount to approximately 102,415.00 $MTCO_2E$ per year, or 1.5 times the 68,276.67 $MTCO_2E$ per year projected for the Proposed Project. This emissions estimate takes into account a less-than-regional-average local trip length and state regulations affecting vehicle engine and fuel manufacture. The reduction in BAU vehicles emissions from these GHG-reducing aspects of the Cumulative Projects would be approximately 40 percent; with approximately 10 percent resulting from smart-growth circulation patterns and 30 percent resulting from statewide regulations.

b. Electricity Emissions

Buildout of Cumulative Projects would be subject to the Chula Vista Increased Energy Efficiency Standards ordinance of the City's Municipal Code. Individual developments would thus be required to achieve at least a 30 percent reduction in building energy (electricity and natural gas) use compared to BAU assumptions. Based on the cumulative coefficient of 1.5,, Cumulative Projects would emit approximately 86,147.18 $MTCO_2E$ each year.

c. Natural Gas Emissions

As stated above in buildout of Cumulative Projects would be subject to increased energy efficiency requirements that would save 30 percent building energy and natural gas use compared to BAU assumptions. Based on the cumulative coefficient of 1.5, Cumulative Projects would emit approximately 28,325.75$MTCO_2E$ of GHG emissions each year associated with natural gas combustion.

d. Water Use Emissions

Buildout of Cumulative Projects would also be subject to the water saving requirements of the City's Green Building Standards ordinance. Individual projects would thus be required to achieve a 20 percent reduction in potable water consumption (and associated embodied energy) compared to BAU assumptions. This water usage amounts to approximately 20 percent less than the average water use for residential and commercial uses built to the current plumbing code. Based on the cumulative coefficient of 1.5, the estimated annual emissions associated with Cumulative Projects water use would be 5,429.53 $MTCO_2E$.

e. Solid Waste Emissions

While Cumulative Projects would implement lumber and other materials conservation in accordance with the City's Green Building Standards (see Section 3.2.4.5) and likely generate less landfill waste than average BAU, these savings cannot be estimated at this time. Therefore, for purposes of this program-level estimation, buildout of Cumulative Projects is based only on the multiplier of 1.5, without additional credit for conservation measures, amounting to approximately 11,877.11$MTCO_2E$ of GHG emissions each year.

f. Construction Emissions

Approximately 61,636.44$MTCO_2E$ per year of construction emissions would be generated by construction of the Cumulative Projects, based on the 1.5 multiplier relative to the Proposed Project.

5.1.2 Significance of Impacts

5.1.2.1 Target Emissions

Based on the calculated BAU project-equivalent emissions and the goal of a 20 percent reduction in BAU 2020 emissions, an emissions cap for the Proposed Project can be determined. As shown in the Table 9 in Section 5.1.2.3 below, the total estimated BAU emissions would be 275,971.62 $MTCO_2E$ each year. A 20 percent reduction in this amount would equal 220,777.29 $MTCO_2E$ each year. Therefore, the Propose Project would be considered to be consistent with the Scoping Plan and AB 32 Year 2020 goals if it were to emit total annual emissions resulting from electricity, natural gas and water use, solid waste disposal and construction activities, equal to or less than 220,777.29 $MTCO_2E$.

5.1.2.2 Proposed Project GHG Reduction Features

As described in Section 2.1, the Proposed Project is a GPA and GDPA to allow the ultimate development of up to 6,050 residential units, 1.8 million square feet of commercial and 2.2 million square feet of industrial uses, 10.8 acres of community purpose use, 51.4 acres of schools, and 55.4 acres of park use. As part of the GPA, proposed text revisions to the GP's Environmental Element, Objective E7 would include the following new Policy E 7.8:

Objective E 7

Promote energy conservation through the efficient use of energy and through the development of local, non-fossil fuel-based renewable sources of energy.

Policy

E 7.8: Ensure that residential and non-residential construction complies with all applicable City of Chula Vista energy efficiency measures that are in effect at the time of discretionary permit review and approval or building permit issuance, whichever is applicable.

This new policy would ensure that all subsequent projects comply with, at a minimum, the existing GBS ordinance and Increased Energy Efficiency Standards ordinance. These two City ordinances are included as Attachment 2 and are hereby incorporated by reference. As described in Sections 3.2.4.5 and 3.2.4.6 respectively, these two ordinances require all new development and redevelopment or remodels over a threshold size to incorporate design that achieves at least 20 percent greater water conservation than the current plumbing code and 15 percent greater energy efficiency than the current 2008 Title 24 energy code (i.e., 30 percent greater energy efficiency than the 2005 Title 24 energy code).

As required in the ordinances, building permits for subsequent development in accordance with the Proposed Project would be thoroughly reviewed by the Building Official for compliance with the ordinances prior to approval. As part of the building permit application, project construction plans and specifications shall indicate the energy and GBS standards, product specifications, and method of construction, in the general notes or individual drawings. No building permit shall be issued for any project until the Building Official has determined that the plans and specifications are in compliance with the requirements of the ordinances. Additional inspections may be conducted as needed to ensure compliance and if at any stage of construction the Building Official determines that the project is not being constructed in accordance with the permitted plans and documents, a stop order may be issued that will remain in effect until the Building Official allows. Prior to issuance of a certificate of occupancy, the Building Official shall review all relevant information and determine whether the project has been built in accordance with the permit. If the Building Official determines that a project applicant has failed to construct the project in accordance with the permitted plans and documents, then the final building approval and certificate of occupancy may be withheld.

5.1.2.3 Proposed Project GHG Reductions Relative to BAU 2020

The total GHG emissions attributed to vehicle use and building occupancies for BAU and the Proposed Project are summarized below in Table 9. The Proposed Project is estimated to generate a total of 197,220.66 $MTCO_2E$ GHG emissions (68,276.67 from vehicle use and 128,944 $MTCO_2E$ from non-transportation-related sources) each year above existing conditions. BAU is estimated to generate a total of 275,971.62 $MTCO_2E$ of GHG emissions each year above existing conditions (113,416.15 $MTCO_2E$ from

vehicle use and 162,555.47 $MTCO_2E$ from non-transportation-related sources). This Proposed Project total reduction of 78,750.95 $MTCO_2E$ equates to a 29 percent reduction in BAU emissions, and results from the Proposed Project's incorporation of smart-growth vehicle circulation patterns, lower-emitting vehicles given state regulations, and advanced energy efficiency and water conservation design that would reduce GHG emissions associated with energy and water use. Of the total Proposed Project reduction, a 33,611.47 $MTCO_2E$, or 21 percent, reduction in non-vehicular BAU would result from the advanced energy efficiency and water conservation design alone. Other Proposed Project features that may reduce GHG emissions, such as landscaping, heat island reduction, lumber conservation, and other actions required in the City's Green Building Standards were not readily quantifiable and are not included in the Proposed Project's emissions estimate.

TABLE 9
SUMMARY OF ESTIMATED GHG EMISSIONS AND PROJECT REDUCTIONS RELATIVE TO BAU ($MTCO_2E$)

Emission Source	BAU Project-Equivalent	Target Emissions	Proposed Project	Percent Reduction
Vehicles Use	113,416.15	--	68,276.67	40
Electricity Use	82,044.93	--	57,431.45	30
Natural Gas Use	29,976.90	--	18,883.83	30
Water Consumption	4,524.61	--	3,619.69	20
Solid Waste Disposal	7,918.07	--	7,918.07	0
Construction	41,090.96	--	41,090.96	0
TOTAL	**275,971.62**	**220,777.29**	**197,220.66**	**29**

As shown in Table 9, a 20 percent reduction in BAU GHG emissions would equal 220,777.29 $MTCO_2E$ per year. The Proposed Project would generate an estimated 197,220.66 $MTCO_2E$ per year. Based only on increased energy and water savings afforded by the proposed General Plan Policy 7.8 and existing City ordinances, the Proposed Project would reduce non-transportation-related BAU emissions by 21 percent. Factoring in vehicle emissions reductions, the Proposed Project would reduce overall BAU emissions by 29 percent, thereby exceeding the City's significance threshold of a 20 percent reduction in GHG emissions relative to BAU 2020. Impacts associated with the Proposed Project's contribution of GHGs to cumulative statewide emissions would therefore be less than significant.

5.1.2.4 Cumulative Projects GHG Emissions

The Cumulative Projects annual GHG emissions would total approximately 295,831.00 $MTCO_2E$ per year. Under BAU, annual GHG emissions would approximate 413,957.43 $MTCO_2E$ per year. These quantities were derived by multiplying the estimates derived through the above BAU and Proposed Project emissions calculations

by a factor of 1.5 to reflect the proportionally greater intensity of development allowed through buildout of projects in an expanded cumulative projects area or that includes Village 8 East and Planning Area 10/University Site.

These calculations provide a cursory estimate of the magnitude of GHG emissions that would occur under Cumulative Projects buildout. Given that individual projects within the Cumulative Projects area would be subject to the City's existing Green Building Standards and Increased Energy Efficiency Standards ordinances, and the proposed GPA new policy E.7.8, future emissions from these projects would be ensured to be at least 20 percent below BAU GHG emissions; and would more likely, as is the case with the Proposed Project, provide reductions in BAU GHG emissions ranging from 21 to 29 percent.

The Proposed Project's contribution to these Cumulative Projects GHG emissions would not be significant; and climate change impacts associated with the Cumulative Projects buildout is anticipated to be less than significant.

5.2 Project Consistency with Adopted Plans, Policies, and Regulations

5.2.1 Impacts

The regulatory plans and policies discussed extensively in Section 3.0 above aim to reduce national, state, and local GHG emissions by primarily targeting the largest emitters of GHGs: the transportation and energy sectors. Plan goals and regulatory standards are thus largely focused on the automobile industry and public utilities. For the transportation sector, the reduction strategy is generally three pronged: to reduce GHG emissions from vehicles by improving engine design; to reduce the carbon content of transportation fuels through research, funding and incentives to fuel suppliers; and to reduce the miles these vehicles travel through land use change and infrastructure investments.

For the energy sector, the reduction strategies aim to: reduce energy demand; impose emission caps on energy providers; establish minimum building energy and green building standards; transition to renewable non-fossil fuels; incentivize homeowners and builders; fully recover landfill gas for energy; expand research and development; and so forth.

5.2.1.1 Local Plans

As discussed above in Section 5.2.2, the Proposed Project would achieve substantial GHG reductions through green building design that includes increase energy efficiency

and improved water conservation, sustainable materials use, waste reduction, lumber conservation, indoor air quality, and heat island reduction. These GHG-reducing design features would be incorporated into subsequent projects as required in the City's Green Building Standards and the Increased Energy Efficiency Standards adopted by ordinance into the Municipal Code. Verification and commissioning of these features would occur through independent third party inspection and diagnostics as part of development permit review and approval.

The Proposed Project would thus be consistent with the City's CPAP and Climate Protection Measures relevant to private land use and development.

5.2.1.2 State Plans

EO S-3-05 established GHG emission reduction targets for the state, and AB 32 launched the Climate Change Scoping Plan that outlined the reduction measures needed to reach these targets. The Scoping Plan and its implementing and complementary regulations are discussed at length in Section 3.2. Also, in Sections 5.1 and 5.2 above, the Project's consistency with the state reduction targets for transportation, energy and other emissions associated with land use and development, is demonstrated. In short, the Proposed Project was shown to provide a 21 percent reduction in non-transportation-related BAU emissions, and a 29 percent reduction in overall BAU emissions, consistent with the percent reduction targeted in the Scoping Plan for land development-related emissions. In addition, the Proposed Project was demonstrated in Section 5.1 to not increase regional VMT, and is therefore consistent with recommendations in the Scoping Plan and assumptions in the BAU 2020 Forecast pertaining to transportation-related emissions. The Proposed Project is also consistent with state goals regarding climate change adaptation and the Scoping Plan's recommendation to expand the use of green building practices in order to reduce the carbon footprint of new buildings and better adapt them to climate change.

The Proposed Project, by providing a 21 percent reduction in non-transportation-related GHG emissions compared to BAU, may be seen to exceed its fair share in achieving the state's reduction target given that the reduction measures and quantities identified in the Scoping Plan that relate specifically to land development (the Regional Transportation-Related Measure, the Building Energy Efficiency measure, and the Million Solar Roofs measure) add up to approximately 20 percent of the total reduction needed statewide.

5.2.2 Significance of Impacts

The Proposed Project is consistent with the goals and strategies of local and state plans, policies, and regulations aimed at reducing GHG emissions from land use and development. Impacts would be less than significant.

6.0 Conclusions and Recommendations

Assuming full implementation of statutory regulations establishing vehicle and fuel emissions limits and technology improvements and shorter than average trip lengths, ADT associated with buildout of the Proposed Project would result in approximately 68,276.67 $MTCO_2E$ of GHG emissions each year above existing conditions. This estimate represents a nearly 40 percent reduction in vehicular GHG emissions compared to the BAU condition which would result in 113,416.15 $MTCO_2E$ of transportation-related GHG emissions per year above existing conditions. Because the Proposed Project's average local trip length would not be large enough to increase the regional average vehicle trip length or regional VMT, its vehicle emissions are consistent with the state's forecasted 2020 BAU vehicle emissions and sector-wide reductions. The Proposed Project's contribution to cumulative transportation-related GHG emissions is therefore less than significant.

The Proposed Project is estimated to generate 128,944 $MTCO_2E$ of non-transportation-related GHG emissions each year above existing conditions, and BAU is estimated to generate 162,555.47 $MTCO_2E$ of non-transportation-related GHG emissions each year above existing conditions. Implementation of the Proposed Project would thus result in a 21 percent reduction in BAU 2020 non-transportation-related emissions, thereby exceeding the 20 percent reduction target established by the City consistent with AB 32 and the CARB Scoping Plan. The Proposed Project's non-transportation-related emissions reduction of approximately 33,611.47 $MTCO_2E$ would result from design features required to be incorporated into subsequent development proposals that substantially reduce energy and water use.

The Proposed Project's overall contribution to cumulative GHG emissions would therefore not be significant and would not conflict with or obstruct the goals and strategies of local and state plans, policies, and regulations aimed at reducing GHG emissions from land development.

7.0 References Cited

American Water Works Association
2001 Handbook of Water Use and Conservation. Amy Vickers. August.

Association of Environmental Professionals (AEP)
2010 Spring 2010 Advanced CEQA Workshop. San Diego Chapter. May 13.

Australian Government

2007 *Montreal Protocol on Substances that Deplete the Ozone Layer.* Department of the Environment and Water Resources (DEWR). Obtained from the DEWR website at http://www.environment.gov.au/atmosphere/ozone/legislation/montp.html on July 27, 2007.

Bay Area Air Quality Management District (BAAQMD)

2006 Source Inventory of Bay Area Greenhouse Gas Emissions. November.

California Air Pollution Control Officers Association (CAPCOA)

2008 CEQA & Climate Change: Evaluating and Addressing Greenhouse Gas Emissions from Projects Subject to the California Environmental Quality Act. January.

2007 California 1990 Greenhouse Gas Emissions Level and 2020 Emissions Limit. November 16.

California Air Resources Board (CARB)

2007 California 1990 Greenhouse Gas Emissions Level and 2020 Emissions Limit. November 16.

2008a Recommended Approaches for Setting Interim Significance Thresholds for Greenhouse Gases under the California environmental Quality Act. Preliminary Draft Staff Proposal. October 24.

2008b Climate Change Scoping Plan: A Framework for Change. Accessed from the CARB website April 15, 2010 at http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf. December.

2008c California 2020 GHG Emissions Forecast. Accessed June 1, 2010 from the CARB website at http://www.arb.ca.gov/cc/inventory/data/forecast.htm. Last updated October 2008; last reviewed May 28, 2010.

2010a *Greenhouse Gas Inventory Data – 2000 to 2008*. Obtained from the CARB website at http://www.arb.ca.gov/cc/inventory/data/data.htm (last updated May 12, 2010) on December 28.

2010b *Climate Car Standards – Pavley, Assembly Bill 1493.* Obtained from the CARB website at http://www.arb.ca.gov/cc/ccms/ccms.htm, last reviewed March 10, 2010, on April 22.

2010c *Senate Bill 375 – Regional Targets*. Obtained from the CARB website at http://www.arb.ca.gov/cc/sb375/sb375.htm on October 29.

California Clean Cars Campaign

2006 Fact Sheet: *California's Vehicle Global Warming Pollution Reduction Regulations: How it Works.* http://www.calcleancars.org/factsheets/staffproposal.pdf.

California Department of Transportation (Caltrans)

2009 2008 California Motor Vehicle Stock, Travel and Fuel Forecast. Division of Transportation System Information Program. June.

California Energy Commission (CEC)

2009 California Energy Commission website, http://www.energy.ca.gov/ab118/index.html, accessed on August 5.

2006 Commercial End-Use Survey (CEUS). 2006 (as cited in the California Emissions Estimator Model, v1.1, 2011). Available online at http://www.energy/ca/gov/ceus.

2004 Residential Appliance Saturation Survey (RASS). 2004 (as cited in the California Emissions Estimator Model, v1.1, 2011). Available online at http://www.energy/ca/gov/rass.

California Environmental Protection Agency (CalEPA)

2005 California Hydrogen Blueprint Plan. Volume 1 Draft Final Report. March.

California, State of

2004 *Climate Change Emission Control Regulations – Fact Sheet.* Obtained from the CARB website at http://www.arb.ca.gov/cc/factsheets/cc_newfs.pdf on May 24, 2007.

2005 *Regulations to Control Greenhouse Gas Emissions from Motor Vehicles; Request for Waiver of Preemption Under Clean Air Act Section 209(b).* California Air Resources Board. December 21. Obtained from the CARB website at http://www.arb.ca.gov/cc/docs/waiver.pdf on May 24, 2007.

2006 *Press Release - Gov. Schwarzenegger Signs Landmark Legislation to Reduce Greenhouse Gas Emissions.* Office of the Governor. September 27. Obtained from the Governor's website at http://gov.ca.gov/index.php?/press-release/4111/ on May 24, 2007.

2009b News Release: California Adopts Low Carbon Fuel Standard. Accessed from the CARB website at http://www.arb.ca.gov/newsrel/nr042309b.htm. April 23.

CalRecycle (California Department of Resources Recycling and Recovery)

2008 Statewide Waste Characterization Study. Contractors Report to the California Integrated Waste Management Board. April.

2009 Estimated Solid Waste Generation Rates for Residential and Commercial Establishments. Accessed from the CalRecycle website at http://www.calrecycle.ca.gov/wastechar/wastegenrates. Updated December 30.

Chula Vista, City of

2005 Greenhouse Gas Emissions Inventory. Accessed June 23 from the Chula Vista city government website at http://www.chulavistaca.gov/clean/conservation/Climate/documents/GHG_2008InventoryReport_FINAL.pdf. September 18.

2006 Climate Zones Map. City of Chula Vista Geographic Information System. Accessed June 10, 2010 from the Chula Vista city government website at http://www.chulavistaca.gov/city_services/development_services/planning_building/Development_Services_Center/documents/climateZonesSm2_000.pdf. February.

2008a Greenhouse Gas Emissions Inventory. Accessed June 23 from the Chula Vista city government website at http://www.chulavistaca.gov/clean/conservation/Climate/documents/GHG_2008InventoryReport_FINAL.pdf. September 18.

2008b City of Chula Vista Climate Protection Measures.

2010 Climate Protection Measures: Implementation Progress Report. Accessed June 23 from the Chula Vista city government website at http://www.chulavistaca.gov/clean/conservation/Climate/documents/CCWGClimateMeasures_18-MonthProgressReport_FINAL.pdf. February.

Institute of Transportation Engineers

2008 Trip Generation: An Informational Report. 8th Edition. December.

Linscott, Law and Greenspan Engineers

2011 Traffic Impact Analysis [for the] Chula Vista General Plan & General Development Plan Amendment[s] for Otay Land Company. February.

Marten Law Group

2008 *California Sues EPA over Vehicle Emissions Standards.* Accessed May 19, 2008 at: http://www.martenlaw.com/news/?20080109-calif-sues-epa.

Otay Water District

2008 Otay Water District Water Resources Master Plan Update. October.

Rimpo and Associates
2007 URBEMIS 2007 for Windows, Version 9.2.4.

Sacramento Bee
2007 "California gets a win on emissions-cut law," by Dale Kasler, December 13. Accessed May 19, 2008 at: http://www.shns.com/shns/g_index2.cfm?action=detail&pk=CAL-EMISSIONSCUT-12-13-07.

San Diego Association of Governments (SANDAG)
2009 Transportation: Roads and Highways. Accessed from the SANDAG website at http://www.sandag.org/index.asp?subclassid=10&fuseaction=home.subclasshome. November 13.

2010a Greenhouse Gas Reduction Targets Set. Accessed from the SANDAG website at http://www.sandag.org/index.asp?newsid=666&fuseaction=news.detail on October 29.

2010b Average Trip Length By Mile for TAZ 4391 and TAZ 4373. Obtained by City of Chula Vista staff from SANDAG staff via personal communications on July 12.

San Diego, City of
2010 Greenhouse Gas Emissions Analysis Technical Report for the Nakano Project. May 24.

2010a Heritage Bluffs Climate Change Analysis. Prepared by Urban Crossroads. April.

2010b Global Climate Change Analysis for Las Casitas, City of San Diego. Prepared by RECON Environmental Inc. July.

Torcellini, P., Long, N., and Judkoff, R.
2003 Consumptive Water Use for U.S. Power Production. Technical Report # NREL-TP-550-33905. National Renewable Energy Laboratory. Golden, CO.

Union of Concerned Scientists (UCS)
2007 *SB 1368 (Perata) Greenhouse Gas Emissions Performance Standard for Major Power Plant Investments – A Fact Sheet of the Union of Concerned Scientists.* Obtained from the UCS web site at http://www.ucsusa.org/assets/documents/global_warming/SB-1368-Perata-fact-sheet.pdf on June 7, 2007.

United Nations Environment Programme (UNEP)

2007 *Achievements in Stratospheric Ozone Protection, The Montreal Protocol on Substances that Deplete the Ozone Layer, Progress Report 1987–2007.* Obtained from the UNEP website at http://ozone.unep.org/Publications/MP_Acheivements-E.pdf on May 23, 2007.

United Nations Framework Convention on Climate Change (UNFCCC)

2007a *The United Nations Framework Convention on Climate Change*. Obtained from the UNFCCC website at http://unfccc.int/essential_background/convention/items/2627.php on May 23, 2007.

2007b *Parties & Observers*. Obtained from the UNFCCC website at http://unfccc.int/parties_and_observers/items/2704.php on May 24, 2007.

2007c *Kyoto Protocol*. Obtained from the UNFCCC website at http://unfccc.int/kyoto_protocol/items/2830.php on May 24, 2007.

2009 *Status of Ratification*. Obtained from the UNFCCC website at http://unfccc.int/kyoto_protocol/background/status_of_ratification/items/2613.php on July 24, 2009.

University of California Transportation Center (UCTC)

1996 A Fuel-Based Motor Vehicle Emission Inventory. Brett Singer and Robert Harley. Department of Civil and Environmental Engineering. University of California Berkeley. Reprinted from the Journal of Air and Waste Management Association.

2000 A Fuel-Based Assessment of Off-Road Diesel Engines Emissions. Andrew Kean, Robert Sawyer and Robert Harley. Departments of Mechanical, Civil and Environmental Engineering. University of California Berkeley. Reprinted from the Journal of Air and Waste Management Association. Journal of Air and Waste Management Association. November.

U.S. Department of Energy (U.S. DOE)

2002 *Updated State-level Greenhouse Gas Emission Coefficients for Electricity Generation 1998-2000*. Energy Information Administration, Office of Integrated Analysis and Forecasting, Energy Information Administration. April. Obtained from the DOE website at http://tonto.eia.doe.gov/FTPROOT/environment/e-supdoc-u.pdf on February 16, 2007.

U.S Energy Information Administration (EIA)

2006 2003 Commercial Buildings Energy Consumption Survey: Consumption and Expenditures Tables. Table C14. Electricity Consumption and Expenditure Intensities for Non-Mall Buildings.

United States Environmental Protection Agency (U.S. EPA)

1998 AP 42, Fifth Edition, Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Section 1.4, Natural Gas Combustion. July.

2002 *Greenhouse Gases and Global Warming Potential Values – Excerpt from the Inventory of U.S. Greenhouse Emissions and Sinks: 1990-2000*. U.S. Greenhouse Gas Inventory Program, Office of Atmospheric Programs. April.

2007a *International Cooperation*. Obtained from the EPA Climate Change website at http://www.epa.gov/climatechange/policy/internationalcooperation.html on May 24, 2007.

2007b *Ozone Depletion Rule and Regulations*. Obtained from the EPA Ozone Depletion website at http://www.epa.gov/ozone/title6/index.html on May 23, 2007.

2007c *U.S. Climate Policy and Actions*. Obtained from the EPA Climate Change website at http://www.epa.gov/climatechange/policy/index.html on May 25, 2007.

2008a *California Greenhouse-Gas Waiver Request*. Obtained from the EPA website at http://www.epa.gov/otaq/ca-waiver.htm on May 19, 2008.

2008b Waste Reduction Model. Obtained from the EPA website at http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_home.html.

2009 Municipal Solid Waste Generation, Recycling, and Disposal in the United States. Detailed Tables and Figures for 2008. Office of Resource Conservation and Recovery. November.

United State Global Change Research Information Office (GCRIO)

1993 U.S. Climate Change Action Plan. Obtained from GCRIO website at http://www.gcrio.org/USCCAP/toc.html on May 31, 2007.

ATTACHMENT 1

Understanding Global Climate Change

RECON

Understanding Global Climate Change

Prepared by

RECON Environmental, Inc.
1927 Fifth Avenue
San Diego, CA 92101-2358
P 619.308.9333 F 619.308.9334

TABLE OF CONTENTS

Understanding Global Climate Change 1

1.0 The Greenhouse Effect 1

2.0 Greenhouse Gases (GHGs) 2

2.1 Non-Fluorinated Gases 4
2.2 Fluorinated Gases 6

3.0 Human Induced Climate Change 7

4.0 Future Projections of Climate Change 11

5.0 Implications of Climate Change 12

6.0 Global, National, and State GHG Emissions 17

7.0 References Cited 23

FIGURES

1: Greenhouse Effect 2
2: Temperature and CO_2 Concentration 9
3: Comparison between Modeled and Observed Temperature 10
4: Main Characteristics of Four SRES Storylines and Scenario Families 13
5: CO_2 Scenarios 14
6: Surface Temperature Scenarios 15
7: Persistence Effect 18
8: CO_2 Emissions from Fossil Fuels per Capita (2001) 21
9: Global Greenhouse Gas Emission Comparison (2002 data) 22

TABLES

1: Global Warming Potentials (GWPs) and Atmospheric Lifetimes (Years) Used in the Inventory 3
2: Total Aggregate Anthropogenic Emissions of CO2, CH4, N2O, HFCs, PFCs, and SF6 Including Emissions/Removals from Land Use, Land-Use Change, and Reforestry 17
3: Net National Greenhouse Gas Emissions 19
4: Net California Greenhouse Gas Emissions 20

Understanding Global Climate Change

The earth's climate is in a state of constant flux with periodic warming and cooling cycles. Extreme periods of cooling are termed "ice ages," which may then be followed by extended periods of warmth. For most of Earth's geologic history, these periods of warming and cooling have been the result of many complicated, interacting natural factors that include volcanic eruptions which spew gases and particles (dust) into the atmosphere, the amount of water, vegetation, and ice covering the earth's surface, subtle changes in the Earth's orbit, and the amount of energy released by the sun (sun cycles). However, since the beginning of the Industrial Revolution around 1750, the average temperature of the Earth has been increasing at a rate that is faster than can be explained by natural climate cycles alone.

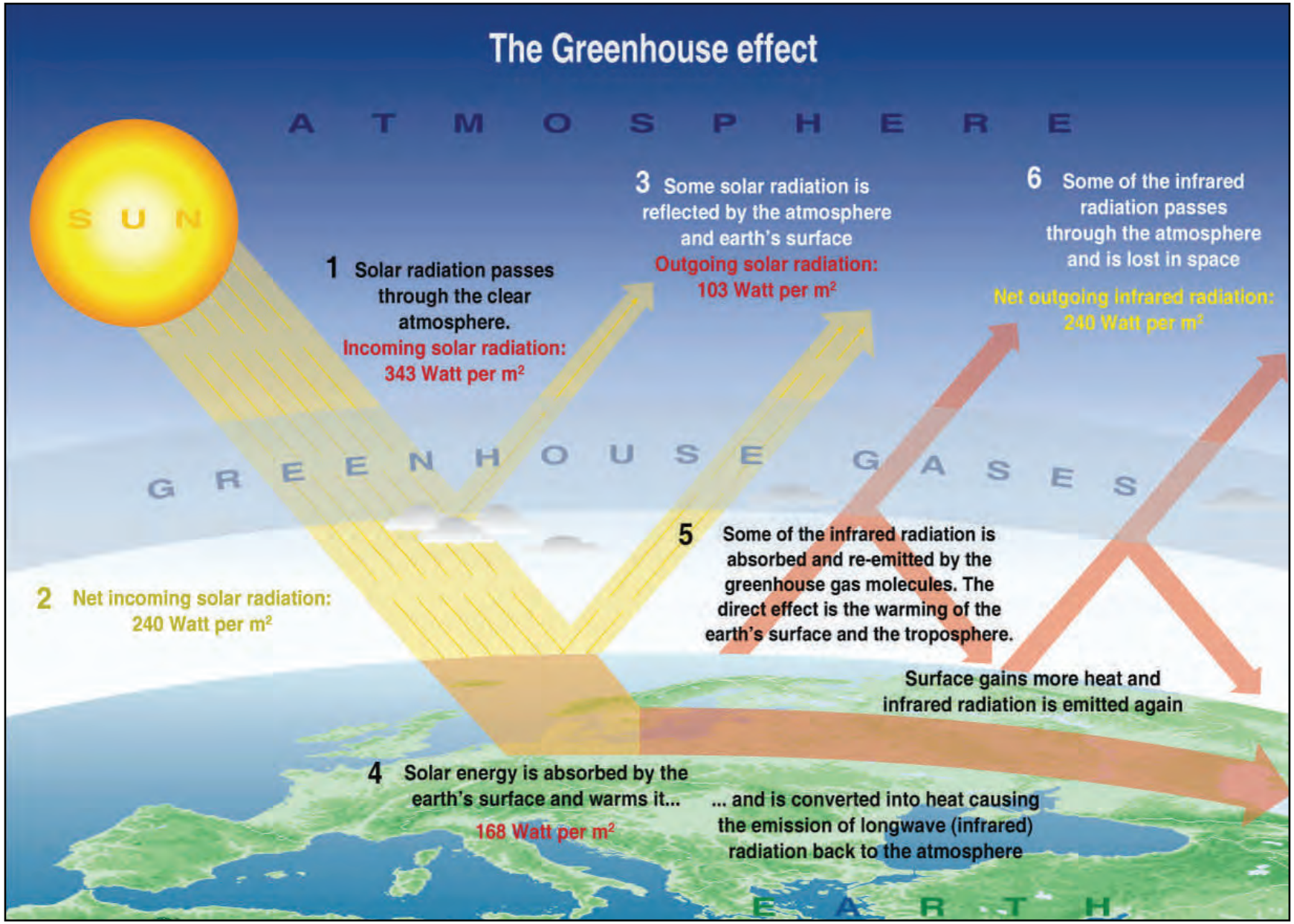
With the Industrial Revolution came an increase in the combustion of carbon-based fuels such as wood, coal, oil, and "biofuels." Industrial processes have also created emissions of substances that are not found in nature. This in turn has led to a marked increase in the emissions of gases that have been shown to influence the world's climate. These gases, termed "greenhouse gases," influence the amount of heat that is trapped in the earth's atmosphere. Because recently observed increased concentrations of GHGs in the atmosphere are related to increased emissions resulting from human activity, the current cycle of "global warming" is generally believed to be largely due to human activity. Of late, "global warming" has arguably become the most important and widely debated environmental issue in the United States and the world.

1.0 The Greenhouse Effect

The presence of natural GHGs in the atmosphere is necessary for life on earth as we know it. The Earth absorbs and reflects incoming solar radiation. The Earth also emits terrestrial (thermal) radiation back out into space. On average, the absorbed solar radiation is balanced by the emitted thermal radiation, thus keeping the Earth at a relatively stable temperature. However, GHGs in the atmosphere absorb a portion of the terrestrial thermal radiation, thus "trapping" heat. The warming of the Earth's surface and atmosphere caused by this trapped heat is known as the "natural greenhouse effect" (United States Environmental Protection Agency [U.S. EPA] 2002). Figure 1 illustrates the "Greenhouse Effect."

Because GHGs "trap" heat in the atmosphere, the Earth's surface is warmer than it would be without the gases. Estimates indicate that without these natural GHGs, the Earth's surface would be about 60 degrees Fahrenheit (°F) colder (U.S. EPA 2007a).

Source: UNEP/GRID–Adrenal 2002a



RECON

FIGURE 1
Greenhouse Effect

2.0 Greenhouse Gases (GHGs)

There are numerous GHGs, both naturally occurring and manmade. Table 1 summarizes some of the most common.

TABLE 1
GLOBAL WARMING POTENTIALS (GWPs) AND ATMOSPHERIC LIFETIMES (YEARS) USED IN THE INVENTORY

Gas	Atmospheric Lifetime	100-year GWP[a]	20-year GWP	500-year GWP
Carbon Dioxide (CO_2)	50-200	1	1	1
Methane (CH_4)[b]	12±3	21	56	6.5
Nitrous oxide (N_20)	120	310	280	170
HFC-23	264	11,700	9,100	9,800
HFC-125	32.6	2,800	4,600	920
HFC-134a	14.6	1,300	3,400	420
HFC-143a	48.3	3,800	5,000	1,400
HFC-152a	1.5	140	460	42
HFC-227ea	36.5	2,900	4,300	950
HFC-236fa	209	6,300	5,100	4,700
HFC-4310mee	17.1	1,300	3,000	400
CF_4	50,000	6,500	4,400	10,000
C_2F_6	10,000	9,200	6,200	14,000
C_4F_{10}	2,600	7,000	4,800	10,100
C_6F_{14}	3,200	7,400	5,000	10,700
SF_6	3,200	23,900	16,300	34,900

Source: U.S. EPA 2002.
[a] GWPs used here are calculated over 100 year time horizon.
[b] The methane GWP includes the direct effects and those indirect effects due to the production of tropospheric ozone and stratospheric water vapor. The indirect effect due to the production of CO_2 is not included.

Of the gases listed in Table 1, carbon dioxide, methane, and nitrous oxide are produced by both natural and anthropogenic (human) sources. The remaining gases (hydrofluorocarbons [HFCs; such as HFC-23], perfluorocarbons [PFCs; such as CF_4], and sulfur hexafluoride [SF_6]) are the result of human processes.

The potential of a gas to trap heat and warm the atmosphere is measured by its "global warming potential" or GWP. Specifically, GWP is defined as the cumulative radiative forcing—both direct and indirect effects—integrated over a period of time from the emission of a unit mass of gas relative to some reference gas (U.S. EPA 2002).

GHGs breakdown or are absorbed over time. Thus the potential of a gas to contribute to global warming is limited by the time it is in the atmosphere, its "atmospheric lifetime." To account for these effects, GWPs are calculated over a specific period of time, such as 20, 100, or 500 years. The parties to the United Nations (UN) Framework Convention on Climate Change (UNFCCC) agreed to use consistent GWPs based upon a 100-year time horizon

(U.S. EPA 2002). Because of its relative abundance in the atmosphere and its relatively long atmospheric lifetime, carbon dioxide (CO_2) has been designated the reference gas for comparing GWPs. Thus the 100-year GWP of CO_2 is equal to 1 (see Table 1).

The importance of these gases to climate change is expressed in terms of the amount (concentration) in the atmosphere and the gas' GWP. For comparison, emissions of all GHGs are often expressed in terms of teragrams of carbon dioxide equivalent (Tg CO_2 Eq.). The relationship between gigagrams (Gg) of a gas and Tg CO_2 Eq. is determined by the following (U.S. EPA 2002):

$$Tg\ CO_2\ Eq. = (Gg\ of\ gas)\ x\ (GWP)\ x\left(\frac{Tg}{1{,}000\ Gg}\right)$$

where:

Tg CO_2 Eq.	=	teragrams of carbon dioxide equivalents
Gg	=	gigagrams (equivalent to a thousand metric tons)
GWP	=	global warming potential
Tg	=	teragrams

In addition to those shown in Table 1, there are other GHGs typically not considered when evaluating the effects on global climate change. These are short-lived gases such as carbon monoxide, water vapor, tropospheric ozone, tropospheric aerosols (e.g. sulfur dioxide products and black carbon), and other ambient air pollutants such, as NO_X and non-methane volatile organic compounds (NMVOCs). Because they are short-lived, concentrations of these gases tend to vary spatially and it is difficult to determine their global radiative forcing impacts. Therefore, GWPs are typically not attributed to these short-lived, spatially inhomogeneous atmospheric gases (U.S. EPA 2002).

Descriptions of the main GHGs follow.

2.1 Non-Fluorinated Gases

These GHGs are created and emitted through both natural and human-associated activities.

2.1.1 Carbon Dioxide (CO_2)

Carbon dioxide is the most prevalent GHG. It is both emitted and absorbed through the "carbon cycle" whereby living organisms both utilize and expel CO_2. CO_2 is also emitted through the combustion of carbon based fuels, wildfires, and other processes. Deforestation contributes to increased atmospheric concentrations of CO_2 by removing CO_2 "sinks." In addition, certain specialized industrial production processes and product uses such as

mineral production, metal production and the use of petroleum-based products can also lead to CO_2 emissions (U.S. EPA 2007b).

Processes that absorb CO_2 are known as "sinks," while processes that emit CO_2 are "sources." The primary "non-natural" source of CO_2 emissions is combustion of carbon-based fuels. The primary natural sources of CO_2 emissions are (U.S. EPA 2007b):

- Plant respiration, by which plants convert oxygen and nutrients into CO_2 and energy;
- Ocean–atmosphere exchange, in which the oceans absorb and release CO_2 at the sea surface; and
- Volcanic eruptions, which release carbon from rocks deep in the Earth's crust (this source is very small).

Humans and animals also produce CO_2 that is expelled during respiration (breathing). Natural sinks of CO_2 include:

- carbon dioxide used in plants during photosynthesis; and
- the exchange of CO_2 between the atmosphere and the oceans.

When in balance, natural sources and sinks keep CO_2 concentrations in the atmosphere relatively steady. However, since the Industrial Revolution, human activities have increased CO_2 concentrations in the atmosphere by about 35 percent relative to pre-Industrial Revolution levels, primarily related to carbon-based fuel combustion (U.S. EPA 2007b).

In addition to methods for directly reducing CO_2 emissions to the atmosphere (e.g., burning less fuel), a number of programs are being developed that are designed to remove CO_2 from the atmosphere. These human-influenced or -created carbon sinks include (U.S. EPA 2007b):

- *Geologic sequestration.* Rather than releasing CO_2 emissions to the atmosphere, CO_2 emissions from industrial or energy-related sources are separated and captured, transported to a storage location, and then injected deep underground for long-term isolation (storage) from the atmosphere.
- *Carbon sequestration.* In this process agricultural and forestry practices are used to remove CO_2 from the atmosphere. Plants on agricultural and forestry lands act as sinks that absorb CO_2 through natural photosynthesis. However, agricultural and forestry practices can also release CO_2 and other GHGs to the atmosphere. Sequestration activities can help prevent global climate change by enhancing carbon storage in trees and soils, preserving existing tree and soil carbon, and by reducing emissions of CO_2,

methane (CH_4) and nitrous oxide (N_2O). This sequestration generally only lasts as long as the plants are alive, after which their carbon may be released during decay.

2.1.2 Methane (CH_4)

Human-related sources of methane include fossil fuel production, animal husbandry (enteric [intestinal] fermentation in livestock and manure management) and other agricultural activities, rice cultivation, biomass burning, waste management (landfills), natural gas and petroleum systems, coal mining, stationary and mobile combustion, wastewater treatment, and certain industrial processes. It is estimated that 60 present of global methane emissions to the atmosphere are related to these human-related activities. Natural sources of methane include wetlands (biomass decomposition), gas hydrates, permafrost, termites, oceans, freshwater bodies, non-wetland soils, and other sources such as wildfires (U.S. EPA 2007c).

2.1.3 Nitrous Oxide (N_2O)

The primary human-related sources of N_2O are agricultural soil management (e.g., fertilizers), animal manure management, sewage treatment, mobile and stationary fuel combustion, adipic acid production (primarily used for the production of nylon), and nitric acid production. N_2O is also produced naturally from a wide variety of biological sources in soil and water, particularly microbial action in wet tropical forests (U.S. EPA 2007d).

2.2 Fluorinated Gases

The remaining gases listed in Table 1 are fluorinated gases that are solely created and emitted through human activities. These gases, also known as "High GWP Gases," are considered the most potent because they have both high GWPs and extremely long atmospheric lifetimes. The result of these long atmospheric lifetimes is the essentially irreversible accumulation of these gases in the atmosphere once they are emitted (U.S. EPA 2007e). However, current concentrations of these gases in the atmosphere are relatively low.

2.2.1 Hydrofluorocarbons (HFCs)

HFCs are man-made chemicals primarily developed as alternatives to ozone-depleting substances for industrial, commercial, and consumer products. As seen in Table 1, the global warming potentials of HFCs range from 140 (HFC-152a) to 11,700 (HFC-23), while the atmospheric lifetime for HFCs varies from just over a year (HFC-152a) to over 260 years (HFC-23). Most of the commercially used HFCs have atmospheric lifetimes less than 15 years. For example, the atmospheric lifetime of HFC-134a, which is used in automobile air conditioning and refrigeration, is 14 years (U.S. EPA 2007e).

The only significant emissions of HFCs before 1990 were of the chemical HFC-23. Between 1978 and 1995, HFC-23 concentrations increased from 3 to 10 parts per trillion (ppt) and continue to rise. Since 1990, when it was almost undetectable, global average concentrations of HFC-134a have risen significantly to almost 10 ppt (parts per trillion). The abundance of certain HFCs is expected to continue to rise in line with their increasing use, particularly as refrigerants around the world (U.S. EPA 2007e).

2.2.2 Perfluorocarbons (PFCs)

The largest known man-made sources of PFCs are primary aluminum production and semiconductor manufacturing. PFCs are also minor substitutes for ozone depleting substances. PFCs are particularly troublesome as GHGs because, in addition to their high GWPs, they also have extremely stable molecular structures and are largely immune to the chemical processes in the lower atmosphere that break down most atmospheric pollutants. It is not until they reach the upper atmosphere (approximately 37 miles above the earth) that they are broken down by high-energy ultraviolet rays from the sun. Thus they have extremely long atmospheric lifetimes (up to tens of thousands of years). Recent relative rates of increase in atmospheric concentrations for two of the most important PFCs are 1.3 percent per year for CF_4 and 3.2 percent per year for C_2F_6 (U.S. EPA 2007e).

2.2.3 Sulfur Hexafluoride (SF_6)

Sulfur hexafluoride is considered the most potent GHG because it has a 100-year GWP of 23,900 coupled with an atmospheric lifetime of 3,200 years. Because of its excellent dielectric properties, SF_6 is used for insulation and current interruption in electric power transmission and distribution equipment. It is also used in the magnesium industry to protect molten magnesium from oxidation and potentially violent burning, in semiconductor manufacturing to create circuitry patterns on silicon wafers, and as a tracer gas for leak detection. Measurements of SF_6 show that its global average concentration has increased by about 7 percent per year during the 1980s and 1990s, from less than 1 ppt in 1980 to almost 4 ppt in the late 1990s (U.S. EPA 2007e).

3.0 Human Induced Climate Change

In 1988, in response to growing concern about the problem of potential global climate change, the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) established the Intergovernmental Panel on Climate Change (IPCC). The IPCC is open to all members of the UN and WMO.

The role of the IPCC is (IPCC 2007a):

> to assess on a comprehensive, objective, open and transparent basis the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation. The IPCC does not carry out research nor does it monitor climate related data or other relevant parameters. It bases its assessment mainly on peer reviewed and published scientific/technical literature.

The IPCC recently published its findings that it is highly likely that observed increases in the globally averaged temperature since the mid-20th century are due to human-caused increases in measured GHG concentrations (IPCC 2007b).

As indicated, GHGs are necessary to life as we know it, because they keep the planet's surface warmer than it otherwise would be. For example, Figure 2 shows how the average earth temperature has varied with CO_2 concentrations in the atmosphere over the last 400,000 years. As also evident by the data shown in this figure, there is a strong correlation between CO_2 concentrations in the atmosphere and the average global temperature.

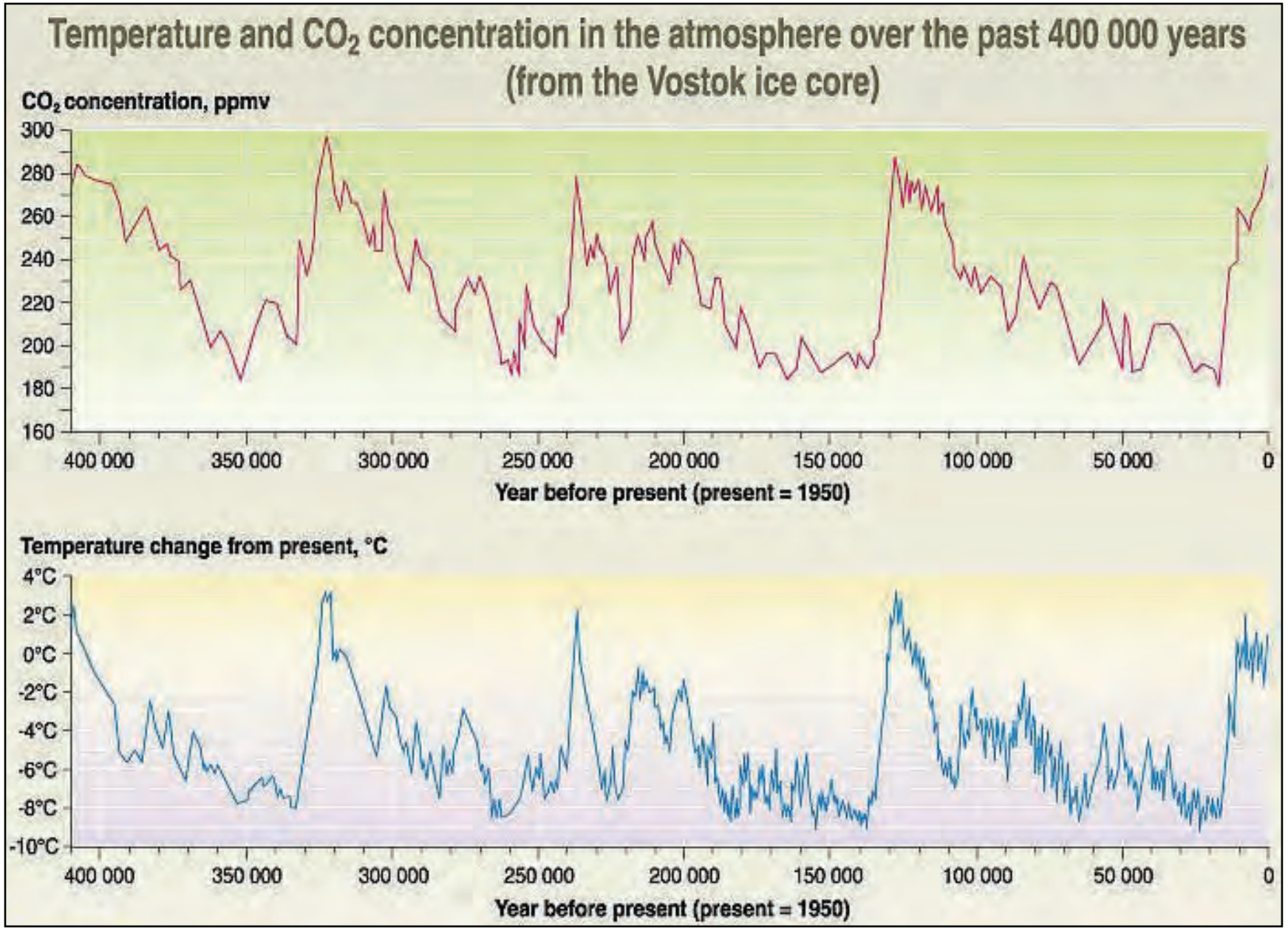
However, concentrations of GHGs are continuing to increase in the atmosphere and it has been observed that the Earth's temperature is climbing above typical past levels. According to National Oceanic and Atmospheric Administration (NOAA) and National Aeronautics and Space Administration (NASA) data, the following observations have been made (U.S. EPA 2007f; NASA 2007):

- Since 1900, the average surface temperature has warmed by about 1.2–1.4 °F.
- Since the mid 1970s, the average surface temperature has warmed about 1 °F.
- The Earth's surface is currently warming at a rate of about 0.32 °F/decade or 3.2 °F/century.
- The five warmest years over the last century have likely been (in order from hottest to coolest): 2005, 1998, 2002, 2003, 2006. The top 10 warmest years have all occurred since 1990.

In addition to temperature increase, other aspects of the global climate are also changing such as rainfall patterns, snow and ice cover, and average sea levels.

In an attempt to evaluate and predict the relationship between GHG emissions and global temperature changes, atmospheric models have been created to simulate the atmospheric temperature changes that occur from both natural and human created emissions of GHGs. Figure 3 shows the results of some such simulations.

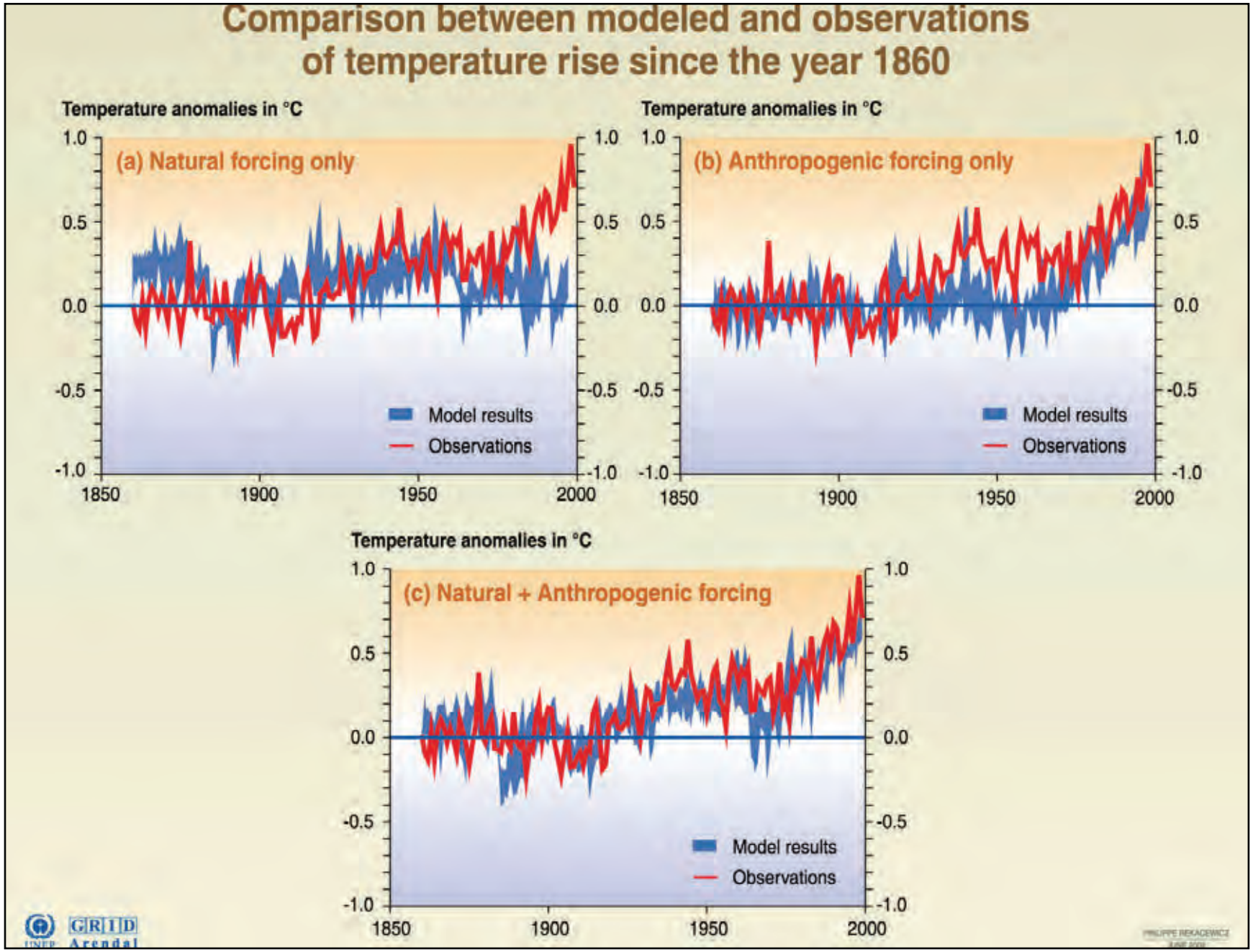
Source: UNEP/GRID–Adrenal 2000



RECON

FIGURE 2
Temperature and CO2 Concentration

Source: UNEP/GRID–Adrenal 2002b



RECON

FIGURE 3
Comparison between Modeled and Observed Temperature

In Figure 3, simulation (a) only includes natural forcings: solar radiation and volcanic activity. As seen, when only natural forcings are included, modeled temperatures do not correlate well with observations, particularly since 1950. Simulation (b) only includes human-caused forcings: GHGs and sulfate aerosols. In this simulation the recent observed rise in temperature matches the modeled temperature fairly well, but modeled temperatures do not match observations around 1950.

Simulation (c) includes both natural and human-caused forcings. As seen, the best match occurs when both natural and human forcings are included.

The relationships between GHG emissions and global climate change are very complex. Therefore, much controversy and debate continues regarding the extent to which human caused GHG emissions are influencing global climate change. Nevertheless, as a result of observations and modeling simulations such as those indicated above, the IPCC has concluded that it is highly likely that most of the warming observed in recent decades is the result of human activities (IPCC 2007b).

4.0 Future Projections of Climate Change

In order to project anticipated future climate changes resulting from human-caused emissions of GHGs, the IPCC developed a series of GHG emission scenarios for use in driving global circulation models for developing climate change scenarios. The emission scenarios were originally released by the IPCC in 1992 and are referred to as the "IS92" scenarios. Subsequent re-evaluation of the scenarios in response to new understanding of possible future GHG emissions and their relationship to climate change led to the development and release of new emission scenarios in 2000. The emission scenarios are based on a number of very complex factors and include not only emission baselines, but also (IPCC 2000):

- Include the latest information on economic restructuring throughout the world;
- Examine different rates and trends in technological change; and
- Expand the range of different economic-development pathways, including narrowing of the income gap between developed and developing countries.

Thus the emissions scenarios cover a wide range of the main driving forces of future emissions, including demographic, technological, and economical factors. As required by IPCC assumptions, none of the scenarios include future policies aimed specifically at climate change. It is intended that the emissions scenarios developed encompass the range of possible emissions of all relevant GHGs, sulfur, and their driving forces (IPCC 2000). The development of the emission scenarios is documented in the IPCC Special Report on Emissions Scenarios (SRES; IPCC 2000). Emissions were developed using four qualitative

"storylines" that yielded four sets of scenarios called "families": A1, A2, B1, and B2. The process resulted in a total of 40 SRES emission scenarios. The 40 emission scenarios were grouped into six scenario groups. All emission scenarios are considered equally valid with no assigned probability of occurrence (IPCC 2000). Figure 4 presents a schematic and narrative of the main characteristics of the SRES emission scenarios.

The emission scenario groups are used to estimate the future CO_2 and other GHG concentrations in the atmosphere. Figure 5 shows the past and projected CO_2 concentrations from the years 1000 to 2100. As seen in this figure, all scenarios project a marked increase in CO_2 concentrations by 2100 relative to past conditions. Figure 6 shows the projected variations in the earth's temperature, relative to the 1990 temperature, that correspond to the emission scenario groups. The results shown in this figure indicate that under best-case emissions, the earth's average temperature is projected to increase by approximately another 2.5 °F by the year 2100. Under worst-case emissions, the earth's average temperature is projected to increase by as much as 10 °F.

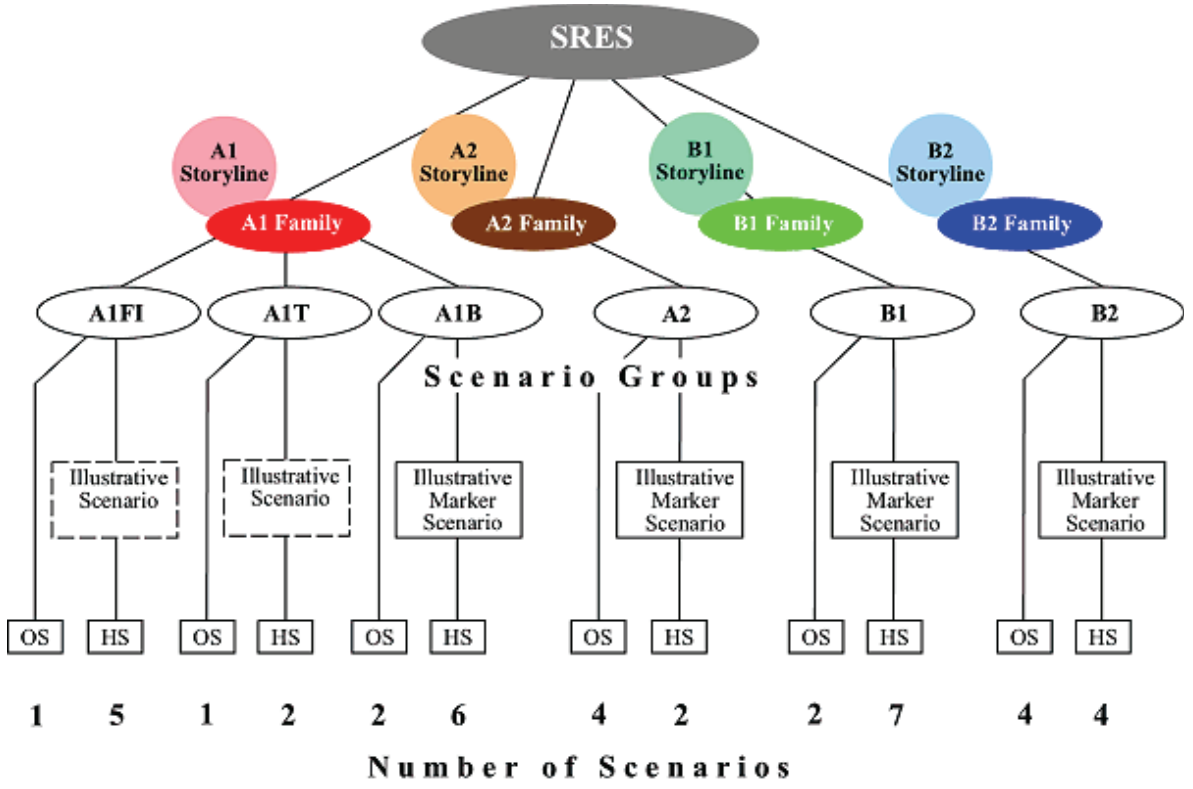
5.0 Implications of Climate Change

The increase in the earth's temperature is expected to have wide ranging effects on the environment. Although global climate change is anticipated to affect all areas of the globe, there are numerous implications of direct importance to California. Statewide average temperatures are anticipated to increase by between 3 and 10.5 °F by 2100. Some climate models indicate that this warming may be greater in the summer than in the winter. This could result in widespread adverse impacts to ecosystem health, agricultural production, water use and supply, and energy demand. A report prepared by the California Climate Change Center focuses on these potential impacts, which are summarized below (State of California 2006a).

- **Precipitation and Water Resources.** Projections indicate that total annual precipitation and rainfall statewide patterns are anticipated to change little over the next century. The predominantly Mediterranean precipitation pattern of most precipitation occurring in the winter months is expected to continue. It is also possible that the intensity and frequency of extreme storm events could increase, thus affecting the balance between water storage and the need for flood control.

  Although most of the precipitation falls during the winter months, water demand is greatest during the summer months. Much of California is reliant on the winter Sierra Nevada snowpack. If temperatures continue to rise as expected, more precipitation will fall as rain instead of snow. Further, that snow which does fall will melt earlier reducing the spring snowpack by as much as 70 to 90 percent. This has potentially major implications for water supply, agriculture, and hydropower generation. This also would adversely impact the economies of communities reliant on winter recreational activities.

Source: IPCC 2000



Schematic illustration of SRES scenarios. Four qualitative storylines yield four sets of scenarios called "families": A1, A2, B1, and B2. Altogether 40 SRES scenarios have been developed by six modeling teams. All are equally valid with no assigned probabilities of occurrence. The set of scenarios consists of six scenario groups drawn from the four families: one group each in A2, B1, B2, and three groups within the A1 family, characterizing alternative developments of energy technologies: A1FI (fossil fuel intensive), A1B (balanced), and A1T (predominantly non-fossil fuel). Within each family and group of scenarios, some share "harmonized" assumptions on global population, gross world product, and final energy. These are marked as "HS" for harmonized scenarios. "OS" denotes scenarios that explore uncertainties in driving forces beyond those of the harmonized scenarios. The number of scenarios developed within each category is shown. For each of the six scenario groups an illustrative scenario (which is always harmonized) is provided. Four illustrative marker scenarios, one for each scenario family, were used in draft form in the 1998 SRES open process and are included in revised form in this report. Two additional illustrative scenarios for the groups A1FI and A1T are also provided and complete a set of six that illustrate all scenario groups. All are equally sound.

By 2100 the world will have changed in ways that are difficult to imagine - as difficult as it would have been at the end of the 19th century to imagine the changes of the 100 years since. Each storyline assumes a distinctly different direction for future developments, such that the four storylines differ in increasingly irreversible ways. Together they describe divergent futures that encompass a significant portion of the underlying uncertainties in the main driving forces. They cover a wide range of key "future" characteristics such as demographic change, economic development, and technological change. For this reason, their plausibility or feasibility should not be considered solely on the basis of an extrapolation of current economic, technological, and social trends.

The A1 storyline and scenario family describes a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and the rapid introduction of new and more efficient technologies. Major underlying themes are convergence among regions, capacity building, and increased cultural and social interactions, with a substantial reduction in regional differences in per capita income. The A1 scenario family develops into three groups that describe alternative directions of technological change in the energy system. The three A1 groups are distinguished by their technological emphasis: fossil intensive (A1FI), non-fossil energy sources (A1T), or a balance across all sources (A1B)[3] .

The A2 storyline and scenario family describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities. Fertility patterns across regions converge very slowly, which results in continuously increasing global population. Economic development is primarily regionally oriented and per capita economic growth and technological change are more fragmented and slower than in other storylines.

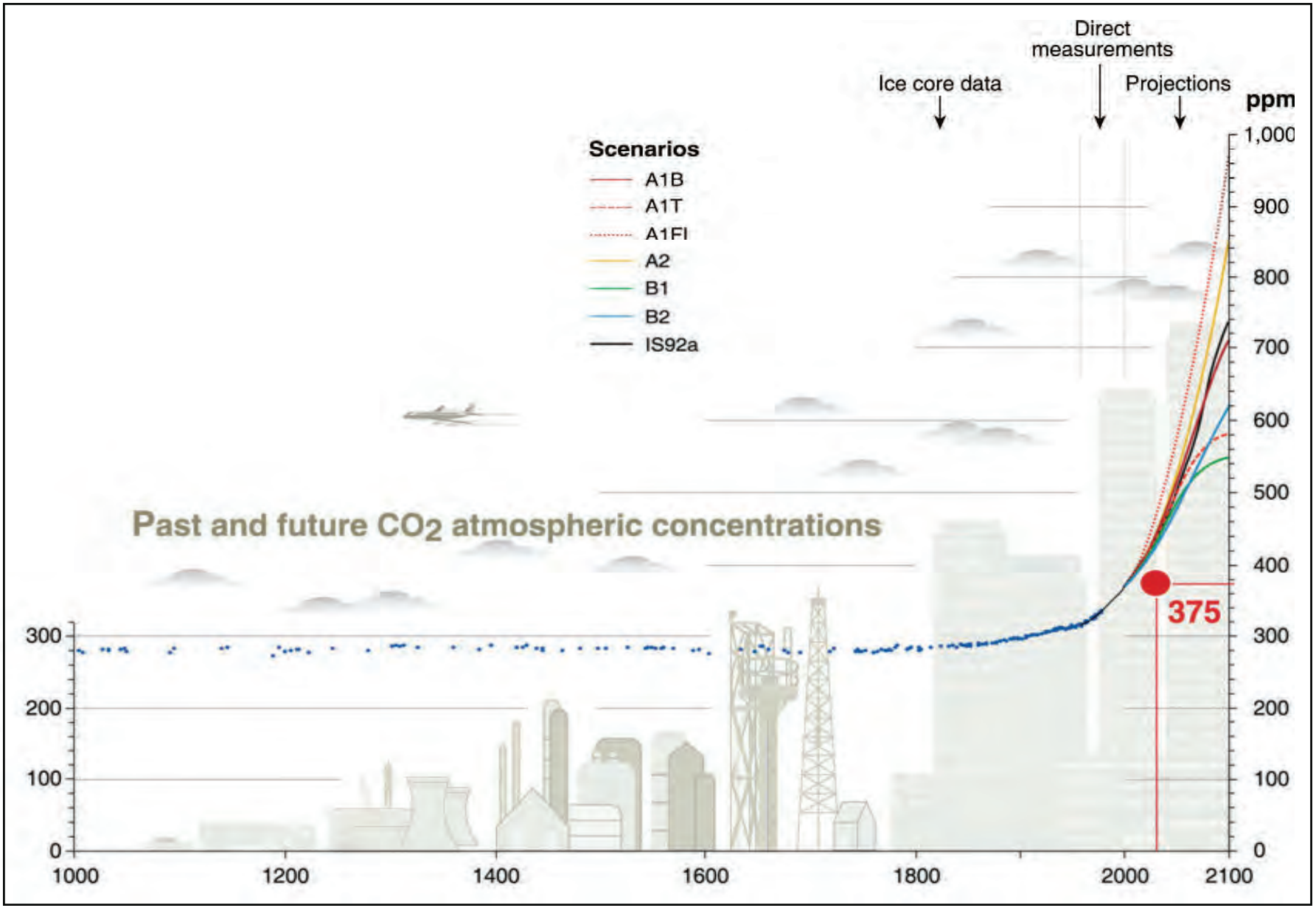
The B1 storyline and scenario family describes a convergent world with the same global population that peaks in mid-century and declines thereafter, as in the A1 storyline, but with rapid changes in economic structures toward a service and information economy, with reductions in material intensity, and the introduction of clean and resource-efficient technologies. The emphasis is on global solutions to economic, social, and environmental sustainability, including improved equity, but without additional climate initiatives.

The B2 storyline and scenario family describes a world in which the emphasis is on local solutions to economic, social, and environmental sustainability. It is a world with continuously increasing global population at a rate lower than A2, intermediate levels of economic development, and less rapid and more diverse technological change than in the B1 and A1 storylines. While the scenario is also oriented toward environmental protection and social equity, it focuses on local and regional levels.

RECON

FIGURE 4
The Main Characteristics of the Four
SRES Storylines and Scenario Families

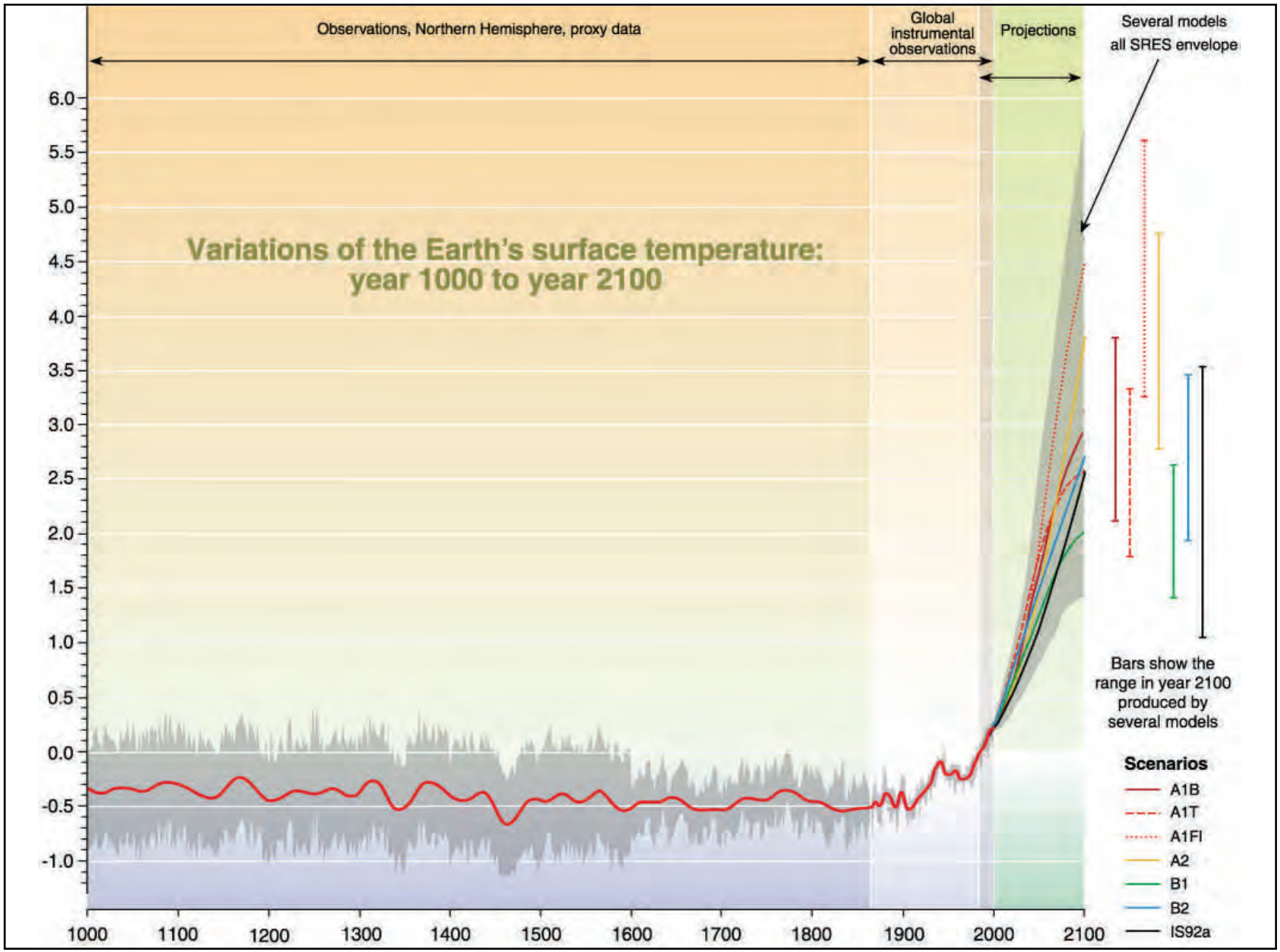
Source: UNEP/GRID–Adrenal 2005a



RECON

FIGURE 5
CO_2 Scenarios

Source: UNEP/GRID–Adrenal 2005b



RECON

FIGURE 6
Surface Temperature Scenarios

Water supplies could also be adversely affected by saltwater intrusion associated with anticipated sea level rises (see below).

- **Public Health.** Although the change in statewide average temperature may not appear to be large, the incidence of extreme temperature events, particularly high temperatures, is anticipated to increase. It is these extreme conditions that pose the greatest health risk. Higher temperatures are expected to increase the frequency, duration, and severity of conditions conducive to the formation of air pollutants, particularly ozone. Furthermore, increased temperatures will be favorable for conditions that lead to increases in wildfires, which emit large quantities of particulate matter.

  By 2100, models indicate that under the worst-case emission trends there could be up to 100 more days with temperatures over 90 °F in Los Angeles and over 95 °F in Sacramento. Such temperature extremes, particularly in densely populated urban centers, could cause a marked increase in heat-related death, particularly due to dehydration, heat stroke/exhaustion, heart attack, stroke, and respiratory diseases. Increased demand for air conditioning would put additional stresses on the state's energy supplies. Increased temperatures could also lead to increases in disease vectors such as mosquitoes.

- **Agriculture.** California agriculture is the largest and most diverse industry in the nation producing more than half of the country's fruits and vegetables. The anticipated climate changes will have widespread affects on the quantity and quality of agricultural products produced in the state. Many fruit and nut trees are particularly sensitive to changes in temperature. High temperatures can stress dairy cows reducing milk production. Rising temperatures will affect the State's ecosystems and will likely shift or increase the range of noxious and invasive weeds. Further, increased temperatures would be beneficial to certain pests and pathogens that otherwise do not survive the winter months, thus leading to an increase in areas subject to infestation as well as increasing the frequency and severity of damaging outbreaks.

- **Forests and Landscapes.** Global climate change is expected to increase the frequency and severity of wildfires, and to alter the distribution and character of natural vegetation. Alpine and sub-alpine ecosystems are the most threatened in the state and are expected to decline by as much as 60 to 80 percent by the end of the century as temperatures continue to increase. Conifer forests may decline by as much as 18 percent by the end of the century, with corresponding economic impacts resulting from decreased forest production and recreation. Overall, much of California's native ecosystems may transition to plants and animals more suited to warmer conditions.

- **Sea Level Rise.** California has more than 1,100 miles of coastline along the Pacific Ocean. These coastlines are also home to unique ecosystems that are considered some of the world's most threatened. These regions will be increasingly threatened by rising sea levels, more intense coastal storms, and warmer water temperatures. Sea

levels have risen about seven inches in the last century. Projections indicate that with increased global temperatures sea levels could rise between 22 and 35 inches by the end of the century. Sea level increases of this magnitude would inundate coastal areas with salt water, accelerate coastal erosion, threaten vital levees and inland water systems, and disrupt wetlands and vital habitats.

Increased sea levels combined with storm surges from severe storms could cause widespread damage along the coast, including levee breaches in low-lying areas such as the San Francisco Bay Delta. Rising sea levels will also reduce beach areas. Increased storms could also accelerate beach erosion leading to significant monetary expenditures on beach replenishment projects in an attempt to maintain the beaches.

It is also important to note that even if GHG emissions were to be eliminated or dramatically reduced, it is projected that the effect of those emissions would continue to affect global climate for centuries. Figure 7 schematically illustrates this persistence effect.

All of the effects outlined above could dramatically impact the economy of the State through increased costs associated with water management strategies, public health costs, agricultural losses or increased pest management costs, and damage resulting from severe storms, wildfires, and sea level rises. Such effects are not limited to the state and similar or related effects are anticipated for other parts of the country and around the earth. These effects are anticipated to impact both national and worldwide population distributions and economies as populations attempt to shift from areas that become uninhabitable or infertile, or in response to disease outbreaks and shortages. Overall, continued global climate change will likely affect every person on the planet in some way.

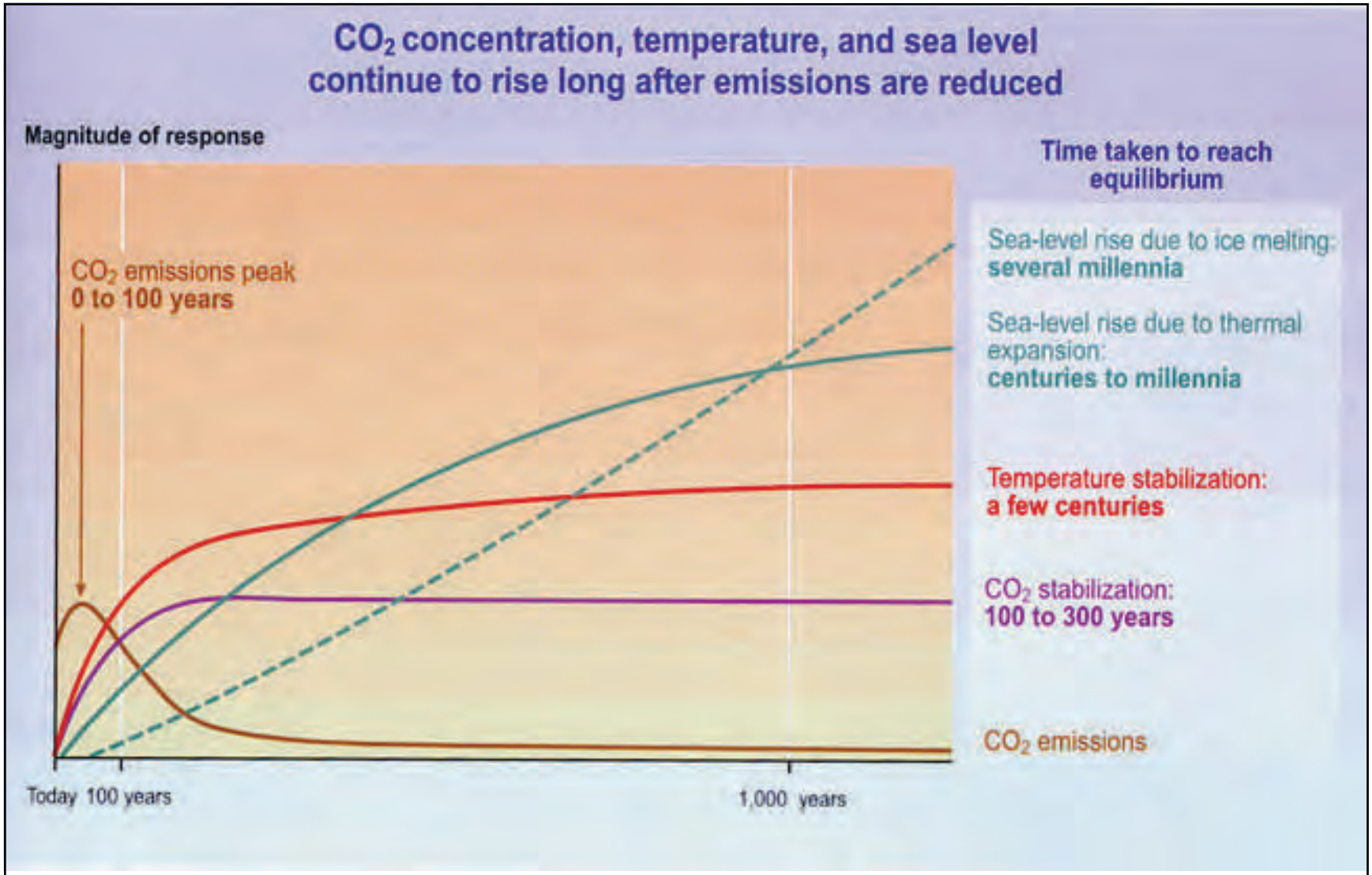
6.0 Global, National, and State GHG Emissions

Estimates of global emissions of GHGs are provided by the UNFCCC for nations that are and are not included in Annex I to the Convention (Annex I and Non-Annex I Parties; see discussion in Section 3.1 below). Given the complexity of estimating global emissions, emission estimates are not available for all countries for all years. Table 2 shows the total equivalent CO_2 emissions for all parties included in Annex I to the Convention (Annex I Parties, made up of 41 nations) for the years 1990, 1995, and 2000 through 2004 (UNFCCC 2006).

TABLE 2
TOTAL AGGREGATE ANTHROPOGENIC EMISSIONS OF CO_2, CH_4, N_2O, HFCs, PFCs, AND SF_6 INCLUDING EMISSIONS/REMOVALS FROM LAND USE, LAND-USE CHANGE, AND REFORESTRY (Tg CO_2 Equivalent)

1990	1995	2000	2001	2002	2003	2004
16,516	15,500	15,709	15,538	15,267	15,291	16,077

Source: IPCC 2001



After CO_2 emissions are reduced and atmospheric concentrations stabilize, surface air temperature continues to rise by a few tenths of a degree per century for a century or more. Thermal expansion of the ocean continues long after CO_2 emissions have been reduced, and melting of ice sheets continues to contribute to sea-level rise for many centuries. This figure is a generic illustration for stabilization at any level between 450 and 1,000 ppm, and therefore has no units on the response axis. Responses to stabilization trajectories in this range show broadly similar time courses, but the impacts become progressively larger at higher concentrations of CO_2.

RECON

FIGURE 7
Persistence Effect

Land-use change and forestry often act as sinks, thus reducing a nation's total GHG emissions. Because nations that are not included in Annex I to the Convention (Non-Annex I Parties comprised of 122 nations) are largely developing countries, emissions data for these countries are more sporadic and incomplete. The most recent emissions data from non-Annex I Parties indicate that total emissions from these nations were approximately 11,931 Tg CO_2 equivalent, including land use-change and forestry (UNFCCC 2005). As such, using the most recent data available for Annex I and Non-Annex I Parties, 2004 global emissions of GHGs were approximately 28,008 Tg CO_2 equivalent, including land-use change and forestry.

Each year, the U.S. EPA prepares an inventory of GHG emissions and sinks report. The report provides information on GHG emissions and sink sources and is used to develop policies and track progress. Inventories are submitted to the UN. The most recent final report, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2007*, was completed in April 2009 (U.S. EPA 2009). The 2010 update is currently undergoing public review. The U.S. EPA also provides guidance for states to develop GHG inventories. The *Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004* completed in December 2006, including subsequent revisions to the in-state electricity production estimates, is the most recent report for California (State of California 2006b, 2007). Tables 3 and 4 summarize the national GHG emissions in 1990, 1995, 2000, and 2005 through 2007, and State GHG emissions from 1990 through 2004, respectively.

TABLE 3
NET NATIONAL GHG EMISSIONS
(Tg CO_2 Equivalent)

Year	CO_2	CH_4	N_2O	HFCs, PFCs, and SF_6[1]	Total[2]	National Population[3]	Total (Mg CO_2 Eq) per Capita
1990	4,235.3	616.6	315.0	90.5	5,257.3	249,464,396	21.1
1995	4,556.9	615.8	334.1	105.5	5,612.3	262,803,276	21.4
2000	5,237.7	591.1	329.2	132.8	6,290.7	282,194,308	22.3
2005	4,968.1	561.7	315.9	140.2	5,985.9	295,895,897	20.2
2006	4,964.4	582.0	312.1	142.1	6,000.6	298,754,819	20.1
2007	5,040.8	585.3	311.9	149.5	6,087.5	301,621,157	20.2

SOURCE: U.S. EPA 2009
[1]Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride
[2]Totals may vary from the sum of the sources due to independent rounding
[3]U.S. Census Bureau 2009
Tg = terragrams = one million metric tons; Mg = megagrams = one metric ton

TABLE 4
NET CALIFORNIA GHG EMISSIONS
(Tg CO_2 Equivalent)

Year	CO_2	CH_4	N_2O	HFCs, PFCs, and SF_6[1]	Total[2]	California Population[3]	Total (Mg CO_2 Eq) per Capita
1990	301.6	26.0	32.7	7.1	367.4	29,950,111	12.3
1991	293.4	24.9	30.4	7.4	356.1	30,414,114	11.7
1992	299.9	23.8	30.5	7.9	362.2	30,875,920	11.7
1993	295.3	25.4	31.5	8.4	360.5	31,147,208	11.6
1994	313.9	25.4	30.0	8.9	378.2	31,317,179	12.1
1995	297.7	26.2	31.9	9.3	365.1	31,493,525	11.6
1996	302.3	25.5	30.8	11.4	370.0	31,780,829	11.6
1997	312.3	24.2	28.8	12.6	378.0	32,217,708	11.7
1998	330.3	25.3	29.2	8.9	393.7	32,682,794	12.0
1999	333.3	26.3	29.4	9.9	398.9	33,145,121	12.0
2000	352.6	26.4	31.4	10.5	420.9	34,004,051	12.4
2001	357.8	26.7	30.8	11.2	426.5	34,525,902	12.4
2002	351.0	27.1	34.5	12.0	424.6	34,963,856	12.1
2003	328.4	27.5	33.9	12.9	402.7	35,376,833	11.4
2004	342.9	27.9	33.3	14.2	418.3	35,721,991	11.7

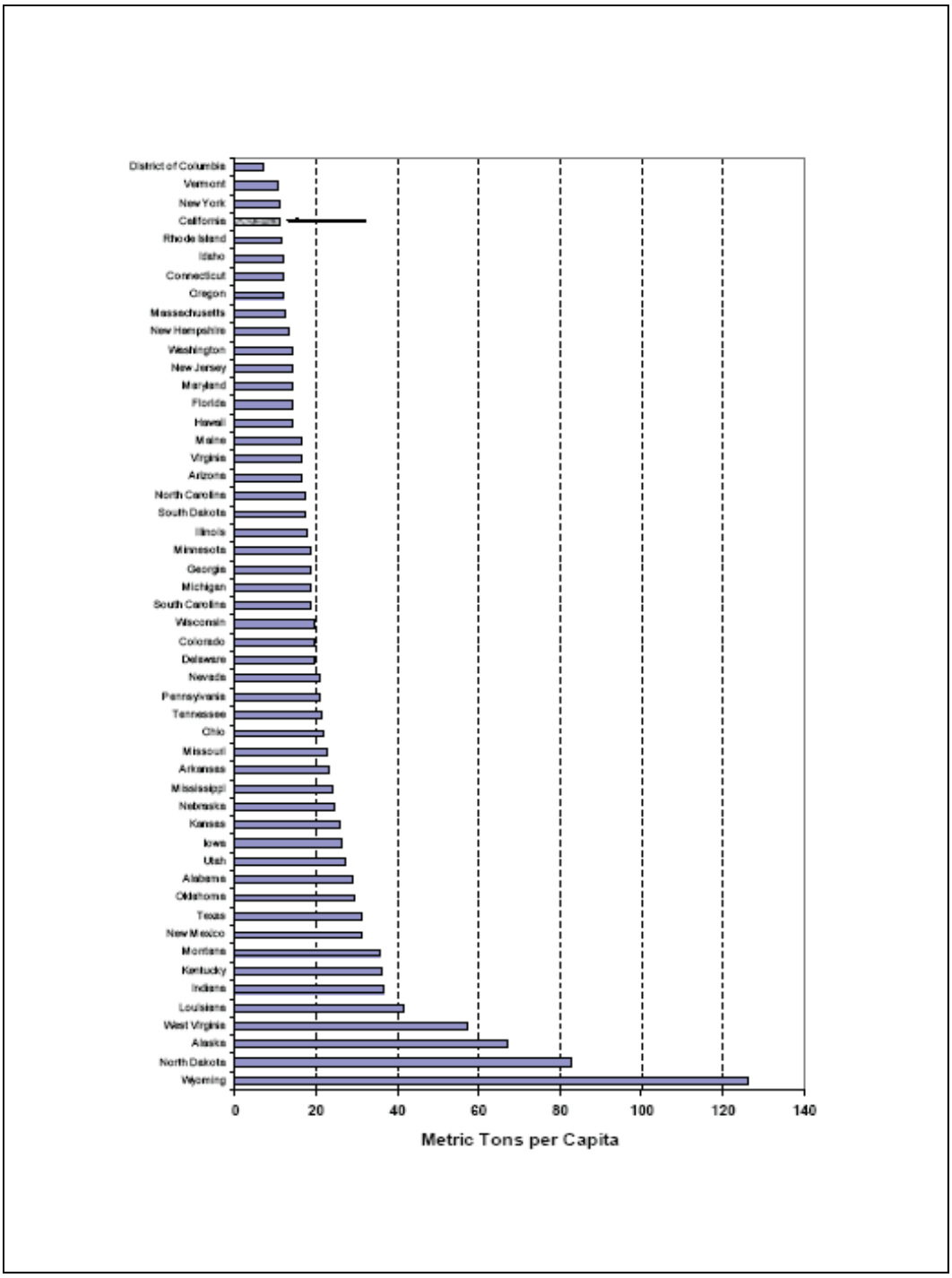
SOURCE: State of California 2007
[1]Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride
[2]Totals may vary from the sum of the sources due to independent rounding
[3]US Census Bureau 2009
Tg = terragrams = one million metric tons; Mg = megagrams = one metric ton

Net GHG emissions are gross emissions minus GHG sinks. As seen in Tables 3 and 4, in 2000, California emitted approximately 421 million metric tons of GHGs compared to approximately 6,291 million metric tons of GHG emissions for the nation as a whole, or about 6.7 percent of the nation's emissions. Tables 3 and 4 also illustrate that although California emits a substantial portion of the nation's GHGs, California's per capita emissions are roughly half the national average. In fact, as illustrated in Figure 8, California has the fourth lowest emission per capita of CO_2 in the nation. According to the data presented in Tables 3 and 4, per capita emissions over the 15-year period illustrated have remained relatively flat. This would imply that the increase in total GHG emissions over time is primarily a result of the increasing population of the state and country, and not due to increased per capita emissions.

Figure 8 compares total GHG emissions from California and the United States to other major emitting countries in the world.

As seen in Figure 9, in 2002 the United States was the largest emitter of GHGs in the world, with China ranking second and California ranking as the 16th largest emitter of GHGs globally. Recent data indicate that China may have surpassed the United States as the greatest emitter of GHGs globally (Environmental News Network 2007), although on a per

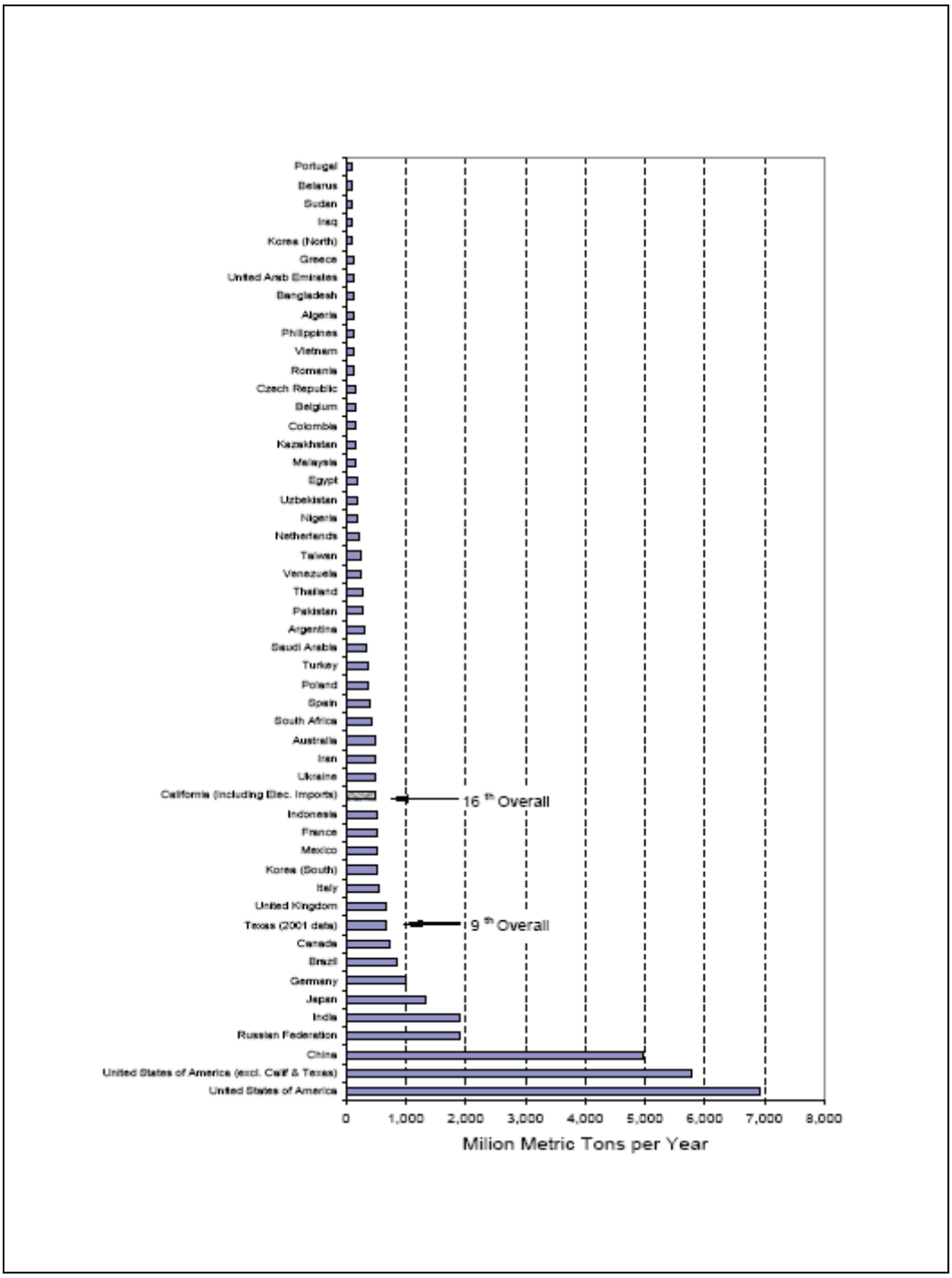
Source: State of California 2006b



RECON

FIGURE 8
CO_2 Emissions from
Fossil Fuels per Capita (2001)

Source: State of California 2006b



RECON

FIGURE 9
Global Greenhouse Gas
Emission Comparison (2002 data)

capita basis China remains well below the United States and California with a per capital CO_2 emission rate around 3 metric tons per year in 2001 (State of California 2006b).

It is important to note that given the global nature of global climate change, it is the total emissions of GHGs to the atmosphere that is important, not necessarily the per capita or total emissions from any single country. However, per capita emissions provide a relative benchmark by which to evaluate emissions.

7.0 References Cited

California, State of

2006a *Our Changing Climate – Assessing the Risks to California.* California Energy Commission, California Climate Change Center. CEC-500-2006-077. July.

2006b *Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004.* CEC-600-2006-013-SF. Fuels and Transportation Division, California Energy Commission. December. Obtained from the State of California website at http://www.climatechange.ca.gov/inventory/index.html on July 23, 2009.

2007 Memorandum: Revisions to the 1990 to 2004 Greenhouse Gas Emissions Inventory Report, Published in December 2006 (CEC 600-2006-013). Fuels and Transportation Division, California Energy Commission. December. Obtained from the State of California website at http://www.climatechange.ca.gov/inventory/index.html on July 23, 2009.

Environmental News Network (ENN)

2007 *China Overtakes U.S. as Top CO2 Emitter.* June 21 by Reuters. Obtained from the ENN website at http://www.enn.com/globe.html?id=1700 on July 31, 2007.

Intergovernmental Panel on Climate Change (IPCC)

2000 *Emissions Scenarios, Summary for Policymakers.* A special report of the IPCC Working Group III.

2001 *Climate Change 2001: Synthesis Report. A Contribution of Working Groups I, II, and III to the Third Assessment Report of the Intergovernmental Panel on Climate Change* [Watson, R.T. and the Core Writing Team (eds.)]. Cambridge University Press, Cambridge, United Kingdom, and New York, NY, USA, 398 pp. Obtained from the IPCC Website at http://www.grida.no/climate/ipcc_tar/vol4/english/042.htm#figspm52 on May 21, 2007.

2007a *About IPCC.* Obtained from the IPCC website at http://www.ipcc.ch/about/about.htm on July 31, 2007.

2007b *Climate Change 2007: The Physical Science Basis, Summary for Policymakers.* February.

National Aeronautics and Space Administration (NASA)

2007 *2006 Was Earth's Fifth Warmest Year.* Accessed from the NASA Goddard Space Flight Center Website at http://www.nasa.gov/centers/goddard/news/topstory/2006/2006_warm.html on May 21, 2007. February 8.

United Nations Environment Programme (UNEP)/GRID-Arendal

2000 *Temperature and CO2 concentration in the atmosphere over the past 400 000 years.* UNEP/GRID-Arendal Maps and Graphics Library, http://maps.grida.no/go/graphic/temperature_and_co2_concentration_in_the_atmosphere_over_the_past_400_000_years (Accessed 16 May 2007)

2002a *Greenhouse effect.* UNEP/GRID-Arendal Maps and Graphics Library, http://maps.grida.no/go/graphic/greenhouse_effect (Accessed 18 May 2007)

2002b *Comparison between modeled temperature rise and observations of temperature since 1860.* UNEP/GRID-Arendal Maps and Graphics Library, http://maps.grida.no/go/graphic/comparison_between_modeled_temperature_rise_and_observations_of_temperature_since_1860 (Accessed 16 May 2007)

2005a *Past and future CO2 concentrations.* UNEP/GRID-Arendal Maps and Graphics Library, http://maps.grida.no/go/graphic/past_and_future_co2_concentrations (Accessed 18 May 2007)

2005b *Temperature trends and projections.* UNEP/GRID-Arendal Maps and Graphics Library, http://maps.grida.no/go/graphic/temperature_trends_and_projections1 (Accessed 21 May 2007)

The United Nations Framework Convention on Climate Change (UNFCCC)

2005 *Sixth Compilation and Synthesis of Initial National Communications from Parties not Included in Annex I to the Convention.* FCCC/SBI/2005/18/Add.2. October 25.

2006 *National Greenhouse Gas Inventory Data for the Period 1990-2004 and Status of Reporting.* FCCC/SBI/2006/26. October 19.

United States Environmental Protection Agency (U.S. EPA)

2002 *Greenhouse Gases and Global Warming Potential Values – Excerpt from the Inventory of U.S. Greenhouse Emissions and Sinks: 1990-2000.* U.S. Greenhouse Gas Inventory Program, Office of Atmospheric Programs. April.

2007a *Greenhouse Effect.* Obtained from the EPA Climate Change website at http://www.epa.gov/climatechange/kids/greenhouse.html on May 9, 2007.

2007b *Carbon Dioxide.* Obtained from the EPA Climate Change website at http://epa.gov/climatechange/emissions/co2.html on May 18, 2007.

2007c *Methane – Sources and Emissions.* Obtained from the EPA Climate Change website at http://www.epa.gov/methane/sources.html on May 15, 2007.

2007d *Nitrous Oxide – Sources and Emissions.* Obtained from the EPA Climate Change website at http://www.epa.gov/nitrousoxide/sources.html on May 15, 2007.

2007e *High GWP Gases and Climate Change.* Obtained from the EPA Climate Change website at http://www.epa.gov/highgwp/scientific.html on May 18, 2007.

2007f *Temperature Changes.* Obtained from the EPA Climate Change website at http://www.epa.gov/climatechange/science/recenttc.html on May 18, 2007.

2009 Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2007. April 15.

ATTACHMENT 2

Chula Vista Green Building Standards and Increased Energy Efficiency Standards Ordinances

Chula Vista Green Building Standards

Per Chula Vista Municipal Code Chapter 15.12, Green Building Standards, the following green building measures shall apply to all new residential construction, remodels, additions, and alterations, and to all new nonresidential construction, remodels, additions, and tenant improvements.

Definitions

"Building Official" means the officer or other designated authority charged with the administration and enforcement of this chapter, or duly authorized representative.

"Composite wood products" include hardwood plywood, particleboard, and medium density fiberboard. Composite wood products does not include hardboard, structural plywood, structural panels, structural composite lumber, oriented strand board, glued laminated timber as specified in "Structural Glued Laminated Timber" (ANSI A190.1-2002) or prefabricated wood I-joists.

"Energy Code" means the California Energy Code, as adopted and amended by the City in Chapter 15.26 of the Municipal Code.

"Green Building" means a holistic approach to design, construction, and demolition that minimizes the building's impact on the environment, the occupants, and the community.

"Infiltration" means an uncontrolled inward air leakage from outside a building or unconditioned space, including leakage through cracks and interstices, around windows and doors and through any other exterior or demising partition or pipe or duct penetration.

"MERV" means filter minimum efficiency reporting value, based on ASHRAE 52.2-1999.

"Moisture content" means the weight of the water in wood expressed in percentage of the weight of the oven-dry wood.

"Outdoor Air" (Outside air) means air taken from outdoors and not previously circulated in the building.

"VOC" means volatile organic compound and is broadly defined as a chemical compound based on carbon chains or rings with vapor pressures greater than 0.1 millimeters of mercury at room temperature. These compounds typically contain hydrogen and may contain oxygen, nitrogen and other elements. See California Code of Regulations (CCR) Title 17, Section 94508(a).

Standards

Buildings and building sites shall be designed to include the following green building measures:

A. Storm Water Management and Discharge Control. Municipal Code Section 14.20

B. Construction Waste Reduction, Disposal and Recycling. Municipal Code Section 8.25.095

C. Energy Efficiency. Buildings shall meet the requirements of the Chula Vista Municipal Code Section15.26

D. Air Sealing.

1. Joints and openings. Openings in the building envelope separating conditioned space from unconditioned space must be sealed by a method acceptable to the building official.
2. Other openings. Whole house exhaust fans shall have insulated louvers or covers that close when the fan is off. Covers or louvers shall have a minimum insulation value of R-4.2.

E. Water Use

1. Indoor Water Use

a. 20% Savings. A schedule of plumbing fixtures and fixture fittings that will reduce the overall use of potable water within the building by 20% shall be provided. The reduction in potable water use shall be demonstrated by one of the following methods.

i. A calculation demonstrating a 20% reduction in the building "water use baseline" as established in Table 1 shall be provided, or

ii. Each plumbing fixture and fitting shall meet the 20% reduced flow rate specified in Table 2

b. Multiple showerheads serving one shower shall not exceed the maximum flow rates specified in the 20% reduction column contained in Table 2 or the shower shall be designed to only allow one showerhead to be in operation at a time.

TABLE 1
WATER USE BASELINE

Fixture Type	**Flow-rate[2]**	**Duration**	**Daily uses**	**Occupants [3,4]**
Showerheads	2.5 gpm @ 80 psi	8 min.	1	X
Showerheads Residential	2.5 gpm @ 80 psi	8 min.	1	X
Lavatory Faucets Residential	2.2 gpm @ 60 psi	0.25 min.	3	X
Kitchen Faucets	2.2 gpm @ 60 psi	4 min.	1	X
Replacement Aerators	2.2 gpm @ 60 psi			X
Wash Fountains	2.2 [rim space (in.) / 20 gpm @ 60 psi]			X
Metering Faucets	0.25 gallons/cycle	.25 min.	3	X
Metering Faucets for Wash Fountains	.25 [rim space (in.) / 20 gpm @ 60 psi]	.25 min.		X
Gravity tank type Water Closets	1.6 gallons/flush	1 flush	1 male[1] 3 female	X
Flushometer Tank Water Closets	1.6 gallons/flush	1 flush	1 male[1] 3 female	X
Flushometer Valve Water Closets	1.6 gallons/flush	1 flush	1 male[1] 3 female	X
Electromechanical Hydraulic Water Closets	1.6 gallons/flush	1 flush	1 male[1] 3 female	X
Urinals	1.0 gallons/flush	1 flush	2 male	X

Fixture "Water Use" = Flow rate x Duration x Occupants x Daily uses

[1] Except for low-rise residential occupancies, the daily use number shall be increased to three if urinals are not installed in the room.

[2] The Flow-rate is from the CEC Appliance Efficiency Standards, Title 20 California Code of Regulations; where a conflict occurs, the CEC standards shall apply.

[3] For low rise residential occupancies, the number of occupants shall be based on two persons for the first bedroom, plus one additional person for each additional bedroom.

[4] For non-residential occupancies, refer to Table A, Chapter 4, 2007 California Plumbing Code, for occupant load factors.

TABLE 2
FIXTURE FLOW RATES

Fixture Type	Flow-rate	Maximum flow rate at 20% Reduction
Showerheads	2.5 gpm @ 80 psi	2 gpm @ 80 psi
Lavatory Faucets Residential	2.2 gpm @ 60 psi	1.8 gpm @ 60 psi
Kitchen Faucets	2.2 gpm @ 60 psi	1.8 gpm @ 60 psi
Wash Fountains	2.2 [rim space (in.) / 20 gpm @ 60 psi]	1.8 [rim space (in.) / 20 gpm @ 60 psi]
Metering Faucets	0.25 gallons/cycle	0.2 gallons/cycle
Metering Faucets for Wash Fountains	0.25 [rim space (in.) / 20 gpm @ 60 psi]	0.20 [rim space (in.) / 20 gpm @ 60 psi]
Gravity tank type Water Closets	1.6 gallons/flush	1.28 gallons/flush[1]
Flushometer Tank Water Closets	1.6 gallons/flush	1.28 gallons/flush[1]
Flushometer Valve Water Closets	1.6 gallons/flush	1.28 gallons/flush[1]
Electromechanical Hydraulic Water Closets	1.6 gallons/flush	1.28 gallons/flush[1]
Urinals	1.0 gallons/flush	0.8 gallons/flush

[1] Includes water closets with an effective flush rate of 1.28 gallons or less when tested per ASME A112.19.2 and ASME A112.19.14.

F. Pollutant Control

1. Covering of duct openings and protection of mechanical equipment during construction. At the time of rough installation until final startup of the heating and cooling equipment, all duct and other related air distribution component openings shall be covered to reduce the amount of dust or debris which may collect in the system.

2. Finish material. Finish materials shall comply with the following:

a. Adhesives and sealants. Adhesives used on the project shall meet the following requirements:

i. Aerosol adhesives shall meet the requirements of California Code of Regulations, Title 17, commencing with Section 94507.

ii. Adhesives, adhesive primers, and bonding primers shall comply with Table 3

Table 3
Adhesive VOC Limit. Less Water and Less Exempt Compounds in Grams per Liter

Architectural Applications	VOC Limit
Indoor Carpet Adhesives	50
Carpet Pad Adhesives	50
Outdoor Carpet Adhesives	150
Wood Flooring Adhesive	100
Rubber Floor Adhesives	60
Subfloor Adhesives	50
Ceramic Tile Adhesives	65
VCT and Asphalt Tile Adhesives	50
Dry Wall and Panel Adhesives	50
Cove Base Adhesives	50
Multipurpose Construction Adhesives	70
Structural Glazing Adhesives	100
Single Ply Roof Membrane Adhesives	250

b. Paints and coatings. Architectural paints and coatings shall comply with Table #4

Table 4
Coating VOC Limits
Grams of VOC Per Liter of Coating, Less Water and Less Exempt Compounds

Coating Category	Limit
Bond Breakers	350
Clear Wood Finishes	275
Varnish	275
Sanding Sealers	275
Lacquer	275
Clear Brushing Lacquer	275
Concrete-Curing Compound	100
Dry-Fog Coatings	150
Fire-Proofing Exterior Coatings	350
Flats	50
Floor Coatings	50
Graphic Arts (Sign) Coatings	500
Industrial Maintenance (IM) Coatings	100
High Temperature IM Coatings	420
Zinc-Rich IM Primers	100
Japans/Faux Finish Coatings	350
Magnesite Cement Coatings	450
Mastic Coatings	300
Metallic Pigmented Coatings	500
Multi-Color Coatings	250
Nonflat Coatings	50
Pigmented Lacquer	275
Pre-Treatment Wash Primers	420
Primers, Sealers, and Undercoaters	100
Quick-Dry Enamels	50
Quick-Dry Primers, Sealers, and Undercoaters	100
Recycled Coatings	250
Roof Coatings	50
Roof Coatings, Aluminum	100
Roof Primers, Bituminous	350
Rust Preventative Coatings	100
Shellac	
Clear	730
Pigmented	550
Specialty Primers	100
Stains	100
Interior	250
Swimming Pool Coatings	
Repair	340
Other	340
Waterproofing Sealers	100
Waterproofing Concrete/Masonry Sealers	100
Wood Preservatives	
Below-Ground	350
Other	350

Verification of compliance with this section shall be provided at the request of the building official. Documentation may include, but not limited to, the following:

a. Manufacturers product specification.
b. Field verification of on-site product containers.

3. Carpet systems.
   a. All carpet installed in the building interior shall meet the testing and product requirements of one of the following:
      i. Carpet and Rug Institute's Green Label or Green Label Plus Program.
      ii. CA Dept. of Public Health Standard Practice for the testing of VOCs (Specification 01350).
      iii. Department of General Services, California Gold Sustainable Carpet Standard.
      iv. Scientific Certifications Systems Indoor Advantage™ Gold.
   b. Carpet cushion. All carpet cushion installed in the building interior shall meet the requirements of the Carpet and Rug Institute Green Label program.
   c. Carpet adhesive. All carpet adhesive shall meet the requirements of Table 3.

4. Composite wood products. Hardwood, plywood, particleboard, and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in Table 5.

Table 5
Formaldehyde Limits
Maximum formaldehyde emissions in parts per million

Phase 1		Phase 2			
Product	Current Limits	Jan 1, 2010	Jan 1, 2011	Jan 1, 2012	Jul 1, 2012
Hardwood Plywood Veneer Core	0.08	0.05			
Hardwood Plywood Composite Core	0.08				0.05
Particle Board	0.18		0.09		
Medium Density Fiberboard	0.21		0.11		
Thin Medium Density Fiberboard (max. thickness of 8 mm)	0.21			0.13	

Documentation. Verification of compliance with this section shall be provided as requested by the building official. Documentation shall include at least one of the following.

a. Product certifications and specifications.
b. Chain of custody certifications.
c. Other methods acceptable to the building official.

G. Indoor Moisture Control
1. Moisture content of building materials. Building materials with visible signs of water damage shall not be installed. Wall and floor framing shall not be enclosed when the framing members exceed 19% moisture content. Moisture content shall be verified in compliance with the following.

   a. Moisture content shall be determined with either a probe-type or a contact-type moisture meter.

b. Moisture readings shall be taken at a point 2 feet to 4 feet from the grade stamped end of each piece to be verified.
c. At least three random moisture readings shall be performed on wall and floor framing with documentation acceptable to the building official provided at the time of approval to enclose the wall and floor framing.

H. Indoor Air Quality and Exhaust
1. Bathroom exhaust fans. Mechanical exhaust fans required in rooms containing a bathtub, shower, or tub shower combination shall be ENERGY STAR compliant and shall terminate outside the building.

2. Filters. Heating and air conditioning filters shall be rated at MERV 6 or higher. Duct system design shall account for pressure drop across the filter.

I. Operation and Maintenance manual. At time of final inspection of a new residential or commercial building, the builder shall place in the building an Operation and Maintenance manual that is acceptable to the Building official. It shall contain directions to the owner or occupant that the manual shall remain with the building throughout the life cycle of the structure.

ORDINANCE NO. 3140

ORDINANCE OF THE CITY OF CHULA VISTA ADDING CHAPTER 15.12, GREEN BUILDING STANDARDS, TO THE CHULA VISTA MUNICIPAL CODE

The City Council of the City of Chula Vista does ordain as follows:

SECTION I. Findings. The City Council finds as follows:

1. The City of Chula Vista has a long standing commitment to leadership in green building standards, sustainable design and construction practices, water and other resource conservation and the reduction of greenhouse gas emissions. The City has committed to reducing its citywide greenhouse gas (GHG) emissions to 20% below 1990 levels by 2010.

2. GHG reduction has been mandated by Governor Schwarzenegger through executive orders and in his signing into law AB 32 in 2006. AB 32 requires a reduction of GHG emissions to 1990 levels by 2020.

3. A 2005 Greenhouse Gas Emissions Inventory indicated that Chula Vista's annual citywide greenhouse gas levels had increased by 35% since 1990 due primarily to residential growth.

4. According to studies published by the United States Green Building Council, the construction, demolition and operation of buildings in the United States collectively consume up to 39% of the total energy used, 12% of all fresh water supply, and 40% of all raw materials used in the United States. Buildings also generate 39% of total emission of greenhouse gases.

5. The California Building Standards Commission (CBSC) and the Department of Housing and Community Development (HCD) developed and approved a California Green Building Standards Code (CGBSC) gleaned from nationally recognized programs and based on an open public adoption process.

6. Green building design, construction, and operation can have a significant positive effect on resource conservation, energy efficiency, waste and pollution generation, and the health and productivity of a building's occupants over the life of the building. Requiring commercial and residential projects to incorporate green building measures is necessary and appropriate to achieve the public health and welfare benefits of green building.

7. Modifications to the California Building Standards, as detailed in this Ordinance, are reasonably necessary due to local climatic conditions. As a result of high summer ambient temperatures and periods of heat waves, average load demand and peak load demand of energy used in Chula Vista is an important factor concerning public safety and adverse economic impacts of power outages or power reductions. Reduction of total and peak energy use will have local and regional benefits in the reduction of energy costs for the building owner, additional available system energy capacity, and a reduction in greenhouse gas emissions.

SECTION II. That Chapter 15.12 is added to the Chula Vista Municipal Code and reads as follows:

Chapter 15.12
Green Building Standards

Sections:

Section 15.12.001 Purpose
Section 15.12.005 Scope
Section 15.12.010 Definitions
Section 15.12.015 Conflicting Provisions
Section 15.12.020 Administration
Section 15.12.025 Alternate Materials, Methods of Design and Methods of Construction
Section 15.12.030 Green Building Standards
Section 15.12.035 Administrative Procedures
Section 15.12.040 Appeal

Section 15.12.001 Purpose

The purpose of this Chapter is to enhance the public health and welfare by promoting the environmental and economic health of the City through the design, construction, maintenance, operation and deconstruction of buildings and other site development by incorporating green building practices into all development. The green building provisions referred to in this Chapter are designed to achieve the following goals:

A. Increase energy efficiency in buildings;
B. Encourage water and resource conservation;
C. Reduce waste generated by construction projects;
D. Provide durable buildings that are efficient and economical to own and operate;
E. Promote the health and productivity of residents, workers, and visitors to the city.

Section 15.12.005 Scope

The provisions of this Chapter shall apply to all new residential construction, remodels, additions, and alterations, and to all new nonresidential construction, remodels, additions, and tenant improvements for which a building permit has been applied for on or after the effective date of this Chapter ("Covered Projects").

Section 15.12.010 Definitions

For the purposes of this Chapter, the following words have the meanings shown in this section. Where a term is not defined in this section, but is defined in Chapter 15.06, or the technical codes Chapters 15.08, 15.10, 15.16, 15.24, 15.26, and 15.28, such term shall have the meaning ascribed to it in Chapter 15.06, or the technical codes Chapters 15.08, 15.10, 15.16, 15.24, 15.26, and 15.28. Where terms are not defined, they shall have their ordinarily accepted meanings within the context with which they are used. Words used in the singular include the plural, and the plural the singular. Words used in the masculine gender include the feminine, and the feminine include the masculine.

"Building Official" means the officer or other designated authority charged with the administration and enforcement of this chapter, or duly authorized representative.

"Chula Vista Green Building Standards" means the green building measures that have been adopted by City Council, and which may be amended from time to time.

"Green Building" means a holistic approach to design, construction, and demolition that minimizes the building's impact on the environment, the occupants, and the community.

Section 15.12.015 Conflicting Provisions

When conflicts occur between this Chapter and other chapters, codes or laws, those provisions providing the greater safety to life shall govern. In other conflicts where sanitation, life safety or fire safety are not involved, the most restrictive provisions shall govern. If there is a conflict with a state or federal law, the higher authority would prevail; if the laws are consistent but the local is more restrictive, the more restrictive would govern.

When there is a conflict between a general requirement and a specific requirement, the specific requirement shall apply.

Section 15.12.020 Administration

The Building Official is authorized and directed to enforce all the provisions of this chapter and to adopt and enforce rules and regulations supplemental to this chapter as may be deemed necessary to clarify the application of the provisions of this chapter. Such interpretations, rules and regulations shall be in conformity with the intent and purpose of this chapter.

Section 15.12.025 Alternate Materials, Methods of Design and Methods of Construction

The provisions of this chapter are not intended to prevent the use of any material, method of design or method of construction not specifically prescribed by this chapter, provided an alternate has been approved and its use authorized by the Building Official.

The Building Official may approve an alternate, provided the Building Official finds that the proposed design is satisfactory and complies with the provisions of this chapter and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this chapter.

The Building Official may require documentation necessary to make findings for approval. The details of an action granting approval of an alternate shall be recorded and entered in the files of the Building Division.

Section 15.12.030 Green Building Standards

Buildings and building sites covered under Section 15.12.005 shall be designed to include Green Building measures, which have been adopted by City Council resolution as the "Chula Vista Green Building Standards," and which may be amended from time to time.

Section 15.12.035 Administrative Procedures

A. Submittal of Documents. As part of the application for a building permit, construction plans and specifications shall indicate in the general notes or individual detail drawings the Green Building Standards and product specifications and methods of construction that are required by this Chapter.

The Building Official may require the applicant to retain the services of a consultant having expertise in Green Building and/or energy efficiency techniques to review and evaluate complex systems and/or alternate methods or materials of construction and provide recommendations as to compliance with the requirements of this Chapter. The cost of such consultant shall be paid by the applicant.

B. Approval of Permit Application. Notwithstanding any other provision of this code, no building permit shall be issued for any covered project until the Building Official has determined that the plans and specifications submitted for the building permit are in compliance with the requirements of this Chapter.

C. Compliance Verification. The Building Official shall verify that the Green Building measures and specifications indicated on the permitted plans and construction documents are being implemented at foundation, framing, electrical, plumbing, mechanical, and any other required inspections, and prior to issuance of a final certificate of occupancy. Additional inspections may be conducted as needed to ensure compliance with this chapter. During the course of construction and following completion of the project, the city may require the applicant to provide information and documents showing use of products, equipment, and materials specified on the permitted plans and documents.

If, at any stage of construction, the Building Official determines that the project is not being constructed in accordance with the permitted plans and documents, a Stop Order may be issued pursuant to CVMC Section 15.06.060.D. At the discretion of the Building Official, the stop work order may apply to the portion of the project impacted by noncompliance or to the entire project. The stop work order shall remain in effect until the Building Official determines that the project will be brought into compliance with the permitted plans and documents and this Chapter.

Prior to final building approval or issuance of a certificate of occupancy, the Building Official shall review the information submitted by the applicant and determine whether the applicant has constructed the project in accordance with the permitted plans and documents. If the Building Official determines that the applicant has failed to construct the project in accordance with the permitted plans and documents, then the final building approval and final certificate of occupancy may be withheld, until the Building Official determines that the project is in compliance with this Chapter.

Section 15.12.040 Appeal

The Board of Appeals and Advisors as established by Chapter 2.26 is hereby designated to hear and decide appeals of orders, decisions, or determinations made by the Building Official relative to the application and interpretation of this Chapter. The Board shall render all decisions and findings in writing to the Building Official and provide a copy to the appellant. The decision of the Board is final.

SECTION III. EFFECTIVE DATE.

This ordinance will take effect and be in force thirty days after final passage.

Presented by

Gary Halbert, P.E., AICP
Deputy City Manager/Development Services Director

Approved as to form by

Bart C. Miesfeld
City Attorney

PASSED, APPROVED, and ADOPTED by the City Council of the City of Chula Vista, California, this 6th day of October 2009, by the following vote:

AYES:	Councilmembers:	Bensoussan, Castaneda, Ramirez, Thompson and Cox
NAYS:	Councilmembers:	None
ABSENT:	Councilmembers:	None

Cheryl Cox, Mayor

ATTEST:

Donna R. Norris, CMC, City Clerk

STATE OF CALIFORNIA)
COUNTY OF SAN DIEGO)
CITY OF CHULA VISTA)

I, Donna R. Norris, City Clerk of Chula Vista, California, do hereby certify that the foregoing Ordinance No. 3140 had its first reading at a regular meeting held on the 15th day of September 2009 and its second reading and adoption at a regular meeting of said City Council held on the 6th day of October 2009; and was duly published in summary form in accordance with the requirements of state law and the City Charter.

Executed this 6th day of October 2009.

Donna R. Norris, CMC, City Clerk

Jan. 26, 2010

(KBS)

ORDINANCE NO. 3149

ORDINANCE OF THE CITY OF CHULA VISTA AMENDING CHAPTER 15.26 OF THE CHULA VISTA MUNICIPAL CODE AND ADDING SECTION 15.26.030, INCREASED ENERGY EFFICIENCY STANDARDS

The City Council of the City of Chula Vista does ordain as follows:

SECTION I. Findings. The City Council finds as follows:

1. Modifications to the California Building Standards and Building Energy Efficiency Standards, as detailed in this Ordinance, are reasonably necessary due to local climatic conditions. As a result of high summer ambient temperatures and periods of heat waves, average load demand and peak load demand of energy used in Chula Vista is an important factor concerning public safety and adverse economic impacts of power outages or power reductions. Reduction of total and peak energy use, as a result of incremental energy conservation measures required by this Ordinance, will have local and regional benefits in the cost-effective reduction of energy costs for the building owner, additional available system energy capacity, and a reduction in greenhouse gas emissions.

2. The increased energy efficiency standards required by Section 15.26.030 will require the diminution of energy consumption levels permitted by the 2008 Building Energy Efficiency Standards and are determined to be cost effective based on a cost-effectiveness study by Gabel Associates, LLC.

SECTION II. That Chapter 15.26 of the Chula Vista Municipal Code is hereby amended to read as follows:

Chapter 15.26
ENERGY CODE

Sections:
15.26.010 California Energy Code adopted by reference.
15.26.020 Outdoor lighting zones.
15.26.030 Increased Energy Efficiency Standards

15.26.010 California Energy Code adopted by reference.
The City of Chula Vista adopts, by reference, that certain document known as the California Energy Code, set forth in Title 24, Part 6, of the California Code of Regulations, as copyrighted by, and as may be amended from time to time by, the California Building Standards Commission. That California Energy Code is adopted as the energy code of the City of Chula Vista for the purpose of regulating building design and construction standards to increase efficiency in the use of energy for new residential and nonresidential buildings, excepting such portions as are modified, or amended by this Chapter to exceed the California Energy Code, set forth in Title 24, Part 6. Chapter 15.06 CVMC shall serve as the administrative, organizational and enforcement rules and regulations for this Chapter.

15.26.020 Outdoor lighting zones.
Pursuant to Section 10-114 (c) of the California Code of Regulations, Title 24, Part 1, the city has adopted an outdoor lighting zones map amending state default lighting zones as applied to certain areas of the City. The location of outdoor lighting zones in the City are per the adopted Outdoor Lighting Zones Map, dated September 2, 2005, and kept on file with the City Planning and Building Department.

15.26.030 Increased Energy Efficiency Standards

A. Scope. The provisions of this Section shall apply to all new residential construction, additions, remodels and alterations, and to all new non-residential construction, additions, remodels and alterations except as follows:
   a. Additions, remodels or alterations to existing low-rise (three stories or less) residential buildings where the addition, remodel or alteration is less than or equal to1,000 square feet of conditioned floor area are exempt from the provisions of this Section.
   b. Additions, remodels or alterations to existing high-rise residential (more than three stories), non-residential or hotel/motel buildings where the addition, remodel or alteration is less than or equal to10,000 square feet of conditioned floor area are exempt from the provisions of this Section.

   Compliance with the California Energy Code is always required even if the increased energy efficiency standards specified in this Section do not apply.

B. Definitions. Terms used in this Section are as defined in the California Energy Code and Chapter 15.06, 19.06 and 19.48 of the Municipal Code.

C. Requirements. In addition to the requirements of the California Energy Code, applications for building permits covered under Section 15.26.030 (A) shall comply with the following:
   a. For Climate Zone 7:
      i. All new low-rise residential buildings or additions, remodels or alterations to existing low-rise residential buildings where the additions, remodels or alterations are greater than 1,000 square feet of conditioned floor area shall use at least 15% less Time Dependent Valuation (TDV) Energy than the 2008 Building Energy Efficiency Standards allows.
      ii. All new non- residential, high-rise residential or hotel/motel buildings, or additions, remodels or alterations to existing non- residential, high-rise residential or hotel/motel buildings where the additions, remodels or alterations are greater than 10,000 square feet of conditioned floor area shall use at least 15% less TDV Energy than the 2008 Building Energy Efficiency Standards allows.

   b. For Climate Zone 10:
      i. All new low-rise residential buildings or additions, remodels or alterations to existing low-rise residential buildings where the additions, remodels or alterations are greater than 1,000 square feet of conditioned floor area shall use at least 20% less TDV Energy than the 2008 Building Energy Efficiency Standards allows.

ii. All new non-residential, high-rise residential or hotel/motel buildings, or additions, remodels or alterations to existing non- residential, high-rise residential or hotel/motel buildings where the additions, remodels or alterations are greater than 10,000 square feet of conditioned floor area shall use at least 15% less TDV Energy than the 2008 Building Energy Efficiency Standards allows.

D. Compliance. No building permit shall be issued unless the permit application demonstrates compliance with the requirements of Section 15.26.030 based on the performance approach as specified in the 2008 Building Energy Efficiency Standards using a California Energy Commission approved energy compliance software program.

E. Compliance Credit Option for Buildings within Sectional Planning Area (SPA) Plan Projects.

For building construction within Sectional Planning Area (SPA) Plan project areas whose SPA is approved subsequent to the effective date of this Ordinance, the developer may meet a portion of the requirements set forth under Section 15.26.030C, provided the SPA Plan has met the qualifying energy savings thresholds for community design and site planning features pursuant to the requirements as set forth in the SPA's approved Air Quality Improvement Plan (AQIP). If the approved AQIP has met the qualifying thresholds, the applicant may request and receive an energy savings credit towards a portion of the requirements specified in Section 15.26.030C subject to approval by the Director of Development Services, provided the project fully complies with the 2008 Building Energy Efficiency Standards (Title 24, Part 6) which are in effect at the time of permitting, and conforms to applicable guidelines in effect at the time of the request for credit.

F. Technical Assistance. The building official may require the applicant to retain the services of a consultant having expertise in energy efficiency techniques to review and evaluate complex systems and/or alternate methods of compliance and provide recommendations as to compliance with the requirements of Section 15.26.030. The cost of such consultant shall be paid by the applicant.

G. Expiration. Section 15.26.030 shall expire upon the date the 2008 Building Energy Efficiency Standards are no longer in effect.

SECTION III. EFFECTIVE DATE.

This ordinance will take effect and be in force thirty days after final passage.

Presented by

Gary Halbert, P.E., AICP
Deputy City Manager/Development Services Director

Approved as to form by

Bart C. Miesfeld
City Attorney

PASSED, APPROVED, and ADOPTED by the City Council of the City of Chula Vista, California, this 26th day of January 2010, by the following vote:

AYES:	Councilmembers:	Bensoussan, Castaneda, Ramirez, Thompson and Cox
NAYS:	Councilmembers:	None
ABSENT:	Councilmembers:	None

Cheryl Cox, Mayor

ATTEST:

Donna R. Norris, CMC, City Clerk

STATE OF CALIFORNIA)
COUNTY OF SAN DIEGO)
CITY OF CHULA VISTA)

I, Donna R. Norris, City Clerk of Chula Vista, California, do hereby certify that the foregoing Ordinance No. 3149 had its first reading at a regular meeting held on the 20th day of October 2009 and its second reading and adoption at a regular meeting of said City Council held on the 26th day of January 2010; and was duly published in summary form in accordance with the requirements of state law and the City Charter.

Executed this 26th day of January 2010.

Donna R. Norris, CMC, City Clerk

ATTACHMENT 3

GHG Emissions Calculations

BAU GHG EMISSIONS (i.e., WITHOUT REDUCTION MEASURES)

Emission Source	CO2	N20	CH4	Total CO2 Eq Emissions (metric tons/year)
Vehicular Emissions	112,991.36	358.08	66.71	113,416.15
Electricity Usage Emissions	49,425.78	219.54	8.60	49,653.92
Natural Gas Usage Emissions	23,680.51	134.58	9.53	23,824.63
Water Usage Emissions	4,298.43	0.04	0.06	4,318.27
Solid Waste Emissions				4,054.40
Construction Emissions				24,465.85
Global Warming Potential	1.00	310.00	21.00	
Total CO2 Eq Emissions				**219,733.22**

TARGET: 20 PERCENT REDUCTION IN BAU **175,786.58**

PROJECT REDUCED GHG EMISSIONS

Emission Source	CO2	N20	CH4	Total CO2 Eq Emissions (metric tons/year)
Vehicular Emissions	68,020.94	1.91	0.70	68,276.67
Electricity Usage Emissions	34,598.05	153.68	6.02	34,757.75
Natural Gas Usage Emissions	16,576.36	94.21	6.67	16,677.24
Water Usage Emissions	3,269.99	0.03	0.05	3,285.08
Solid Waste Emissions				4,054.40
Construction Emissions				24,465.85
Global Warming Potential	1.00	310.00	21.00	
Total CO2 Eq Emissions				**151,516.98**

Reduction in BAU:

39.800	percent
30.000	percent
30.000	percent
23.926	percent
0.000	percent
0.000	percent
31.045	percent TOTAL
68,216.24	MTCO2E TOTAL
106,317.07	(BAU non-vehicular)
83,240.32	Project non-vehicular
23,076.75	Reduction in BAU non-vehicular
21.71	percent reduction non-vehicular

OTAY RANCH
GHG CALCULATIONS

BAU VEHICLE EMISSIONS CALCULATIONS

Parameters

Average Fuel Economy:	18.80	miles per gallon (mpg)
Average Daily Traffic (ADT):	113,073.00	trips
Average Trip Length:	5.80	miles (SANDAG 2009)
VMT per Day:	655,823.40	miles
VMT per Year:	239,375,541.00	miles
Total Gallons of Fuel (per day):	34,884.22	
Total Gallons of Fuel (per year):	12,732,741.54	gallons per year

Vehicle Emission Factors (pounds/gallon)

CO2	19.56400
CH4	0.00055
N2O	0.00020

Vehicle Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	249,103,355.54	2,204.62	112,991.36	1.00	112,991.36
CH4	7,003.01	2,204.62	3.18	21.00	66.71
N2O	2,546.55	2,204.62	1.16	310.00	358.08
TOTAL metrics tons of CO2 Eq per Year:					113,416.15

PROJECT VEHICLE EMISSIONS CALCULATIONS

Accounting for State Regulations and Project-Specific Trip Lengths

Parameters

Average Fuel Economy:	18.80	miles per gallon (mpg)
Average Daily Traffic (ADT) - Village 8 West:	43,564.00	trips
Average Trip Length - Village 8 West:	4.62	miles (SANDAG 2010b)
VMT per Day - Village 8 West:	201,265.68	miles per day
Average Daily Traffic (ADT) - Village 9:	56,123.00	trips
Average Trip Length - Village 9:	5.08	miles (SANDAG 2010b)
VMT per Day - Village 9:	285,104.84	miles per day
Average Daily Traffic (ADT) - RTP Village 10:	13,386.00	trips
Average Trip Length - RTP Village 10:	5.80	miles (SANDAG 2009)

OTAY RANCH
GHG CALCULATIONS

VMT per Day - RTP Village 10:	77,638.80	miles per day
Total ADT (combining Village 8W, 9 and RTP)	113,073.00	Total ADT
Total VMT per Day:	564,009.32	miles per day
Total VMT per Year:	205,863,401.80	mils per year
Total Gallons of Fuel per Day:	30,000.50	
Total Gallons of Fuel:	10,950,180.95	gallons

Vehicle Emission Factors (pounds/gallon)

CO2	19.56400
CH4	0.00055
N2O	0.00020

Vehicle Emissions (accounting for Project average trip lengths)

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	214,229,340.04	2,204.62	97,172.78	1.00	97,172.78
CH4	6,022.60	2,204.62	2.73	21.00	57.37
N2O	2,190.04	2,204.62	0.99	310.00	307.95
TOTAL metrics tons of CO2 Eq per Year:					97,538.09

Reduced Vehicle Emissions (accounting for State regulations in addition to shorter Project average trip lengths)

Low Carbon Fuel Standards	Reduce emissions from transportation fuels by 10 percent
AB 1493 Pavley I	Reduce emissions acorss passenger fleet by 18 percent

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	149,960,538.03	2,204.62	68,020.94	1.00	68,020.94
CH4	4,215.82	2,204.62	1.91	21.00	40.16
N2O	1,533.03	2,204.62	0.70	310.00	215.56
TOTAL metrics tons of CO2 Eq per Year:					**68,276.67**

Percent Reduction in BAU	0.397998723

ELECTRICITY EMISSIONS CALCULATIONS
BAU
Residential Parameters

Single-Family Consumption per Unit per Month:	590.88	kWh per consumer per month average
Single-Family Consumption per Unit per Year:	7,090.56	kWh per consumer per year
Number of Single-Family Units:	887.00	units
Single-Family Total Consumption (kWh):	6,289,326.72	kWh per year
Single-Family Total Consumption (MWh):	6,289.33	MWh per year
Multi-Family Consumption per Unit per Month:	360.39	kWh per consumer per month average
Multi-Family Consumption per Unit per Year:	4,324.68	kWh per consumer per year
Number of Multi-Family Units:	5,163.00	units
Multi-Family Total Consumption (kWh)):	22,328,322.84	kWh per year
Multi-Family Total Consumption (MWh):	22,328.32	MWh per year
Combined Residential Total Consumption (kWh):	28,617,649.56	kWh per year
Combined Residential Total Consumption (MWh):	28,617.65	MWh per year
[Project Reduction of 30 Percent =	20,032.35	MWh per year]

Commercial Parameters

Annual Consumption per Square Foot:	14.10	kWh per square foot per year
Total Commercial Square Feet:	1,800,000.00	square feet
Total kWh:	25,380,000.00	kWh
Total Annual MWh:	25,380.00	MWh
[Project Reduction of 30 Percent =	17,766.00	MWh per year

Industrial Parameters

Average Monthly Consumption per Consumer:	53,568.00	kWh per consumer per month	
Annual Consumption per Consumer:	642,816.00	kWh per consumer per year	
Total Industrial Square Feet:	2,221,560.00	square feet	
Minimum Lot Area:	52,272.00	square feet*	*EXAMPLE: For lot area = 2 acres (Zoning Ordinance)
Maximum Number of Consumers:	42.50	Consumers	FAR = 0.6
Total kWh:	27,319,680.00	kWh	(2 acres)(43,560 sq ft per acre)(0.6) = 52,272 sq ft
Total Annual MWh:	27,319.68	MWh	
[Project Reduction of 30 Percent =	19,123.78	MWh per year]	
Total Combined Annual MWh:	81,317.33	MWh per year	
[Project Reduction of 30 Percent =	56,922.13	MWh per year]	

Electricity Generation Emission Factors (pounds/MWh)

CO2	1,340.0000
CH4	0.0111
N2O	0.0192

Residential Electricity Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq	
CO2	38,347,650.41	2,204.62	17,394.20	1.00	17,394.20	
CH4	317.66	2,204.62	0.14	21.00	3.03	
N2O	549.46	2,204.62	0.25	310.00	77.26	
TOTAL metrics tons of CO2 Eq per Year:					17,474.49	
[Project Reduction of 30 Percent =					12,232.14	MTCO2Eq per year]

Commercial Electricity Emissions

Emissions	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq	
CO2	34,009,200.00	2,204.62	15,426.31	1.00	15,426.31	
CH4	281.72	2,204.62	0.13	21.00	2.68	
N2O	487.30	2,204.62	0.22	310.00	68.52	
TOTAL metrics tons of CO2 Eq per Year:					15,497.51	
[Project Reduction of 30 Percent =					10,848.26	MTCO2Eq per year]

OTAY RANCH
GHG CALCULATIONS

Industrial Electricity Emissions

Emissions	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq	
CO2	36,608,371.20	2,204.62	16,605.28	1.00	16,605.28	
CH4	303.25	2,204.62	0.14	21.00	2.89	
N2O	524.54	2,204.62	0.24	310.00	73.76	
TOTAL metrics tons of CO2 Eq per Year:					16,681.92	MTCO2Eq per year]
[Project Reduction of 30 Percent =					11,677.34	

Total Combined Electricity Emissions

Total Emissions	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq	
CO2	108,965,221.61	2,204.62	49,425.78	1.00	49,425.78	
CH4	902.62	2,204.62	0.41	21.00	8.60	
N2O	1,561.29	2,204.62	0.71	310.00	219.54	
TOTAL metrics tons of CO2 Eq per Year:					49,653.92	
[Project Reduction of 30 Percent =					34,757.75	MTCO2Eq per year]
					34,757.75	

PROJECT GHG REDUCTIONS

Exceed Title 24 Year 2005 by 30 percent:

30 percent reduction in BAU CO2Eq	34,757.75	MTCO2Eq per year
Consume 30 percent less energy than BAU	56,922.13	MWh per year

NATURAL GAS EMISSIONS CALCULATIONS
BAU
Residential Parameters

Single Family Consumption per Unit per Month:	5,198.70	cubic feet per month
Single Family Consumption per Unit per Year:	62,384.40	cubic feet per year
Single Family Units:	887.00	units
Multi-Family Consumption per Unit per Month:	3,128.97	cubic feet per month
Multi-Family Consumption per Unit per Year:	37,547.64	cubic feet per year
Multi-Family Units:	5,163.00	units
Total Residential Consumption (cubic feet):	249,193,428.12	cubic feet per year
Total Residential Consumption (million cubic feet):	249.19	million cubic feet per year
[Project Reduction of 30 percent =	174.44	million cubic feet per year]

Commercial Parameters

Retail Consumption per Square Foot per Month:	2.90	cubic feet per month
Retail Consumption per Square Foot per Year:	34.80	cubic feet per year
Retail Amount:	1,800,000.00	square feet
Office Consumption per Square Foot per Month:	2.00	cubic feet per month
Office Consumption per Square Foot per Year:	24.00	cubic feet per year
Office Amount:	0.00	square feet
Total Office Consumption (cubic feet):	62,640,000.00	cubic feet per year
Total Office Consumption (million cubic feet):	62.64	million cubic feet per year
[Project Reduction of 30 percent =	43.85	million cubic feet per year]

Industrial Parameters

Consumption per Consumer per Month:	241,611.00	cubic feet per consumer per month	
Consumption per Consumer per Year:	2,899,332.00	cubic feet per consumer per year	
Industrial Amount	2,221,560.00	square feet	
Minimum Lot Area:	52,272.00	square feet*	*EXAMPLE: For lot area = 2 acres (Zoning Ordinance)
Maximum Number of Consumers:	42.50	Consumers	FAR = 0.6
Total Consumption (cubic feet):	123,221,610.00	cubic feet per year	(2 acres)(43,560 sq ft per acre)(0.6) = 52,272 sq ft
Total Industrial Consumption (million cubic feet):	123.22	million cubic feet per year	
[Project Reduction of 30 percent =	86.26	million cubic feet per year]	
Total Combined Annual Consumption:	435.06	million cubic feet per year	
[Project Reduction of 30 percent =	304.54	million cubic feet per year]	
	304.54		

Natural Gas Combustion Emission Factors (pounds/million cubic feet)

CO2	120,000.0
CH4	2.3
N2O	2.2

Residential Natural Gas Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq	
CO2	29,903,211.37	2,204.62	13,563.87	1.00	13,563.87	
CH4	573.14	2,204.62	0.26	21.00	5.46	
N2O	548.23	2,204.62	0.25	310.00	77.09	
TOTAL metrics tons of CO2 Eq per Year:					13,646.41	
[Project Reduction of 30 percent =					9,552.49	MTCO2Eq per year]

Commercial Natural Gas Emissions

Emissions	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq	
CO2	7,516,800.00	2,204.62	3,409.56	1.00	3,409.56	
CH4	144.07	2,204.62	0.07	21.00	1.37	
N2O	137.81	2,204.62	0.06	310.00	19.38	
TOTAL metrics tons of CO2 Eq per Year:					3,430.31	
[Project Reduction of 30 percent =					2,401.22	MTCO2Eq per year]

Industrial Natural Gas Emissions

Emissions	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq	
CO2	14,786,593.20	2,204.62	6,707.08	1.00	6,707.08	
CH4	283.41	2,204.62	0.13	21.00	2.70	
N2O	271.09	2,204.62	0.12	310.00	38.12	
TOTAL metrics tons of CO2 Eq per Year:					6,747.90	
[Project Reduction of 30 percent =					4,723.53	MTCO2Eq per year]

OTAY RANCH
GHG CALCULATIONS

Total Combined Natural Gas Emissions

Total Emissions	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	52,206,604.57	2,204.62	23,680.51	1.00	23,680.51
CH4	1,000.63	2,204.62	0.45	21.00	9.53
N2O	957.12	2,204.62	0.43	310.00	134.58
TOTAL metrics tons of CO2 Eq per Year:					23,824.63
[Project Reduction of 30 percent =					16,677.24 MTCO2Eq per year]

PROJECT GHG REDUCTIONS

Exceed Title 24 Year 2005 by 30 percent:

30 percent reduction in BAU CO2Eq	16,677.24	MTCO2Eq per year
Consume 30 percent less energy than BAU	60.38	MWh per year

OTAY RANCH
GHG CALCULATIONS

WATER EMISSIONS CALCULATIONS
BAU
Residential Parameters

Single Family Demand per Unit per Day:	500.00	gallons per day (gpd)
Single Family Demand per Unit per Year:	182,500.00	gallons per year (gpy)
Single Family Units:	887.00	units
Multi-Family Demand per Unit per Day:	255.00	gallons per day (gpd)
Multi-Family Demand per Unit per Year:	93,075.00	gallons per year (gpy)
Multi-Family Units:	5,163.00	units
Total Daily Residential Water Demand (gal):	1,760,065.00	gallons per day (gpd)
Total Annual Residential Water Demand (gal):	642,423,725.00	gallons per year (gpy)
	642,423,725.00	check

School/Educational Parameters

School Demand per Acre per Day:	1,428.00	gallons per day (gpd)
School Demand per Acre per Year:	521,220.00	gallons per year (gpy)
School Acres Amount:	54.40	acres
Total Daily Schools Water Demand (gal):	77,683.20	gallons per day (gpd)
Total Annual Schools Water Demand (gal):	28,354,368.00	gallons per year (gpy
	28,354,368.00	check

Park Parameters

Park Demand per Acre per Day:	643.69	gallons per day (gpd)
Park Demand per Acre per Year:	234,946.85	gallons per year (gpy)
Park Acres Amount:	53.10	acres
Total Daily Park Water Demand (gal):	34,179.94	gallons per day (gpd)
Total Annual Park Water Demand (gal):	12,475,677.74	gallons per year (gpy)
	12,475,677.74	check

Commercial Parameters

Commercial Demand per Square Foot per Day:	0.14	gallons per day (gpd)
Commercial Demand per Square Foot per Year:	51.10	gallons per year (gpy)
Commercial Amount:	1,800,000.00	square feet
Total Daily Commerical Water Demand (gal):	252,000.00	gallons per day (gpd)
Total Annual Commercial Water Demand (gal):	91,980,000.00	gallons per year (gpy)
	91,980,000.00	check

OTAY RANCH
GHG CALCULATIONS

Industrial Parameters

Industrial Demand per Square Foot per Day:	0.07	gallons per day (gpd)
Industrial Demand per Square Foot per Year:	25.55	gallons per year (gpy)
Industrial Amount	2,221,560.00	square feet
Total Daily Industrial Water Demand (gal):	155,509.20	gallons per day (gpd)
Total Annual Industrial Water Demand (gal):	56,760,858.00	gallons per year (gpy)
	56,760,858.00	check
Total Combined Daily Water Demand:	2,279,437.34	gallons per day (gpd)
Total Combined Annual Water Demand:	831,994,628.74	gallons per year (gpy)
	831,994,628.74	check

Parameters

Daily Water Use:	2,279,437.34	gallons
Annual Water Use:	831,994,628.74	gallons
Embodied Energy Rate:	0.0085	kWh per gallon
Total Annual Water Energy Use (in kWh):	7,071,954.3442	kWh per year
Total Annual Water Energy Use (in MWh):	7,071.95	MWh per year
	7,071.95	check

Electricity Generation Emission Factors (pounds/MWh)

CO2	
CH4	1,340.0000
N2O	0.0111
	0.0192

Water Emissions

CO2	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CH4	9,476,418.82	2,204.62	4,298.43	1.00	4,298.43
N2O	78.50	2,204.62	0.04	21.00	0.75
TOTAL metrics tons of CO2 Eq per Year:	135.78	2,204.62	0.06	310.00	19.09
					4,318.27

WATER EMISSIONS CALCULATIONS
PROJECT GHG REDUCTIONS

Residential Parameters

Single Family Demand per Unit per Day:	400.00	gallons per day (gpd)
Single Family Demand per Unit per Year:	146,000.00	gallons per year (gpy)
Single Family Units:	887.00	units
Multi-Family Demand per Unit per Day:	204.00	gallons per day (gpd)
Multi-Family Demand per Unit per Year:	74,460.00	gallons per year (gpy)
Multi-Family Units:	5,163.00	units
Total Daily Residential Water Demand (gal):	1,408,052.00	gallons per day (gpd)
Total Annual Residential Water Demand (gal):	513,938,980.00	gallons per year (gpy)

School/Educational Parameters

School Demand per Acre per Day:	1,142.40	gallons per day (gpd)
School Demand per Acre per Year:	416,976.00	gallons per year (gpy)
School Acres Amount:	54.40	acres
Total Daily Schools Water Demand (gal):	62,146.56	gallons per day (gpd)
Total Annual Schools Water Demand (gal):	22,683,494.40	gallons per year (gpy
	22,683,494.40	check

Park Parameters

Park Demand per Acre per Day:	514.95	gallons per day (gpd)
Park Demand per Acre per Year:	187,957.48	gallons per year (gpy)
Park Acres Amount:	53.10	acres
Total Daily Park Water Demand (gal):	27,343.95	gallons per day (gpd)
Total Annual Park Water Demand (gal):	9,980,542.19	gallons per year (gpy)
	9,980,542.19	check

Commercial Parameters

Commercial Demand per Square Foot per Day:	0.11	gallons per day (gpd)
Commercial Demand per Square Foot per Year:	40.88	gallons per year (gpy)
Commercial Amount:	1,800,000.00	square feet
Total Daily Commerical Water Demand (gal):	201,600.00	gallons per day (gpd)
Total Annual Commercial Water Demand (gal):	73,584,000.00	gallons per year (gpy)

OTAY RANCH
GHG CALCULATIONS

Industrial Parameters

Industrial Demand per Square Foot per Day:	0.06	gallons per day (gpd)
Industrial Demand per Square Foot per Year:	20.44	gallons per year (gpy)
Industrial Amount	2,221,560.00	square feet
Total Daily Industrial Water Demand (gal):	124,407.36	gallons per day (gpd)
Total Annual Industrial Water Demand (gal):	45,408,686.40	gallons per year (gpy)
Total Combined Daily Water Demand:	1,734,059.36	gallons per day
Total Combined Annual Water Demand:	632,931,666.40	gallons per year
	632931666.4	

Parameters

Daily Water Use:	1,734,059.36	gallons
Annual Water Use:	632,931,666.40	gallons
Embodied Energy:	0.0085	kWh per gallon
Total Annual Water Energy Use (in kWh):	5,379,919.16	kWh
Total Annual Water Energy Use (in MWh):	5,379.92	MWh

Electricity Generation Emission Factors (pounds/MWh)

CO2	1,340.0000
CH4	0.0111
N2O	0.0192

Water Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	7,209,091.68	2,204.62	3,269.99	1.00	3,269.99
CH4	59.72	2,204.62	0.03	21.00	0.57
N2O	103.29	2,204.62	0.05	310.00	14.52
TOTAL metrics tons of CO2 Eq per Year:					**3,285.08**

SOLID WASTE EMISSIONS CALCULATIONS
BAU/PROJECT

Residential Parameters

Pounds Generated per Unit per Day:	8.60	pounds
Pounds Generated per Unit per Year:	3,139.00	pounds
Number of Units:	6,050.00	units
Total Pounds Generated per Year:	18,990,950.00	pounds
Total Residential Tons Generated per Year:	9,495.48	tons

Commercial Parameters

Pounds Generated per Square Foot per Day:	0.046	pounds
Pounds Generated per Square Foot per Year:	16.79	pounds
Total Commercial Square Feet:	1,800,000.00	square feet
Total Pounds Generated per Year:	30,222,000.00	pounds
Total Office Tons Generated per Year:	15,111.00	tons

Industrial Parameters

Pounds Generated per Square Foot per Day:	0.046	pounds
Pounds Generated per Square Foot per Year:	16.79	pounds
Total Industrial Square Feet:	2,221,560.00	square feet
Total Pounds Generated per Year:	37,299,992.40	pounds
Total Industrial Tons Generated per Year:	18,650.00	tons

Total Combined Tons Generated per Year: 43,256.47

Material	WARM Input Catergory	Percent Generated	Percent Recovered	Percent Landfilled
Paper	Mixed Paper (General)	31.0%	55.5%	44.5%
Glass	Glass	4.9%	23.1%	76.9%
Metals	Mixed Metals	8.4%	34.6%	65.4%
Plastics	Mixed Plastics	12.0%	7.1%	92.9%
Rubber and Leather	Mixed MSW	3.0%	14.3%	85.7%
Textiles	Mixed MSW	5.0%	15.3%	84.7%
Wood	Dimensional Lumber	6.6%	9.6%	90.4%
Other	Mixed MSW	1.7%	25.6%	74.4%
Food Scraps	Food Scraps	13%	2.5%	97.5%
Yard Trimming	Yard Trimmings	13.2%	64.7%	35.3%
Miscellaneous Inorganic Waste	Mixed MSW	1.5%	0.0%	100.0%
TOTAL		100.0%		

OTAY RANCH
GHG CALCULATIONS

Enter These Values Into the EPA WARM Model					
Material	WARM Input Catergory	Tons Generated	Tons Recovered	Tons Landfilled	
Paper	Mixed Paper (General)	13,409.5	7,442.3	5,967.2	
Glass	Glass	2,119.6	489.6	1,629.9	
Metals	Mixed Metals	3,633.5	1,257.2	2,376.3	
Plastics	Mixed Plastics	5,190.8	368.5	4,822.2	
Rubber and Leather	Mixed MSW	1,297.7	185.6	1,112.1	
Textiles	Mixed MSW	2,162.8	330.9	1,831.9	
Wood	Dimensional Lumber	2,854.9	274.1	2,580.9	
Other	Mixed MSW	735.4	188.3	547.1	
Food Scraps	Food Scraps	5,493.6	137.3	5,356.2	
Yard Trimming	Yard Trimmings	5,709.9	3,694.3	2,015.6	
Miscellaneous Inorganic Waste	Mixed MSW	648.8	0.0	648.8	
TOTAL		43,256	14,368	28,888	43,256
		4,844.7	704.7	4,140.0	
	Enter WARM Value Here:				
TOTAL metrics tons of CO2 Eq per Year:	**4,054.40**	CO2 Eq			

OTAY RANCH
GHG CALCULATIONS

CONSTRUCTION EMISSIONS CALCULATIONS
BAU and PROJECT GHG CALCULATIONS

Residential Parameters

Emissions per Residential Unit Construction:	0.077	MTCO2E per unit per year
Number of Residential Units being Constructed:	6,050.00	units
Total Annual Residential Construction Emissions:	465.85	MTCO2E per year

Commercial Parameters

Emissions per Commercial Square Foot Construction:	0.006	MTCO2E per square foot per year
Commercial Amount Being Constructed:	1,800,000.00	square feet
Total Annual Commerical Construction Emissions:	10,800.00	MTCO2E per year

Industrial Parameters

Emissions per Industrial Square Foot Construction:	0.006	MTCO2E per square foot per year
Industrial Amount Being Constructed:	2,200,000.00	square feet
Total Annual Industrial Construction Emissions:	13,200.00	MTCO2E per year

Total Annual Combined Construction Emissions:	**24,465.85**	MTCO2E per year

CUMULATIVE PROJECT EMISSIONS CALCULATIONS:

BAU GHG EMISSIONS SUMMARY

Emission Source	Total CO2 Eq Emissions (metric tons/year)
Vehicular Emissions	113,416.15
Electricity Usage Emissions	49,653.92
Natural Gas Usage Emissions	23,824.63
Water Usage Emissions	4,318.27
Solid Waste Emissions	4,054.40
Construction Emissions	24,465.85
Total CO2 Eq Emissions	219,733.22

PROJECT REDUCED GHG EMISSIONS SUMMARY

Emission Source	Total CO2 Eq Emissions (metric tons/year)
Vehicular Emissions	68,276.67
Electricity Usage Emissions	34,757.75
Natural Gas Usage Emissions	16,677.24
Water Usage Emissions	3,285.08
Solid Waste Emissions	4,054.40
Construction Emissions	24,465.85
Total CO2 Eq Emissions	151,516.98

CUMULATIVE PROJECTS GHG EMISSIONS SUMMARIES

ASSUMING BAU ASSUMPTIONS - Multiply BAU Emissions by 1.5

Emission Source	Total CO2 Eq Emissions (metric tons/year)
Vehicular Emissions	170,124.22
Electricity Usage Emissions	74,480.88
Natural Gas Usage Emissions	35,736.94
Water Usage Emissions	6,477.41
Solid Waste Emissions	6,081.60
Construction Emissions	36,698.78
Total CO2 Eq Emissions	**329,599.83**

ASSUMING PROJECT REDUCTIONS - Multiply Propoposed Project Emissions by 1.5

Emission Source	Total CO2 Eq Emissions (metric tons/year)
Vehicular Emissions	102,415.00
Electricity Usage Emissions	52,136.62
Natural Gas Usage Emissions	25,015.86
Water Usage Emissions	4,927.62
Solid Waste Emissions	6,081.60
Construction Emissions	36,698.78
Total CO2 Eq Emissions	**227,275.47**

Percent Reduction in BAU 31.04502659 percent

APPENDIX H2

Project Specific Greenhouse Gas Calculations

Village 8 West GHG Calculations

BAU GHG Emissions (i.e., Without Reduction Masures)

Emission Source	Total CO2e Emissions (metric tons/year)	Precent Total Emissions
Vehicular	43,696	49.3%
Electricity	22,790	25.7%
Natural Gas	7,459	8.4%
Water	1,589	1.8%
Solid Waste	1,504	1.7%
Construction	11,601	13.1%
Total CO2e emissions	**88,639**	100.0%

Target: 20 Percent Reduction in BAU **70,911**

Project Reduced GHG Emissions

Emission Source	Total CO2e Emissions (metric tons/year)	Precent Total Emissions	Reduction in BAU
Vehicular	24,364	41%	44%
Electricity	15,953	27%	30%
Natural Gas	5,221	9%	30%
Water	1,271	2%	20%
Solid Waste	1,504	3%	0%
Construction	11,601	19%	0%
Total CO2e emissions	**59,915**	100%	32%

28,724.41 MTCO2e reduction

Village 8 West GHG Calculations

BAU VEHICLE EMISSIONS CALCULATIONS

Parameters

Average Fuel Economy:	18.80	miles per gallon (mpg)
Average Daily Traffic (ADT):	43,564.00	trips
Average Trip Length:	5.80	miles (SANDAG 2009)
VMT per Day:	252,671.20	miles
VMT per Year:	92,224,988.00	miles
Total Gallons of Fuel (per day):	13,439.96	
Total Gallons of Fuel (per year):	4,905,584.47	gallons per year

Vehicle Emission Factors (pounds/gallon)

CO2	19.56400
CH4	0.00055
N2O	0.00020

Vehicle Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	95,972,854.53	2,204.62	43,532.61	1	43,532.61
CH	2,698.07	2,204.62	1.22	21	25.70
N2O	981.12	2,204.62	0.45	310	137.96
TOTAL metrics tons of CO2 Eq per Year:					43,696.27

PROJECT VEHICLE EMISSIONS CALCULATIONS

Accounting for State Regulations and Project-Specific Trip Lengths

Parameters

Average Fuel Economy:	18.80	miles per gallon (mpg)
Average Daily Traffic (ADT):	43,564.00	trips
Average Trip Length:	4.62	miles (SANDAG 2009)
VMT per Day:	201,265.68	miles
VMT per Year:	73,461,973.20	miles
Total Gallons of Fuel (per day):	10,705.62	
Total Gallons of Fuel (per year):	3,907,551.77	gallons per year

Village 8 West GHG Calculations

Vehicle Emission Factors (pounds/gallon)

CO2	19.56400
CH4	0.00055
N2O	0.00020

Vehicle Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	76,447,342.75	2,204.62	34,675.97	1	34,675.97
CH	2,149.15	2,204.62	0.97	21	20.47
N2O	781.51	2,204.62	0.35	310	109.89
TOTAL metrics tons of CO2 Eq per Year:					34,806.34

Reduced Vehicle Emissions (accounting for State regulations in addition to shorter Project average trip lengths)

Low Carbon Fuel Standards Reduce emissions from transportation fuels by 10 percent

AB 1493 Pavley I Reduce emissions acorss passenger fleet by 18 percent

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	53,513,139.92	2,204.62	24,273.18	1	24,273.18
CH	1,504.41	2,204.62	0.68	21	14.33
N2O	547.06	2,204.62	0.25	310	76.92
TOTAL metrics tons of CO2 Eq per Year:					24,364.43

Percent Reduction in BAU	0.44

ELECTRICITY EMISSIONS CALCULATIONS

BAU

Residential Parameters

Single-Family Consumption per Unit per Month:	590.88	kWh per consumer per month average
Single-Family Consumption per Unit per Year:	7,090.56	kWh per consumer per year
Number of Single-Family Units:	621.00	units
Single-Family Total Consumption (kWh):	4,403,237.76	kWh per year
Single-Family Total Consumption (MWh):	4,403.24	MWh per year
Multi-Family Consumption per Unit per Month:	360.39	kWh per consumer per month average
Multi-Family Consumption per Unit per Year:	4,324.68	kWh per consumer per year
Number of Multi-Family Units:	1,429.00	units
Multi-Family Total Consumption (kWh)):	6,179,967.72	kWh per year
Multi-Family Total Consumption (MWh):	6,179.97	MWh per year
Combined Residential Total Consumption (kWh):	10,583,205.48	kWh per year
Combined Residential Total Consumption (MWh):	10,583.21	MWh per year
[Project Reduction of 30 Percent =	7,408.24	MWh per year]

School Parameters

Annual Consumption per Square Foot	6.35	kWh/square foot/year
Total School Acreage	31.60	acres
Total School Square Footage	1,376,496.00	square feet
Total School Consumption (kWh):	8,740,749.60	kWh per year
Total School Consumption (MWh):	8,740.75	MWh per year
[Project Reduction of 30 Percent =	6,118.52	MWh per year]

Park Parameters

Annual Consumption per Square Foot	9.38	kWh/square foot/year for health or racquet club
Total PArk Acreage	27.90	acres
Total Park Square Footage	1,215,324.00	square feet
Total Park Consumption (kWh):	11,399,739.12	kWh per year
Total Park Consumption (MWh):	11,399.74	MWh per year
[Project Reduction of 30 Percent =	7,979.82	MWh per year]

Community Purpose Parameters

Annual Consumption per Square Foot	9.38	kWh/square foot/year for place of worship
Total Community Purpose Acreage	5.80	acres
Total Community Purpose Square Footage	252,648.00	square feet
Total Community Purpose Consumption (kWh):	2,369,838.24	kWh per year
Total Community Purpose Consumption (MWh):	2,369.84	MWh per year
[Project Reduction of 30 Percent =	1,658.89	MWh per year]

Commercial Parameters

Annual Consumption per Square Foot	14.10	kWh/square foot/year for health or racquet club
Total Commercial Square Feet	300,000.00	square feet
Total Commercial Consumption (kWh):	4,230,000.00	kWh per year
Total Commercial Consumption (MWh):	4,230.00	MWh per year
[Project Reduction of 30 Percent =	2,961.00	MWh per year]

Total Combined Annual Consumption in MWh:	37,323.53	MWh per year
[Project Reduction of 30 percent =	26,126.47	MWh per year]

Electricity Generation Emissions Factors (pounds/MWh)

CO2	1,340.0000
CH4	0.0111
N2O	0.0192

Residential Electricity Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	14,181,495.34	2,204.62	6,432.63	1	6,432.63
CH	117.47	2,204.62	0.05	21	1.12
N2O	203.20	2,204.62	0.09	310	28.57
TOTAL metrics tons of CO2 Eq per Year:					6,462.32

[Project Reduction of 30 Percent = 4,523.62 MT CO2e per year]

School Electricity Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	11,712,604.46	2,204.62	5,312.75	1	5,312.75
CH	97.02	2,204.62	0.04	21	0.92
N2O	167.82	2,204.62	0.08	310	23.60
TOTAL metrics tons of CO2 Eq per Year:					5,337.28

[Project Reduction of 30 Percent = 3,736.09 MT CO2e per year]

Park Electricity Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	15,275,650.42	2,204.62	6,928.93	1	6,928.93
CH	126.54	2,204.62	0.06	21	1.21
N2O	218.87	2,204.62	0.10	310	30.78
TOTAL metrics tons of CO2 Eq per Year:					6,960.91

[Project Reduction of 30 Percent = 4,872.64 MT CO2e per year]

Community Purpose Electricity Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	3,175,583.24	2,204.62	1,440.42	1	1,440.42
CH	26.31	2,204.62	0.01	21	0.25
N2O	45.50	2,204.62	0.02	310	6.40
TOTAL metrics tons of CO2 Eq per Year:					1,447.07

[Project Reduction of 30 Percent = 1,012.95 MT CO2e per year]

Commercial Electricity Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	5,668,200.00	2,204.62	2,571.06	1	2,571.06
CH	46.95	2,204.62	0.02	21	0.45
N2O	81.22	2,204.62	0.04	310	11.42
TOTAL metrics tons of CO2 Eq per Year:					2,582.92

[Project Reduction of 30 Percent = 1,808.05 MT CO2e per year]

Total Combined Electricity Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	50,013,533.47	2,204.62	22,685.78	1	22,685.78
CH	414.29	2,204.62	0.19	21	3.95
N2O	716.61	2,204.62	0.33	310	100.77
TOTAL metrics tons of CO2 Eq per Year:					22,790.50

[Project Reduction of 30 Percent = 15,953.35 MT CO2e per year]

PROJECT GHG REDUCTIONS

Consume 30 percent less energy than BAU by	37,323.53	MWh per year electricity consumption
exceeding Title 24 Year 2005 by 30 percent:	15,953.35	MTCO2Eq per year generation
Diffference between Project and BAU:	6,837.15	MTCO2Eq per year generation
Percent Reduction in BAU: 30.00 percent	30%	

NATURAL GAS EMISSIONS CALCULATIONS

BAU

Residential Parameters

Single-Family Consumption per Unit per Month:	5,198.70	cubic feet per month
Single-Family Consumption per Unit per Year:	62,384.40	cubic feet per year
Number of Single-Family Units:	621.00	units
Multi-Family Consumption per Unit per Month:	3,128.97	cubic feet per month
Multi-Family Consumption per Unit per Year:	37,547.64	cubic feet per year
Number of Multi-Family Units:	1,429.00	units
Total Residential Consumption (cubic feet):	92,396,289.96	cubic feet per year
Total Residential Consumption (million cubic feet):	92.40	million cubic feet per year
[Project Reduction of 30 Percent =	64.68	million cubic feet per year]

School Parameters

Annual Consumption per Square Foot	15.50	cubic feet per year
School Consumpation per Square Foot	1.29	cubic feet per month
Total School Acreage	31.60	acres
Total School Square Footage	1,376,496.00	square feet
Total School Consumption (kWh):	21,335,688.00	cubic feet per year
Total School Consumption (MWh):	21.34	million cubic feet per year
[Project Reduction of 30 Percent =	14.93	million cubic feet per year]

Park Parameters

Annual Consumption per Square Foot	3.00	cubic feet per year
Park Consumption per Square foot	0.25	cubic feet per month
Total PArk Acreage	27.90	acres
Total Park Square Footage	1,215,324.00	square feet
Total Park Consumption (kWh):	3,645,972.00	cubic feet per year
Total Park Consumption (MWh):	3.65	million cubic feet per year
[Project Reduction of 30 Percent =	2.55	million cubic feet per year]

Community Purpose Parameters

Annual Consumption per Square Foot	33.20	cubic feet per year
Annual Consumption per Square Foot	2.77	cubic feet per month
Total Community Purpose Acreage	5.80	acres
Total Community Purpose Square Footage	252,648.00	square feet
Total Community Purpose Consumption (kWh):	8,387,913.60	cubic feet per year
Total Community Purpose Consumption (MWh):	8.39	million cubic feet per year
[Project Reduction of 30 Percent =	5.87	million cubic feet per year]

Commercial Parameters

Retail Consumption per Square Foot/Month	2.90	cubic feet
Retail Consumption per Square Foot/Year	34.80	cubic feet
Total Commercial Square Feet	300,000.00	square feet
Total Commercial Consumption (kWh):	10,440,000.00	cubic feet per year
Total Commercial Consumption (MWh):	10.44	million cubic feet per year
[Project Reduction of 30 Percent =	7.31	million cubic feet per year]

Total Combined Annual Consumption in MWh:	136.21	MWh per year
[Project Reduction of 30 percent =	95.34	MWh per year]

Natural Gas Generation Emissions Factors (pounds/million cubic feet)

CO2	120,000.0
CH4	2.3
N2O	2.2

Residential Natural Gas Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	11,087,554.80	2,204.62	5,029.24	1	5,029.24
CH	212.51	2,204.62	0.10	21	2.02
N2O	203.27	2,204.62	0.09	310	28.58
TOTAL metrics tons of CO2 Eq per Year:					5,059.84
[Project Reduction of 30 Percent =					3,541.89 MT CO2e per year]

School Natural Gas Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	2,560,282.56	2,204.62	1,161.33	1	1,161.33
CH	49.07	2,204.62	0.02	21	0.47
N2O	46.94	2,204.62	0.02	310	6.60
TOTAL metrics tons of CO2 Eq per Year:					1,168.39
[Project Reduction of 30 Percent =					817.88 MT CO2e per year]

Park Natural Gas Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	437,516.64	2,204.62	198.45	1	198.45
CH	8.39	2,204.62	0.00	21	0.08
N2O	8.02	2,204.62	0.00	310	1.13
TOTAL metrics tons of CO2 Eq per Year:					199.66
[Project Reduction of 30 Percent =					139.76 MT CO2e per year]

Community Purpose Natural Gas Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	1,006,549.63	2,204.62	456.56	1	456.56
CH	19.29	2,204.62	0.01	21	0.18
N2O	18.45	2,204.62	0.01	310	2.59
TOTAL metrics tons of CO2 Eq per Year:					459.34
[Project Reduction of 30 Percent =					321.54 MT CO2e per year]

Commercial Natural Gas Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	1,252,800.00	2,204.62	568.26	1	568.26
CH	24.01	2,204.62	0.01	21	0.23
N2O	22.97	2,204.62	0.01	310	3.23
TOTAL metrics tons of CO2 Eq per Year:					571.72
[Project Reduction of 30 Percent =					400.20 MT CO2e per year]

Total Combined Natural Gas Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	16,344,703.63	2,204.62	7,413.84	1	7,413.84
CH	313.27	2,204.62	0.14	21	2.98
N2O	299.65	2,204.62	0.14	310	42.14
TOTAL metrics tons of CO2 Eq per Year:					7,458.96
[Project Reduction of 30 Percent =					5,221.27 MT CO2e per year]

PROJECT GHG REDUCTIONS

Consume 30 percent less energy than BAU by	136.21	MWh per year natural gas consumption
exceeding Title 24 Year 2005 by 30 percent:	5,221.27	MTCO2Eq per year
Diffference between Project and BAU:	2,237.69	MTCO2Eq per year
Percent Reduction in BAU: 30.00 percent	30%	

WATER EMISSIONS CALCULATIONS

BAU

Residential Parameters

Single-Family Consumption per Unit per Day:	500.00	gallons per day (gpd)
Single-Family Consumption per Unit per Year:	182,500.00	gallons per year (gpy)
Number of Single-Family Units:	621.00	units
Multi-Family Consumption per Unit per Day:	255.00	gpd
Multi-Family Consumption per Unit per Year:	93,075.00	gpy
Number of Multi-Family Units:	1,429.00	units
Total Daily Residential Consumption (gal):	674,895.00	gpd
Total Annual Residential Consumption (gal):	246,336,675.00	gpy

School Parameters

School Demand Per Acre per Day	1,785.00	gpd
School Demand Per Acre per Year	651525	gpy
Total School Acreage	31.60	acres
Total Daily School Consumption (gal):	56,406.00	gpd
Total Annual School Consumption (gal):	20,588,190.00	gpy

Park Parameters

Park Demand Per Acre per Day	2,155.00	gpd
Park Demand Per Acre per Year	786,575.00	gpy
Total Park Acreage	27.90	acres
Total Daily Park Consumption (gal):	60,124.50	gpd
Total Annual PArk Consumption (gal):	21,945,442.50	gpy

Community Purpose Parameters

Community Purpose Demand Per Acre per Day	893.00	gpd
Community Purpose Demand Per Acre per Year	325,945.00	gpy
Total Community Purpose Acreage	5.80	acres
Total Daily Community Purpose Consumption (gal):	5,179.40	gpd
Total Annual Community Purpose Consumption (gal):	1,890,481.00	gpy

Commercial Parameters

Commerical Demand Per Square Feet per Day	0.14	gpd
Commerical Demand Per Square Feet per Year	51.10	gpy
Total Commerical Square Footage	300,000.00	square feet
Total Daily Commerical Consumption (gal):	42,000.00	gpd
Total Annual Commerical Consumption (gal):	15,330,000.00	gpy

Total Combined Daily Consumption:	838,604.90	MWh per year
Total Combined Annual Consumption:	306,090,788.50	MWh per year

Parameters

Daily Water Use	838,604.90	gallons
Annual Water Use	306,090,788.50	gallons
Embodied Energy Rate	0.0085	kWh per gallon
Total Annual Water Energy Use (in kWh)	2,601,771.70	kWh per year
Total Annual Water Energy Use (in MWh)	2,601.77	MWh per year

Electricty Generation Emissions Factors (pounds/MWh)

CO2	1340
CH4	0.0111
N2O	0.0192

Water Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	3,486,374.08	2,204.62	1,581.39	1	1,581.39
CH	28.88	2,204.62	0.01	21	0.28
N2O	49.95	2,204.62	0.02	310	7.02
TOTAL metrics tons of CO2 Eq per Year:					1,588.69

WATER EMISSIONS CALCULATIONS

Project GHG Reductions

Residential Parameters

Single-Family Consumption per Unit per Day:	400.00	gallons per day (gpd)
Single-Family Consumption per Unit per Year:	146,000.00	gallons per year (gpy)
Number of Single-Family Units:	621.00	units
Multi-Family Consumption per Unit per Day:	204.00	gpd
Multi-Family Consumption per Unit per Year:	74,460.00	gpy
Number of Multi-Family Units:	1,429.00	units
Total Daily Residential Consumption (gal):	539,916.00	gpd
Total Annual Residential Consumption (gal):	197,069,340.00	gpy

School Parameters

School Demand Per Acre per Day	1,428.00	gpd
School Demand Per Acre per Year	521220	gpy
Total School Acreage	31.60	acres
Total Daily School Consumption (gal):	45,124.80	gpd
Total Annual School Consumption (gal):	16,470,552.00	gpy

Park Parameters

Park Demand Per Acre per Day	1,724.00	gpd
Park Demand Per Acre per Year	629,260.00	gpy
Total Park Acreage	27.90	acres
Total Daily Park Consumption (gal):	48,099.60	gpd
Total Annual PArk Consumption (gal):	17,556,354.00	gpy

Community Purpose Parameters

Community Purpose Demand Per Acre per Day	714.00	gpd
Community Purpose Demand Per Acre per Year	260,756.00	gpy
Total Community Purpose Acreage	5.80	acres
Total Daily Community Purpose Consumption (gal):	4,141.20	gpd
Total Annual Community Purpose Consumption (gal):	1,512,384.80	gpy

Commercial Parameters

Commerical Demand Per Square Feet per Day	0.11	gpd
Commerical Demand Per Square Feet per Year	40.88	gpy
Total Commerical Square Footage	300,000.00	square feet
Total Daily Commerical Consumption (gal):	33,000.00	gpd
Total Annual Commerical Consumption (gal):	12,264,000.00	gpy

Total Combined Daily Consumption:	670,281.60	MWh per year
Total Combined Annual Consumption:	244,872,630.80	MWh per year

Parameters

Daily Water Use	670,281.60	gallons
Annual Water Use	244,872,630.80	gallons
Embodied Energy Rate	0.0085	kWh per gallon
Total Annual Water Energy Use (in kWh)	2,081,417.36	kWh per year
Total Annual Water Energy Use (in MWh)	2,081.42	MWh per year

Electricty Generation Emissions Factors (pounds/MWh)

CO2	1340
CH4	0.0111
N2O	0.0192

Water Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	2,789,099.26	2,204.62	1,265.12	1	1,265.12
CH	23.10	2,204.62	0.01	21	0.22
N2O	39.96	2,204.62	0.02	310	5.62
TOTAL metrics tons of CO2 Eq per Year:					1,270.96

SOLID WASTE EMISSIONS CALCULATIONS

BAU/Project

Residential Parameters

Single-Family Pounds Generated per Unit per Day:	11.40	pounds
Single-Family Pounds Generated per Unit per Year:	4,161.00	pounds
Number of Single-Family Units:	621.00	units
Single-Family Total Pounds Generated:	2,583,981.00	pounds
Multi-Family Pounds Generated per Unit per Day:	8.60	pounds
Multi-Family Pounds Generated per Unit per Year:	3,139.00	pounds
Number of Multi-Family Units:	1,429.00	units
Multi-Family Total Pounds Generated Per Year:	4,485,631.00	pounds
Total Residential Pounds Generated:	7,069,612.00	pounds
Total Residential Tons Generated:	3,534.81	tons

School Parameters

Tons Generated per 1000 Square Feet/Year	1.30	tons/1000SF/year
Tons Generated per Square Feet/Year	0.0013	tons/SF/year
Pounds Generated per Square Feet per Day	2.60	pounds
School Acreage	31.60	acres
Number of Square Feet	1,376,496.00	square feet
Number of 1000 Square feet	1,376.50	1000 SF
Total School Tons Generated Per Year	1,789.44	tons

Park Parameters

Tons Generated per Park Acre per year	4.76	tons/acre/year
Pounds Generated per Park Acre per year	9,520.00	pounds/acre/year
Number of Acres	27.90	acres
Total Park Tons Generated per Year	132.80	tons

Community Purpose Parameters

Tons Generated per 1000 Square Feet/Year	5.70	tons/1000SF/year
Tons Generated per Square Feet/Year	0.0057	tons/SF/year
Pounds Generated per Square Feet per Day	11.40	pounds
CPF Acres	5.80	acres
Number of Square Feet	252,648.00	square feet
Number of 1000 Square feet	252.65	1000 SF
Total CPF Tons Generated Per Year	1,440.09	tons

Commercial Parameters

Pounds Generated per SF per day	0.046	pounds
Pounds Generated per SF per year	16.79	pounds
Total Commercial Square Feet	300,000.00	square feet
Total Pounds Generated per year	5,037,000.00	pounds
Total Commerical Tons	2,518.50	tons

Total Combined Tons Generated per Year:	9,415.65	tons
Total SEIR Solid Waste Generation	52,397.07	
Proportion of Waste	0.18	
Total SEIR Solid Waste Emissions	8,370.33	CO2e
Proportion Attributable to Project	**1,504.13**	CO2e

CONSTRUCTION EMISSIONS CALCULATIONS

BAU/Project

Residential Parameters

Emissions per Residential Unit Construction	0.08	MT CO2e per unit per year
Number of Residential Units being Constructed	2,050.00	units
Total Annual Residential Construction Emissions	157.85	MT CO2e per year

School Parameters

Emissions per Square Foot of SChool Construction	0.01	MT CO2e per square foot per year
School Bering Constructed (Total Acres)	31.6000	acres
School Amount Being Constructed (Acres)*:	25.28	acres
School Structure Amount Bering Constructed (Square Feet)*	1,101,196.80	square feet
Total Annual School Emissions	6,607.18	MT CO2e per year

Park Parameters

Emissions per Square Foot ofPark Construction	0.006	MT CO2e per square foot per year
Park Bering Constructed (Total Acres)	27.9000	acres
Park Amount Being Constructed (Acres)**:	6.98	acres
Park Structure Amount Bering Constructed (Square Feet)*:	303,831.00	square feet
Total Annual ParkEmissions	1,822.99	MT CO2e per year

Community Purpose Parameters

Emissions per Square Foot of CPF Construction	0.01	MT CO2e per square foot per year
CPF Bering Constructed (Total Acres)	5.8000	acres
CPF Amount Being Constructed (Acres)*:	4.64	acres
CPF Structure Amount Bering Constructed (Square Feet)*:	202,118.40	square feet
Total Annual CPF Emissions	1,212.71	MT CO2e per year

Commercial Parameters

Emissions per Commerical Square Foot Construction	0.006	MT CO2e per square foot per year
Commercial Amount Being Constructed	300,000.00	units
Total Annual Commerical Construction Emissions	1,800.00	MT CO2e per year

Total Annual Combined Construction Emissions:	11,600.73	MT CO2e per year

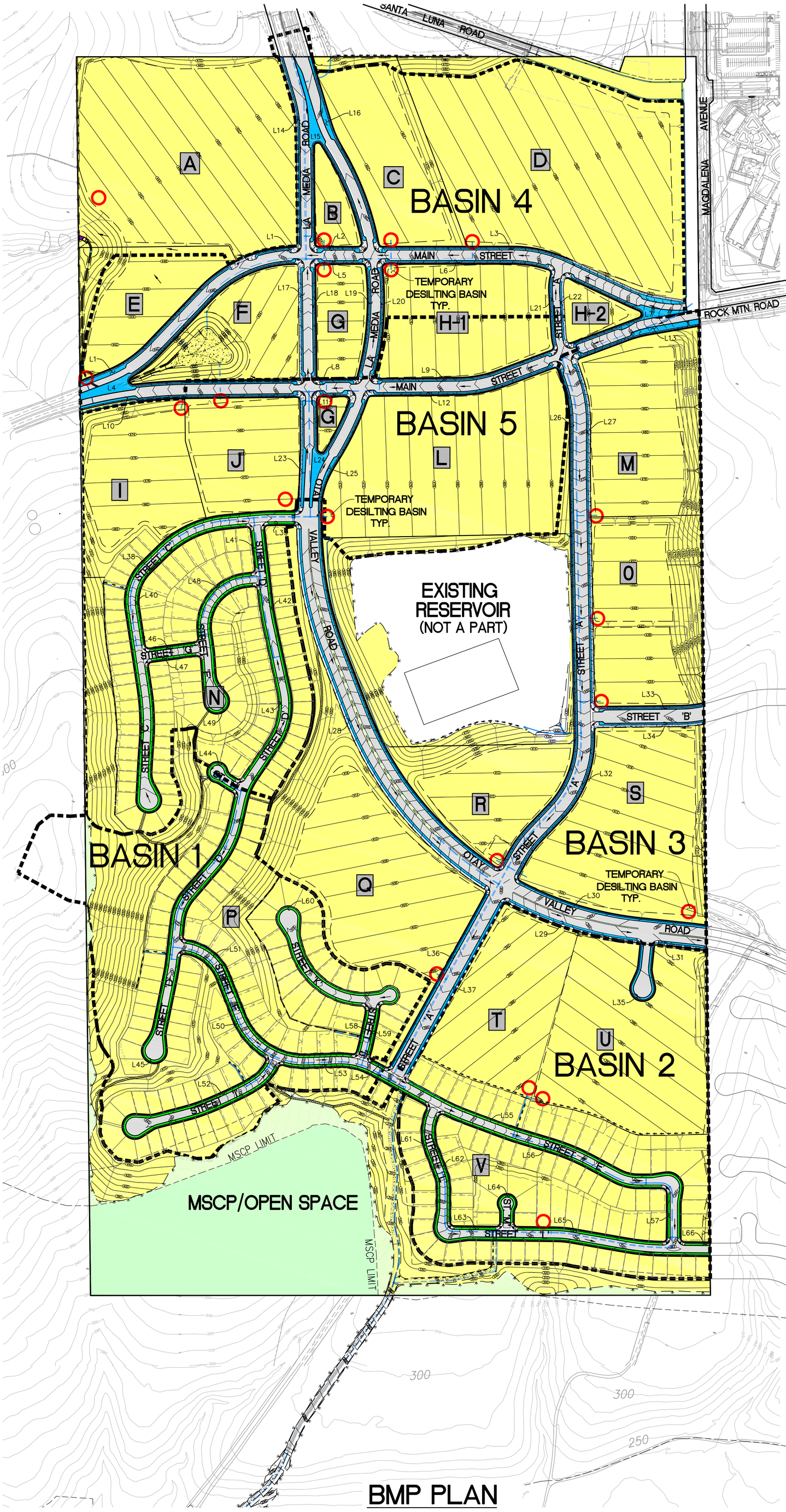
*=Determined by multiplying total school acreage by coverage ratio of 0.80:1

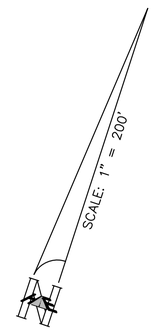
**Determined by multiplying total park acreage by structure coverage ratio of 0.25:1

WATER QUALITY TECHNICAL REPORT

BMP PLAN

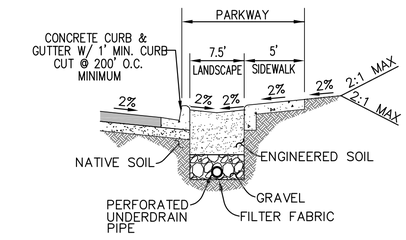
OTAY RANCH, VILLAGE 8 WEST





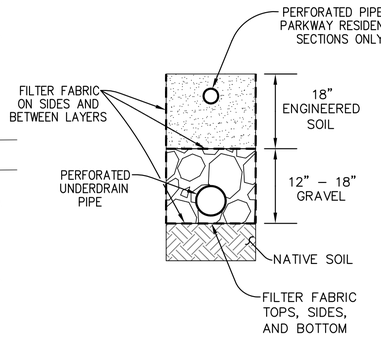
LEGEND

- SUBDIVISION BOUNDARY
- PROPOSED LOT LINE
- EXISTING CONTOUR
- PROPOSED CONTOUR
- PROPOSED CUT/FILL SLOPE (2:1 MAX)
- PROPOSED DAYLIGHT LINE
- PROPOSED DIRECTION OF DRAINAGE
- PROPOSED DRAINAGE DITCH
- PROPOSED PUBILIC STORM DRAIN (18" MIN)
- PROPOSED PUBLIC STORM DRAIN INLET
- PROPOSED PUBLIC STORM DRAIN CLEANOUT
- PROPOSED RIP RAP ENERGY DISSIPATOR
- PROPOSED TEMPORARY DESILTIING BASIN
- PROPOSED AC PAVEMENT
- PROPOSED PCC PAVEMENT
- PROPOSED MASS GRADING
- PROPOSED SWALE BIORETENTION BMP
- PROPOSED TREE WELL BIORETENTION BMP
- PROPOSED OPEN SPACE/LANDSCAPING
- PROPOSED MSCP AREA
- DRAINAGE BASIN BOUNDARY
- NEIGHBORHOOD BOUNDARY
- DRAINAGE BASIN — BASIN 1 (L1)
- BIO-RETENTION/TREE WELL DMA DESIGNATION
- PLANNING AREA DESIGNATION — A

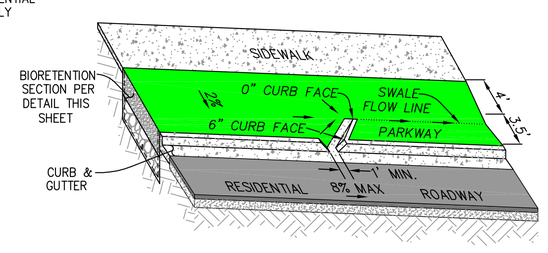


*NOTE: ALL VAULTS, UTILITY BOXES, AND LIGHT STANDARDS SHALL BE LOCATED OUTSIDE OF THE PROPOSED BIORETENTION BMPS

PARKWAY- RESIDENTIAL

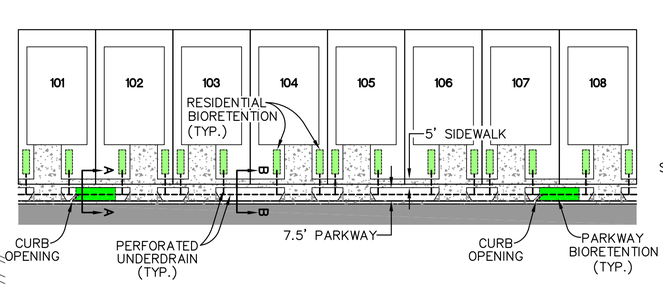


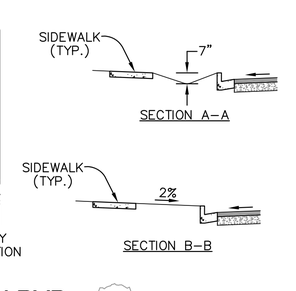
BIORETENTION SECTION



CURB OPENING

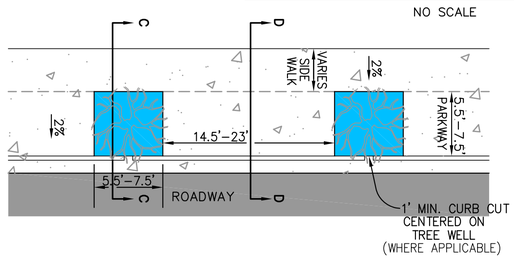
*NOTE: 1' CURB OPENING TO OCCUR 300' O.C. MINIMUM

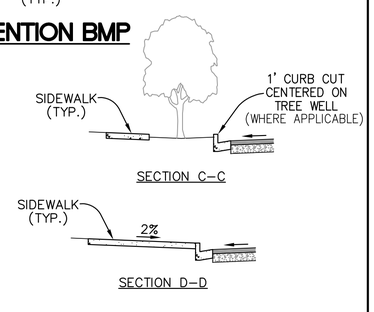




DETAIL-SWALE BIORETENTION BMP

NO SCALE



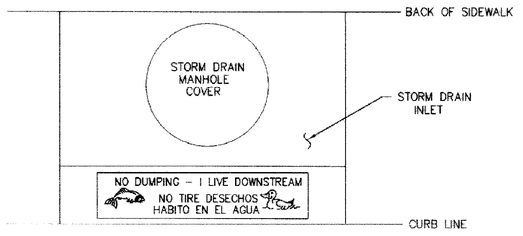


DETAIL-TREE WELL BIORETENTION BMP

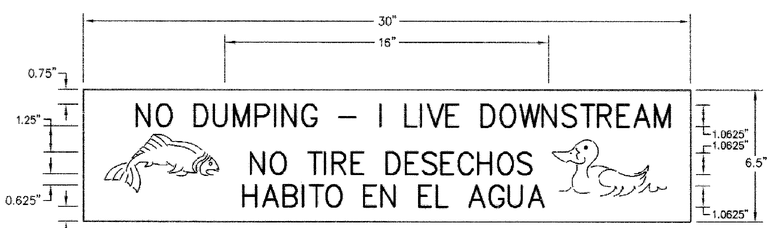
NO SCALE

NOTES:

1. DEPTH OF IMPRINT SHALL BE 0.25 INCH, MINIMUM
2. STAMP SHALL BE RIGID AND FABRICATED FROM METAL, HARD RUBBER, OR APPROVED EQUAL.



PLAN VIEW
NO SCALE



DETAIL-STORM DRAIN STENCILING (STD DWG CVCS 24)

NO SCALE

LID AND SITE DESIGN BMPS

- INCORPORATE ALTERNATIVE STREET LAYOUTS
- DESIGN TO MINIMUM STREET AND SIDEWALK WIDTH
- PRESERVE EXISTING VEGETATION
- PLANT NATIVE OR DROUGHT TOLERANT SPECIES
- MINIMIZE IMPERVIOUS SURFACES IN LANDSCAPE DESIGN
- MINIMIZE GRADING AND STABILIZE SLOPES
- UTILIZE NATURAL DRAINAGE SYSTEMS
- MINIMIZE SOIL COMPACTION
- DRAIN IMPERVOUS SURFACES INTO ADJACENT LANDSCAPING
- MINIMIZE DISTURBANCE TO NATURAL DRAINAGE SYSTEM
- CONVEY RUNOFF SAFTELY FROM TOPS OF SLOPES
- CONTROL/TREAT RUNOFF IN LANDSCAPING PRIOR TO DRAINING TO NATURAL DRAINAGE SYSTEM
- INSTALL ENERGY DISSIPATORS AS NEEDED

SOURCE CONTROL BMPS

- STORM DRAIN STENCILING AND SIGNAGE
- USE EFFICIENT IRRIGATION AND LANDSCAPE DESIGN
- INCORPORATE REQUIREMENTS APPLICABLE TO THE FOLLOWING INDIVIDUAL PRIORITY PROJECTS:
  - * ROADWAYS

PROJECT TREATMENT BMPS

- BIORETENTION FACILITIES
- TREE WELLS

PROJECT RECEIVING WATERS

WOLF CANYON (910.20), OTAY RIVER (910.20), SAN DIEGO BAY

LAND USE + ANTICIPATED POLLUTANTS

STREETS & ROADWAYS
SEDIMENTS, NUTRIENTS, HEAVY METALS, ORGANIC COMPOUNDS, TRASH & DEBRIS, AND OIL & GREASE

TOWN CENTER, RESIDENTAIL, AND PARKS AND SCHOOLS
SEDIMENTS, NUTRIENTS, HEAVY METALS, TRASH & DEBRIS, OXYGEN DEMANDING SUBSTANCES, OIL & GREASE, BACTERIA & VIRUSES, AND PESTICIDES

200 0 200 400 600

SCALE 1" = 200'

ORIGINAL: 04/06/09

PREPARED BY:
HALE ENGINEERING
7910 CONVOY COURT
SAN DIEGO, CA 92111
TEL: (858) 715-1420 FAX: (858) 715-1424

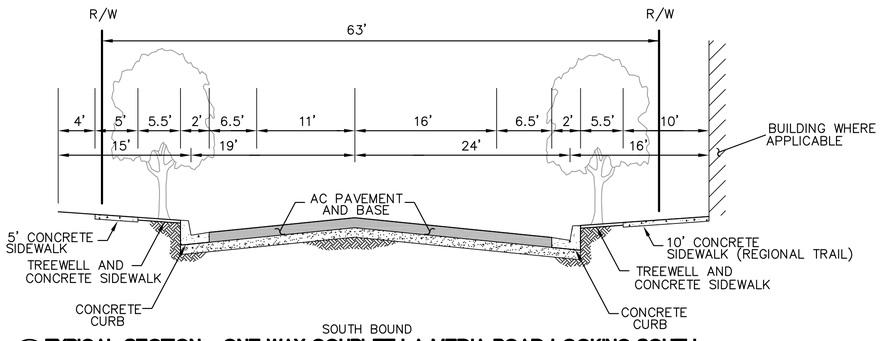
REVISIONS	DATE	BY

WATER QUALITY TECHNICAL REPORT
BMP PLAN
OTAY RANCH, VILLAGE 8 WEST
CHULA VISTA TRACT NO. 09-XX
CITY OF CHULA VISTA, CALIFORNIA

SHEET 1 OF 2

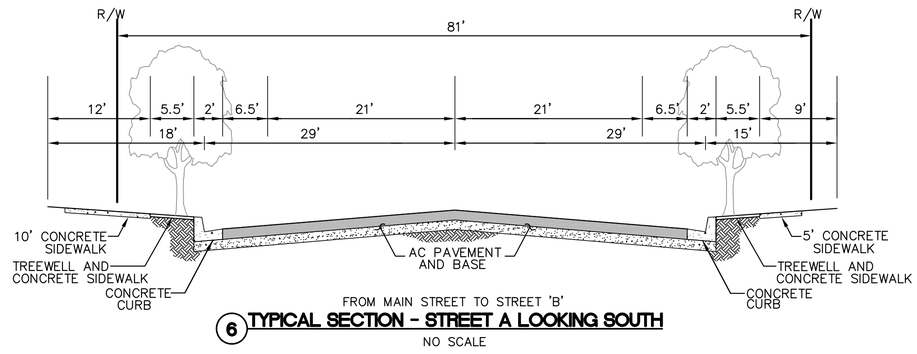
JOB NO. 08020 12/06/2010

WATER QUALITY TECHNICAL REPORT
DMA CALCULATIONS
OTAY RANCH, VILLAGE 8 WEST



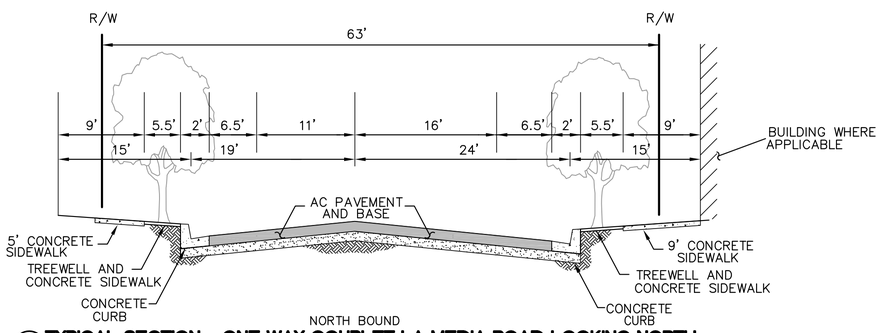
1 TYPICAL SECTION - ONE WAY COUPLET LA MEDIA ROAD LOOKING SOUTH

NO SCALE



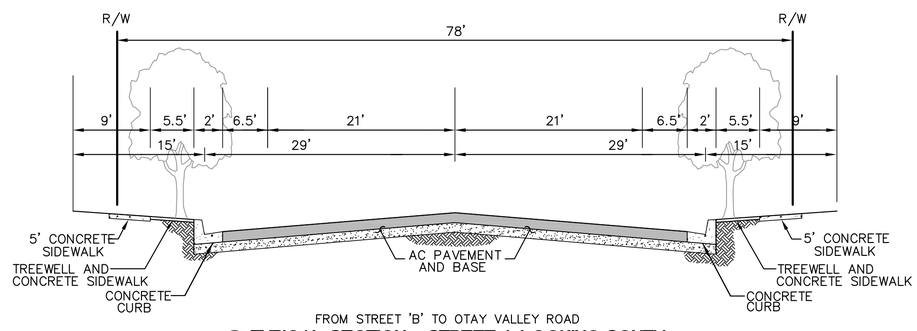
6 TYPICAL SECTION - STREET A LOOKING SOUTH

NO SCALE



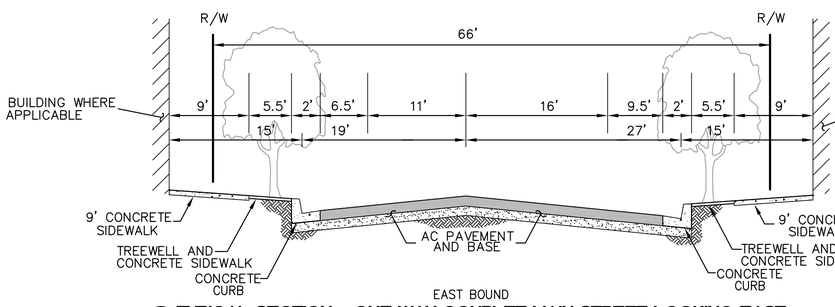
2 TYPICAL SECTION - ONE WAY COUPLET LA MEDIA ROAD LOOKING NORTH

NO SCALE



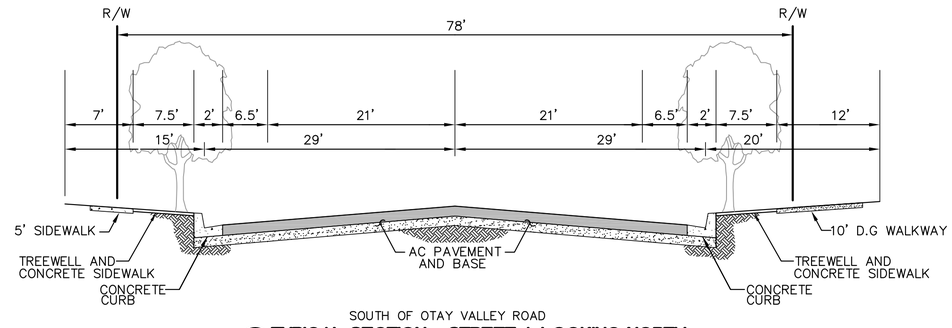
7 TYPICAL SECTION - STREET A LOOKING SOUTH

NO SCALE



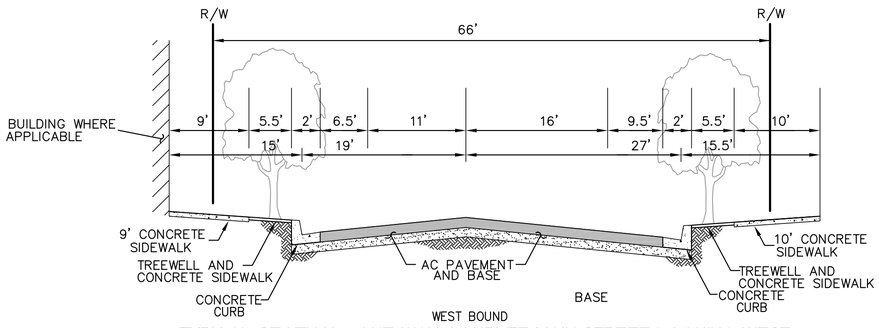
3 TYPICAL SECTION - ONE WAY COUPLET MAIN STREET LOOKING EAST

NO SCALE



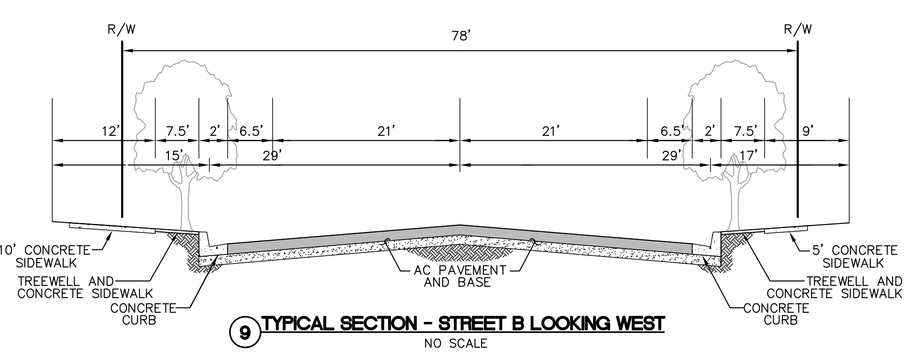
8 TYPICAL SECTION - STREET A LOOKING NORTH

NO SCALE



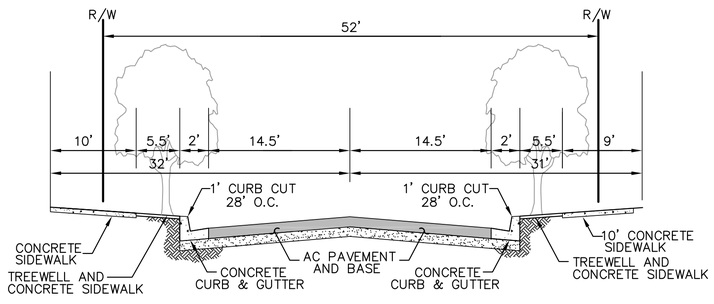
4 TYPICAL SECTION - ONE WAY COUPLET MAIN STREET LOOKING WEST

NO SCALE



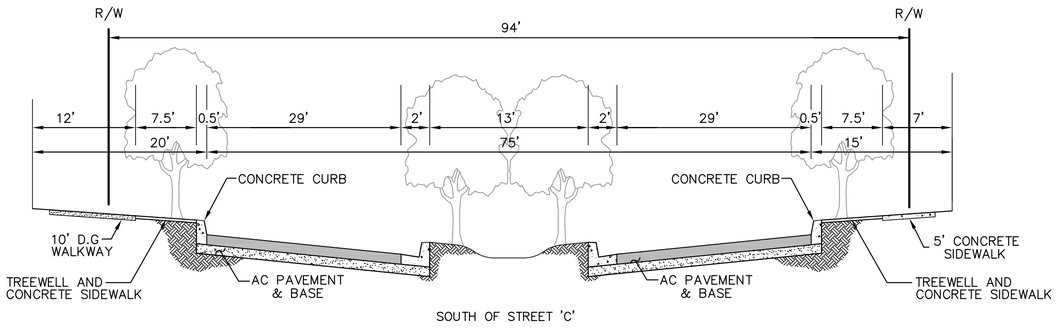
9 TYPICAL SECTION - STREET B LOOKING WEST

NO SCALE



5 TYPICAL SECTION - STREET A LOOKING SOUTH

NO SCALE



10 TYPICAL SECTION -OTAY VALLEY ROAD LOOKING WEST

NO SCALE

11 TYPICAL SECTION - PARKWAY RESIDENTIAL

NO SCALE

ORIGINAL: 04/06/09

PREPARED BY:

HALE ENGINEERING
7910 CONVOY COURT
SAN DIEGO, CA 92111
TEL: (858) 715-1420 FAX: (858) 715-1424

REVISIONS	DATE	BY

WATER QUALITY TECHNICAL REPORT
BMP PLAN
OTAY RANCH, VILLAGE 8 WEST
CHULA VISTA TRACT NO. 09-XX
CITY OF CHULA VISTA, CALIFORNIA

SHEET 2 OF 2

JOB NO. 08020 12/06/2010

APPENDIX I1

Water Quality Report

Preliminary Water Quality Technical Report

Otay Ranch
Village 8 West
Chula Vista Tract No. 09-XX

John A. Hayes, P.E.
R.C.E. # 58003
Expiration Date: June 30, 2014

Prepared By
Hale Engineering
7910 Convoy Court
San Diego, CA 92111
(858) 715-1420

Prepared For
Otay Land Company, LLC
1903 Wright Place, Suite 220
Carlsbad, CA 92008
(760) 602-3777



Date: December 8, 2011

H.E. Job No. 08020

Table of Contents

1 Project Description 1
2 Priority Project Determination 1
2.1 Storm Water Quality Information 2
2.1.1 Topography & Soils 2
2.1.2 Land Use 2
2.1.3 Existing and Proposed Project Hydrology 3
2.1.4 Receiving Waters 6
2.1.5 303(d) Impairments 7
3 Watershed 7
3.1 Beneficial Uses of Receiving Waters 7
4 Pollutants and Conditions of Concern 10
4.1 Backbone Infrastructure 11
4.2 Town Center, Residential, Parks and Schools 13
5 Post Construction BMPs 15
5.1 Backbone Infrastructure 16
5.2 Town Center, Residential, Parks and Schools 18
5.3 LID and Site Design BMPs for Backbone Infrastructure 20
5.4 Source Control BMPs for Backbone Infrastructure 22
5.5 Treatment Control BMPs for Backbone Infrastructure 23
5.5.1 Structural BMP Selection 23
5.5.2 Structural BMP Locations 24
5.5.3 Restrictions on the Use of Infiltration BMPs 24
5.5.4 Design Criteria and Numeric Sizing 24
6 Maintenance 25
6.1 Annual Maintenance Costs 25
6.2 Maintenance Mechanisms 26
6.3 Maintenance Requirements 26
6.4 Fiscal Resources 27
7 Geotechnical/Soils Report 28
8 Construction Activity BMPs 29
9 Hydromodification 29

Tables

Table 2.1.3.1 Otay River Hydrologic Data……5
Table 2.1.3.2 Wolf Canyon Hydrologic Data……5
Table 2.1.3.3 Wolf Canyon Hydromodification Data……...6
Table 2.1.4.1 Project Receiving Waters……6
Table 3.0.1 Proportion of Watershed Area……7
Table 3.1.1 Beneficial Uses of Inland Receiving Waters……10
Table 3.1.2 Beneficial Uses of Ground Receiving Waters……10
Table 3.1.3 Beneficial Uses of Coastal Receiving Waters……10
Table 4.1.1 Anticipated and Potential Pollutants……11
Table 4.2.1 Anticipated and Potential Pollutants……13
Table 5.1.1 Site Design and Source Control Storm Water BMP Selection Matrix……16
Table 5.1.2 Pollutants of Concern Response to Treatment…… 17
Table 5.1.3 Treatment Control BMP Selection Matrix……17
Table 5.2.1 Site Design and Source Control Storm Water BMP Selection Matrix……17
Table 5.2.2 Pollutants of Concern Response to Treatment……..19
Table 5.2.3 Treatment Control BMP Selection Matrix……19
Table 6.1.1 Estimated O&M Costs for Structural BMPs Within the Right-of-Way……25
Table 6.1.2 Estimated O&M Costs for Public Facilities……....25
Table 6.1.3 Estimated O&M Costs for Private Structural Facilities……..25
Table 6.2.1 BMP Maintenance Mechanisms……...26

Appendices

Appendix A Vicinity Map
Appendix B Project BMP Plan
Appendix C DMA Calculations
Appendix D Storm Water Management Facilities Maintenance Agreement With Grant of Access and Covenants Template
Appendix E Geotechnical Investigation
Appendix F Inspection, Operation, and Maintenance Plan

1 Project Description

The project site is a 320-acre (gross) parcel located within the City of Chula Vista. The property has been assigned assessor's parcel number 644-070-12 and 644-070-14 and can be found on page 1331 E4 of the 2007 edition of the Thomas Guide to San Diego.

The project is referred to as Village 8 West of the Otay Ranch Land Use Plan. At this time, the proposed site development includes the construction of backbone roadways, infrastructure (including storm drain and utilities), the mass grading of pads for future development, and the construction of an off-site utility access roadway. This WQTR shall identify both the water quality concerns due to the backbone infrastructure and roadways as currently proposed and those due to future development. Where stub outs for future improvements are proposed, temporary erosion control measures will be implemented. The measures taken to preserve water quality shall meet all State and City agency standards for the treatment of urban runoff.

The future development includes service and mixed retail within the proposed Town Center, residential (attached and detached), schools and parks. Typical anticipated pollutants from such developments are identified in Section 4.2 and appropriate BMP measures are described in Section 5.2. As detailed site plans are not available at this time, developers for each planning area associated with the Village 8 SPA Plan will be required to submit for City review and approval site-specific Water Quality Technical Reports prior to obtaining any land development permits. Individual developers will also be responsible for implementing and maintaining all BMPs until new owners take responsibility for the maintenance of post-construction BMPs into perpetuity. The measures taken to preserve water quality of the future development shall meet all State and City agency standards for the treatment of urban runoff.

2 Priority Project Determination

The proposed project includes backbone infrastructure (roadways and utilities) for Village 8 West. Per Section 3.I of the City of Chula Vista's Development Storm Water Manual (January 2011), the project meets the definition of the following Priority Development Project classification: Streets, Highways, and Freeways.

Future development of the project includes service and mixed retail within the proposed Town Center, residential (attached and detached), schools and parks. Per Section 3.I of the City of Chula Vista's Development Storm Water Manual, the future development meets the definition of the following Priority Development Project classifications: Detached Residential Development, Attached Residential Development; Restaurants, Hillside Development and Parking Lots.

2.1 Storm Water Quality Information

2.1.1 Topography & Soils

The property consists of two topographic regimes. The northern and eastern portions of the property are underlain by the Otay Formation and are characterized by rolling hills punctuated by south draining "V" shaped drainages. Locally, along incised flow-lines, gradients on the order of 1:5:1 (horizontal to vertical) or steeper exist. However, most of the drainages are broad and relatively shallow. This regime terminates to the south in low-relief river terraces bordering the Otay River. The southwestern portion of the site (approximately 37.3 acres), comprising the second topographic regime, consists of boulders and more rugged terrain underlain by the Santiago Peak Volcanics. Relief over the volcanic area, referred to as Rock Mountain, is greater than 300 feet and slopes are estimated at greater than 25%. The southerly extension of the 30-foot utility access road extends through approximately 4,000 feet of relatively level Terrace deposits before dropping into the alluviated Otay River drainage.

Per the site reconnaissance and subsurface investigation conducted by Advanced Geotechnical Services, INC. (AGS) no indications of mass wasting were observed nor mapped within the Santiago Peak Volcanics. Relatively stable, steep slopes and the absence of mass wasting are common within this unit. The pervasive Otay Formation is less resistant to erosion and slumping. Surficial slumps and deeper landslides do occur regionally, and are often associated with the La Nacion fault and/or bentonite beds are exposed by erosion and baseline down cutting. However, no significant landslides were identified during the site reconnaissance and subsurface investigation conducted by Advanced Geotechnical Services, INC.

For further information, please see Appendix E Geotechnical Investigation.

2.1.2 Land Use

Currently, the site is used for light agrarian (dry farming) purposes. An existing City of San Diego reservoir occupies a central portion of the property. Reservoir-associated large diameter aqueducts forming the Coronado Wye traverse the site. The MSCP Subarea Plan Preserve occupies approximately 16 acres in the southwest corner of the project site. Under the proposed project, the site will be developed per the Otay Ranch Land Use plan as Village 8 West. The site will contain the existing reservoir, mass graded pads, infrastructure, major roadways, and a utility access road that extends from southwest corner of the project into the MSCP. The large diameter aqueducts will be relocated and the associated City of San Diego waterline easement vacated.

Future development of the project site includes service and mixed retail within the proposed Town Center, residential (attached and detached), schools and parks.

2.1.3 Existing and Proposed Project Hydrology

In the existing condition, the site is composed of 3 drainage areas with three distinct discharge points. Drainage areas A and B drain southwesterly toward two outlet points along the southern boundary of the project; drainage area C drains westerly toward an outlet point along the western boundary of the project.

Pre-Project Drainage Area A is an 83.9-acre drainage area with a high point of 511.7 and a flow line elevation of 310.0 at the outlet point. Flow through the drainage area consists of natural mountain channel flow. The flow path from the highest point in the basin to the lowest is 4,340 feet. This flow exits the project limits at the MSCP boundary and continues s'ly along the natural channel to Otay River.

Pre-Project Drainage Area B is a 127.1-acre drainage area with a high point of 514.4 and a flow line elevation of 276.7 at the outlet point. This basin receives offsite flow from Village 7 Vista Verde; quantities are determined in the drainage study prepared by Rick Engineering. Flow through the drainage area consists of natural mountain channel flow. The flow path from the highest point in the basin to the lowest is 4,375 feet. This flow exits the project boundary and continues s'ly along the natural channel to Otay River.

Pre-Project Drainage Area C is a 183.6-acre drainage area composed of 89.6 acres of offsite flow and 94.0 acres of onsite flow; with a high point of 430.0 and a flow line elevation of 367.1 at the outlet point. This basin receives offsite flow from Otay Ranch Village 7; quantities are determined in the hydrology study prepared by Hunsaker Engineering. Flow through the drainage area consists of natural mountain channel flow. The flow path from the highest point in the basin to the lowest is 3,100 feet. This flow exits the project boundary and continues sw'ly along the natural channel to Wolf Creek which is tributary to Otay River.

In the post-project condition, the site is comprised of 5 drainage areas. Drainage areas 1, 2 and 3 drain southerly toward the Otay River; drainage areas 4 and 5 drain westerly to Wolf Canyon.

Post-Project Drainage Area 1 is a 36.7-acre drainage area; proposed improvements within this drainage area include mass grading of pads and portions of Streets 'D', 'E', 'H', 'I', & 'K' within Parcel P for future development. Runoff is transported to the proposed storm drain system via proposed catch basins and curb inlets located at intervals within the proposed roadways. This storm drain system ultimately confluences with areas 2 & 3 and conveys s'ly through storm drain to the Otay River.

Post-Project Drainage Area 2 is a 42.3-acre drainage area; proposed improvements within this area include mass grading of pads and portions of Streets 'E', 'M', & 'L' within Parcels T, U, & V for future development. Runoff is transported to the proposed storm drain system via proposed curb inlet located at intervals within the drainage area. This storm drain ultimately confluences with

area 1 and conveys s'ly through storm drain to the outlet point and continuing to the Otay River.

Post-Project Drainage Area 3 is a 100.3-acre drainage area composed of 20.1 acres of offsite flow and 82.7 acres of onsite flow. A south east segment of Otay Valley Road discharges to the east .Proposed improvements within this area include mass grading of pads and portions of Streets 'A', 'B', & La Media within Parcels M, O, Q, R, S, & the reservoir for future development. This basin receives offsite flow from Village 7 Vista Verde; quantities are determined in the drainage study prepared by Rick Engineering. Runoff is transported to the proposed storm drain system via proposed curb inlet located at intervals within the proposed roadways. This storm drain ultimately confluences with area 1 and conveys s'ly through storm drain to the outlet point and continuing to the Otay River. Velocity for the 3 drainage areas is dissipated with a USBR type VI impact basin and 20' rip rap energy dissipator.

Otay Valley Road – The section of road east of Street A does not combine with Drainage areas 1 – 3.

Post-Project Drainage Area 4 is a 143.6-acre drainage area composed of 89.6 acres of offsite flow and 54.0 acres of onsite flow; proposed improvements within this drainage area include mass grading of pads & portions of La Media Road, Street 'A', and Main Street within parcels B, C, D, E, F, G (portion), H (portion), and W for future development. This basin receives offsite flow from Otay Ranch Village 7; quantities are determined in the hydrology study prepared by Hunsaker Engineering. Runoff is transported to the proposed storm drain system via proposed catch basins and curb inlets located at intervals within the proposed roadways. This storm drain system confluences with area 5 and ultimately outlets to an existing natural drainage channel after discharging from a detention basin designed to manage development hydromodification. This discharge confluences drainage areas 4 & 5 with the City of Chula Vista property Basin P (a park to be developed by the city and not included in the hydromodification design). Discharge outlets through energy dissipaters (impact basin and rip rap) and flows westerly from the outlet point to Wolf Canyon.

Post-Project Drainage Area 5 is a 59.0-acre drainage area; proposed improvements within this drainage area include mass grading of pads & portions of La Media Road, Main Street, and Streets 'A', 'D', 'F', & 'G', and within parcels G (portion), H (portion), I, J, L, & N for future development. Runoff is transported to the proposed storm drain system via proposed catch basins and curb inlets located at intervals within the proposed roadways. This storm drain system confluences with area 4 and Basin P and ultimately outlets to an existing natural drainage channel running westerly from the outlet point to Wolf Canyon.

The following table lists the Pre- and Post-Project Hydrology data for the Otay River discharge as determined per the County of San Diego Hydrology Manual Methodology.

Table 2.1.3.1 Otay River Hydrologic Data

		Otay River			
		Pre Project **Q**e			Post Project **Q**p
Tributary Basins		A	B	A+B	1-3
Area (acres)		83.9	127.1	211.0	179.3
2-Year Storm	**Q** (cfs)	47.8	70.8	118.6	155.5
	Tc (min)	18.1	30.6		22.2
10-Year Storm	**Q** (cfs)	78.7	112.5	191.2	243.9
	Tc (min)	16.4	28.6		21.5
25-Year Storm	**Q** (cfs)	84.0	119.5	203.5	258.7
	Tc (min)	16.2	28.4		21.4
50-Year Storm	**Q** (cfs)	105.7	147.7	253.4	317.9
	Tc (min)	15.5	27.6		21.2
100-Year Storm	**Q** (cfs)	122.3	169.1	291.4	362.5
	Tc (min)	15.0	27.1		21.0

The following table lists the Pre- and Post-Project Hydrology data for the Wolf Canyon discharge point as determined per the County of San Diego Hydrology Manual Methodology.

Table 2.1.3.2 Wolf Canyon Hydrologic Data

		Wolf Canyon				
		Pre Project	Post Project			
		Qe	Flow Into Detention Basin **Q**p	Flow Out of Detention Basin **Q**m	Lot 'A' **Q**p	Total **Q**t
Tributary Basins		C	4,5	4,5	Lot 'A'	
Area (acres)		183.6	202.6	202.6	16.3	
2-Year Storm	**Q** (cfs)	155.6	243.8	42.6	18.4	61.0
	Tc (min)	15.4	13.8			
10-Year Storm	**Q** (cfs)	246.0	380.1	136.4	28.7	165.1
	Tc (min)	14.9	13.6			
25-Year Storm	**Q** (cfs)	261.2	402.8	157.2	30.5	187.7
	Tc (min)	14.8	13.5			
50-Year Storm	**Q** (cfs)	322.3	493.8	241.2	37.4	278.6
	Tc (min)	14.6	13.5			
100-Year Storm	**Q** (cfs)	368.3	559.3	313.4	42.4	355.8
	Tc (min)	14.5	13.5			

Note, the detention basin design located within Lot 'W' is based upon the more conservative values calculated via the HMP methodology.

The following table lists the Pre- and Post-Project Hydrology data for the Wolf Canyon discharge point as determined by HSPF in accordance with the criteria per the County of San Diego Final Hydromodification Management Plan (HMP).

Table 2.1.3.3 Wolf Canyon Hydromodification Data

		Wolf Canyon	
		Pre Project **Q**e	Post Project (Mitigated) **Q**m
Tributary Basins		C	4,5
Area (acres)		183.6	202.6
2-Year Storm	**Q** (cfs)	28.6	17.1
5-Year Storm	**Q** (cfs)	39.0	31.8
10-Year Storm	**Q** (cfs)	55.6	40.1
25-Year Storm	**Q** (cfs)	93.0	63.9

As shown above, peak flows increase with urban development of the Village 8 West site. This is due to increased impervious surface areas. However, a Hydromodification Management Plan (HMP) was prepared for the County of San Diego, and approved on July 14, 2010[1]. Per the Hydromodification Management Plan Technical Advisory Committee (HMPTAC) recommendations, the HMP has listed the Otay River Valley as a facility that is exempt from hydromodification. Therefore, hydromodification measures are not required for those areas directly tributary to the Otay River. Hydromodification shall be implemented for the areas tributary to the Wolf Canyon discharge point to maintain the integrity of Wolf Canyon.

2.1.4 Receiving Waters

The proposed project is part of the Otay Watershed, more specifically described as the Otay Valley Hydrologic Area, basin number 910.20. The receiving waters for the project are Wolf Canyon, the Otay River, and the San Diego Bay.

Table 2.1.4.1 Project Receiving Waters

Number	Name	Distance from Site
910	Wolf Canyon (Otay Valley HA)	0.4 miles
910.20	Otay River (Otay Valley HA)	0.6 miles
-NA-	San Diego Bay	8.6 miles

Revised 12/8/2011

[1] The Final HMP entered the implementation phase on January 14, 2011.

2.1.5 303(d) Impairments

According to the California 2006 303(d) list, which identifies impaired and threatened waters, published by the San Diego Regional Water Quality Control Board (RWQCB Region 9) the San Diego Bay is impaired for PCBs (Organic Compounds). Neither Wolf Canyon or Otay River are on the 303(d) list.

3 Watershed

The proposed project is part of the Otay River Watershed, more specifically described as the Chula Vista Hydrologic Area, basin number 910.2. The receiving waters for the project are the Otay River, and the San Diego Bay.

Table 3.0.1 Proportion of Watershed Area

	Area (acres)	Area as a Percentage of		
		Otay Watershed	Otay Valley Hydrologic Area	Project Site
Otay Watershed (910)	102,400	100	-	-
Otay Valley Hydrologic Area (910.2)	29,569	28.9	100	-
Project Site	320	0.3	1.1	100

3.1 Beneficial Uses of Receiving Waters

The Porter-Cologne Act establishes a comprehensive program for the protection of beneficial uses of the waters of the state. California Water Code Section 13050(f) describes the beneficial uses of surface and ground waters that may be designated by the State or Regional Board for protection as follows:

"Beneficial uses of the waters of the state that may be protected against quality degradation include, but are not necessarily limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves."

Beneficial uses for surface waters are designated under the Clean Water Act Section 303 in accordance with regulations contained in 40 CFR 131. The State is required to specify appropriate water uses to be achieved and protected. The beneficial use designation of surface waters of the state must take into consideration the use and value of water for public water supplies, protection and propagation of fish, shellfish and wildlife, recreation in and on the water, agricultural, industrial and other purposes including navigation.

In 1972, the State Board adopted a uniform list and description of beneficial uses to be applied throughout all basins of the State. During the 1994 Basin Plan update, beneficial use definitions were revised and some new beneficial uses were added. Overall, the following twenty-three beneficial uses are now defined statewide and are designated within the San Diego Region:

Municipal and Domestic Supply (MUN) - Includes uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.

Agricultural Supply (AGR) - Includes uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.

Industrial Process Supply (PROC) - Includes uses of water for industrial activities that depend primarily on water quality.

Industrial Service Supply (IND) - Includes uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.

Ground Water Recharge (GWR) - Includes uses of water for natural or artificial recharge of ground water for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.

Freshwater Replenishment (FRSH) - Includes uses of water for natural or artificial maintenance of surface water quantity or quality (e.g., salinity).

Navigation (NAV) - Includes uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.

Hydropower Generation (POW) - Includes uses of water for hydropower generation.

Contact Water Recreation (REC-1) - Includes uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and SCUBA diving, surfing, white water activities, fishing, or use of natural hot springs.

Non-Contact Water Recreation (REC-2) - Includes the uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

Commercial and Sport Fishing (COMM) - Includes the uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

Aquaculture (AQUA) - Includes the uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes.

Warm Freshwater Habitat (WARM) - Includes uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.

Cold Freshwater Habitat (COLD) - Includes uses of water that support cold-water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.

Inland Saline Water Habitat (SAL) - Includes uses of water that support inland saline water ecosystems including, but not limited to, preservation or enhancement of aquatic saline habitats, vegetation, fish, or wildlife, including invertebrates.

Estuarine Habitat (EST) - Includes uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).

Marine Habitat (MAR) - Includes uses of water that support marine ecosystems including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).

Wildlife Habitat (WILD) - Includes uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

Preservation of Biological Habitats of Special Significance (BIOL) - Includes uses of water that support designated areas or habitats, such as established refuges, parks, sanctuaries, ecological reserves, or Areas of Special Biological Significance (ASBS), where the preservation or enhancement of natural resources requires special protection.

Water quality objectives must protect the most sensitive of the beneficial uses, which have been designated for a water body. Water quality objectives may be numerical values for water quality constituent or narrative descriptions. Water quality objectives must be based upon sound scientific water quality criteria needed to protect the most sensitive of the beneficial uses, which have been designated for a water body. Water quality objectives must be as stringent or more stringent than water quality criteria.

The RWQCB San Diego Basin Plan identifies several beneficial uses of receiving waters. Tables 3.1.1 and 3.1.2 summarize the beneficial uses identified for downstream receiving waters.

Table 3.1.1 Beneficial Uses of Inland Receiving Waters

Receiving Waters	HU/ Basin Number	MUN	AGR	IND	PROC	GWR	FRSH	POW	REC1	REC2	BIOL	WARM	COLD	WILD	RARE	SPWN
Otay River	910.20	+	●	○					○	●		●		●	●	
Wolf Canyon	910.20	+	●	●					●	●		●		●	●	

● Existing Beneficial Use ○ Potential Beneficial Use + Exempt from Municipal Use

Table 3.1.2 Beneficial Uses of Ground Receiving Waters

Receiving Waters	HU/ Basin Number	MUN	AGR	IND	PROC	GWR	FRSH
Otay Valley HA	910.20	●	●	●			

● Existing Beneficial Use

Table 3.1.3 Beneficial Uses of Coastal Receiving Waters

Receiving Waters	HU/ Basin Number	IND	NAV	REC 1	COMM	BIOL	EST	WILD	RARE	MAR	AQUA	MIGR	SPAWN	WARM	SHELL
San Diego Bay		●	●	●	●	●	●	●	●	●		●	●		●

● Existing Beneficial Use

4 Pollutants and Conditions of Concern

Per Section 3.6.1.b of the City of Chula Vista's Development Storm Water Manual, pollutants generated by the proposed project that exhibit one or more of the following characteristics are considered pollutants of concern:

- Current loadings or historical deposits of the pollutant are impairing the beneficial uses of a receiving water;
- Elevated levels of the pollutant are found in water or sediments of a receiving water and/or have the potential to be toxic to or bioaccumulate in organisms therein; and
- Inputs of the pollutants are at a level high enough to be considered potentially toxic.

Per Section 3.6.1.b of the Development Storm Water Manual, any anticipated pollutants to be generated by the project which also are on the 303(d) list of impairments for the receiving waters shall be considered as pollutants of concern.

4.1 Backbone Infrastructure

Table 4.1.1 Anticipated and potential pollutants

Priority Project Categories	General Pollutant Categories								
	Sediments	Nutrients	Heavy Metals	Organic Compounds	Trash & Debris	O.D.S	Oils & Grease	Bacteria & Viruses	Pesticides
Detached Residential	X	X			X	X	X	X	X
Attached Residential	X	X			X	P(1)	P(2)	P	X
Commercial (> 1 ac)	P(1)	P(1)		P(2)	X	P(5)	X	P(3)	P(5)
Heavy Industry/ Industrial Development	X		X	X	X	X	X		
Auto Repair Shops			X	X (4) (5)	X		X		
Restaurants					X	X	X	X	
Hillside Development (>5,000 S.F.)	X	X			X	X	X		X
Parking Lots	P(1)	P(1)	X		X	P(1)	X		P(1)
Retail Gasoline Outlets			X	X	X	X	X		
Streets, Highways, and Freeways	X	P(1)	X	X (4)	X	P(5)	X		

(1) A potential pollutant if landscaping exists on-site; (2) A potential pollutant if the project includes uncovered parking areas; (3) A potential pollutant if land use involved food or animal waste products; (4) Including petroleum hydrocarbons; (5) Including solvents.

X Anticipated Pollutants P Potential Pollutants

As noted in Section 2, the proposed backbone infrastructure is classified as Streets, Highways, and Freeways. The following are the anticipated pollutants for the site:

Sediment- Sediments are soils or other surface materials eroded and then transported or deposited by the action of wind, water, ice, or gravity. Sediments can increase turbidity, clog fish gills, reduce spawning habitat, lower young aquatic organisms survival rates, smother bottom dwelling organisms, and suppress aquatic vegetation growth.

Nutrients[2]- Nutrients are inorganic substances, such as nitrogen and phosphorus. They commonly exist in the form of mineral salts that are either dissolved or suspended in water. Primary sources of nutrients in urban runoff are fertilizers and eroded soils. Excessive discharge of nutrients to water bodies and streams can cause excessive aquatic algae and plant growth. Such excessive production, referred to as cultural eutrophication, may lead to excessive decay of organic matter in the water body, loss of oxygen in the water, release of toxins in sediment, and the eventual death of aquatic organisms.

[2] Nutrients are an anticipated pollutant due to the inclusion of landscaping in the project design.

Heavy Metals- Metals are raw material components in non-metal products such as fuels, adhesives, paints, and other coatings. Primary sources of metal pollution in storm water are typically commercially available metals and metal products. Metals of concern include cadmium, chromium, copper, lead, mercury, and zinc. Lead and chromium have been used as corrosion inhibitors in primer coatings and cooling tower systems. At low concentrations naturally occurring in the soil, metals are not toxic. However, at higher concentrations, certain metals can be toxic to aquatic life. Humans can be impacted from contaminated ground water resources, and bioaccumulation of metals in fish and shellfish. Environmental concerns, regarding the potential for release of metals to the environment, have already led to restricted metal usage in certain applications.

Organic Compounds- Organic Compounds are carbon-based. Commercially available or naturally occurring are found in pesticides, solvents, and hydrocarbons. Organic Compounds can, at certain concentrations, indirectly or directly constitute a hazard to life or health. When rinsing off objects, toxic levels of solvents and cleaning compounds can be discharged to storm drains. Dirt, grease, and grime retained in the cleaning fluid or rinse water may also absorb levels of Organic Compounds that are harmful or hazardous to aquatic life.

Trash and Debris - Trash (such as paper, plastic, polystyrene packing foam, and aluminum materials) and biodegradable organic matter (such as leaves, grass cuttings, and food waste) are general waste products on the landscape. The presence of trash and debris may have a significant impact on the recreational value of a water body and aquatic habitat. Excess organic matter can create a high biochemical oxygen demand in a stream and thereby lower its water quality. In addition, in areas where stagnant water exists, the presence of excess organic matter can promote septic conditions resulting in the growth of undesirable organisms and the release of odorous and hazardous compounds such as hydrogen sulfide.

Oil and Grease - Oil and grease are characterized as high-molecular weight Organic Compounds. The primary sources of oil and grease are petroleum hydrocarbon products, motor products from leaking vehicles, esters, oils, fats, waxes, and high molecular-weight fatty acids. Introduction of these pollutants to the water bodies are very possible due to the wide uses and applications of some of these products in municipal, residential, commercial, industrial, and construction areas. Elevated oil and grease content can decrease the aesthetic value of the water body, as well as the water quality.

Since the 303(d) impairment of the receiving waters is PCBs (Organic Compounds), and per Table 4.1.1 Organic Compounds is an anticipated pollutant, Organic Compounds is a Pollutant of Concern associated with the backbone infrastructure and requires special consideration. Storm water BMPs are chosen that maximize removal of Organic Compounds from storm water runoff. Storm water BMPs are also chosen such that they are consistent with the Maximum Extent Practicable (MEP) standard for Sediments, Nutrients, Heavy Metals, Trash & Debris, and Oil & Grease.

4.2 Town Center (Service & Mixed Retail), Residential (attached & detached), Parks and Schools

Table 4.2.1 Anticipated and potential pollutants

Priority Project Categories	General Pollutant Categories								
	Sediments	Nutrients	Heavy Metals	Organic Compounds	Trash & Debris	O.D.S	Oils & Grease	Bacteria & Viruses	Pesticides
Detached Residential	X	X			X	X	X	X	X
Attached Residential	X	X			X	P(1)	P(2)	P	X
Commercial (> 1ac)	P(1)	P(1)		P(2)	X	P(5)	X	P(3)	P(5)
Heavy Industry/ Industrial Development	X		X	X	X	X	X		
Auto Repair Shops			X	X (4) (5)	X		X		
Restaurants					X	X	X	X	
Hillside Development (>5,000 S.F.)	X	X			X	X	X		X
Parking Lots	P(1)	P(1)	X		X	P(1)	X		P(1)
Retail Gasoline Outlets			X	X	X	X	X		
Streets, Highways, and Freeways	X	P(1)	X	X (4)	X	P(5)	X		

(1) A potential pollutant if landscaping exists on-site; (2) A potential pollutant if the project includes uncovered parking areas; (3) A potential pollutant if land use involved food or animal waste products; (4) Including petroleum hydrocarbons; (5) Including solvents.

X Anticipated Pollutants P Potential Pollutants

As noted in Section 2, the future development is classified as Detached Residential Development, Attached Residential Development; Restaurants, Hillside Development and Parking Lots. The following are the anticipated pollutants for the site:

Sediment - Sediments are soils or other surface materials eroded and then transported or deposited by the action of wind, water, ice, or gravity. Sediments can increase turbidity, clog fish gills, reduce spawning habitat, lower young aquatic organisms survival rates, smother bottom dwelling organisms, and suppress aquatic vegetation growth.

Nutrients - Nutrients are inorganic substances, such as nitrogen and phosphorus. They commonly exist in the form of mineral salts that are either dissolved or suspended in water. Primary sources of nutrients in urban runoff are fertilizers and eroded soils. Excessive discharge of nutrients to water bodies and streams can cause excessive aquatic algae and plant growth. Such excessive production, referred to as cultural eutrophication, may lead to excessive decay of organic matter in the water body, loss of oxygen in the water, release of toxins in sediment, and the eventual death of aquatic organisms.

Heavy Metals- Metals are raw material components in non-metal products such as fuels, adhesives, paints, and other coatings. Primary sources of metal pollution in storm water are typically commercially available metals and metal products. Metals of concern include cadmium, chromium, copper, lead, mercury, and zinc. Lead and chromium have been used as corrosion inhibitors in primer coatings and cooling tower systems. At low concentrations naturally occurring in the soil, metals are not toxic. However, at higher concentrations, certain metals can be toxic to aquatic life. Humans can be impacted from contaminated ground water resources, and bioaccumulation of metals in fish and shellfish. Environmental concerns, regarding the potential for release of metals to the environment, have already led to restricted metal usage in certain applications.

Trash and Debris - Trash (such as paper, plastic, polystyrene packing foam, and aluminum materials) and biodegradable organic matter (such as leaves, grass cuttings, and food waste) are general waste products on the landscape. The presence of trash and debris may have a significant impact on the recreational value of a water body and aquatic habitat. Excess organic matter can create a high biochemical oxygen demand in a stream and thereby lower its water quality. In addition, in areas where stagnant water exists, the presence of excess organic matter can promote septic conditions resulting in the growth of undesirable organisms and the release of odorous and hazardous compounds such as hydrogen sulfide.

Oxygen Demanding Substances – This category includes biodegradable organic material as well as chemicals that react with dissolved oxygen in water to form other compounds. Proteins, carbohydrates, and fats are examples of biodegradable organic compounds. Compounds such as ammonia and hydrogen sulfide are examples of oxygen-demanding compounds. The oxygen demand of a substance can lead to depletion of dissolved oxygen in a water body and possibly the development of septic conditions.

Oil and Grease - Oil and grease are characterized as high-molecular weight Organic Compounds. The primary sources of oil and grease are petroleum hydrocarbon products, motor products from leaking vehicles, esters, oils, fats, waxes, and high molecular-weight fatty acids. Introduction of these pollutants to the water bodies are very possible due to the wide uses and applications of some of these products in municipal, residential, commercial, industrial, and construction areas. Elevated oil and grease content can decrease the aesthetic value of the water body, as well as the water quality.

Bacteria and Viruses – Bacteria and viruses are ubiquitous microorganisms that thrive under certain environmental conditions. Their proliferation is typically caused by the transport of animal or human fecal wastes from the watershed. Water, containing excess bacteria and viruses can alter the aquatic habitat and create a harmful environment for humans and aquatic life. Also, the decomposition of organic waste causes increased growth of undesirable organisms in the water.

Pesticides – Pesticides (including herbicides) are chemical compounds commonly used to control nuisance growth or prevalence of organisms. Excessive application of a pesticide may result in runoff containing toxic levels of its active component.

Since the 303(d) impairment of the receiving waters is PCBs (Organic Compounds), and per Table 4.2.1 Organic Compounds is not an anticipated pollutant for the future development, storm water BMPs are chosen that meet the MEP standard for the above described pollutants.

5 Post Construction BMPs

Site Design BMPs may reduce the need for Source and/or Treatment Control BMPs, and Source Control BMPs may reduce the amount of Treatment Control BMPs needed. The proposed project shall consider, incorporate, and implement storm water BMPs in the following progression:

- ❑ Low Impact Development (LID) and Site Design BMPs
- ❑ Source Control BMPs
- ❑ Treatment BMPs

For further information see the BMP Site Map and DMA calculations included in Appendices B and C respectively of this WQTR.

5.1 Backbone Infrastructure

Table 5.1.1 Site Design and Source Control Storm Water BMP Selection Matrix

Priority Project Category	Site Design BMPs[1]	Source Control BMPs[2]	Requirements Applicable to Individual Priority Project Categories[(3)]										
			a. Private Roads	b. Residential Driveways & Guest Parking	c. Dock Areas	d. Maintenance BayS	e. Vehicle Wash Areas	f. Outdoor Processing Areas	g. Equipment Wash Areas	h. Parking Areas	i. Roadways	j. Fueling Areas	k. Hillside Landscaping
Detached Residential Development	R	R	R	R									R
Attached Residential Development	R	R	R										
Commercial Development	R	R			R	R	R	R					
Automotive Repair Shop	R	R			R	R	R		R			R	
Restaurants	R	R			R				R				
Hillside Development	R	R	R										R
Parking Lots	R	R								R[(4)]			
Streets, Highways & Freeways	R	R									R		

R= Required
(1) Refer of Section 3.6.2.a of the Development Storm Water Manual
(2) Refer of Section 3.6.2.b of the Development Storm Water Manual
(3) Priority project categories must apply specific storm water BMP requirements, where applicable. Projects are subject to the requirements of all priority project categories that apply.
(4) Applies if the paved area totals>5,000 square feet or with >15 parking spaces and is potentially exposed to urban runoff.

Per Table 5.1.1, the proposed project shall incorporate Site Design and Source Control BMPs as well as the requirements applicable individual priority projects as highlighted above.

Table 5.1.2 Pollutants of Concern Response to Treatment

Pollutant	Coarse Sediment and Trash	Pollutants that tend to associate with fine particles during treatment	Pollutants that tend to be dissolved following treatment
Sediment	X	X	
Nutrients		X	X
Heavy Metals		X	
Organic Compounds		X	
Trash & Debris	X		
O.D.S		X	
Bacteria		X	
Oil & Grease		X	
Pesticides		X	

Per Section 4 of this WQTR, the Pollutant of Concern for the proposed project is Organic Compounds. As shown above, Organic Compounds tend to associate with fine particles during treatment. The project is anticipated to produce Sediment, Nutrients, Heavy Metals, Trash & Debris, and Oil & grease; BMPs for these pollutants must meet the MEP standard. Therefore, only those Treatment Control BMPS with a medium to high removal efficiency for coarse sediment and trash, pollutants that tend to associate with fine particles during treatment, or pollutants that tend to be dissolved following treatment shall be considered for use in the proposed project.

Table 5.1.3 Treatment Control BMP Selection Matrix

Pollutant of Concern	Bioretention Facilities (LID)	Settling Basins (Dry Ponds)	Wet Ponds and Wetlands	Infiltration Facilities or Practices (LID)	Media Filters	High-rate Biofilters	High-rate Media Filters	Trash Racks & Hydrodynamic Devices
Coarse Sediment and Trash	**H**	H	**H**	**H**	H	H	H	H
Pollutants that tend to associate with fine particles during treatment	**H**	H	**H**	**H**	H	M	M	L
Pollutants that tend to be dissolved following treatment	**M**	L	**M**	**H**	L	L	L	L

Per Table 5.1.3, only Bioretention Facilities, Wet Ponds and Wetlands, and Infiltration Facilities provide a high removal efficiency for the pollutant of concern, Organic Compounds, and meet the MEP standard for the other pollutants associated with the proposed project.

5.2 Town Center (Service & Mixed Retail), Residential (attached & detached), Parks and Schools

Table 5.2.1 Site Design and Source Control Storm Water BMP Selection Matrix

Priority Project Category	Site Design BMPs[1]	Source Control BMPs[2]	Requirements Applicable to Individual Priority Project Categories[3]										
			a. Private Roads	b. Residential Driveways & Guest Parking	c. Dock Areas	d. Maintenance BayS	e. Vehicle Wash Areas	f. Outdoor Processing Areas	g. Equipment Wash Areas	h. Parking Areas	i. Roadways	j. Fueling Areas	k. Hillside Landscaping
Detached Residential Development	R	R	R	R									R
Attached Residential Development	R	R	R										
Commercial Development	R	R			R	R	R	R					
Automotive Repair Shop	R	R			R	R	R		R			R	
Restaurants	R	R			R				R				
Hillside Development	R	R	R										R
Parking Lots	R	R								R[4]			
Streets, Highways & Freeways	R	R									R		

R= Required
(1) Refer of Section 3.6.2.a of the Development Storm Water Manual
(2) Refer of Section 3.6.2.b of the Development Storm Water Manual
(3) Priority project categories must apply specific storm water BMP requirements, where applicable. Projects are subject to the requirements of all priority project categories that apply.
(4) Applies if the paved area totals>5,000 square feet or with >15 parking spaces and is potentially exposed to urban runoff.

Per Table 5.2.1, the future development shall incorporate Site Design and Source Control BMPs as well as the requirements applicable individual priority projects as highlighted above. Detailed site plans and priority project classifications for individual lots are not available at this time; additional priority project classifications may become applicable as said site plans become available. Developers for each planning area associated with the Village 8 SPA Plan will be required to submit for City review and approval site-specific Water Quality Technical Reports prior to obtaining any land development permits. Such site specific WQTRs shall specify those priority project classifications appropriate to the specific project and shall meet all associated priority project specific BMP requirements.

Table 5.2.2 Pollutants of Concern Response to Treatment

Pollutant	Coarse Sediment and Trash	Pollutants that tend to associate with fine particles during treatment	Pollutants that tend to be dissolved following treatment
Sediment	**X**	**X**	
Nutrients		**X**	**X**
Heavy Metals		**X**	
Organic Compounds		**X**	
Trash & Debris	**X**		
O.D.S		**X**	
Bacteria		**X**	
Oil & Grease		**X**	
Pesticides		**X**	

Per Section 4 of this WQTR, there are no Pollutants of Concern. However, only storm water BMPs meeting the MEP standard for Sediments, Nutrients, Heavy Metals, Trash & Debris, O.D.S, Bacteria, Oil & Grease, and Pesticides shall be permitted. Therefore, only those Treatment Control BMPs with a medium to high removal efficiency for coarse sediment and trash, pollutants that tend to associate with fine particles during treatment, or tend to be dissolved following treatment shall be considered for use in the proposed project.

Table 5.2.3 Treatment Control BMP Selection Matrix

Pollutant of Concern	Bioretention Facilities (LID)	Settling Basins (Dry Ponds)	Wet Ponds and Wetlands	Infiltration Facilities or Practices (LID)	Media Filters	High-rate Biofilters	High-rate Media Filters	Trash Racks & Hydrodynamic Devices
Coarse Sediment and Trash	**H**	H	**H**	**H**	H	H	H	H
Pollutants that tend to associate with fine particles during treatment	**H**	H	**H**	**H**	H	M	M	L
Pollutants that tend to be dissolved following treatment	**M**	L	**M**	**H**	L	L	L	L

Per Table 5.2.3, only Bioretention Facilities, Wet Ponds and Wetlands, and Infiltration Facilities have a medium to high removal efficiency and meet the MEP standard for the pollutants associated with the future development. As discussed in Section 1, specific water quality measures related to the development of individual pads will be addressed in development specific WQTRs. Treatment Control BMPs with a medium to high removal efficiency for pollutants specific to the development shall be chosen and described within the development specific supplemental WQTRs.

5.3 LID and Site Design BMPs for Backbone Infrastructure

Similar to most development projects, peak flows increase with urban development of Village 8 West. However, Per the HMPTAC recommendations, the HMP has listed the Otay River Valley as a facility that is exempt from hydromodification. Therefore, hydromodification measures are not be needed for the areas tributary to the Otay River discharge point. Hydromodification shall be implemented for the areas tributary to the Wolf Canyon discharge point to maintain the integrity of Wolf Canyon.

Additionally, the backbone infrastructure shall be designed to minimize directly connected impervious surfaces and to promote infiltration using LID techniques. To this end, the project shall minimize, to the maximum extent practicable, the introduction of Pollutants and Conditions of Concern into the storm water conveyance system. This objective shall be addressed through the following means:

- Minimizing the Impervious Footprint
  - Incorporating alternative street layouts to reduce road networks. La Media Road, a 4-Lane Major road is designed with a 94' right-of-way rather than the typical 100' right-of-way.
  - Provided that public safety and a walkable environment for pedestrians is not compromised, constructing streets and sidewalks to the minimum widths. All sidewalks are constructed to the minimum width.
  - Whenever practical, preserving existing native trees and shrubs to maximize canopy interception and water conservation. A total of 21.1 acres of the project site is to remain undeveloped and set aside as a combination of Open Space and MSCP.
  - Planting native or drought tolerant trees and large shrubs to maximize canopy interception and water conservation.
  - Minimizing the use of impervious surfaces, such as decorative concrete, in the landscape design. Landscaping within the parkways throughout the project also serve as Bioretention BMPs and contain minimal use of impervious surfaces.

- Conserving Natural Resources and Areas
  - Utilizing natural drainage systems to the maximum extent practicable. The site shall outlet to three existing discharge points. Two of the three points discharge directly to the Otay River; the third point discharges to an existing drainage path in Wolf Canyon that ultimately outlets to the Otay River as well.
  - Minimizing soil compaction.

- Minimizing Directly Connected Impervious Areas
  - Where landscaping is proposed, draining impervious sidewalks, pathways, and trails into adjacent landscaping prior to discharging to the storm drain. Specifically, all sidewalks within the proposed parkways are designed to

drain to the adjacent landscaped areas prior to discharging to the storm drain.

- Protecting Slopes and Channels
  - Minimizing disturbances to natural drainages. The project utilizes existing discharge points to minimize impacts to natural drainages. A regional analysis for the overall Otay development directly tributary to the Otay River is being undertaken to demonstrate that an increase in peak 100-year event flows will not have a negative effect on the downstream receiving waterway. This regional analysis will also investigate hydromodification impacts upon the Otay River to address current Hydromodification Management Plan (HMP) criteria.
  - Conveying runoff safely from the tops of slopes. Runoff is collected within concrete drainage ditches located at the tops of the proposed slopes and transported safely to the proposed storm drain system.
  - Vegetating slopes with native or drought tolerant vegetation
  - Controlling and treating flows in landscaping and/or other controls prior to reaching existing natural drainage systems. The proposed project incorporates Bioretention BMPs in the median along La Media Road and parkways throughout the site. These BMPs shall treat flows prior to their entrance to the proposed storm drain system and subsequent discharge to the existing natural drainage systems.
  - Installing energy dissipators, such as rip rap, at the outlets of new storm drains, culverts, or conduits that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipators shall be installed at each of the three outlet points in such a way as to minimize impacts to receiving waters.

- Using Natural Site Design Features (LID) to the MEP
  - Incorporating alternative street layouts to reduce road networks. La Media Road, a 4-Lane Major road is designed with a 94' right-of-way rather than the typical 100' right-of-way
  - Whenever practical, preserving existing native trees and shrubs to maximize canopy interception and water conservation. A total of 21.1 acres of the project site is to remain undeveloped and set aside as a combination of Open Space and MSCP.
  - Planting native or drought tolerant trees and large shrubs to maximize canopy interception and water conservation.
  - Minimizing soil compaction.
  - Utilizing natural drainage systems to the maximum extent practicable. The site shall outlet to three existing discharge points. Two of the three points discharge directly to the Otay River; the third point discharges to an existing drainage path in Wolf Canyon that ultimately outlets to the Otay River as well.
  - Where landscaping is proposed, draining impervious sidewalks, pathways, and trails into adjacent landscaping prior to discharging to the storm drain. Specifically, all sidewalks within the proposed parkways are designed to

drain to the adjacent landscaped areas prior to discharging to the storm drain.

5.4 Source Control BMPs for Backbone Infrastructure

Source-control BMPs are activities, practices, and procedures (primarily non-structural) that are designed to prevent urban runoff pollution. These measures either reduce the amount of runoff from the site or prevent contact between potential pollutants and storm water. In addition, source-control BMPs are often the best method to address non-storm (dry-weather) flows.

❑ **Provide Storm Drain System Stenciling and Signage**

Storm drain stencils are highly visible source control messages, typically placed directly adjacent to storm drain inlets. The stencils contain a brief statement that prohibits the dumping of improper materials into the urban runoff conveyance system. Graphical icons, either illustrating anti-dumping symbols or images of receiving water fauna, are effective supplements to the anti-dumping message. The project design shall include the following requirements:

- Providing stenciling or labeling of all storm drain inlets and catch basins with the project area with prohibitive language (such as "NO DUMPING-I LIVE DOWNSTREAM") and/or graphical icons to discourage illegal dumping.
- Maintaining legibility of stencils and signs.

Note: Storm drain stenciling and signage within public right-of-way shall be in accordance with Chula Vista Construction Standard CVCS 24 (See Appendix B).

❑ Use Efficient Irrigation Systems and Landscape Design, and Employ Integrated Pest Management Principles

The project shall design the timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water conveyance system. In compliance with the Water Conservation in Landscaping Act, the following methods to reduce excessive irrigation runoff shall be considered, and incorporated and implemented where determined applicable and feasible by the City of Chula Vista:

- Employ rain shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements
- Use flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.

❑ Incorporate Requirements Applicable to Individual Priority Project Categories

Per Table 5.1.1, the following requirements shall be implemented within the proposed project:

– Roadways

Per Section 3.6.2 of the Development Storm Water Manual, The project shall select Treatment Control BMPs following the treatment control selection procedure identified within the section:

- The project shall compare the list of pollutants for which the downstream receiving waters are impaired with the pollutants anticipated to be generated by the project as identified by Table 3.1 of the Manual (Table 5.1.1 of this WQTR).
- Any pollutants identified by Table 3.1, which are also causing a Clean Water Act section 303(d) impairment of the receiving waters, shall be considered Primary Pollutants of Concern.
- The project shall meet all applicable BMP requirements identified in Section 3.6.2
- The project shall select a single or combination of storm water BMPs from Table 3.3 (Table 5.1.3 of this WQTR), which maximize pollutant removal efficiency for the particular Primary Pollutant(s) of Concern.

See Sections 4 and 5 of this WQTR for further information.

5.5 Treatment Control BMPs for Backbone Infrastructure

Post-construction “treatment control” storm water management BMPs provide treatment for storm water emanating from the project site. Implementation of NPDES General Permit requirements entails the use of post-construction BMPs that will remain in service to protect water quality throughout the life of the project. Structural BMPs are an integral element of post-construction storm water management and include storage, filtration, and infiltration practices. BMPs have varying degrees of effectiveness versus different pollutants of concern. In addition, treatment-control BMPs are often the best method to address initial (first flush) flows.

5.5.1 Structural BMP Selection

The Pollutant of Concern for the proposed backbone infrastructure is Organic Compounds. Other anticipated pollutants for the proposed project are Sediments, Nutrients, Heavy Metals, Trash & Debris, and Oil and Grease. Bioretention Facilities have a high pollutant removal efficiency for Organic Compounds, meet the MEP standard for all other anticipated pollutants, are relatively inexpensive to construct and maintain, can be incorporated into the proposed landscaping, have a low probability of ground water contamination, and require a relatively small footprint for treatment. Therefore, Bioretention Facilities shall be incorporated in the form of bioretention tree wells and bioretention swales. Bio-retention areas

shall be incorporated for all detached-residential lots; these areas shall be tied to the bioretention swales within the roadways via perforated pipe.

The proposed off-site utility access road consists of a 12' wide asphalt paved roadway edged on either side with permeable gravel. Given the minimal traffic expected on this roadway, the lack of run-on onto the roadway, and the desire to minimize the impact to the MSCP, no bioretention BMPs are proposed along this portion of roadway. Rather, the permeable gravel shall provide adequate infiltration of the minor runoff due to the access roadway.

5.5.2 Structural BMP Locations

The chosen Structural Treatment Control storm water BMPs are located on-site to minimize costs and maximize pollutant removal prior to runoff entering receiving waters. The Bioretention BMPs have a high pollutant removal efficiency rating for Organic Compounds, the Pollutant of Concern. Each Bioretention BMP shall be fully operational prior to the use of any dependent phase of development. In the event that interim storm water BMPs are deemed necessary, said interim BMPs shall proved equivalent or greater treatment than is required per the design criteria set forth in the Development Storm Water Manual. Such interim BMPs shall remain in use until the permanent Structural BMPs are operational.

5.5.3 Restrictions on the Use of Infiltration BMPs

The Bioretention BMPs are not designed to function primarily as infiltration devices and are, therefore, not subject to the limitations as set forth in Section 3.6.2.c of the Development Storm Water Manual.

5.5.4 Design Criteria and Numeric Sizing

The Bioretention IMPs are designed to meet the area-based Treatment Control BMP Standards as set forth in Section 3.6.2.C of the Development Storm Water Manual.

All BMP design calculations assume that all off-site (Village 7, City of San Diego Reservoir, and Parcel 'A') and future development (Town Center, Attached & Detached Residential, Parks and Schools) runoff is treated prior to the confluence with backbone storm drain system. BMP calculations are included for the bioretention tree wells necessary to provide treatment for runoff from the small portion of Otay Valley Road that drains easterly to Village 8 East such that the runoff from Village 8 West is treated prior to the confluence with the Village 8 East backbone storm drain system. Each single family residential lots shall be designed with a bio-retention area within the lot that is sized to treat runoff per the area-based Treatment Control BMP Standards as set forth in Section 3.6.2.C of the Development Storm Water Manual. Lot specific Structural BMPs for the Town Center, Attached Residential, Parks, and Schools shall be implemented as these lots are developed and shall meet the numeric sizing standards set forth in the Development Storm Water Manual.

BMP design calculations are included in Appendix C.

6 Maintenance

The responsible party shall ensure ongoing long-term maintenance of all Structural BMPs through such means as may be appropriate, at the discretion of the City of Chula Vista, including but not limited to covenants, legal agreements, maintenance agreements, and/or conditional use permits.

6.1 Annual Maintenance Costs

This section provides a cost estimate for the construction and maintenance of the post-construction BMPs proposed for the project site.

Table 6.1.1 Estimated O&M Costs for Structural BMPs Within the Right-of-Way

BMP Type	Maintenance Type	Maintenance Interval	Annual Maintenance Cost	Maintenance Area	Total Maintenance Cost
Tree Well	Inspection & Maintenance	Monthly	$10/Tree Well	1,443 Tree Wells	$14,430
Bioretention Swale	Inspection & Maintenance	Monthly	$0.70/ft^2	39,010 ft^2	$27,307
				Subtotal	$41,737
				10% Contingency	$4,174
				Total	$45,911

Table 6.1.2 Estimated O&M Costs for Public Facilities

BMP Type	Maintenance Type	Maintenance Interval	Annual Maintenance Cost	Maintenance Area	Total Maintenance Cost
Hydromod Basin	Inspection & Maintenance	Monthly	$0.20/ft^2	85,000 ft^2	$17,000
				Subtotal	$17,000
				10% Contingency	$1,700
				Total	$18,700

Table 6.1.3 Estimated O&M Costs for Private Structural Facilities

BMP Type	Maintenance Type	Maintenance Interval	Annual Maintenance Cost	Maintenance Area	Total Maintenance Cost
SF Bio-Retention Areas	Inspection	Twice Annually	$0.25/ft^2	56,500 ft^2	$14,125
				Subtotal	$14,125
				10% Contingency	$1,413
				Total	$15,538

6.2 Maintenance Mechanisms

The following is a list of City approved maintenance mechanisms:

Table 6.2.1 BMP Maintenance Mechanisms

☐	Public Entity Maintenance. The City of Chula Vista may approve a public or quasi-public entity (e.g. the County Flood Control District, or annex to an existing assessment district, an existing utility district, a state or federal resource agency, or a conservation conservancy) to assume responsibility for maintenance, repair and replacement of the BMPs. Unless otherwise approved by the City, public entity maintenance agreements shall ensure estimated costs are front-funded or reliably guaranteed. (e.g. through a trust fund, assessment district fees, bond, letter of credit or similar means). In addition, the City may seek protection from liability by appropriate releases and indemnities. The City must be identified as a third party beneficiary empowered to enforce any such maintenance agreement within its jurisdiction.
☐	Project Proponent Agreement to Maintain Storm Water BMPs. The City enters into a contract with the project proponent obliging the project proponent and successors to maintain, repair, and replace the storm water BMP as necessary into perpetuity. Security may be required.
☐	Assessment District. The City approves an Assessment District or other funding mechanism created by the project proponent to provide funds for storm water BMP maintenance, repair, and replacement on an ongoing basis. Any agreement with such a District shall be subject to the Public Entity Maintenance provisions above.
☐	Lease Provisions. In those cases where the City of Chula Vista holds title to the land in question, and the land is being leased to another party for private or public use, the County may assure storm water BMP maintenance, repair and replacement through conditions in the lease.
☐	Conditional Use Permits. For discretionary projects that require a use permit, the City may assure maintenance of storm water BMPs through the inclusion of maintenance conditions in the Conditional Use Permit. Security may be required.
☐	Alternative Mechanism. The City may in its discretion accept alternative maintenance mechanisms if such mechanisms are as protective as those listed above

Of the above listed maintenance mechanisms, an Assessment District is the most suitable choice for the proposed project. Otay Land Company, LLC shall create a Community Facilities District (CFD), maintenance of the public Treatment Control BMPs shall be amongst the responsibilities of the CFD. Individual homeowners shall be responsible for maintenance of the bioretention areas located within the single family lots.

6.3 Maintenance Requirements

Per Section 3.7.3 of the Development Storm Water Manual, a copy of the project Inspection, Operation, and Maintenance Plan (IOMP) is included as Appendix F of this Water Quality Technical Report.

The CFD, as responsible party for the maintenance of the proposed project BMPs, shall maintain the IOMP forms to document all maintenance requirements and retain records for at least 5 years. These documents shall be made available to the City for inspection upon request at any time.

Per Section 8 of the Development Storm Water Manual, the Owner shall enter into a maintenance agreement with the City of Chula Vista for the inspection and maintenance of storm water facilities. This agreement shall provide City staff access to BMPs for inspection purposes. The agreement shall run with the land throughout the life of the project, until such time that the storm water BMPs requiring maintenance and access are replaced and maintenance and access are no longer needed, all to the satisfaction of the City of Chula Vista. A template for this agreement is included as Appendix D.

6.4 Fiscal Resources

There are multiple bioretention based BMPs within the Otay Ranch Village 8 West site for storm water quality treatment.

Funding for all water quality treatment BMPs within the public right-of-way shall be provided by the CFD. The CFD will be responsible to perform the maintenance activities and to ensure adequate funding into perpetuity.

The City of Chula Vista Watershed protection, Stormwater Management, and Discharge Control Ordinance require ongoing maintenance of BMPs to ensure the proper function and operation of these BMPs. Costs for the maintenance of BMPs within the right-of-way shall be the responsibility of the CFD at the time of inception and by the contractor during construction of the development.

The CFD for the Otay Ranch Village 8 West development shall be fiscally responsible for the maintenance and upkeep of the BMPs within the right-of-way indefinitely.

Additionally, a BMP Maintenance Agreement with Easement and/or Covenant shall be entered into with the City which will function in three ways. The easement will be dedicated on the Final Map. The agreement will commit the land to being used only for the purposes of the BMP. The agreement will include an agreement by the landowner to maintain the facilities in accordance with the WQTR. This agreement shall be passed on to future purchasers or successors of the landowner as a covenant. The final map shall include an easement giving the City the right to enter onto the land and any adjacent land needed for access to inspect the BMPs.

At no such time shall the maintenance of the post-construction BMPs go unperformed for any reason.

7 Geotechnical/Soils Report

Advanced Geotechnical Solutions, INC. (AGS) issued "Revised Geotechnical Investigation Village 8 West, Otay Ranch, Chula Vista, CA" dated October 22, 2010. The following as a summary of the findings and recommendations pertinent to water quality contained within that report:

- Potential for Infiltration BMPs
  The infiltration of standing water into all BMP's could potentially be detrimental to improvements such as slopes, foundations, utility trenches, retaining walls and pavement sections. Geotechnical review of grading plans should be performed when available to determine which storm drain imfiltration devices may require mitigation such as collection and discharging accumulated subsurface water away from improvements.

- Site Design Recommendations
  - Six-(6) and eight-(8) inch canyon subdrains are recommended for on-site canyon areas that will receive compacted fill. The drains should be placed along the lowest alignment of canyon removals. Final determination of drain locations will be made in the field based on exposed conditions.

  - In some instances post-grading irrigation practices and rainfall patterns can create seepage in cut and fill slopes. This seepage is more prevalent in cut slopes excavated in Santiago Peak Volcanics or fill slopes constructed out of shot rock. Where nuisance seepage is observed, drains are typically installed to collect this water and outlet it into suitable surface or subsurface drainage devices. These drains, if required, should be installed on a case by case basis per the geotechnical consultant's recommendations.

  - The infiltration of standing water into all BMPs could potentially be detrimental to improvements such as slopes, foundations, utility trenches, retaining walls and pavement sections. Geotechnical review of grading plans should be performed when available to determine which storm drain infiltration devices may require mitigation such as collecting and discharging accumulated subsurface water away from improvements.

- Groundwater
  Active springs or surface seeps were not observed during the geologic field mapping or subsurface investigation. It is possible that seasonal groundwater associated with precipitation intermittently occurs in on-site drainages. Owing to the depth of cut, it is possible that seasonal nuisance water trapped along joints or beds may be encountered during grading especially in the Santiago Peak Volcanics. Minor seeps or wet areas were observed in Borings BA-9, BA-11, and BA-12.

For further information, please see Appendix E Geotechnical Investigation.

Grading operations are subject to possible phasing. Section 7 of the City of Chula Vista Development Storm Water Manual identifies potential limitations to "unprotected" disturbed area. It may be necessary to deploy erosion and sediment control BMP's in disturbed areas where grading operations are not completed.

8 Construction Activity BMPs

Discharge of storm water runoff associated with construction activities shall be addressed in a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP shall be prepared in accordance with the Regional Water Quality Control Board (RWQCB) and City of Chula Vista requirements.

The construction activity BMPs will be implemented to reduce construction related impacts and provide acceptable stabilization of the project site. It may be necessary to implement some BMPs prior to clearing and grubbing. If the proposed project incorporates phased grading operations, the construction activity BMPs shall take into account the interim grading conditions.

9 Hydromodification

The attenuation provided by the Savage Dam on 60% of the overall watershed mitigates the increase in flows from development downstream of the dam (i.e. a 492.8 cfs increase from Village 9 and 12) as compared to the flows prior to the dam construction. Detention for any development below the dam would be ineffective as the peak flows from these smaller watersheds would pass well before the reservoir would fill to the point that flows would overtop the spillway.

Per the Otay River Watershed Assessment Report, the existing Otay River downstream of the dam is starved for sediment and peak flows, stating "Theoretically, an increase in peak flow would tend to counteract the degradation trends by replacing water impounded by the reservoir and helping the River maintain its original platform". Therefore no detention basins are proposed for this project other than bioretention and extended detention basins that may be used as Water Quality Devices.

A Hydromodification Management Plan (HMP) was prepared for the County of San Diego, and approved on July 14, 2010[3]. The plan exempts the Otay River from hydromodification criteria, based in part, on the contributing drainage area exceeding 100 square miles as well as having a 100-year design flow over 20,000 cfs. Based on the HMP, river systems meeting this criteria tend to be "depositional and have very wide floodplains". In addition, the HMP states that river systems of the like, "typically have very low gradients. The combination of low gradients, significant peak attenuation, and wide floodplain areas translate to

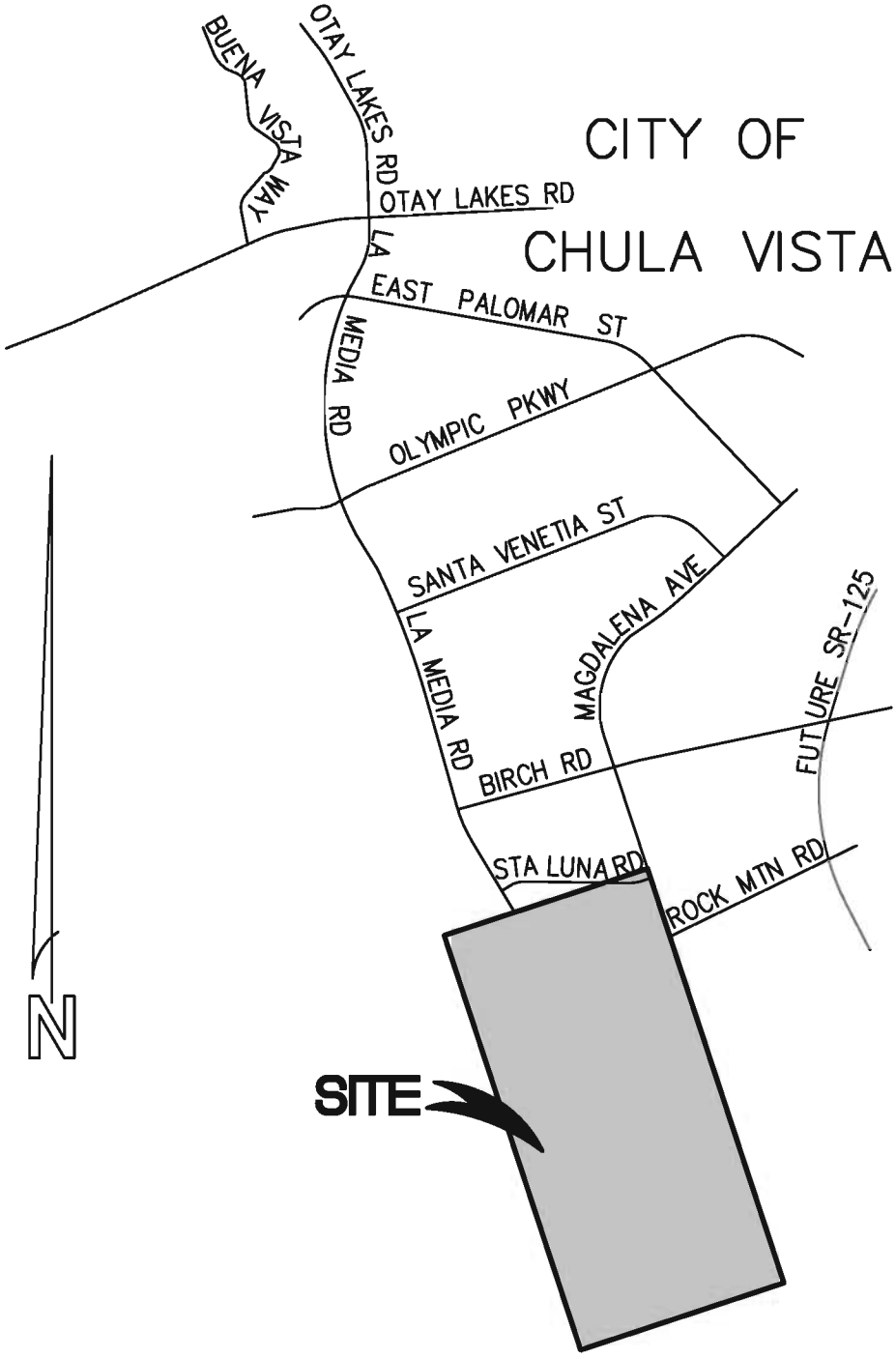
[3] The Final HMP entered the implementation phase on January 14, 2011.

a low potential for channel erosion". Therefore, the portion of the project directly tributary to the Otay River is exempt from the Hydromodification Criteria.

Hydromodification shall be implemented for the areas tributary to the Wolf Canyon discharge point to maintain the integrity of Wolf Canyon. Calculations for the sizing of the Wolf Canyon retention basin are included in the Hale Engineering Report entitled "Hydromodification Study For Otay Ranch Village 8 West" Dated May 11, 2011.

Appendix A

WATER QUALITY TECHNICAL REPORT
VICINITY MAP
OTAY RANCH, VILLAGE 8 WEST
CHULA VISTA TRACT NO. 09-XX
CITY OF CHULA VISTA, CALIFORNIA



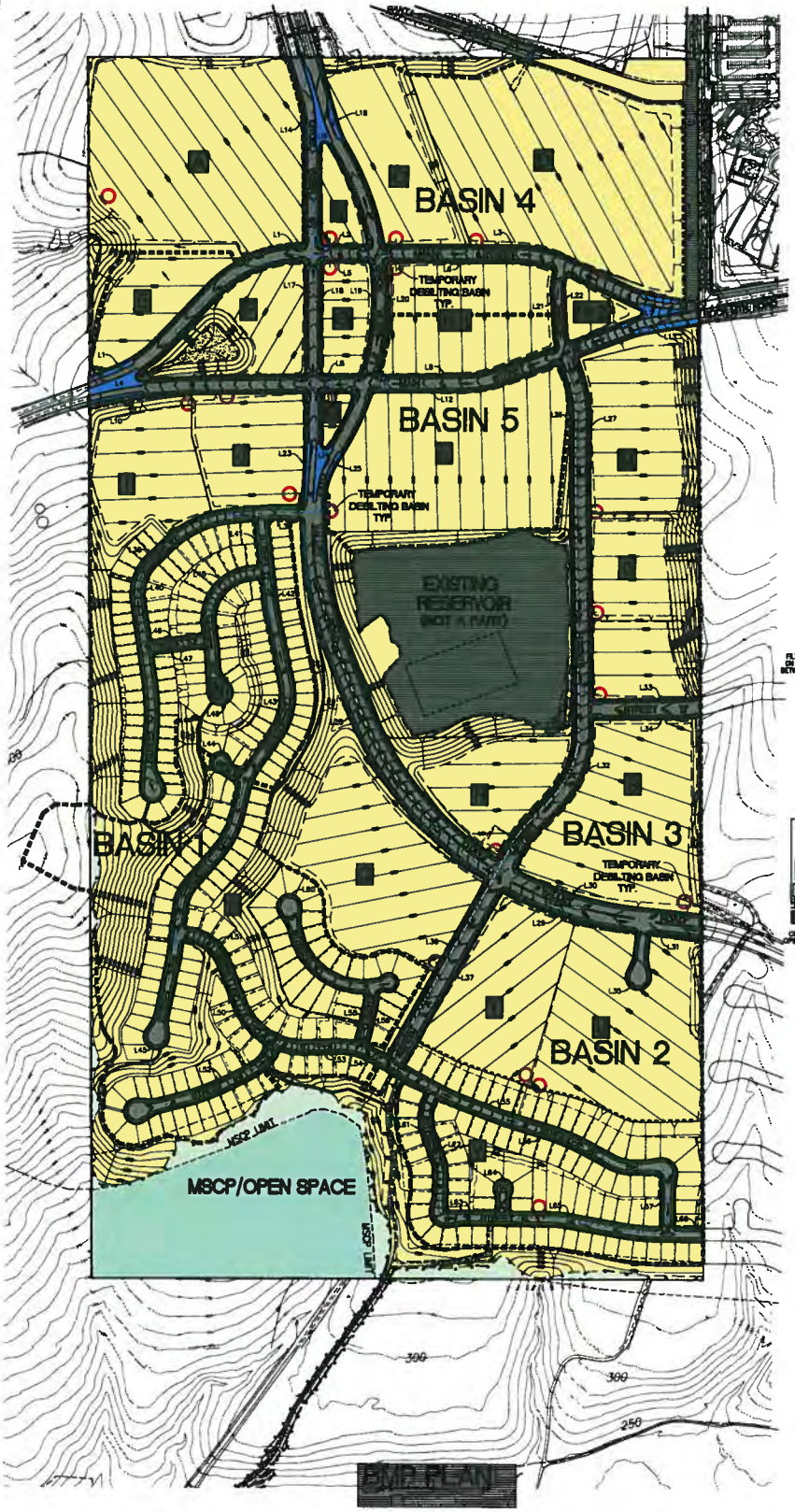
JOB NO. 08020 02/03/2011

Appendix B

WATER QUALITY TECHNICAL REPORT

BMP PLAN

OTAY RANCH, VILLAGE 8 WEST

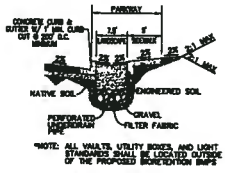


LEGEND

- SUBDIVISION BOUNDARY
- PROPOSED LOT LINE
- EXISTING CONTOUR
- PROPOSED CONTOUR
- PROPOSED CUT/FILL SLOPE (2:1 MAX)
- PROPOSED DAYLIGHT LINE
- PROPOSED DIRECTION OF DRAINAGE
- PROPOSED DRAINAGE DITCH
- PROPOSED PUBLIC STORM DRAIN (18" MIN)
- PROPOSED PUBLIC STORM DRAIN INLET
- PROPOSED PUBLIC STORM DRAIN CLEANOUT
- PROPOSED RIP RAP ENERGY DISSIPATOR
- PROPOSED TEMPORARY DESILTING BASIN
- PROPOSED AC PAVEMENT
- PROPOSED PCC PAVEMENT
- PROPOSED MASS GRADING
- PROPOSED SWALE BIORETENTION BMP
- PROPOSED TREE WELL BIORETENTION BMP
- PROPOSED OPEN SPACE/LANDSCAPING
- PROPOSED MSCP AREA
- DRAINAGE BASIN BOUNDARY
- NEIGHBORHOOD BOUNDARY
- DRAINAGE BASIN
- BIO-RETENTION/TREE WELL DMA DESIGNATION
- PLANNING AREA DESIGNATION

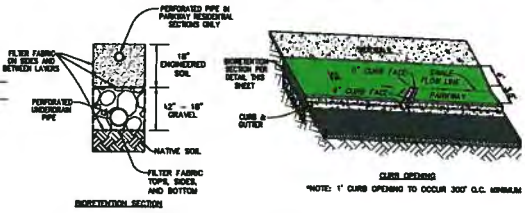
BASIN 1
L1

SCALE 1" = 200'



*NOTE: ALL VAULTS, UTILITY BOXES, AND LIGHT STANDARDS SHALL BE LOCATED OUTSIDE OF THE PROPOSED BIORETENTION BMPS

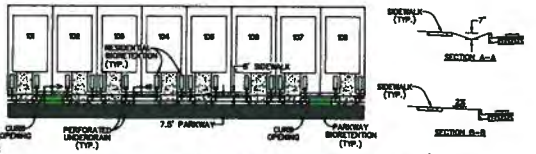
PARKWAY- RESIDENTIAL



BIORETENTION SECTION

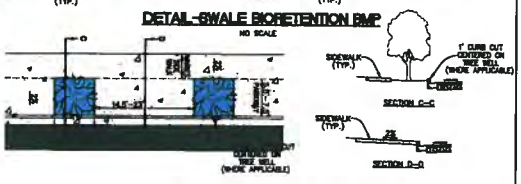
CURB OPENING

*NOTE: 1' CURB OPENING TO OCCUR 300' O.C. MINIMUM



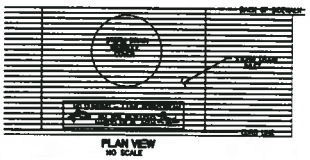
DETAIL-SWALE BIORETENTION BMP

NO SCALE



DETAIL-TREE WELL BIORETENTION BMP

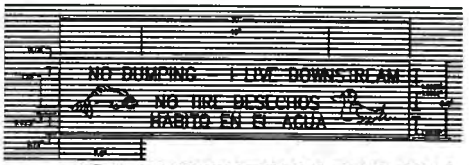
NO SCALE



PLAN VIEW

NO SCALE

NOTES:
1. DEPTH OF IMPRINT SHALL BE 0.25 INCH, MINIMUM
2. STAMP SHALL BE RIGID AND FABRICATED FROM METAL, HARD RUBBER, OR APPROVED EQUAL.



DETAIL-STORM DRAIN STENCILING (STD DWG CYCS 24)

NO SCALE

LID AND SITE DESIGN BMPS

- INCORPORATE ALTERNATIVE STREET LAYOUTS
- DESIGN TO MINIMUM STREET AND SIDEWALK WIDTH
- PRESERVE EXISTING VEGETATION
- PLANT NATIVE OR DROUGHT TOLERANT SPECIES
- MINIMIZE IMPERVIOUS SURFACES IN LANDSCAPE DESIGN
- MINIMIZE GRADING AND STABILIZE SLOPES
- UTILIZE NATURAL DRAINAGE SYSTEMS
- PROTECT SOIL COMPACTION
- DRAIN IMPERVIOUS SURFACES INTO ADJACENT LANDSCAPING
- MINIMIZE DISTURBANCE TO NATURAL DRAINAGE SYSTEM
- DIRECT RUNOFF SAFELY FROM TOPS OF SLOPES
- CONTROL/TREAT RUNOFF IN LANDSCAPING PRIOR TO DRAINING TO NATURAL DRAINAGE SYSTEM
- INSTALL ENERGY DISSIPATORS AS NEEDED

SOURCE CONTROL BMPS

- STORM DRAIN STENCILING AND SIGNAGE
- USE EFFICIENT IRRIGATION AND LANDSCAPE DESIGN INCORPORATE REQUIREMENTS APPLICABLE TO THE FOLLOWING INDIVIDUAL PRIORITY PROJECTS:
  - ROADWAYS

PROJECT TREATMENT BMPS

- BIORETENTION FACILITIES
- TREE WELLS

PROJECT RECEIVING WATERS

WOLF CANYON (910.32), OTAY RIVER (910.30), SAN DIEGO BAY

LAND USE + ANTICIPATED POLLUTANTS

STREETS & ROADWAYS
SEDIMENTS, NUTRIENTS, HEAVY METALS, ORGANIC COMPOUNDS, TRASH & DEBRIS, AND OIL & GREASE

TOWN CENTER, RESIDENTIAL, AND PARKS AND SCHOOLS
SEDIMENTS, NUTRIENTS, HEAVY METALS, TRASH & DEBRIS, OXYGEN DEMANDING SUBSTANCES, OIL & GREASE, BACTERIA & VIRUSES, AND PESTICIDES

200 0 200 400 800
SCALE 1" = 200'

ORIGINAL: 04/06/09

PREPARED BY:
HALE ENGINEERING
7210 CONFOY COURT
SAN DIEGO, CA 92111
TEL: (858) 715-1490 FAX: (858) 715-1491

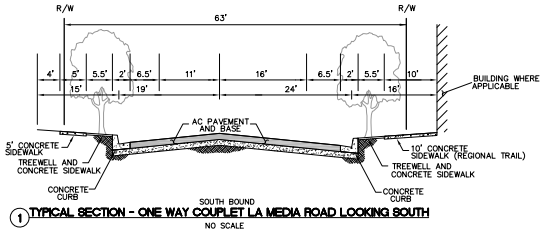
REVISIONS	DATE	BY

WATER QUALITY TECHNICAL REPORT
BMP PLAN
OTAY RANCH, VILLAGE 8 WEST
CHULA VISTA TRACT NO. 09-02
CITY OF CHULA VISTA, CALIFORNIA

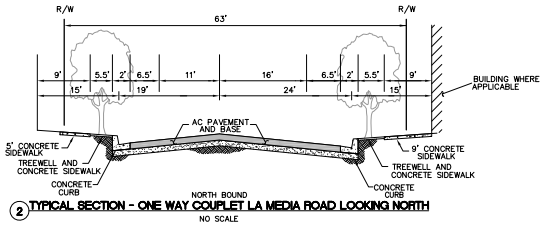
SHEET 1 OF 2

JOB NO. 08020 12/09/2010

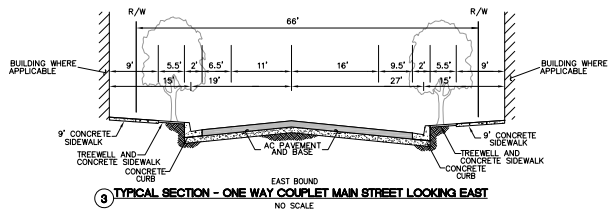
WATER QUALITY TECHNICAL REPORT
DMA CALCULATIONS
OTAY RANCH, VILLAGE 8 WEST



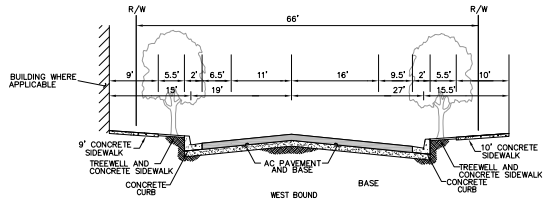
1 TYPICAL SECTION - ONE WAY COUPLET LA MEDIA ROAD LOOKING SOUTH
NO SCALE



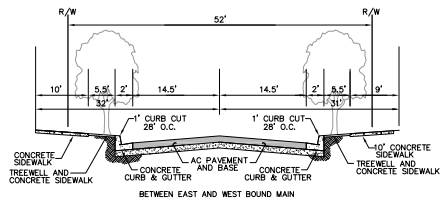
2 TYPICAL SECTION - ONE WAY COUPLET LA MEDIA ROAD LOOKING NORTH
NO SCALE



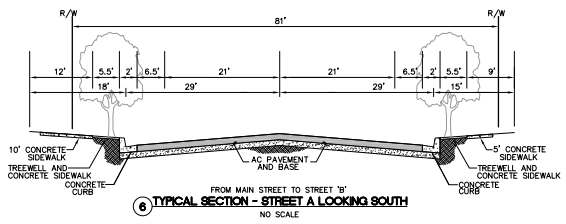
3 TYPICAL SECTION - ONE WAY COUPLET MAIN STREET LOOKING EAST
NO SCALE



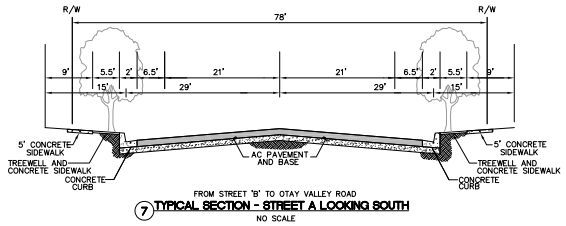
4 TYPICAL SECTION - ONE WAY COUPLET MAIN STREET LOOKING WEST
NO SCALE



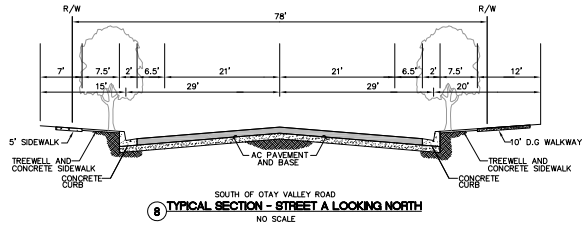
5 TYPICAL SECTION - STREET A LOOKING SOUTH
NO SCALE



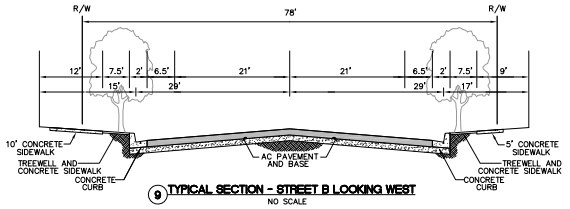
6 TYPICAL SECTION - STREET A LOOKING SOUTH
NO SCALE



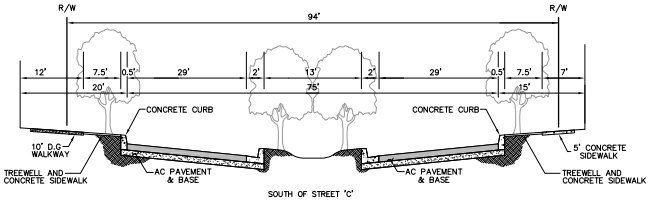
7 TYPICAL SECTION - STREET A LOOKING SOUTH
NO SCALE



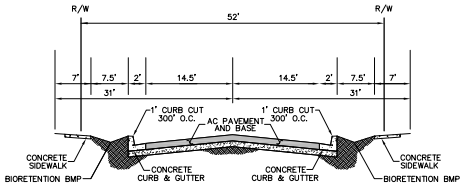
8 TYPICAL SECTION - STREET A LOOKING NORTH
NO SCALE



9 TYPICAL SECTION - STREET B LOOKING WEST
NO SCALE



10 TYPICAL SECTION -OTAY VALLEY ROAD LOOKING WEST
NO SCALE



11 TYPICAL SECTION - PARKWAY RESIDENTIAL
NO SCALE

ORIGINAL: 04/06/09

PREPARED BY:

HALE ENGINEERING
7910 CONVOY COURT
SAN DIEGO, CA 92111
TEL: (858) 715-1420 FAX: (858) 715-1424

REVISIONS	DATE	BY

WATER QUALITY TECHNICAL REPORT
BMP PLAN
OTAY RANCH, VILLAGE 8 WEST
CHULA VISTA TRACT NO. 09-XX
CITY OF CHULA VISTA, CALIFORNIA

SHEET 2 OF 2

JOB NO. 08020 12/06/2010

Appendix C

Bio-Retention BMP Access Spacing Calculations

I. Curb Cut Spacing Tree Wells

Given:

- Proposed 1' Curb Cut @ 23' O.C.
- Tributary roadway width = 57.5'
- Runoff Coefficient, C = 0.85
- Water Quality Runoff Rate, I = 0.2 in/hr
- Max Roadway Slope, S = 0.059

Then:

- Tributary area, A = 23'x57.5' = 1,323 ft^2
- Water Quality Flow, Q = CIA = 0.85x(0.2 in/hr)x(1,323 ft^2) = 0.052 cfs

Depth of Flow in Gutter

Given Input Data:

Shape ..... Trapezoidal
Solving for ..... Depth of Flow
Flowrate ..... 0.0520 cfs
Slope ..... 0.0590 ft/ft
Manning's n 0.0160
Height ..... 6.0000 in
Bottom width ..... 0.0000 in
Left slope ..... 0.0833 ft/ft (V/H)
Right slope ..... 1000.0000 ft/ft (V/H)

Computed Results:

Depth ..... 0.7631 in
Velocity ..... 2.1421 fps
Full Flowrate ..... 12.7112 cfs
Flow area 0.0243 ft2
Flow perimeter ..... 9.9557 in
Hydraulic radius ..... 0.3511 in
Top width ..... 9.1616 in
Area 1.5007 ft2
Perimeter ..... 78.2783 in
Percent full ..... 12.7184 %

Capacity of Curb Cut at Flow Depth

- L_t = 1'
- a = 0.17'
- y = depth of flow in gutter = 0.7631" = 0.06'
- $Q = 0.7xL_tx(a+y)^{1.5}$ = 0.079 cfs

Inlet Capacity = 0.079 cfs > Gutter Flow = 0.052 cfs OK

II. Curb Cut Spacing at Bio-Swales

Given:

- Proposed 1' Curb Cut @ 300' O.C.
- Tributary roadway width = 31'
- Runoff Coefficient, C = 0.81
- Water Quality Runoff Rate, I = 0.2 in/hr
- Max Roadway Slope, S = 0.087

Then:

- Tributary area, A = 300'x31' = 9,300 ft^2
- Water Quality Flow, Q = CIA = 0.81x(0.2 in/hr)x(9,300 ft^2) = 0.035 cfs

Depth of Flow in Gutter

Given Input Data:

Shape ..... Trapezoidal
Solving for ..... Depth of Flow
Flowrate ..... 0.0350 cfs
Slope ..... 0.0870 ft/ft
Manning's n 0.0160
Height ..... 6.0000 in
Bottom width ..... 0.0000 in
Left radius ..... 0.0000 in
Right radius ..... 0.0000 in
Left slope ..... 0.0833 ft/ft (V/H)
Right slope ..... 1000.0000 ft/ft (V/H)

Computed Results:

Depth ..... 0.6116 in
Velocity ..... 2.2444 fps
Full Flowrate ..... 15.4355 cfs
Flow area 0.0156 ft2
Flow perimeter ..... 7.9794 in
Hydraulic radius ..... 0.2814 in
Top width ..... 7.3430 in
Area 1.5007 ft2
Perimeter ..... 78.2783 in
Percent full ..... 10.1937 %

Capacity of Curb Cut at Flow Depth

- L_t = 1'
- a = 0.17'
- y = depth of flow in gutter = 0.5251" = 0.04
- $Q = 0.7xL_tx(a+y)^{1.5}$ = 0.069 cfs

Inlet Capacity = 0.069 cfs > Gutter Flow = 0.035 cfs OK

TYPICAL SINGLE FAMILY BIORETNTION BMP SIZING

NOTE:

The Bioretention IMPs are designed to meet the area–based Treatment Control BMP Standards as set forth in Section 3.6.2.C of the Development Storm Water Manual.

For all calculations, a 60:40 impervious to pervious area is assumed for each lot. Single family residential lot bioretention BMP sizing shall be adjusted in final engineering based upon the actual impervious to pervious area ratio occuring on–site.

BIORETENTION CALCULATIONS:

$A_b = ISF \times (C_i A_i + C_p A_p)$

Where:

A = Total area of lot (sq. ft.)
A_b = Total area of bioretention requred for the lot (sq. ft.)
A_i = Impervious Area (sq. ft.) = 0.6A (for sample calculations only, actual value will vary)
A_p = Pervious Area (sq. ft.) = 0.4A (for sample calculations only, actual value will vary)
C_i = Impervious Runoff Factor = 1.0
C_p = Pervious Runoff Factor = 0.10
ISF = IMP Sizing factor = 0.04

SAMPLE CALCULATIONS:

a) Neigborhood N

Typical Lot Size = 45' x 90'
A = 4,050 sq. ft.
A_i = 2,430 sq. ft.
A_p = 1,620 sq. ft.

$A_b = 0.04x(1.0x2,430 + 0.1x1,620) = 104$ sq. ft.

b) Neigborhood P

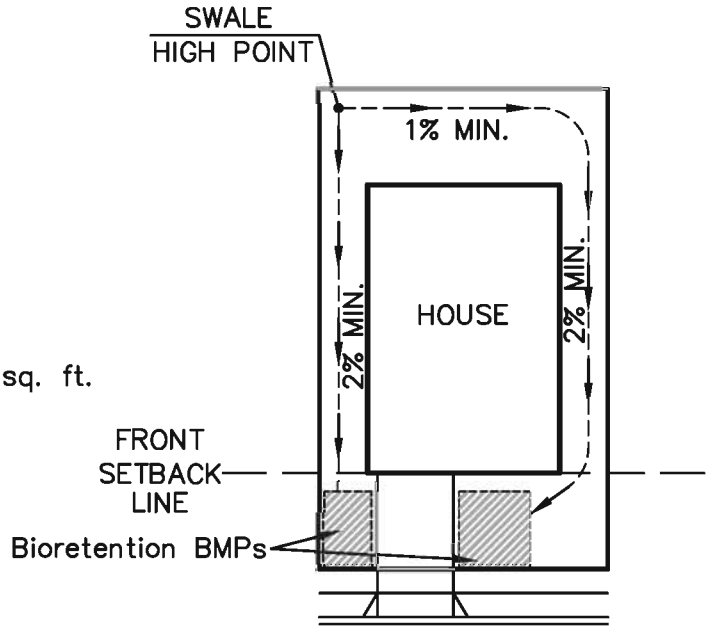
Typical Lot Size = 55' x 100'
A = 5,500 sq. ft.
A_i = 3,300 sq. ft.
A_p = 2,200 sq. ft.

$A_b = 0.04x(1.0x3,300 + 0.1x2,200) = 141$ sq. ft.

c) Neigborhood V

Typical Lot Size = 60' x 100'
A = 6,000 sq. ft.
A_i = 3,600 sq. ft.
A_p = 2,400 sq. ft.

$A_b = 0.04x(1.0x3,600 + 0.1x2,400) = 154$ sq. ft.



TYPICAL LOT DRAINAGE

Note: Runoff from all impervous areas shall be directed to the Bioretention BMPs either via direct drainage (driveways) or via a proposed swale (rooftop and misc. hardscape)

DMA Calculations

Project Name: Otay Ranch Village 8 West

Project Location: Chula Vista, CA

APN: 664-070-07

Total Project Area: 47.70 Acres (Backbone Infrastructure Only)

85TH Percentile Storm Depth: 0.55 in

I. Bio-Retention IMPs:

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L1	GUE	PCC	3,453	1.00	3,453	Curb Length=	960	lf
	Roadway	AC	29,986	1.00	29,986	Spacing=	16	o.c.
	Sidewalk/ Curb	PCC	5,328	1.00	5,328	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	5,029	1.00	5,029			
	6,814.00	Tree Well	1,785	0.10	178			
		Total	45,581	0.96	43,975	0.04	1,759	1,785

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L2	GUE	Landscape	777	0.10	78	Curb Length=	172	lf
	Roadway	AC	7,591	1.00	7,591	Spacing=	11	o.c.
	Sidewalk/ Curb	PCC	1,854	1.00	1,854	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	1,005	1.00	1,005			
	1,459.00	Tree Well	454	0.10	45			
		Total	11,681	0.91	10,573	0.04	423	454

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L3	GUE	PCC	3,197	1.00	3,197	Curb Length=	1,343	lf
	Roadway	AC	33,724	1.00	33,724	Spacing=	18	o.c.
	Sidewalk/ Curb	PCC	10,303	1.00	10,303	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	7,034	1.00	7,034			
	9,242.00	Tree Well	2,208	0.10	221			
		Total	56,466	0.96	54,479	0.04	2,179	2,208

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L4	GUE	PCC	6,486	1.00	6,486	Curb Length=	1,982	lf
	Roadway	AC	38,801	1.00	38,801	Spacing=	21	o.c.
	Sidewalk/ Curb	PCC	10,031	1.00	10,031	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	15,716	1.00	15,716			
	18,590.00	Tree Well	2,874	0.10	287			
		Total	73,908	0.97	71,322	0.04	2,853	2,874

DMA Calculations

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L5	GUE	PCC	831	1.00	831	Curb Length=	179	lf
	Roadway	AC	5,915	1.00	5,915	Spacing=	14	o.c.
	Sidewalk/ Curb	PCC	1,284	1.00	1,284	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	1,449	1.00	1,449			
	1,842.00	Tree Well	393	0.10	39			
		Total	9,872	0.96	9,518	0.04	381	393

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L6	GUE	PCC	2,888	1.00	2,888	Curb Length=	686	lf
	Roadway	AC	15,814	1.00	15,814	Spacing=	19	o.c.
	Sidewalk/ Curb	PCC	4,716	1.00	4,716	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	2,944	1.00	2,944			
	4,033.00	Tree Well	1,089	0.10	109			
		Total	27,451	0.96	26,471	0.04	1,059	1,089

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L7	GUE	PCC	2,774	1.00	2,774	Curb Length=	972	lf
	Roadway	AC	14,821	1.00	14,821	Spacing=	24	o.c.
	Sidewalk/ Curb	PCC	4,848	1.00	4,848	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	8,416	1.00	8,416			
	9,656.00	Tree Well	1,240	0.10	124			
		Total	32,099	0.97	30,983	0.04	1,239	1,240

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L8	GUE	PCC	665	1.00	665	Curb Length=	136	lf
	Roadway	AC	4,794	1.00	4,794	Spacing=	12	o.c.
	Sidewalk/ Curb	PCC	1,602	1.00	1,602	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	740	1.00	740			
	1,073.00	Tree Well	333	0.10	33			
		Total	8,134	0.96	7,835	0.04	313	333

DMA Calculations

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L9	GUE	PCC	3,128	1.00	3,128	Curb Length=	747	lf
	Roadway	AC	16,675	1.00	16,675	Spacing=	20	o.c.
	Sidewalk/ Curb	PCC	5,077	1.00	5,077	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	3,243	1.00	3,243			
	4,392.00	Tree Well	1,150	0.10	115			
		Total	29,272	0.96	28,237	0.04	1,129	1,150

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L10	GUE	PCC	6,132	1.00	6,132	Curb Length=	886	lf
	Roadway	AC	24,512	1.00	24,512	Spacing=	16	o.c.
	Sidewalk/ Curb	PCC	5,595	1.00	5,595	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	4,608	1.00	4,608			
	6,272.00	Tree Well	1,664	0.10	166			
		Total	42,511	0.96	41,014	0.04	1,641	1,664

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L11	GUE	PCC	545	1.00	545	Curb Length=	108	lf
	Roadway	AC	6,361	1.00	6,361	Spacing=	8	o.c.
	Sidewalk/ Curb	PCC	1,678	1.00	1,678	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	671	1.00	671			
	1,064.00	Tree Well	393	0.10	39			
		Total	9,648	0.96	9,294	0.04	372	393

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L12	GUE	PCC	3,278	1.00	3,278	Curb Length=	772	lf
	Roadway	AC	24,357	1.00	24,357	Spacing=	16	o.c.
	Sidewalk/ Curb	PCC	5,508	1.00	5,508	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	3,040	1.00	3,040			
	4,522.00	Tree Well	1,482	0.10	148			
		Total	37,665	0.96	36,331	0.04	1,453	1,482

DMA Calculations

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L13	GUE	PCC	2,139	1.00	2,139	Curb Length=	527	lf
	Roadway	AC	14,965	1.00	14,965	Spacing=	15	o.c.
	Sidewalk/ Curb	PCC	3,447	1.00	3,447	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	6,525	1.00	6,525			
	7,614.00	Tree Well	1,089	0.10	109			
		Total	28,165	0.97	27,185	0.04	1,087	1,089

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L14	Roadway	AC	27,658	1.00	27,658	Curb Length=	814	lf
	Sidewalk/ Curb	PCC	8,844	1.00	8,844	Spacing=	15	o.c.
	Parkway	PCC	2,870	1.00	2,870	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	4,473.00	Tree Well	1,603	0.10	160			
		Total	40,975	0.96	39,532	0.04	1,581	1,603

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L15	GUE	Landscape	3,746	0.10	375	Curb Length=	1,555	lf
	Roadway	AC	16,476	1.00	16,476	Spacing=	32	o.c.
	Sidewalk/ Curb	PCC	6,725	1.00	6,725	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	12,946	1.00	12,946			
	14,428.00	Tree Well	1,482	0.10	148			
		Total	41,375	0.89	36,670	0.04	1,467	1,482

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L16	Roadway	AC & PCC	25,786	1.00	25,786	Curb Length=	839	lf
	GUE	PCC	3,197	1.00	3,197	Spacing=	16	o.c.
	Sidewalk/ Curb	PCC	5,233	1.00	5,233	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	5,698	1.00	5,698			
	7,331.00	Tree Well	1,634	0.10	163			
		Total	41,547	0.96	40,077	0.04	1,603	1,634

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L17	Roadway	AC	11,456	1.00	11,456	Curb Length=	454	lf
	Sidewalk/ Curb	PCC	5,975	1.00	5,975	Spacing=	17	o.c.
	Parkway	PCC	2,017	1.00	2,017	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	2,803.00	Tree Well	787	0.10	79			
		Total	20,234	0.97	19,526	0.04	781	787

DMA Calculations

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L18	GUE	Landscape	1,945	0.10	195	Curb Length=	455	lf
	Roadway	AC	8,983	1.00	8,983	Spacing=	23	o.c.
	Sidewalk/ Curb	PCC	3,430	1.00	3,430	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	2,198	1.00	2,198			
	2,803.00	Tree Well	605	0.10	61			
		Total	17,161	0.87	14,866	0.04	595	605

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L19	GUE	Landscape	1,967	0.10	197	Curb Length=	464	lf
	Roadway	AC	8,855	1.00	8,855	Spacing=	23	o.c.
	Sidewalk/ Curb	PCC	3,385	1.00	3,385	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Planter	PCC	2,243	1.00	2,243			
	2,848.00	Tree Well	605	0.10	61			
		Total	17,055	0.86	14,740	0.04	590	605

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L20	GUE	PCC	1,936	1.00	1,936	Curb Length=	451	lf
	Roadway	AC	11,129	1.00	11,129	Spacing=	18	o.c.
	Sidewalk/ Curb	PCC	3,507	1.00	3,507	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	2,016	1.00	2,016			
	2,772.00	Tree Well	756	0.10	76			
		Total	19,344	0.96	18,663	0.04	747	756

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L21	Roadway	AC	4,873	1.00	4,873	Curb Length=	292	lf
	GUE	Landscape	1,324	0.10	132	Spacing=	24	o.c.
	Sidewalk/ Curb	PCC	2,321	1.00	2,321	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	1,240	1.00	1,240			
	1,603.00	Tree Well	363	0.10	36			
		Total	10,121	0.85	8,603	0.04	344	363

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L22	Roadway	AC	4,594	1.00	4,594	Curb Length=	257	lf
	Sidewalk/ Curb	PCC	3,601	1.00	3,601	Spacing=	20	o.c.
	Parkway	PCC	1,002	1.00	1,002	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	1,395.00	Tree Well	393	0.10	39			
		Total	9,590	0.96	9,236	0.04	369	393

DMA Calculations

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L23	GUE	PCC	488	1.00	488	Curb Length=	447	lf
	Roadway	AC	9,994	1.00	9,994	Spacing=	17	o.c.
	Sidewalk/ Curb	PCC	5,517	1.00	5,517	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	3,339	1.00	3,339			
	4,125.00	Tree Well	787	0.10	79			
		Total	20,124	0.96	19,416	0.04	777	787

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L24	GUE	Landscape	2,074	0.10	207	Curb Length=	892	lf
	Roadway	AC	10,875	1.00	10,875	Spacing=	28	o.c.
	Sidewalk/ Curb	PCC	4,235	1.00	4,235	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	8,508	1.00	8,508			
	9,476.00	Tree Well	968	0.10	97			
		Total	26,660	0.90	23,922	0.04	957	968

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L25	GUE	PCC	7,725	1.00	7,725	Curb Length=	2,266	lf
	Sidewalk/ Curb	PCC	13,348	1.00	13,348	Spacing=	29	o.c.
	Roadway	AC & PCC	72,724	1.00	72,724	IMP Sizing Factor	Minimum DMA Area	Proposed DMA Area
	Median	Landscape	6,738	0.10	674			
	Parkway	PCC	12,394	1.00	12,394	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	16,725.00	Tree Well	4,331	0.10	433			
		Total	117,260	0.92	107,297	0.04	4,292	4,331

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L26	GUE	Landscape	9,060	0.10	906	Curb Length=	2,213	lf
	Roadway	AC	65,129	1.00	65,129	Spacing=	19	o.c.
	Sidewalk/ Curb	PCC	13,007	1.00	13,007	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	8,762	1.00	8,762			
	12,331.00	Tree Well	3,570	0.10	357			
		Total	99,527	0.89	88,160	0.04	3,526	3,570

DMA Calculations

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)	Curb Length=	1,444	lf
L27	Roadway	AC	42,326	1.00	42,326	Spacing=	17	o.c.
	Sidewalk/ Curb	PCC	16,345	1.00	16,345	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	5,486	1.00	5,486			
	8,087.00	Tree Well	2,602	0.10	260			
		Total	66,758	0.96	64,417	0.04	2,577	2,602

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)	Curb Length=	1,777	lf
L28	Trail	D.G.	17,915	0.10	1,792	Spacing=	33	o.c.
	Sidewalk/ Curb	PCC	1,515	1.00	1,515			
	Roadway	AC & PCC	61,242	1.00	61,242			
	Median	Landscape	6,738	0.10	674	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	10,315	1.00	10,315			
	13,352.00	Tree Well	3,038	0.10	304			
		Total	100,762	0.75	75,840	0.04	3,034	3,038

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)	Curb Length=	571	lf
L29	Trail	D.G.	5,767	0.10	577			
	Sidewalk/ Curb	PCC	891	1.00	891			
	Roadway	AC & PCC	25,550	1.00	25,550	Spacing=	26	o.c.
	Median	Landscape	457	0.10	46	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Planter	PCC	3,057	1.00	3,057			
	4,294.00	Landscape	1,238	0.10	124			
		Total	36,959	0.82	30,244	0.04	1,210	1,238

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)	Curb Length=	829	lf
L30	GUE	Landscape	1,677	0.10	168			
	Sidewalk/ Curb	PCC	4,792	1.00	4,792			
	Roadway	AC & PCC	36,265	1.00	36,265	Spacing=	25	o.c.
	Median	Landscape	557	0.10	56	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Planter	PCC	4,346	1.00	4,346			
	6,202.00	Landscape	1,856	0.10	186			
		Total	49,492	0.93	45,811	0.04	1,832	1,856

DMA Calculations

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L31	Trail	D.G.	2,078	0.10	208			
	Sidewalk/ Curb	PCC	414	1.00	414	Curb Length=	205	lf
	Roadway	AC & PCC	10,715	1.00	10,715	Spacing=	23	o.c.
	Median	Landscape	100	0.10	10	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	1,045	1.00	1,045			
	1,551.00	Tree Well	506	0.10	51			
		Total	14,858	0.84	12,442	0.04	498	506

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L32	GUE	Landscape	2,937	0.10	294	Curb Length=	706	lf
	Roadway	AC & PCC	24,269	1.00	24,269	Spacing=	16	o.c.
	Sidewalk/ Curb	PCC	4,497	1.00	4,497	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	2,621	1.00	2,621			
	3,922.00	Tree Well	1,301	0.10	130			
		Total	35,625	0.89	31,811	0.04	1,272	1,301

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L33	GUE	Landscape	1,828	0.10	183	Curb Length=	442	lf
	Roadway	AC & PCC	13,293	1.00	13,293	Spacing=	18	o.c.
	Sidewalk/ Curb	PCC	2,897	1.00	2,897	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	1,851	1.00	1,851			
	2,607.00	Tree Well	756	0.10	76			
		Total	20,625	0.89	18,299	0.04	732	756

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L34	Roadway	AC & PCC	13,379	1.00	13,379	Curb Length=	442	lf
	Sidewalk/ Curb	PCC	5,239	1.00	5,239	Spacing=	16	o.c.
	Parkway	PCC	1,759	1.00	1,759	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	2,606.00	Tree Well	847	0.10	85			
		Total	21,224	0.96	20,462	0.04	818	847

DMA Calculations

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L35	Roadway	AC	11,681	1.00	11,681	Curb Length=	494	lf
	GUE	Landscape	1,091	0.10	109	Spacing=	20	o.c.
	Sidewalk/ Curb	PCC	3,320	1.00	3,320	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	3,039	1.00	3,039			
	3,795.00	Tree Well	756	0.10	76			
		Total	19,887	0.92	18,224	0.04	729	756

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L36	GUE	Landscape	1,713	0.10	171	Curb Length=	840	lf
	Sidewalk/ Curb	PCC	5,093	1.00	5,093	Spacing=	18	o.c.
	Roadway	AC & PCC	25,375	1.00	25,375	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	Parkway	PCC	4,837	1.00	4,837			
	6,289.00	Tree Well	1,452	0.10	145			
		Total	38,470	0.93	35,622	0.04	1,425	1,452

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L37	Sidewalk/ Curb	PCC	9,392	1.00	9,392	Curb Length=	837	lf
	Roadway	AC & PCC	25,370	1.00	25,370	Spacing=	16	o.c.
	Parkway	PCC	4,666	1.00	4,666	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
	6,269.00	Tree Well	1,603	0.10	160			
		Total	41,031	0.96	39,588	0.04	1,584	1,603

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)			
L38	Roadway	AC	41,539	1.00	41,539	No. of Lots =	43	ea
	GUE	Landscape	5,066	0.10	507	Curb length =	2,443	lf
	Sidewalk/ Curb	PCC	14,325	1.00	14,325	Spacing =	72	o.c.
	Parkway	PCC	5,805	1.00	5,805	IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
		Landscape	10,017	0.10	1,002			
	18,372.00	Bio-Swale	2,550	0.10	255			
		Total	79,302	0.80	63,432	0.04	2,537	2,550

DMA Calculations

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L39	Roadway	AC	4,723	1.00	4,723
	GUE	Landscape	251	0.10	25
	Sidewalk/ Curb	PCC	1,116	1.00	1,116
	Parkway	PCC	0	1.00	0
		Landscape	482	0.10	48
	827.00	Bio-Swale	345	0.10	35
		Total	6,917	0.86	5,947

No. of Lots = 0 ea
Curb length = 112 lf
Spacing = 56 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	238	345

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L40	Roadway	AC	14,717	1.00	14,717
	GUE	Landscape	1,629	0.10	163
	Sidewalk/ Curb	PCC	4,881	1.00	4,881
	Parkway	PCC	1,755	1.00	1,755
		Landscape	3,257	0.10	326
	6,047.00	Bio-Swale	1,035	0.10	104
		Total	27,274	0.80	21,945

No. of Lots = 13 ea
Curb length = 814 lf
Spacing = 136 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	878	1,035

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L41	Roadway	AC	5,424	1.00	5,424
	GUE	Landscape	366	0.10	37
	Sidewalk/ Curb	PCC	1,383	1.00	1,383
	Parkway	PCC	0	1.00	0
		Landscape	866	0.10	87
	1,211.00	Bio-Swale	345	0.10	35
		Total	8,384	0.83	6,965

No. of Lots = 0 ea
Curb length = 163 lf
Spacing = 81 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	279	345

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L42	Roadway	AC	29,828	1.00	29,828
	GUE	Landscape	3,780	0.10	378
	Sidewalk/ Curb	PCC	10,776	1.00	10,776
	Parkway	PCC	4,725	1.00	4,725
		Landscape	7,370	0.10	737
	13,992.00	Bio-Swale	1,898	0.10	190
		Total	58,376	0.80	46,634

No. of Lots = 35 ea
Curb length = 1,869 lf
Spacing = 170 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	1,865	1,898

DMA Calculations

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L43	Roadway	AC	13,822	1.00	13,822
	GUE	Landscape	1,741	0.10	174
	Sidewalk/ Curb	PCC	5,183	1.00	5,183
	Parkway	PCC	2,160	1.00	2,160
		Landscape	3,215	0.10	322
	6,410.00	Bio-Swale	1,035	0.10	104
		Total	27,156	0.80	21,764

No. of Lots = 16 ea
Curb length = 859 lf
Spacing = 143 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	871	1,035

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L44	Roadway	AC	5,016	1.00	5,016
	GUE	Landscape	702	0.10	70
	Sidewalk/ Curb	PCC	2,199	1.00	2,199
	Parkway	PCC	675	1.00	675
		Landscape	1,220	0.10	122
	2,240.00	Bio-Swale	345	0.10	35
		Total	10,157	0.80	8,117

No. of Lots = 5 ea
Curb length = 288 lf
Spacing = 144 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	325	345

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L45	Roadway	AC	32,256	1.00	32,256
	GUE	Landscape	3,550	0.10	355
	Sidewalk/ Curb	PCC	10,031	1.00	10,031
	Parkway	PCC	3,780	1.00	3,780
		Landscape	7,238	0.10	724
	12,915.00	Bio-Swale	1,898	0.10	190
		Total	58,752	0.81	47,336

No. of Lots = 28 ea
Curb length = 1,711 lf
Spacing = 156 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	1,893	1,898

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L46	Roadway	AC	3,140	1.00	3,140
	GUE	Landscape	433	0.10	43
	Sidewalk/ Curb	PCC	1,679	1.00	1,679
	Parkway	PCC	0	1.00	0
		Landscape	1,116	0.10	112
	1,461.00	Bio-Swale	345	0.10	35
		Total	6,713	0.75	5,008

No. of Lots = 0 ea
Curb length = 196 lf
Spacing = 98 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	200	345

DMA Calculations

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L47	Roadway	AC	4,532	1.00	4,532
	GUE	Landscape	440	0.10	44
	Sidewalk/ Curb	PCC	1,571	1.00	1,571
	Parkway	PCC	0	1.00	0
		Landscape	1,097	0.10	110
	1,442.00	Bio-Swale	345	0.10	35
		Total	7,985	0.79	6,291

No. of Lots = 0 ea
Curb length = 194 lf
Spacing = 97 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	252	345

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L48	Roadway	AC	7,424	1.00	7,424
	GUE	Landscape	866	0.10	87
	Sidewalk/ Curb	PCC	2,717	1.00	2,717
	Parkway	PCC	1,350	1.00	1,350
		Landscape	1,079	0.10	108
	2,946.00	Bio-Swale	518	0.10	52
		Total	13,953	0.84	11,737

No. of Lots = 10 ea
Curb length = 389 lf
Spacing = 130 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	469	518

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L49	Roadway	AC	19,242	1.00	19,242
	GUE	Landscape	1,962	0.10	196
	Sidewalk/ Curb	PCC	5,723	1.00	5,723
	Parkway	PCC	2,565	1.00	2,565
		Landscape	3,283	0.10	328
	7,055.00	Bio-Swale	1,208	0.10	121
		Total	33,982	0.83	28,175

No. of Lots = 19 ea
Curb length = 936 lf
Spacing = 134 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	1,127	1,208

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L50	Roadway	AC	10,832	1.00	10,832
	GUE	Landscape	1,204	0.10	120
	Sidewalk/ Curb	PCC	3,672	1.00	3,672
	Parkway	PCC	675	1.00	675
		Landscape	2,997	0.10	300
	4,362.00	Bio-Swale	690	0.10	69
		Total	20,070	0.78	15,668

No. of Lots = 5 ea
Curb length = 585 lf
Spacing = 146 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	627	690

DMA Calculations

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L51	Roadway	AC	16,733	1.00	16,733
	GUE	Landscape	1,957	0.10	196
	Sidewalk/ Curb	PCC	5,742	1.00	5,742
	Parkway	PCC	1,755	1.00	1,755
		Landscape	4,389	0.10	439
	7,179.00	Bio-Swale	1,035	0.10	104
		Total	31,611	0.79	24,968

No. of Lots = 13 ea
Curb length = 959 lf
Spacing = 160 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	999	1,035

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L52	Roadway	AC	25,499	1.00	25,499
	GUE	Landscape	3,020	0.10	302
	Sidewalk/ Curb	PCC	8,535	1.00	8,535
	Parkway	PCC	3,375	1.00	3,375
		Landscape	5,968	0.10	597
	10,895.00	Bio-Swale	1,553	0.10	155
		Total	47,949	0.80	38,463

No. of Lots = 25 ea
Curb length = 1,442 lf
Spacing = 160 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	1,539	1,553

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L53	Roadway	AC	13,869	1.00	13,869
	GUE	Landscape	1,337	0.10	134
	Sidewalk/ Curb	PCC	3,990	1.00	3,990
	Parkway	PCC	1,215	1.00	1,215
		Landscape	2,756	0.10	276
	4,833.00	Bio-Swale	863	0.10	86
		Total	24,029	0.81	19,570

No. of Lots = 9 ea
Curb length = 647 lf
Spacing = 129 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	783	863

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L54	Roadway	AC	5,475	1.00	5,475
	GUE	Landscape	167	0.10	17
	Sidewalk/ Curb	PCC	819	1.00	819
	Parkway	PCC	0	1.00	0
		Landscape	118	0.10	12
	463.00	Bio-Swale	345	0.10	35
		Total	6,924	0.92	6,357

No. of Lots = 0 ea
Curb length = 63 lf
Spacing = 31 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	254	345

DMA Calculations

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L55	Roadway	AC	27,240	1.00	27,240
	GUE	Landscape	3,549	0.10	355
	Sidewalk/ Curb	PCC	8,710	1.00	8,710
	Parkway	PCC	3,240	1.00	3,240
		Landscape	6,224	0.10	622
	11,189.00	Bio-Swale	1,725	0.10	173
		Total	50,688	0.80	40,340

No. of Lots = 24 ea
Curb length = 1,489 lf
Spacing = 149 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	1,614	1,725

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L56	Roadway	AC	16,692	1.00	16,692
	GUE	Landscape	2,035	0.10	204
	Sidewalk/ Curb	PCC	5,987	1.00	5,987
	Parkway	PCC	2,160	1.00	2,160
		Landscape	4,191	0.10	419
	7,386.00	Bio-Swale	1,035	0.10	104
		Total	32,100	0.80	25,565

No. of Lots = 16 ea
Curb length = 985 lf
Spacing = 164 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	1,023	1,035

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L57	Roadway	AC	4,125	1.00	4,125
	GUE	Landscape	434	0.10	43
	Sidewalk/ Curb	PCC	1,592	1.00	1,592
	Parkway	PCC	0	1.00	0
		Landscape	1,071	0.10	107
	1,416.00	Bio-Swale	345	0.10	35
		Total	7,567	0.78	5,902

No. of Lots = 0 ea
Curb length = 190 lf
Spacing = 95 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	236	345

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L58	Roadway	AC	4,366	1.00	4,366
	GUE	Landscape	405	0.10	41
	Sidewalk/ Curb	PCC	1,469	1.00	1,469
	Parkway	PCC	405	1.00	405
		Landscape	607	0.10	61
	1,357.00	Bio-Swale	345	0.10	35
		Total	7,597	0.84	6,376

No. of Lots = 3 ea
Curb length = 183 lf
Spacing = 92 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	255	345

DMA Calculations

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L59	Roadway	AC	4,458	1.00	4,458
	GUE	Landscape	454	0.10	45
	Sidewalk/ Curb	PCC	1,576	1.00	1,576
	Parkway	PCC	540	1.00	540
		Landscape	627	0.10	63
	1,512.00	Bio-Swale	345	0.10	35
		Total	8,000	0.84	6,717

No. of Lots = 4 ea
Curb length = 202 lf
Spacing = 101 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	269	345

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L60	Roadway	AC	25,094	1.00	25,094
	GUE	Landscape	3,020	0.10	302
	Sidewalk/ Curb	PCC	8,496	1.00	8,496
	Parkway	PCC	3,240	1.00	3,240
		Landscape	5,890	0.10	589
	10,682.00	Bio-Swale	1,553	0.10	155
		Total	47,292	0.80	37,876

No. of Lots = 24 ea
Curb length = 1,403 lf
Spacing = 156 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	1,515	1,553

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L61	Roadway	AC	29,108	1.00	29,108
	GUE	Landscape	3,502	0.10	350
	Sidewalk/ Curb	PCC	9,741	1.00	9,741
	Parkway	PCC	3,915	1.00	3,915
		Landscape	7,072	0.10	707
	12,884.00	Bio-Swale	1,898	0.10	190
		Total	55,235	0.80	44,011

No. of Lots = 29 ea
Curb length = 1,709 lf
Spacing = 155 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	1,760	1,898

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L62	Roadway	AC	7,979	1.00	7,979
	GUE	Landscape	975	0.10	98
	Sidewalk/ Curb	PCC	3,064	1.00	3,064
	Parkway	PCC	945	1.00	945
		Landscape	2,025	0.10	202
	3,487.00	Bio-Swale	518	0.10	52
		Total	15,505	0.80	12,340

No. of Lots = 7 ea
Curb length = 468 lf
Spacing = 156 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	494	518

DMA Calculations

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L63	Roadway	AC	3,903	1.00	3,903
	GUE	Landscape	399	0.10	40
	Sidewalk/ Curb	PCC	1,460	1.00	1,460
	Parkway	PCC	0	1.00	0
		Landscape	985	0.10	99
	1,330.00	Bio-Swale	345	0.10	35
		Total	7,092	0.78	5,536

No. of Lots = 0 ea
Curb length = 179 lf
Spacing = 89 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	221	345

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L64	Roadway	AC	4,986	1.00	4,986
	GUE	Landscape	638	0.10	64
	Sidewalk/ Curb	PCC	2,057	1.00	2,057
	Parkway	PCC	810	1.00	810
		Landscape	846	0.10	85
	2,001.00	Bio-Swale	345	0.10	35
		Total	9,682	0.83	8,036

No. of Lots = 6 ea
Curb length = 256 lf
Spacing = 128 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	321	345

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L65	Roadway	AC	13,434	1.00	13,434
	GUE	Landscape	1,288	0.10	129
	Sidewalk/ Curb	PCC	3,923	1.00	3,923
	Parkway	PCC	1,215	1.00	1,215
		Landscape	2,589	0.10	259
	4,666.00	Bio-Swale	863	0.10	86
		Total	23,311	0.82	19,046

No. of Lots = 9 ea
Curb length = 623 lf
Spacing = 125 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	762	863

DMA Calculations

DMA Name	DMA Description	Post-Project Surface Type	Area (ft^2)	Runoff Factor	Area x Runoff Factor (ft^2)
L66	Roadway	AC	3,148	1.00	3,148
	GUE	Landscape	239	0.10	24
	Sidewalk/ Curb	PCC	845	1.00	845
	Parkway	PCC	0	1.00	0
		Landscape	644	0.10	64
	816.00	Bio-Swale	173	0.10	17
		Total	5,048	0.81	4,099

No. of Lots = 0 ea

Curb length = 108 lf

Spacing = 108 o.c.

IMP Sizing Factor	Minimum DMA Area (ft^2)	Proposed DMA Area (ft^2)
0.04	164	173

Total area tributary to Bio-Retention IMPs: 47.70 acres

x Runoff Factor: 41.89 acres

Total Bio-Retention IMPArea: 1.74 acres

4.2% of Total effective impervious area tributary to Bio-Retention IMPs

Appendix D

RECORDING REQUESTED BY,
AND WHEN RECORDED
MAIL TO:

CITY OF CHULA VISTA
CITY CLERK
276 FOURTH AVENUE
CHULA VISTA, CA 91910

No transfer tax is due as this is a conveyance to a public agency of less than a fee interest for which no cash consideration has been paid or received

For Recorder's Use Only

File No. _____

STORM WATER MANAGEMENT FACILITIES MAINTENANCE
AGREEMENT WITH GRANT OF ACCESS AND COVENANTS

(Insert Project Reference Numbers)

DEFINITIONS

"Agreement" means this Storm Water Facilities Maintenance Agreement with Grant of Access and Covenants.

"Best Management Practices, or BMPs" means structural or non-structural pollution prevention measures, such as site design, source control, and treatment control methods required to minimize polluted runoff from the development during the post-development phase of the project. BMPs include, but are not limited to, Storm Water Management Facilities.

"City" means the City of Chula Vista, an official of the City, or any designated staff member acting on behalf of the City. The City Council, in Resolution No. _____ dated _____, has authorized the City Engineer to sign this Agreement on behalf of the City.

"Inspection, Operation, and Maintenance Plan, or IOMP" means a description of inspection, operation, and maintenance activities and schedules required to ensure proper operation and effectiveness of the SWMFs into perpetuity, as required in the Chula Vista Development Storm Water Manual. A copy of the IOMP, as amended from time-to-time, shall be included in the Water Quality Technical Report for the project before issuance of a construction permit, and a copy shall be maintained on file with the office of the City Engineer. City may require amendments to the IOMP at its sole discretion.

"Owner" means the owner of Property signatory to this Agreement applying for a development or redevelopment project that includes permanent BMPs, and all Owner's successors in interest in Property, jointly (such as a Home Owners' Association) and/or individually.

"Property" means the property on which development is proposed, a legal description of which is attached herewith as Exhibit B.

"Responsible Party" means Owner and any other person, corporation, or legal entity accepting, in writing and in City approved form, responsibility on behalf of Owner.

"Security" means any Bond, Cash Deposit, or Letter of Credit that City may require from Owner as a result of Owner's failure to effectively maintain development's SWMFs, and is to assure the faithful performance of the obligations of this Agreement.

"Storm Water Management Facilities" ("SWMFs") means all onsite and offsite structural facilities constructed for the treatment of project's storm water runoff, proposed as part of the development project submittals, as approved by City prior to the issuance of a development permit, or as amended with City's approval after the development is complete.

AGREEMENT

This Agreement for the inspection, maintenance, and repair of certain Storm Water Management Facilities is entered into between _____ ("Owner") and City for the benefit of City, Owner, successors in interest to City or Owner, and the public generally.

Pursuant to City's urban runoff regulations, including Chula Vista Municipal Code, Chapter 14.20 (the "Storm Water Management and Discharge Control Ordinance) and the Chula Vista Development Storm Water Manual, Owner has prepared and submitted to City a Water Quality Technical Report ("WQTR"), which is on file in the office of the City Engineer. The WQTR proposes that storm water runoff from Property be detained and treated by the use of permanent SWMFs which are identified in the WQTR as Treatment Control BMPs.

The WQTR specifies the manner and standards by which the SWMFs must be inspected, maintained, and repaired in order to retain their effectiveness. City requires Owner to enter into Agreement for the installation, inspection, maintenance, and repair of permanent SWMFs prior to the issuance of construction permits by City for work on Property (Improvements). It is the purpose of this Agreement to assure that the SWMFs are inspected, maintained, and repaired by creating obligations which are enforceable against Owner. Owner hereby covenants and agrees with City as follows:

1. Maintenance of Storm Water Management Facilities. Owner shall install, inspect, maintain, repair, and replace all SWMFs for the Improvements as required by the Director of Public Works, or his/her designated representative ("Director). Maintenance shall include inspection and servicing of SWMFs on the

schedule determined necessary to ensure the SWMFs retain their effectiveness. Owner shall maintain, repair and replace the SWMFs until all obligations under this Agreement are transferred to, and assumed by, another owner or entity, satisfactory to City. Owner shall grant Responsible Party assuming any obligation under this Agreement all necessary access right. Owner shall include a copy of the Inspection, Operation, and Maintenance Plan ("IOMP") for the SWMFs in the WQTR for the project and submit a copy to City, at the time this Agreement is executed.

The IOMP shall describe employee training programs and duties, routine inspection, service and operating schedules, maintenance frequency, and specific maintenance activities. Through the IOMP, Owner may also designate a Responsible Party, satisfactory to City, to maintain the BMPs. The IOMP may be amended from time-to-time by Owner, subject to City approval. Owner shall also be responsible for amending the IOMP upon City's direction.

2. Record Keeping. The designation of a Responsible Party to maintain the SWMFs does not relieve Owner of any of the obligations or duties under this Agreement. Owner, its successors, or a designated Responsible Party, shall retain records of the IOMP and maintenance and inspection activities for at least five years. Said records shall be made available within 5 days, upon request by City.

3. Defense and Indemnity. Owner agrees to defend, indemnify, protect, and hold harmless City, its agents, officers and employees, from and against all claims, demands, causes of action, liability or loss asserted or established for damages or injuries to any person or property arising out of the installation, inspection, maintenance, repair, or replacement of the BMPs. Claims, demands, causes of action, liability or loss that arise from, are connected with, or are caused or claimed to be caused by the acts or omission of Owner, Owner's agents, officers and employees are covered.

Also covered are the claims, demands, causes of action, liability or loss arising from, connected with, caused by, or claimed to be caused by the active or passive negligent acts or omissions of City, its agents, officers, or employees which may be in combination with the negligence of Owner, its employees, agents or officers, or any third party. Owner's duty to defend, indemnify, protect and hold harmless shall not include any claims or liabilities arising from the established sole negligence or sole willful misconduct of City, its agents, officers or employees.

Owner further agrees that indemnification referred to above and the duty to defend City requires Owner to pay any costs City incurs that are associated with enforcing the indemnification provision, and defending any claims arising from the installation, inspection, maintenance, repair, or replacement of the SWMFs. If City elects, at its sole discretion, to conduct its own defense, participate in its own defense, or obtain independent legal counsel in defense on any claim related to the installation, inspection, maintenance, repair or replacement of the SWMFs, Owner agrees to pay the reasonable value of attorney's fees and all of City's reasonable costs.

4. Insurance. Owner shall maintain a policy of liability insurance, as required by and in an amount approved by, City. This policy, with City named as an

additional insured, will protect City from any potential claims, which may arise from the installation, inspection, maintenance, repair or replacement of the SWMFs.

5. Notices. Owner agrees that it shall, prior to transferring ownership of any land on which any of the SWMFs covered by this Agreement are located, and also prior to transferring ownership of any such SWMFs, provide clear written notice of the above maintenance obligations associated with that SWMF to the transferee. Owner further agrees to provide evidence that Owner has requested the California Department of Real Estate to include in the public report issued for the development of Property, a notification regarding the SWMF maintenance requirements described in this Agreement.

6. CITY's Right to Perform Maintenance. It is agreed that City shall have the right, but not the obligation, to elect to perform any or all of the maintenance activities if, in City's sole judgment, Owner has failed, after a five-day written notice (from the date of postmark or personal delivery) has been provided by City to Owner, to perform the maintenance as agreed. In cases where immediate threat to water quality is imminent, a five-day notice will not be required. If City performs any of the maintenance activities, after City has first (1) served notice to Owner in accordance with the provisions of Chula Vista Municipal Code Chapter 1.40 to perform the maintenance activities and (2) Owner has failed to do so within the reasonable time stated in City's notice, then Owner shall pay all City costs incurred in performing said maintenance activities. Owner's obligation to pay City's costs of performing maintenance activities is a continuing obligation and shall apply whether or not City has required or used all or any portion of Security provided pursuant to Paragraph 8.

7. Grant of Access. City will conduct inspections of the SWMFs from time-to-time as required by the National Pollutant Discharge Elimination System Municipal Permit, Order No. R9-2007-0001 and any re-issuances thereof, to ensure adequate maintenance and effectiveness of the SWMFs. Owner grants to City a perpetual access to the SWMFs for performing inspections or any of the maintenance activities specified in paragraph 1. City shall have the right, at any time and without prior notice to Owner, to enter upon any part of Property as may be necessary or convenient for inspection purposes. Owner shall at all times maintain Property so as to make City's access clear and unobstructed. Owner agrees to pay all inspection fees as may be established by City.

8. Security. If upon two inspections within any five-year period, City inspectors determine that Owner has failed to effectively operate, maintain, or repair the SWMFs, City may require Owner to provide City with Security to assure the faithful performance of the obligations of this Agreement. Security may be in the form of a Bond, a Cash Deposit, or a Letter of Credit in an amount equal to two-years' cost of maintaining the SWMFs, as determined in the project WQTR and adjusted at 5% per annum. City may use Security to provide funding for the cost to City to perform any of the maintenance activities for the development's SWMFs. City may use all or any part of Security at any time pursuant to this Agreement. Should any portion of Security be used by City, Owner shall deposit additional funds or provide an additional Letter of Credit to City within thirty (30) days in the amount used by City to bring the amount available back up to the amount specified. If Security is a Cash Deposit, and a

Substitute Cash Deposit or Letter of Credit is provided that is acceptable to City, any amount of the Cash Deposit not used by City shall be returned to Owner in accordance with City's accounting procedures. The Letter of Credit shall be submitted on bank letterhead using City-approved form. Once Owner has demonstrated effective operation, maintenance, and repair, as determined by City, the Security shall be kept for one year for the first occurrence, and two years for the second occurrence, after which time the Security shall be cancelled and any unused funds returned to Owner.

9. Agreement Binds Successors and Runs with PROPERTY. It is understood and agreed that the terms, covenants and conditions contained in this Agreement shall constitute covenants running with the land and shall be binding upon the heirs, executors, administrators, successors and assigns of Owner and City and shall be deemed to be for the benefit of all persons owning any interest in Property. It is the intent of the parties that this Agreement be recorded and be binding upon all persons purchasing or otherwise acquiring all or any lot, unit or other portion of Property, who shall be deemed to have consented to and become bound by all the provisions of this Agreement. This Agreement shall commence upon execution of this Agreement by all parties named in the Agreement.

10. Enforcement. Failure to comply with the terms of this Agreement constitutes a violation of the Chula Vista Municipal Code Chapter 14.20 "Storm Water Management and Discharge Control" and may result in enforcement action pursuant to City's storm water regulations and administrative procedures.

11. Governing Law and Severability. This Agreement shall be governed by the laws of the State of California. Venue in any action related to this Agreement shall be in the Superior Court of the State of California, County of San Diego, South County Division. In the event that any of the provisions of this Agreement are held to be unenforceable or invalid by any court of competent jurisdiction, the validity, and enforceability of the remaining provisions shall not be affected by the judgment.

SIGNATURE PAGE FOR
STORM WATER MANAGEMENT FACILITIES MAINTENANCE
AGREEMENT WITH GRANT OF ACCESS AND COVENANTS
(Insert Project Reference Numbers)

IN WITNESS WHEREOF, the parties have executed this Agreement on the _____ day of _____, 20__.

OWNER:

_____

By: _____

Its: _____

By: _____

Its: _____

CITY OF CHULA VISTA:

_____
City Engineer

APPROVED AS TO FORM:

_____
City Attorney

ATTEST:

_____
City Clerk

Dated: _____

(Notary to attach acknowledgment for each signature.)
(Corporate Authority required for each Signatory, if applicable.)

Attachments:

Exhibit A: Legal Description for Property

Appendix E

ADVANCED GEOTECHNICAL SOLUTIONS, INC.
25220 Hancock Avenue, Suite 420
Murrieta, California 92562
Telephone: (619) 708-1649 Fax: (714) 409-3287

OTAY LAND COMPANY
1903 Wright Place, Suite 220
Carlsbad, CA 92008-1420

March 11, 2011
P/W 1009-05
Report No. 1009-05-B-4

Attention: Mr. Jeff O'Connor

Subject: **Geotechnical Opinion Letter, Hydro-Modification and Scour in Wolf Canyon Drainage, Otay Ranch, Village 8 West, Chula Vista, California**

1. *Geology of the Otay Mesa Quadrangle, Kennedy, M.P., and Peterson, G.L., 1975, Geology of the eastern San Diego metropolitan area, California: California Division of Mines and Geology Bulletin 200*
2. *Preliminary Tentative Map, Otay Ranch, Village 8 West, Chula Vista, California, Sheet 3 of 7 prepared by Hale Engineering (last revision dated August 11, 2010)*
3. *Revised Geotechnical Investigation, Village 8 West, Otay Ranch, Chula Vista, California, prepared by Advanced Geotechnical Solutions, Inc., dated October 22, 2010 (Report No. 1009-05-B-2)*

Mr. O'Connor:

Pursuant to your request Advanced Geotechnical Solutions, Inc. (AGS) has prepared this geotechnical opinion letter regarding the hydro-modification of the drainage at the southwest corner of Planning Area A, Otay Ranch, Village 8 West, Chula Vista, California. Specifically, the proposed hydro-modification basin will be constructed in Planning Area F with the proposed storm drain outfall westerly subjacent to Planning Areas A and E. In preparing this opinion letter representatives of AGS conducted the following:

- Reviewed the referenced Preliminary Tentative Map prepared by Hale Engineering.
- On February 22, 2011 observed and mapped the surface geology of the existing drainage in the approximate area described above.
- Reviewed the published and proprietary geologic maps for the area (references).

Based upon this information AGS has developed the following observations and conclusions:

Geomorphology

Based upon our recent observations of the existing channel and review of the referenced geologic maps, the geology along the eastern portion of the drainage consists of minor amounts of modern alluvial soils (1 to 5 feet) overlying a Mezozoic-aged Santiago Peak Volcanics. Within the existing channel the geology consists of Otay formation along the east side and Santiago Peak Volcanics along the west side. With a thin veneer of modern alluvium at in the broader flatter portions of Wolf Creek near the top of the existing channel. Approximately 1,500 feet southwest of the proposed storm drain outfall, the exposed geology transitions to Tertiary-aged Otay Formation which non-conformably overlies the Santiago Peak

Volcanics. Thicker sections of modern alluvial soils are anticipated to exist within this western portion of the drainage.

The alluvium consists of a dark brown to brown, moist, loose to medium dense, silty to clayey sand with gravel and is considered moderately erosive. Some cobble sized clasts were noted at the contact of the underlying Santiago Peak Volcanics. The Santiago Peak Volcanics are generally dense and mildly metamorphosed volcanic and volcaniclastic rocks. Composition of the volcanic rocks varies from basalt to rhyolite but is predominantly dacite and andesite. The erosive character of the Santiago Peak Volcanics is considered to be very low. The Otay Formation is predominantly composed of poorly to moderately indurated siltstone, sandstone, 'gritstone', and gravel to cobble rich Breccia subunits and is considered to be very low to low erosive.

Channel Observations

Based upon our observations, natural scour and down cutting of the channel has occurred from the easterly end of the proposed outfall structure to approximately 1,500 lineal feet downstream. In this upper portion of the Wolf Creek channel down cutting has exposed Otay formation along the east side and Santiago Peak Volcanics along the west side of the channel. Numerous boulders and cobbles are present in the channel bottom and there is a significant population of small trees and scrub brush. Additional down cutting is unlikely in this area due to the hard nature of the bedrock exposed in the chamel bottom and the existing growth situated in the channel indicative of a "mature" drainage. Below this area of Wolf Creek the scouring and down cutting ends and a depositional regime begins as indicated by the transition from a predominantly straight channel to a meandering channel with more and larger mature trees and heavy foliage. Deposition in this area is likely related to the flatter channel gradients and subsequent lower flow velocities.

Conclusions and Opinions

In conclusion, scouring and down cutting has occurred in the eastern portion of the channel, extending approximately 1,500 feet southwest from the proposed outfall structure. The scouring and down cutting is a result of the natural higher velocities in this reach due to a steeper gradient. This natural down cutting of the weaker more erosive alluvial soils present in the channel have exposed the much less erosive bedrock units (Otay Formation and Santiago Peak Volcanic Rock). No other portions of the channel appear to be experiencing active erosion. Based upon the designed hydro-modifications a reduction of peak storm flows of approximately 40% to 50% are expected in this reach of the Wolf Creek channel once Village 8 West is developed. Accordingly, appreciable scouring and down cutting is not anticipated to occur in this reach of the Wolf Creek due to the erosion resistant nature of the bedrock exposed in the channel and the reduction of peak flows in the channel. It is AGS's opinion that the proposed hydro-modifications constructed in conjunction with Village 8 West will not create additional scour or result in any significant modification to the existing Wolf Creek channel.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to contact the undersigned.

Respectfully Submitted,
Advanced Geotechnical Solutions, Inc.

JEFFREY A. CHANEY, Vice President
RCE 46544/GE 2314 Exp.6/30/11

Distribution: Addressee (4)
Hale Engineering Attn: Mr. John Hayes (1)



REVISED GEOTECHNICAL INVESTIGATION
VILLAGE 8 WEST
OTAY RANCH
CHULA VISTA, CA

For:
OTAY LAND COMPANY

October 22, 2010

P/W 1009-05
Report No. 1009-05-B-2

ADVANCED GEOTECHNICAL SOLUTIONS, INC.

TABLE OF CONTENTS

1.0 INTRODUCTION 3
1.1 Background and Purpose 3
1.2 Scope of Study 3
1.3 Project Location and Description 4
1.4 Land Use 4
1.5 Proposed Development 4
1.6 Previous Geotechnical Studies 5
2.0 GEOLOGIC SETTING 5
2.1 Regional. 5
2.2 Stratigraphy 5
2.2.1 Santiago Peak Volcanics (Map Symbol Jsp) 5
2.2.2 Unnamed Fanglomerate Deposits (Map Symbol Tfg) 6
2.2.3 Otay Formation (Map Symbol Oo) 6
2.2.4 Terrace Deposits (Map Symbol Qt) 6
2.2.5 Alluvium (Map Symbol Qal) 7
2.2.6 Topsoil 7
2.2.7 Artificial Fills (Map Symbol af) 7
2.3 Geologic Structure/Tectonic Setting 7
2.3.1 Tectonic Framework 7
2.3.2 Regional Faulting 7
2.3.3 Site Geologic Structure 8
2.4 Groundwater 8
2.5 Non-Seismic Geologic Hazards 8
2.5.1 Mass Wasting 8
2.5.2 Flooding 8
2.5.3 Subsidence and Ground Fissuring 8
2.6 Seismic Hazards 9
2.6.1 Surface Fault Rupture 9
TABLE 2-1 9
2.6.2 Ground Motion 10
TABLE 2-2 10
2.6.3 Liquefaction 11
2.6.4 Seismically-Induced Landsliding 11
2.6.5 Seiches and Tsunamis 11
3.0 ENGINEERING ANALYSES 11
3.1 Material Properties 11
3.1.1 Excavation Characteristics 11
3.1.2 Compressibility 12
3.1.3 Expansion Potential 12
3.1.4 Earthwork Adjustments 12

TABLE 3-1 12
3.1.5 Chemical Analyses 13
3.2 Slope Stability 13
4.0 GEOTECHNICAL CONCLUSIONS AND RECOMMENDATIONS 13
4.1 Site Preparation and Removals 13
TABLE 4-1 14
4.2 Slope Stability Remediation 14
4.2.1 Cut Slopes 14
4.2.2 Fill Slopes 15
4.2.3 Natural Slopes 15
4.3 Overexcavation of Building Pads and Streets 15
4.3.1 Building Pads 15
4.3.2 Streets 15
4.4 Subsurface Drainage 16
4.5 Construction Staking and Survey 16
4.6 Settlement Monitoring 17
4.7 Earthwork Considerations 17
4.7.1 Compaction Standards 17
4.7.2 Documentation of Removals and Drains 17
4.7.3 Treatment of Removal Bottoms 17
4.7.4 Fill Placement 17
4.7.5 Benching 17
4.7.6 Mixing 18
4.7.7 Fill Slope Construction 18
4.7.8 Oversized Materials 18
4.7.8.1 Rock Blankets 19
4.7.8.2 Rock Windrows 19
4.7.8.3 Individual Rock Burial 19
4.7.8.4 Rock Disposal Logistics 19
4.8 Haul Roads 20
4.9 Import Materials 20
5.0 DESIGN RECOMMENDATIONS 20
5.1 Structural Design - Residential 20
5.1.1 Foundation Design 20
5.1.2 Post- Tensioned Slab Foundation System Design Recommendations 21
5.1.3 Conventional Slab Recommendations 21
5.1.4 Total & Differential Settlement.. 21
5.1.5 Deepened Footings and Structural Setbacks 22
FIGURE 5.1 22
5.1.6 Miscellaneous Foundation Recommendations 23

5.2 Retaining Wall Design 23
5.2.1 Earth Pressure Coefficients - Select Backfill.. 23
5.2.2 Other Design Considerations 23
5.2.3 Waterproofing and Drainage System 23
FIGURE 5.2 24
5.3 Other Design and Construction Recommendations 24
5.3.1 Site Drainage 24
5.3.2 Concrete Flatwork and Lot Improvements 24
5.3.3 Utility Trench Excavation 25
5.3.4 Utility Trench Backfill 25
5.4 Preliminary Pavement Design 25
TABLE 5-1 26
6.0 FUTURE STUDY NEEDS 26
7.0 LIMITATIONS 27

APPENDIX A - REFERENCES
APPENDIX B - SUBSURFACE INVESTIGATION
APPENDIX C - LABORATORY TESTING
APPENDIX D - SLOPE STABILITY ANALYSIS
APPENDIX E – GENERAL EARTHWORK SPECIFICATIONS AND GRADING DETAILS
APPENDIX F - HOMEOWNERS MAINTENANCE GUIDELINES

POCKET ENCLOSURES:
SHEETS 3 through 5 and 7
PLATE 1

ADVANCED GEOTECHNICAL SOLUTIONS, INC.
529 West 4th Street, Suite B
Escondido, California 92025
Telephone: (619) 850-3980 Fax: (714) 409-3287

OTAY LAND COMPANY
1903 Wright Place, Suite 220
Carlsbad, CA 92008-1420

October 22, 2010
P/W 1009-05
Report No. 1009-05-B-2

Attention: **Mr. Curt Noland**
Vice President

Subject: **Geotechnical Investigation, Village 8 West, Otay Ranch, Chula Vista, California**

References: Appendix A

Gentlemen:

Presented herein is Advanced Geotechnical Solutions, Inc. (AGS) revised Geotechnical Investigation for Village 8 West, Otay Ranch, Chula Vista, California. AGS has been retained by Otay Land Company to complete the geotechnical services supporting the EIR and Tentative Tract submittal and approval process for this project. Signatories on this report have previous experience on this project and have accepted the findings and recommendations from the reports prepared on the project by Pacific Soils Engineering, Inc. (PSE). Based upon this previous work, AGS will become the Geotechnical Engineer and Engineering Geologist of record for the project.

The purpose of this revision to the Geotechnical Investigation is to address outstanding review comments on the May 26, 2010 Geotechnical Investigation report prepared by PSE. An EIR level investigation was prepared by PSE (2006) based upon subsurface work compiled in 2004 (PSE). That information and data is included herein. In response to outstanding review comments, the May 26, 2010 document was published by PSE. Additional review comments have been provided addressing that submittal and this document has been produced to respond to those comments via a revised version of the May 26, 2010 report.

Presented in this transmittal is explanatory text and geotechnical maps and cross sections utilizing the most current Tentative Tract Map (dated August 11, 2010) prepared by Hale Engineering (Sheets 3 through 5, & 7 of 7).

AGS appreciates the opportunity to provide you with geotechnical consulting services on this project. If you have questions concerning this report, please do not hesitate to contact the undersigned at (619) 708-1649

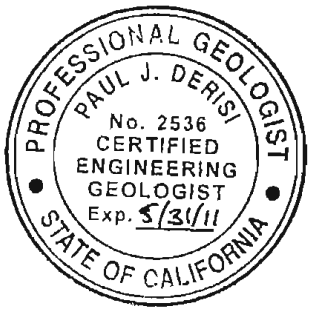
Respectfully submitted,
Advanced Geotechnical Solutions, Inc.

JEFFREY A. CHANEY, Vice President
RCE 46544/RGE 2314, Reg. Exp. 6-30-11

PAUL J. DERISI, Vice President
CEG 2536, Reg. Exp. 5-31-11

Distribution: (8) Addressee
(1) Hale Engineering, Attn: John Hayes (pdf)





1.0 INTRODUCTION

1.1 Background and Purpose

The purpose of this report is to provide a "Tentative Tract Map" (TTM) level geotechnical study of portions of Otay Ranch, Village 8 West, Chula Vista, California that may be utilized to support the EIR submittal. This report has been revised to geotechnically address the most current TTM design prepared by Hale Engineering and to integrate responses to outstanding City of Chula Vista review comments. This report has been prepared in a manner consistent with City of Chula Vista geotechnical report guidelines and the current standard of practice. Geotechnical conclusions and recommendations are presented herein and items addressed include: 1.) Unsuitable soil removals; 2.) Cut, fill and natural slope stability and remedial grading, where necessary; 3.) Buttress/Stabilization fill requirements; 4.) Cut/fill pad over excavation criteria; 5.) Remedial and design grading recommendations; 6.) Handling and disposal of oversize hard earth materials; and 6.) Foundations design recommendations based upon anticipated as graded soil conditions.

1.2 Scope of Study

This study is aimed at providing geotechnical/geologic conclusions and recommendations for development of TTM for residential uses, attendant streets, parks, school and open space areas. The scope of this study included the following tasks:

- Review of readily available maps, literature and aerial photographs (Appendix A).
- Review of site geologic mapping conducted by PSE and refinement by AGS for this report.
- Compilation of previous subsurface data from PSE (2004) including seventy-three (73) backhoe test pits and sixteen (16) bucket auger borings that were also included in the subsequent 2006 EIR study (Appendix B). This data has been plotted onto the current Tentative Tract map for Village 8 West (Sheets 3 through 5, and 7 of 7) prepared by Hale Engineering (dated August 11, 2010).
- Compilation of previous laboratory testing conducted by PSE (Appendix C).
- Preparation of geologic cross sections (Plate 1).
- Stability analysis of both the highest cut and fill slopes (Appendix D).
- Data analyses in relation to the site specific proposed improvement.
- Analysis of the excavation characteristics (i.e. rippability) of onsite bedrock materials.
- Discussion of pertinent geologic and geotechnical topics.
- Preparation of this report and accompanying exhibits.

1.3 Project Location and Description

The subject tentative tract map is part of the larger Otay Ranch Master Planned Community. Specifically, this report covers portions of Otay Ranch, Village 8 West. The 320-acre property is rectangular-shaped, and is located along the southern portions of the Otay Mesa, north of the Otay River (Figure 1). The site consists of two (2) bedrock controlled, topographic regimes. The north and east portions are underlain by Otay Formation and consist of gently rolling terrain that is punctuated by south flowing "V"-shaped drainages. Most drainages are broad and relatively shallow; however, locally along incised flow-lines, gradients on the order of 1.5: 1 (horizontal to vertical) or steeper exist. Low-relief river terraces superjacent to the Otay River occupy the southernmost portion of this terrain. The southwest portion of the parcel reflects more rugged terrain underlain by Santiago Peak Volcanics. Surface outcrops and large in-place exposed boulders are common, reflecting the bedrocks resistant character.

Approximately 37.3 acres of slopes with gradients greater than 25% are present within the project limits. This area is referred to as Rock Mountain and relief over the volcanic area within project limits is over 300 feet (Sheet 4). The southerly extension of the offsite 30 foot access road for the proposed sewer, storm drain, and water mains extends approximately 4,000 feet traversing through relatively level Terrace deposits before it drops into the alluviated Otay River drainage.

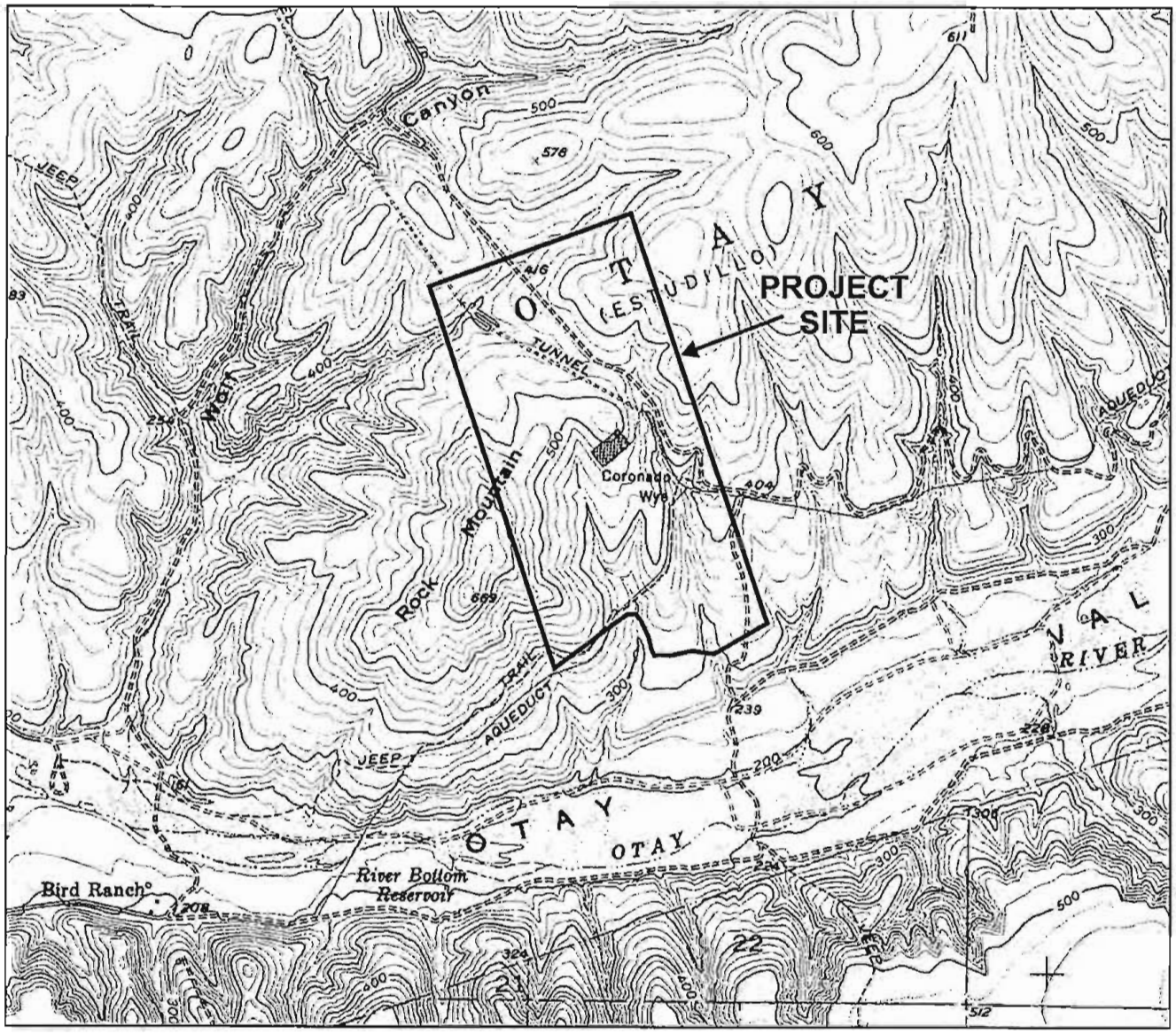
1.4 Land Use

Current and past use includes light agriculture such as dry farming and pasture. A 19.6-acre City of San Diego reservoir occupies the central part of the site (Sheet 3). Reservoir-associated large-diameter aqueducts forming the *Coronado Wye* traverse the site at the approximate locations shown on Sheets 3, 4, 5 and 7. The aqueducts were conducted by cut and cover methods and in tunnels whose locations are within the easements shown on the accompanying plates. A rock quarry is located southwest of the project.

1.5 Proposed Development

It is AGS's understanding that the Otay Ranch, Village 8 West will be developed to include mixed use of residential, commercial, recreational and institutional components. The approximate 320-acre site is scheduled for 2050 living units with 21 acres allocated for a school site and 19.8 acres for three parks. Additionally, a sewer access road is proposed at the south project boundary and ties into the existing sewer that parallels the Otay Valley (Sheet 7). Dedicated open space totals 22.8 acres and public streets cover 28.6 acres. It is estimated that 4,676,000 cubic yards of excavation will be required to grade the project. Import or export of materials is not planned for the project.

The grading concept shown on Sheet 3 through 5 depicts 20 large pads located on the north and east portions of the property. Grade splits of several feet to as much as 30 feet separate the pads. The single-family neighborhoods flank these larger pads to the south and southwest. Cuts as deep as 150± feet are planned in the southwest portion of the site while fills up to about 50 feet deep are shown in the south portion of the site. The cut slopes onsite are designed at ratios of 2:1



N

APPROX. SCALE
1" = 2000'

SITE LOCATION MAP

VILLAGE 8 WEST
CHULA VISTA, CALIFORNIA

SOURCE MAP: U.S.G.S. - OTAY MESA 7.5' QUADRANGLE

FIGURE 1

PROJECT:	REPORT:	DATE:
P/W 1009-05	1009-05-B-2	10/22/10

AGS
ADVANCED GEOTECHNICAL SOLUTIONS, INC.
25220 Hancock Street, Suite 420
Murrieta, California 92562
Telephone: (619) 708-1649 Fax: (714) 409-3287

(horizontal to vertical) to vertical heights of 135 feet. Fill slopes are designed at ratios of 2:1 (horizontal to vertical) up to vertical heights of 70 feet. It is our understanding that the existing City of San Diego Reservoir will remain in-place and that the large-diameter aqueducts will be relocated.

1.6 Previous Geotechnical Studies

Pacific Soils Engineering, Inc. (2003) has completed a feasibility-level geotechnical report for Parcels "A", "B" and "C". Neblitt and Associates, Inc. (NA, 2003) undertook geologic mapping along a waterline trench excavation in Parcel "B". An EIR level report was prepared in June of 2006 utilizing data generated from a subsurface investigation (conducted in 2004). A revised Geotechnical Investigation was prepared by PSE in May of 2010. AGS has reviewed the PSE and NA reports and have incorporated those findings and revisions into this study.

2.0 GEOLOGIC SETTING

2.1 Regional

Otay Mesa in general and Village 8 West in particular are part of a broad, relatively undeformed, uplifted highland encompassing much of western and southern San Diego County. Elements of the Elsinore and Laguna Salada Faults bound the highlands in the east and the Rose Canyon and associated offshore fault to the west. Otay Mesa consists of Mesozoic metamorphic, volcanic and igneous rocks on which marine and non-marine Cretaceous through Holocene sediments have been deposited (Kennedy and Tan, 1977). These deposits have been only mildly deformed and are easily recognized as widespread, near-horizontal, sedimentary beds forming the broad tablelands and rolling hills of Otay Mesa.

2.2 Stratigraphy

The local stratigraphy reflects the regional, near-horizontal to gently southwest dipping Oligocene Otay Formation, and a Tertiary un-named fanglomerate. These mapped units non-conformably overlie volcanic and metavolcanic rocks of the Mesozoic Santiago Peak Volcanics. In turn, various Pleistocene and Holocene non-marine sediments mantle those formations, particularly in the south part of the site. Approximate geologic contacts are shown on Sheets 3 through 5 and sheet 7 with subsurface relationships depicted on the geologic cross sections (Plate 1).

2.2.1 Santiago Peak Volcanics (Map Symbol Jsp)

The Santiago Peak Volcanics crop out in the southwest part of the property and represent the east flank of Rock Mountain. The contact between the Santiago Peak Volcanics and the overlying younger geologic units represents a significant geologic hiatus. This contact is irregular and reflects a relatively high relief Mesozoic landscape. Subsequent erosion has exhumed portions of this ancient landscape, creating modern topographic highs including Rock Mountain.

In addition, buried, near-surface Santiago Peak Volcanics were observed in the subsurface investigation generally along the west property line (BA-12, TP-43 and TP-46) of Sheet 3 and cross section A-A'.

The Santiago Peak Volcanics are generally dense and mildly metamorphosed volcanic rocks. Large in-place surface boulders occur on natural slope areas in Neighborhoods P and N (Sheet 4). Composition of the volcanic rocks varies from basalt to rhyolite but is predominantly dacite and andesite (Kennedy and Tan, 1977). Typically the meta-volcanics display crude to moderate bedding and foliation. Fracturing is poorly to moderately well developed. In general, outside of boulder areas, a weathered halo of only a few feet thick exists. Below this the rock is very dense and will require blasting to excavate. Blasting operations have been widespread in the nearby quarry, where the formation has been mined for aggregate.

2.2.2 Unnamed Fanglomerate Deposits (Map Symbol Tfg)

A Tertiary fanglomerate initially mapped by Kennedy and Tan (1977) crops out in the lower-elevation slopes above the Otay River (Sheets 4, 5 and 7). This mapping unit either locally pinches out or is covered by river terrace deposits south of the property. Angular metamorphic boulders typify the clasts within the unit. The matrix is rubified, dense and moderately to well cemented. Crude horizontal to sub-horizontal stratification is identifiable in some outcrops. Rubification, cementation and presence of subrounded "meta-breccia" cobbles distinguish this formation from overlying Pleistocene terrace deposits.

2.2.3 Otay Formation (Map Symbol Oo)

The Oligocene Otay Formation underlies most of the study area. Brown to light gray sandstone/gritstone typifies the formation. It is generally poorly to moderately indurated and is locally cross-bedded. Infrequent to common gray bentonite beds occur throughout the section. Typically, these beds are one to several feet thick and have relatively sharp contact with the interbedded sandstones. The clay beds are expansive and exhibit low shear strengths when wetted. Harder and more resistant "gritstone" sub-units are common within the Otay Formation and can range from a few feet to tens of feet thick. Breccia sub-units consisting of rounded to angular cobbles to boulder-sized clasts can also be found within the Otay Formation near the contact of the Santiago Peak Volcanics. These beds are likely equivalent to the Tertiary Fanglomerate (Kennedy and Tan, 1977). The Breccia subunits encountered in the subsurface explorations onsite consisted of gravel to cobble-sized clasts. The Otay Formation is less resistant than the Santiago Peak Volcanics and unnamed Fanglomerate and thus forms subdued, rolling topography exemplifying Otay Mesa. Its steepest slopes occur where young consequent tributaries to the Otay River are actively eroding headward and downward.

2.2.4 Terrace Deposits (Map Symbol Qt)

Veneers of Pleistocene cobbley to bouldery, well oxidized, dense sands have been mapped on surfaces 90 to 170 feet above the modern Otay River channel. These deposits are depicted as terrace deposits in Neighborhoods U and V (Sheet 5) and along the majority of the sewer access road alignment (sheet 7). These deposits vary from a few tens of feet thick to only a veneer of lag gravel composed of residual dense cobbles and boulders.

2.2.5 Alluvium (Map Symbol Qal)

Alluvium occupies the onsite drainages. The alluvium observed is porous, expansive, and exhibits low in-situ density. Typical these sediments vary from a few to ten (10) feet in thickness with local variations.

2.2.6 Topsoil

A mantle of residual "topsoil" is present over much of the rolling hills underlain by Otay Formation. The soils are typically one (1) to five (5) feet thick, low density, organic-rich and porous. Generally, the areas underlain by Santiago Peak Volcanics have thinner soils and are locally absent as evidenced by the frequent occurrence of surface boulders.

2.2.7 Artificial Fills (Map Symbol af)

Significant deposits of artificial fill are associated with the reservoir and also exist over the aqueducts crossing the site. Sheets 2 through 5, and 7 depict the locations of the major, most recognizable artificial fill. Small prisms of fill that have not been mapped are primarily associated with unimproved Jeep trails.

2.3 Geologic Structure/Tectonic Setting

2.3.1 Tectonic Framework

The Otay Mesa is part of the Santa Ana sub-block of the Peninsular Ranges that extends from Baja California in the south and that terminates in the north against the Transverse Ranges east of Los Angeles (Jennings, 1994). The Santa Ana sub-block is a highland bounded by the Elsinore Fault Zone on the east and by the Rose Canyon Fault Zone on the west. Many areas, especially in the San Diego region, have remained relatively un-deformed. The Otay Mesa is such an example as indicated by the unfolded, nearly horizontal section of sedimentary rocks.

2.3.2 Regional Faulting

Regional faults in southernmost California typically trend northwest (Figure 2) and display major right lateral slip with common smaller scale vertical displacements (Jennings, 1994). Significant faults of this system displaying Holocene offset are the San Andreas, Elsinore, San Jacinto, Coronado Bank, Newport-Inglewood and Rose Canyon Faults. Of these, the Rose Canyon Fault is the closest, being approximately twelve (12) miles (19.3 km) west.

The closest mapped fault is the La Nacion (Kennedy and Tan, 1977) about two (2) miles to the west. Those authors show the fault separating Tertiary sedimentary rocks in the west from Mesozoic rocks in the east. A nearby subsurface investigation by PSE along that fault demonstrated that it is not active as evidenced by unbroken Pleistocene sediments overlying the fault. Jennings (1994) mapped a "pre-Quaternary" fault in and paralleling the Otay River. The "matching" of Mission Valley Formation outcroppings west of the study sites on either side of the Otay River (Kennedy and Tan, 1977) argue for limited displacement along this postulated fault, if it even exists.

2.3.3 Site Geologic Structure

The Santiago Peak Volcanics typically exhibit poorly to moderately well developed fracturing and display crude to moderate bedding/foliations. As-exposed in the nearby quarry, joints and foliation/bedding dip steeply.

The Tertiary fanglomerate and Otay Formation are only slightly fractured and represent an essentially horizontal section of rocks. Local dips of less than 5 degrees to the south or southwest have been recognized in the region (Kennedy and Tan, 1977) although local undulations are possible. These dips may reflect broad up-warping of the region or, alternatively, they may represent initial dips. Faults were not mapped within onsite outcrops or subsurface explorations.

2.4 Groundwater

Active springs or surface seeps were not observed during our geologic field mapping or subsurface investigation. It is possible that seasonal groundwater associated with precipitation intermittently occurs in onsite drainages. Owing to the depth of cut, it is possible that seasonal nuisance water trapped along joints or beds may be encountered during grading especially in the Santiago Peak Volcanics. Minor seeps or wet areas were observed in Borings BA-9, BA-11 and BA-12.

2.5 Non-Seismic Geologic Hazards

2.5.1 Mass Wasting

The Otay Formation is susceptible to erosion and slumping. Surficial slumps and bedrock landslides were observed within the Otay Formation west of the project but not onsite. These features often are associated with the La Nacion fault and/or bentonite beds exposed by erosion and baseline down cutting.

No indications of mass wasting was observed nor mapped within the Santiago Peak Volcanics. The absence of mass wasting and the existence of relatively stable, steep natural slopes is common is this erosion resistant unit.

Within the project significant landslides were not identified during site reconnaissance and subsurface investigation.

2.5.2 Flooding

According to FEMA, the site is not within a FEMA identified flood hazard.

2.5.3 Subsidence and Ground Fissuring

The Santiago Peak Volcanics, Otay Formation and the Fanglomerate/Terrace deposits are not susceptible to subsidence and or ground fissuring. The surficial units on site (alluvium, undocumented fill and topsoil) can be susceptible to minor amounts of subsidence and ground fissuring.

2.6 Seismic Hazards

The project is located in the tectonically active southern California, and will likely experience some effects from future earthquakes. Alquist-Priolo Fault Hazard Zones have not been imposed within the subject property. The State of California Seismic Hazards Mapping program identifying areas of potential liquefaction and earthquake induced landsliding has not addressed the Otay Quadrangle as of this writing.

The type or severity of seismic hazards affecting the site is chiefly dependent upon the distance to and direction from causative faults, the intensity and duration of the seismic events, and the onsite soil characteristics. The seismic hazard may be primary, such as surface rupture and/or ground shaking, or secondary, such as liquefaction or landsliding. The following is a brief seismic hazards assessment for the project.

2.6.1 Surface Fault Rupture

Active, potentially active and inactive faults are not known to exist at the site. According to the literature, the nearest known active fault is the Rose Canyon Fault, a Type "B" fault (UBC, 1997), located approximately twelve (12) miles (19 km) west. Accordingly, the potential for fault surface rupture within the project is not significant. A listing of active faults within about 100-kilometers (62 miles) of the site is presented in Table 2-1.

Table 2-1

Distance to Known Active Faults

Fault Name	Distance		Maximum Moment Magnitude (Mmax)*
	(mi)	(Km)	
Rose Canyon	12	19	6.9
Coronado Bank	28	28	7.4
Elsinore-Julian	43	69	7.1
Elsinore-Coyote Mountain	45	73	6.8
Earthquake Valley	46	75	6.5
Newport-Inglewood (Offshore)	47	75	6.5
Elsinore-Temecula	54	88	6.9
San Jacinto-Coyote Creek	63	105	6.8
San Jacinto-Borrego	63	105	6.6
Laguna Salada	66	106	7.0

* Petersen and others (1996) and Blake *(FRISKSP,* ver.4.0

2.6.2 Seismicity

Although no known active faults exist within the project limits, the site will experience ground motion and associated effects from earthquakes generated along regional active faults such as those listed in Table 2-1. Figures 2 and 3 are generalized maps showing the active faults considered in the assessment of ground motion. Figures 4 and 5 show regional historical earthquakes between 1800 to 1999.

To estimate potential ground shaking, PSE performed a probabilistic seismic hazard analysis (PSHA) that is consistent with the commonly accepted procedures outlined in Petersen and others (1996) and the UBC (ICBO, 1997). PSE used *FRISKSP,* developed from United States Geologic Survey software *(FRISK)* by Blake (2000); to derive hypothetical probabilistic peak horizontal accelerations using three commonly employed attenuation relationships of Boore and others (1997), Campbell (1997,1999 Revised) and Sadigh and others (1997). Subsoil types SB (shear wave velocity 1070 m/s) and SD (shear wave velocity 250 m/s) were used by *FRISKSP.* Based on limited information, soil type SB is representative of the Santiago Peak Volcanics and SD was preliminarily judged typical of all other soil/rock types. For a complete discussion of the software and probabilistic methods, the reader is referred to Blake (2000).

Table 2-2 presents the horizontal ground accelerations and the average of same, representing the UBC-consistent 10 percent probability of exceedance in 50-years (475-year return period) as calculated by *FRISKSP.* Figures 6 through 11 show the probability of exceedance curves for each attenuation relationship, using both subsoil types. Whereas the 10 percent probability of exceedance in 50 years is the Design Basis Earthquake generally applied to "normal" structures such as housing, the Upper Bound Earthquake (10 % chance of exceedance in 100 years) is required for design of critical structures such as schools and emergency facilities. The Upper Bound numbers can be deduced by inspection of Figures 6 through 11.

Table 2-2
Horizontal Ground Accelerations

Investigators	Volcanics	Other Geologic Units (onsite)
Boore and others 1997	0.17g	0.25g
Campbell, 1997	0.17g	0.21g
Sadigh and others, 1997	0.2g	0.2g
Average	***0.18g***	***0.22g***

It should be noted that these hypothetical numbers are based on recent standards of practice (for example, Martin and Lew, 1999, Petersen, 1996) and thus differ from numbers derived from past standards of practice.

In sum, these results are based on many unavoidable geological and statistical uncertainties, yet are consistent with current standard of practice. As engineering seismology evolves and as more fault-specific geological data are gathered, more certainty and different methodologies may also evolve.

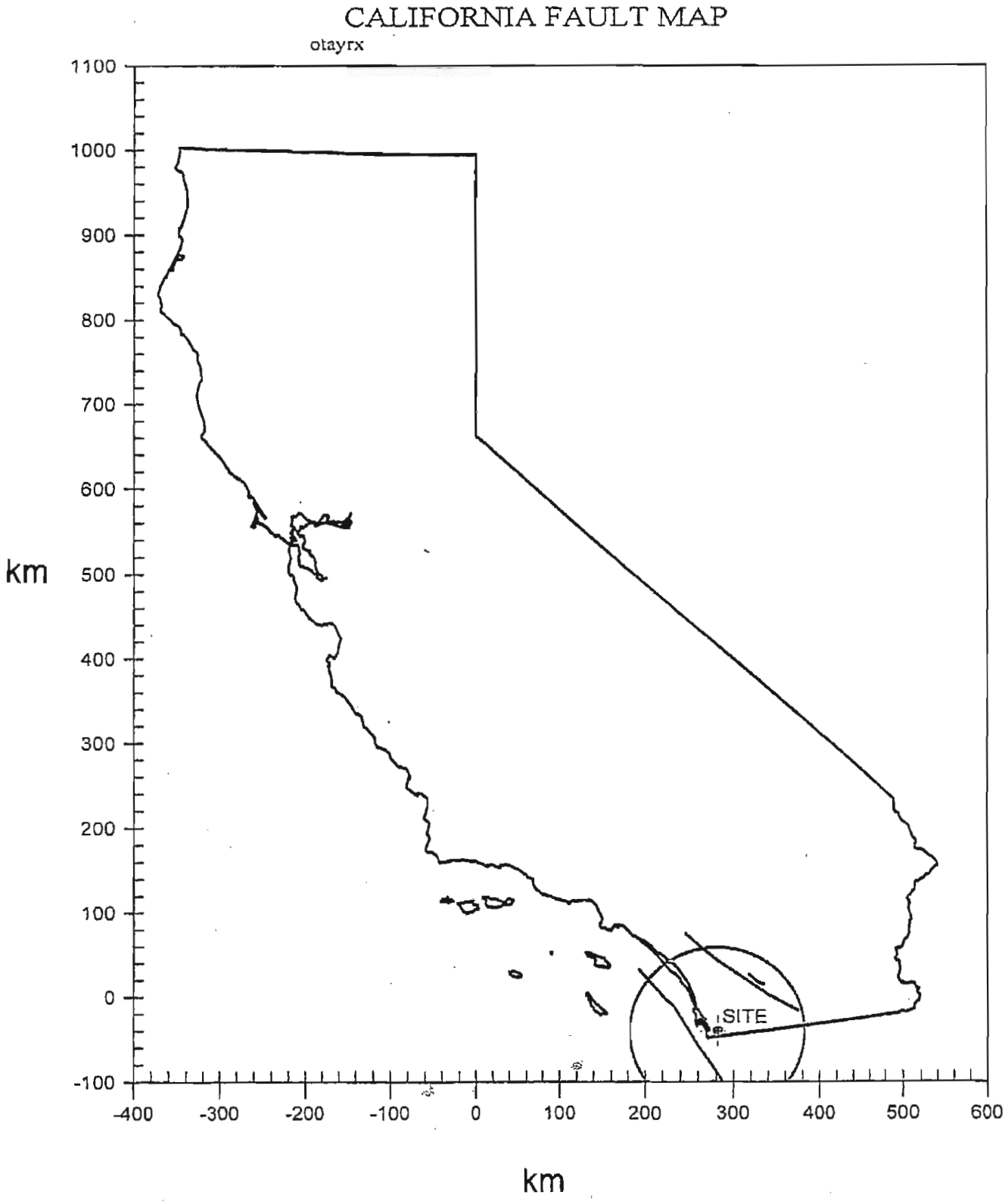

CALIFORNIA FAULT MAP
otayrx
1100
1000
900
800
700
600
500
400
300
200
100
0
-100
km
-400
-300
-200
-100
0
100
200
300
400
500
600
km
SITE

FIGURE 2

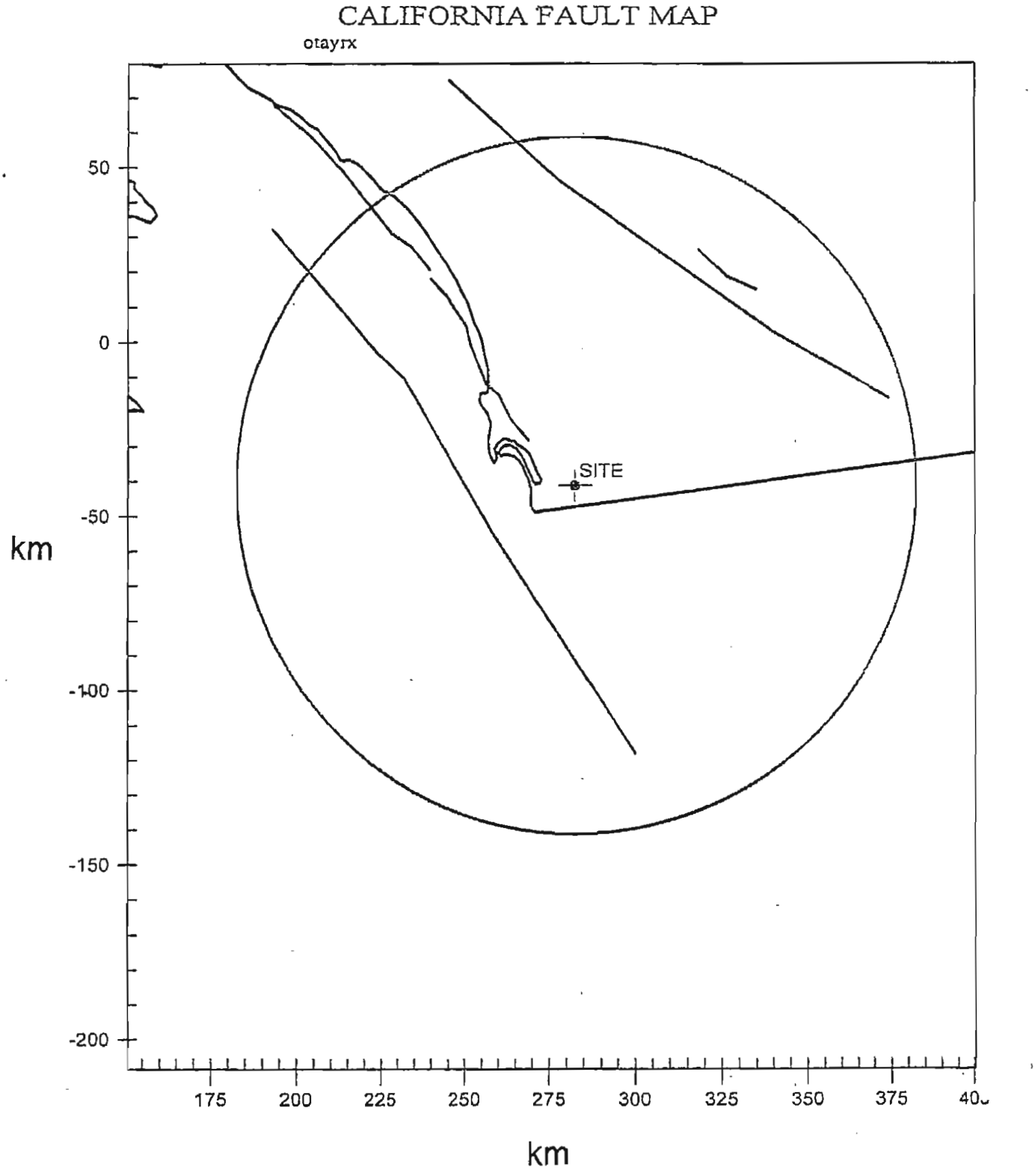

CALIFORNIA FAULT MAP
otayrx
SITE
50
0
-50
-100
-150
-200
km
175
200
225
250
275
300
325
350
375
km

FIGURE 3

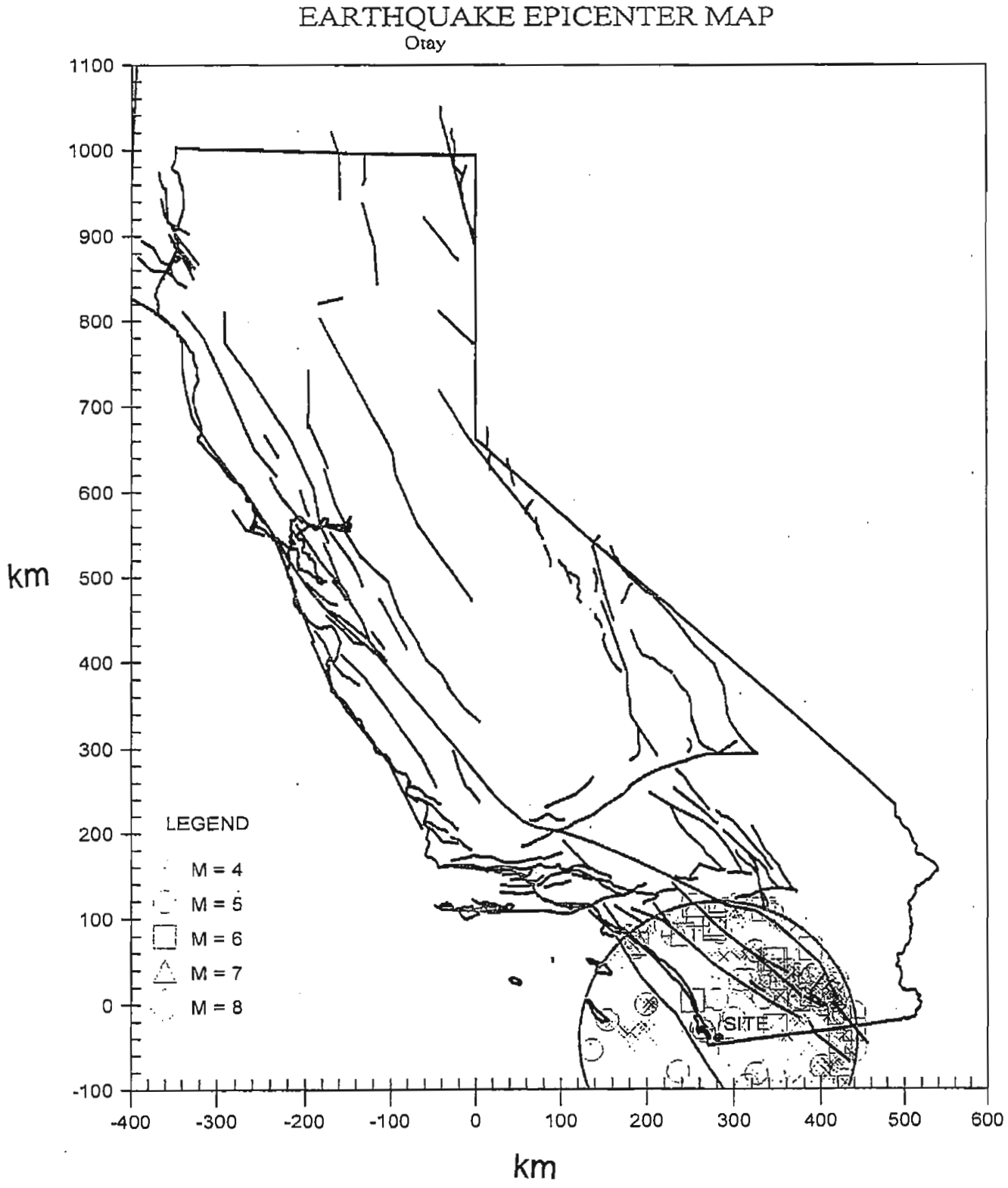

EARTHQUAKE EPICENTER MAP
Otay
1100
1000
900
800
700
600
500
400
300
200
100
0
-100
km
-400
-300
-200
-100
0
100
200
300
400
500
600
km
LEGEND
M = 4
M = 5
M = 6
M = 7
M = 8
SITE

FIGURE 4

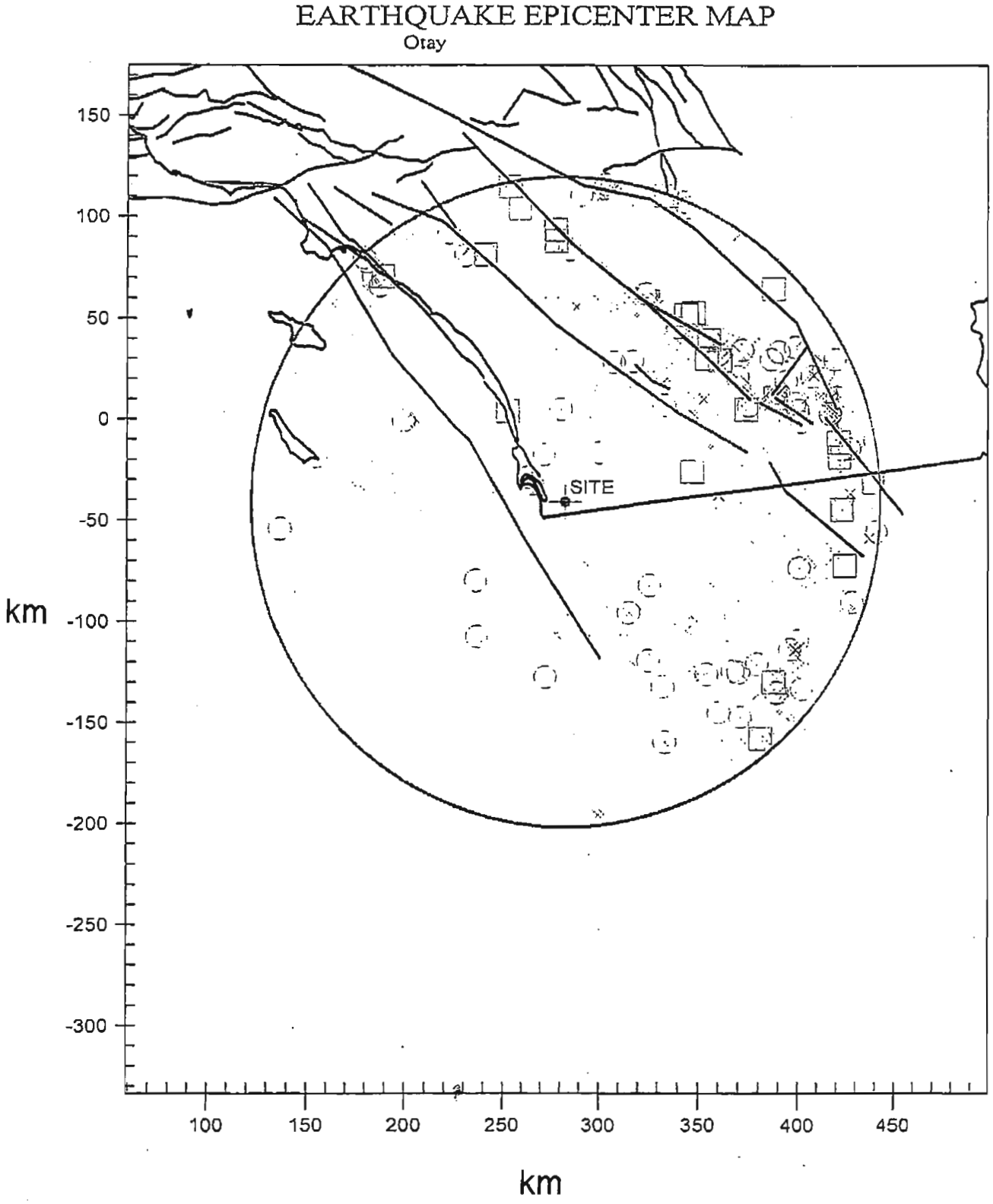

EARTHQUAKE EPICENTER MAP
Otay
SITE
km
km
150
100
50
0
-50
-100
-150
-200
-250
-300
100
150
200
250
300
350
400
450

FIGURE 5

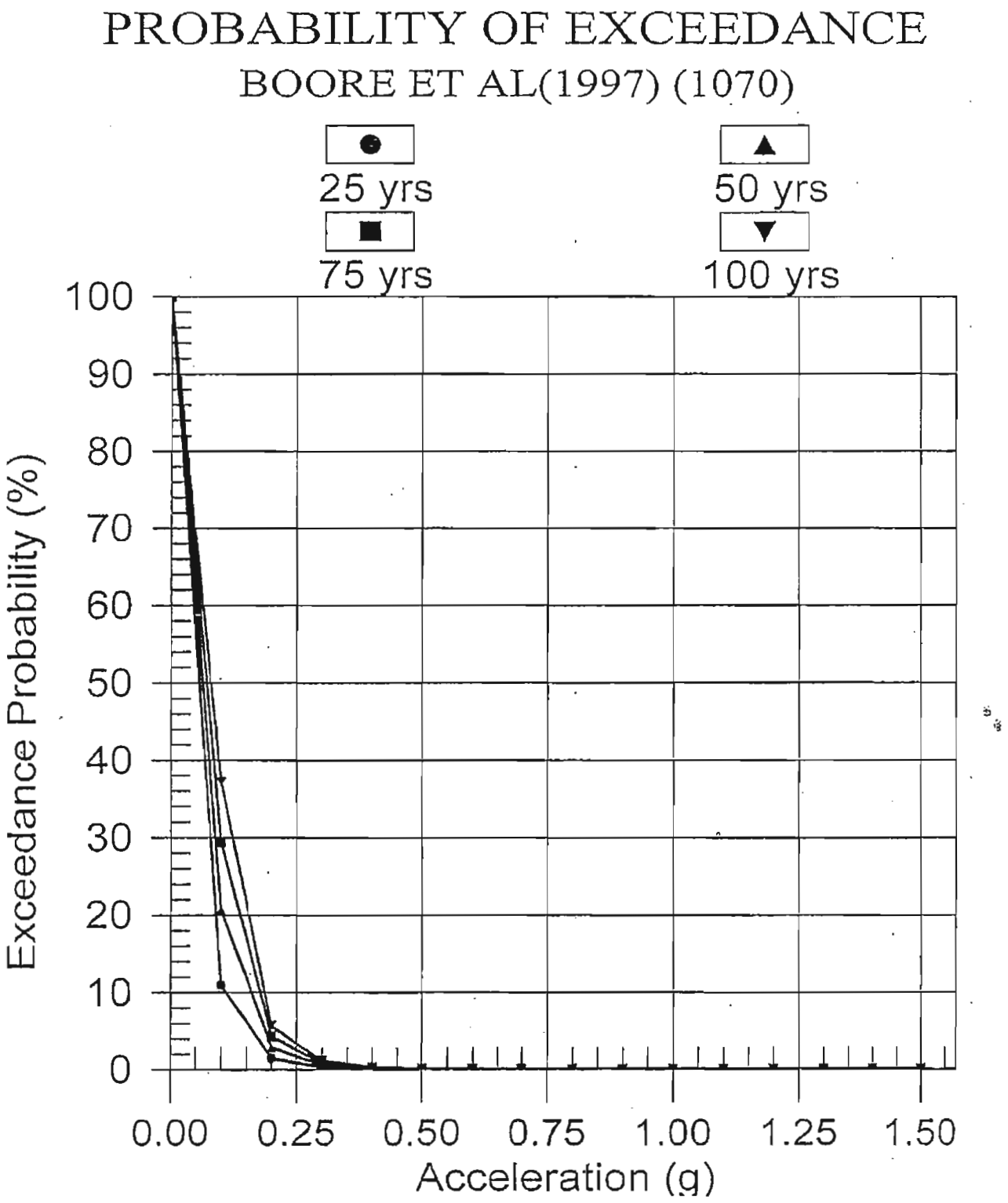

PROBABILITY OF EXCEEDANCE
BOORE ET AL(1997) (1070)
25 yrs
50 yrs
75 yrs
100 yrs
Exceedance Probability (%)
100
90
80
70
60
50
40
30
20
10
0
0.00
0.25
0.50
0.75
1.00
1.25
1.50
Acceleration (g)

FIGURE 6

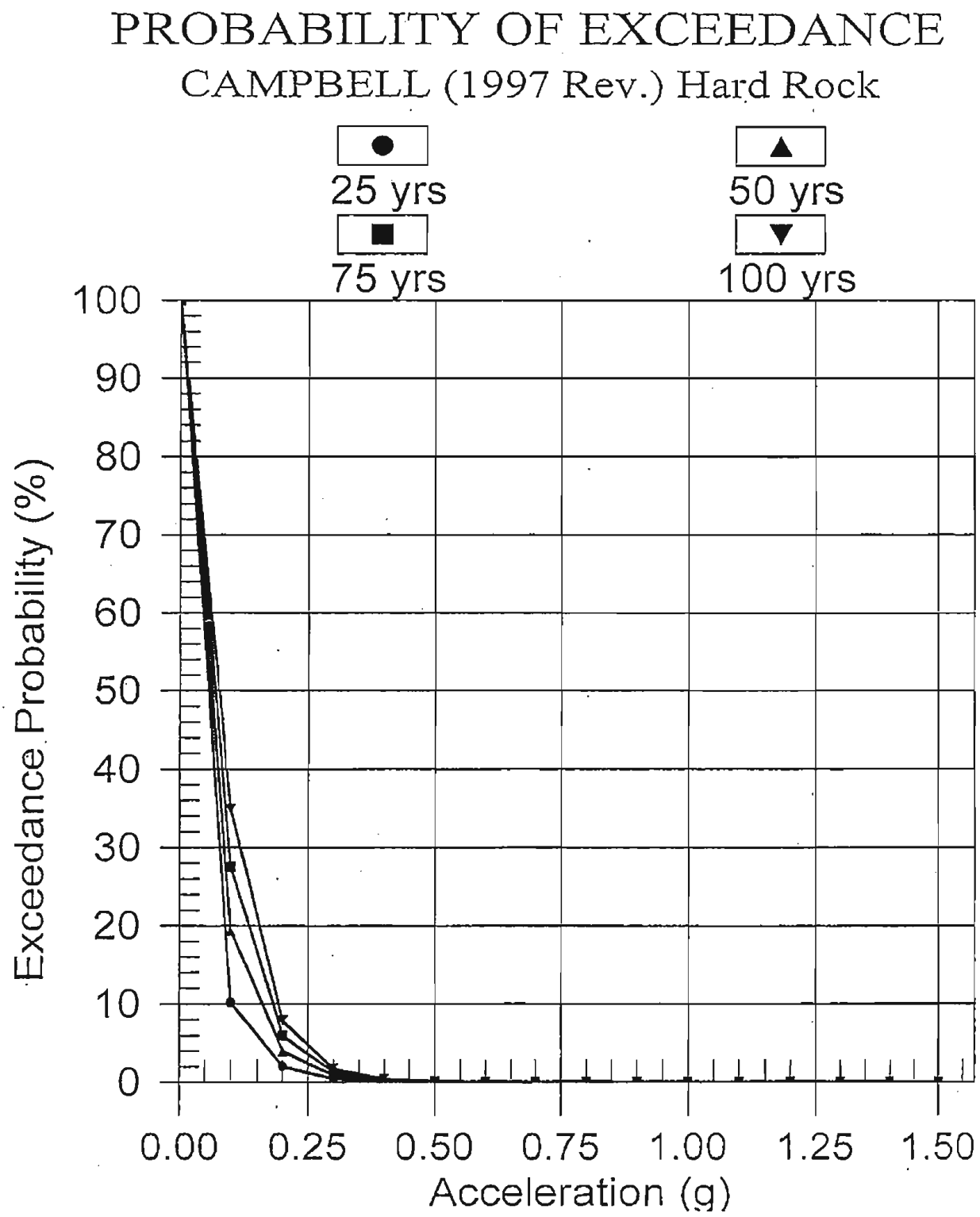

PROBABILITY OF EXCEEDANCE
CAMPBELL (1997 Rev.) Hard Rock
25 yrs
50 yrs
75 yrs
100 yrs
Exceedance Probability (%)
100
90
80
70
60
50
40
30
20
10
0
0.00
0.25
0.50
0.75
1.00
1.25
1.50
Acceleration (g)

FIGURE 7

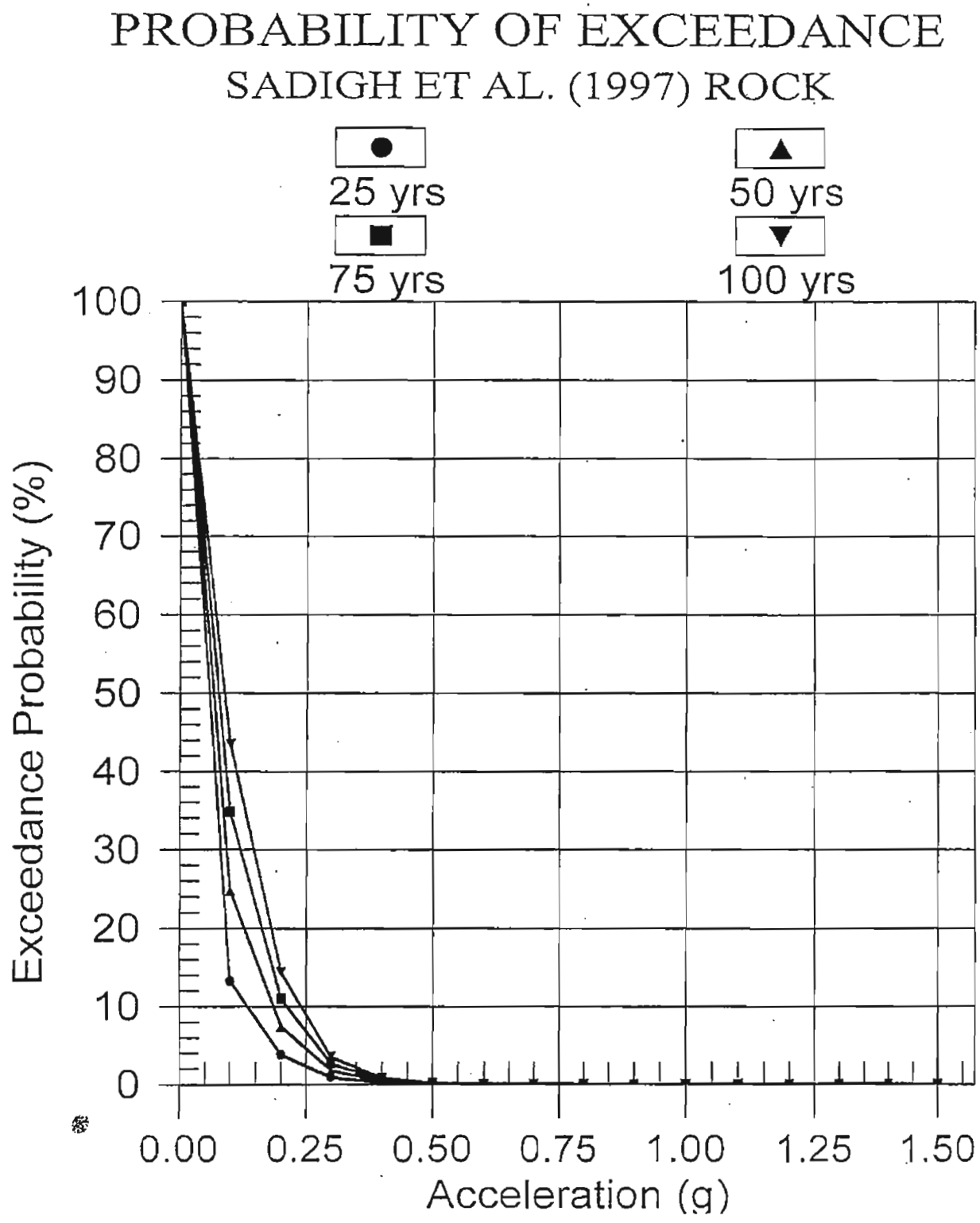

PROBABILITY OF EXCEEDANCE
SADIGH ET AL. (1997) ROCK
25 yrs
50 yrs
75 yrs
100 yrs
Exceedance Probability (%)
100
90
80
70
60
50
40
30
20
10
0
0.00
0.25
0.50
0.75
1.00
1.25
1.50
Acceleration (g)

FIGURE 8

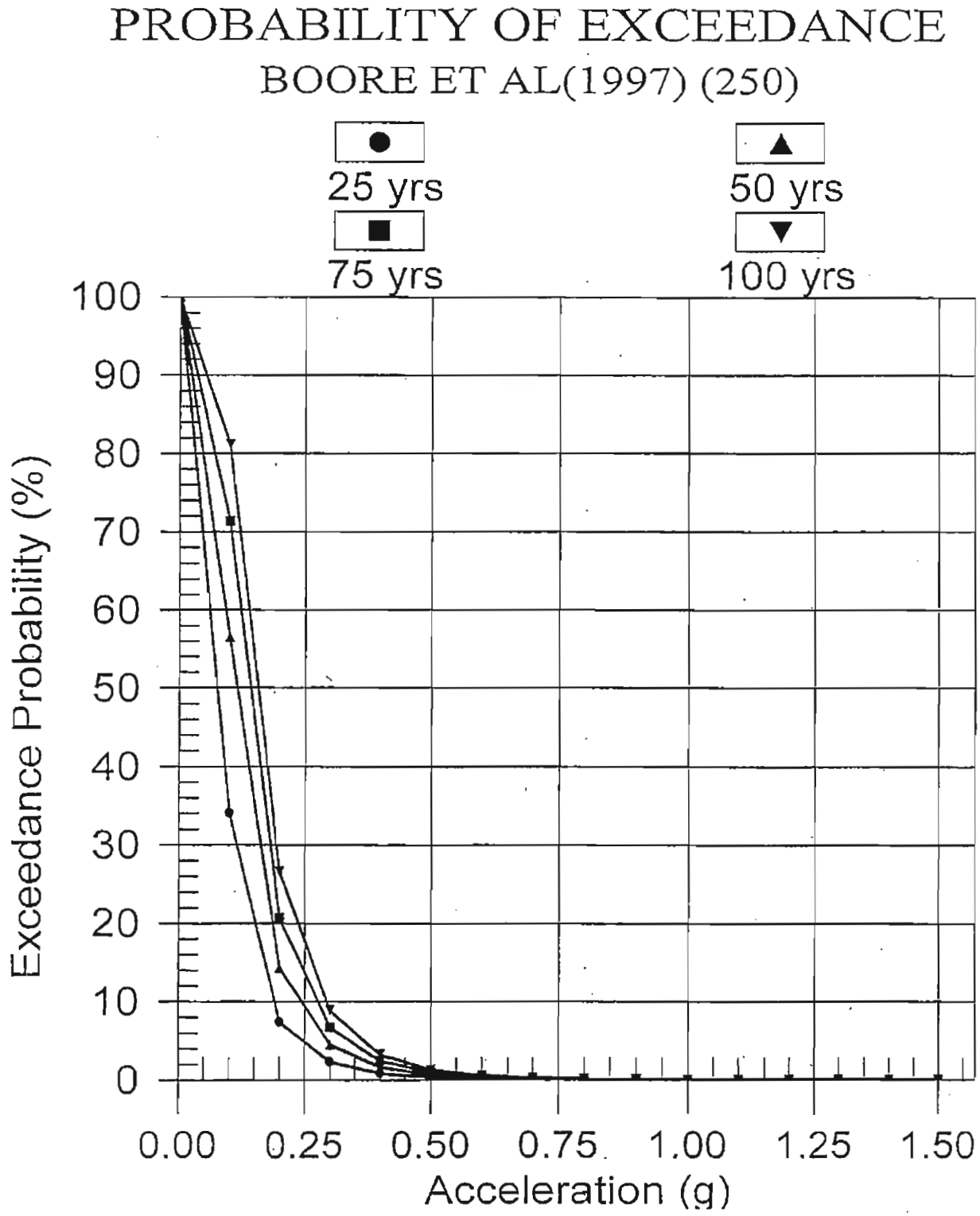

PROBABILITY OF EXCEEDANCE
BOORE ET AL(1997) (250)
25 yrs
50 yrs
75 yrs
100 yrs
Exceedance Probability (%)
100
90
80
70
60
50
40
30
20
10
0
0.00
0.25
0.50
0.75
1.00
1.25
1.50
Acceleration (g)

FIGURE 9

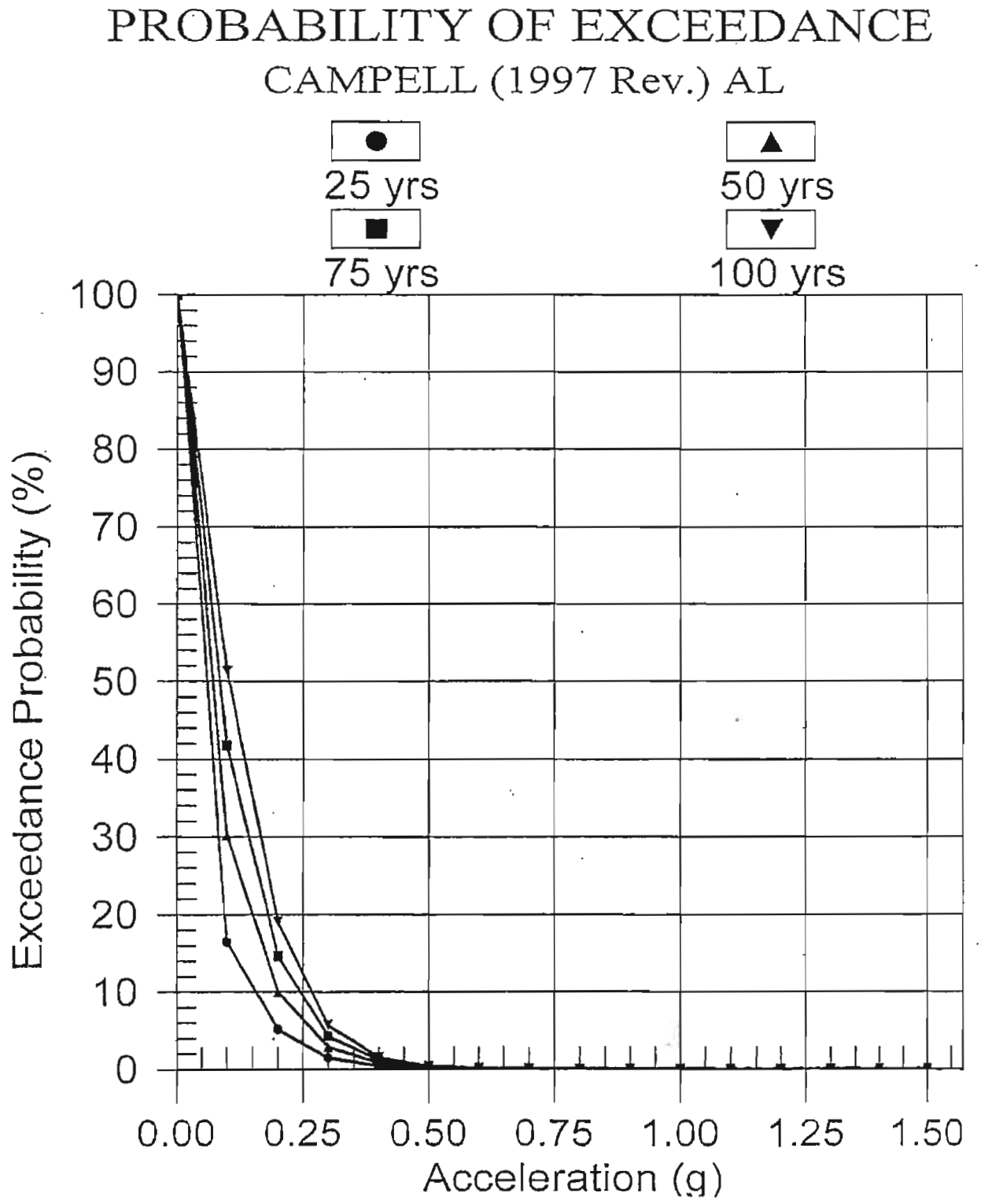

PROBABILITY OF EXCEEDANCE
CAMPELL (1997 Rev.) AL
25 yrs
50 yrs
75 yrs
100 yrs
Exceedance Probability (%)
100
90
80
70
60
50
40
30
20
10
0
0.00
0.25
0.50
0.75
1.00
1.25
1.50
Acceleration (g)

FIGURE 10

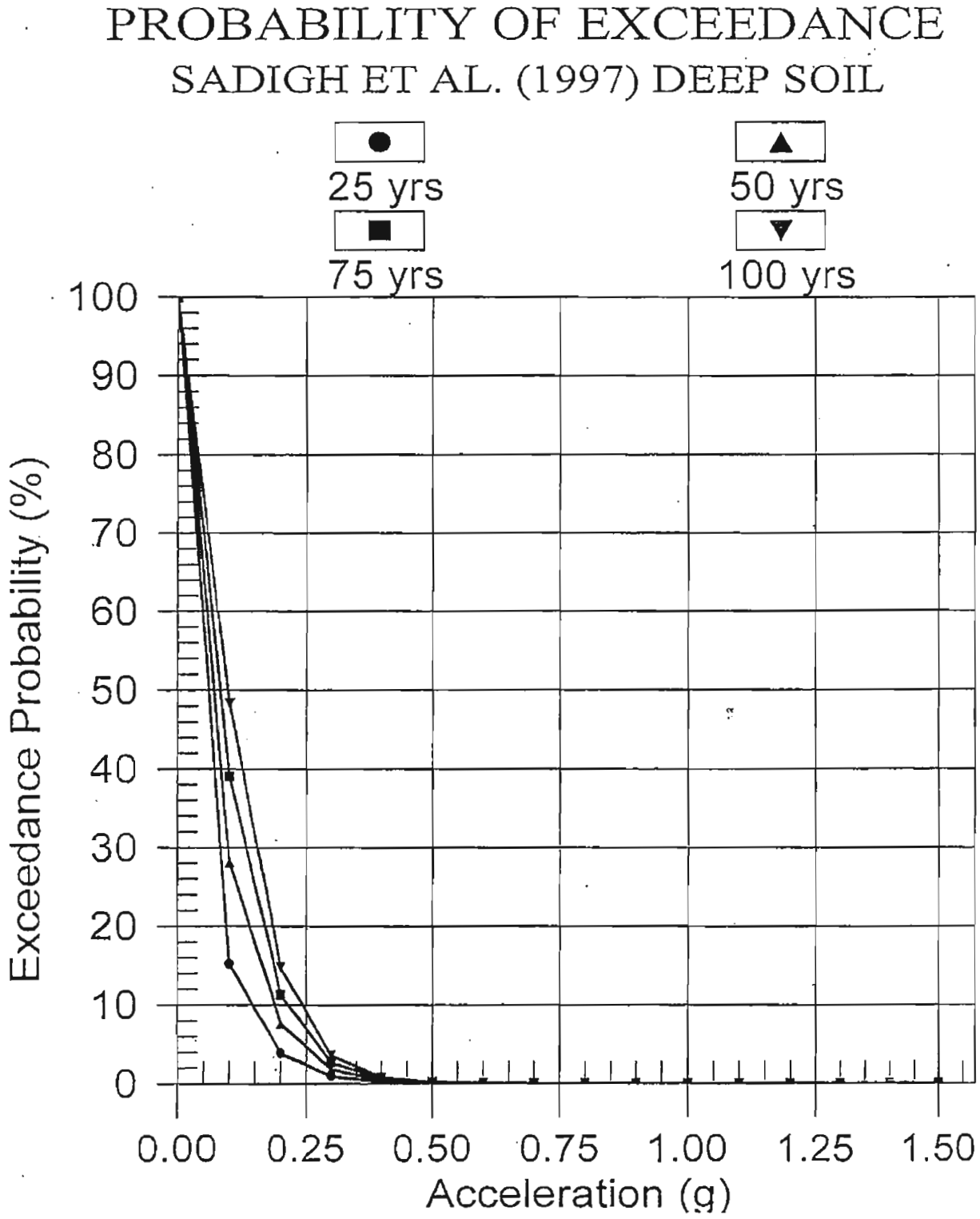

PROBABILITY OF EXCEEDANCE
SADIGH ET AL. (1997) DEEP SOIL
25 yrs
50 yrs
75 yrs
100 yrs
Exceedance Probability (%)
100
90
80
70
60
50
40
30
20
10
0
0.00
0.25
0.50
0.75
1.00
1.25
1.50
Acceleration (g)

FIGURE 11

2.6.3 Liquefaction

Seismic agitation of relatively loose saturated sands and silty sands can result in a buildup of pore pressure. If the pore pressure exceeds the overburden stresses, a temporary quick condition known as liquefaction may occur. The effects of liquefaction at a site can manifest in several ways, and may include: 1) ground oscillations; 2) loss of bearing; 3) lateral spread; 4) dynamic settlement; and 5) flow failure.

Within the vast majority of the project, the potential for liquefaction in both the pre- and post-development condition is very low due to the lack of liquefaction susceptible earth materials and the dense nature of the onsite geologic units.

2.6.4 Seismically-Induced Landsliding

No landslides, including shallow surficial failures, have been mapped onsite. This indicates the lack of any seismically activated land sliding during past historic and ancient seismic events. Seismically induced land sliding is not considered a significant concern in both the pre- and post-development site conditions.

2.6.5 Seiches and Tsunamis

Seismically induced hazards such as tsunamis and earthquake-induced flooding are not considered significant hazards. If at full capacity, it is possible that during a strong seismic event with a long duration of shaking, minor localized overtopping of the City of San Diego reservoir could occur. It appears that adequate freeboard exists for nearly the entire reservoir with the possible exception at the low point where the paved access road meets the reservoir. At this location, any overtopping would be directed onto the proposed paved access road and down to storm drain improvements. Given the likelihood, volume of the reservoir, and area of potential overtopping, it is likely that this event would not be a significant hazard.

3.0 ENGINEERING ANALYSES

Presented herein is a discussion of the geotechnical properties of the various soil types and earth materials that have been developed from our site-specific analyses of the design as shown on Sheets 2 through 5 and 7, PSE's subsurface investigation, and the referenced reports.

3.1 Material Properties

3.1.1 Excavation Characteristics

The excavation characteristics of the onsite materials are highly variable. The meta-volcanic rock, which occurs in the southwest portion of the site, will require blasting at or near the natural ground surface for efficient excavation in order to achieve design grade as well as the undercuts to accommodate footings, utilities and other subsurface improvements. It is likely that the blasting and excavation operations will generate oversized rock fragments requiring specialized grading techniques.

The other onsite materials, including Otay Formation, Tertiary Fanglomerate, terrace deposits, topsoil and artificial fill can be excavated with conventional techniques (scrapers) assisted by minor to moderate ripping. Oversize material can be expected in the Fanglomerate. Heavy ripping and possible local blasting should be anticipated in some localized areas of the Otay Formation. In most cases this would be due to highly cemented sandstone, gritstone and/or the presence of cobbles, boulders and concretions. Excavations into this formation can possibly generate oversize material that may require special handling and placement within selected fill areas (See Section 4.7.8). Discussion of undercut recommendations is contained in Section 4.3 of this report.

3.1.2 Compressibility

Onsite materials that are significantly compressible include slope wash, topsoil and the undocumented artificial fill, and the highly weathered portions of older alluvium, terrace, Tertiary Fanglomerate, Otay Formation and metavolcanic rock. Mitigation measures addressing potentially compressible soils are presented in Section 4.1.

3.1.3 Expansion Potential

It is anticipated that the expansion potential of the majority of onsite materials will vary from "low" to "very high". The majority of earth materials to be used in grading will possess an expansion index in this range with some of the bentonite clays possibly in the "Very high" category (UBC Table 18-1). Review of the grading design and boring information preliminarily indicates a paucity of thick and common bentonite sub-units with the Otay section. Mitigation for this condition is further discussed in sections 5.1.

3.1.4 Earthwork Adjustments

In consideration of the proposed mass grading to develop the project as currently proposed on the *Preliminary Tentative Tract* maps the following average earthwork adjustment factors presented in Table 3-1 have been formulated for use in the earthwork design of the project.

Table 3-1

Earthwork Adjustments

Geologic Unit (map symbol)	Adjustment Factor
Undocumented Artificial Fill (afu)	6%-10% Shrink
Alluvium (Qal)	8%-12% Shrink
Terrace/Fanglomerate (Qt/Tfg)	0%- 2% Bulk
Otay Formation (Oo)	0%- 5% Bulk
Santiago Peak Volcanics (Jsp)	15%- 25% Bulk

3.1.5 Chemical Analyses

The results of chemical/resistivity tests, presented in Appendix C (Plates C-1 through C-13) indicate that the soluble sulfate potential for the majority of the site can be classified as "negligible" in accordance with ACI 318-05 per the 2007 CBC. Test results for chloride and pH indicate a potential for corrosive attack on metal portions of the proposed structures. We recommend that a corrosion engineer be consulted for additional testing and design/construction recommendations. Testing should be conducted on the near-surface soils after grading completion. Mitigation for this condition is further discussed in section 5.1.

3.2 Slope Stability

Typically, the Santiago Peak Volcanics are grossly stable in cut and natural slopes owing to their induration. Local wedge-type failures are not likely, but should be assessed by geologic mapping during grading. The Otay Formation in many places possesses only moderate to weak shear strengths, particularly where bentonite beds are present. The wetting of the bentonite can lead to further reduction in shear strengths both along and across bedding. Review of the subsurface data and proposed design indicates that bentonitic claystone beds could possibly daylight on the face of proposed cut slopes. The Fanglomerate and the Terrace deposits are anticipated to be grossly and surficially stable in cut and natural slopes owing to their lack of defined bedding and the granular nature of these deposits.

Slope stability analyses were performed using the Modified Bishop Method for circular and non-circular failure surfaces. Stability calculations were compiled using *STEDwin* in conjunction with *GSTABL7* computer code. The results of our analyses are presented on Plates D-1 through D-4 in Appendix D. Additionally, a surficial slope stability analysis was conducted and is presented on Plate D-5.

4.0 GEOTECHNICAL CONCLUSIONS AND RECOMMENDATIONS

Development of the subject property as proposed is considered feasible, from a geotechnical standpoint, provided that the conclusions and recommendations presented herein are incorporated into the design and construction of the project. Presented below are issues identified by this study or previous studies as possibly impacting site development. They are further summarized and described in Sections 2.0 and 3.0. Recommendations to mitigate these issues and geotechnical recommendations for use in planning and design are presented in the following sections of this report.

4.1 Site Preparation and Removals

Grading should be accomplished under the observation and testing of the project soils engineer and engineering geologist or their authorized representative in accordance with the recommendations contained herein, the current Municipal Code of the City of Chula Vista, and AGS' *Earthwork Specifications* (Appendix E). Existing vegetation, trash, debris and other deleterious materials should be removed and wasted from the site prior to removal of unsuitable soils and placement of compacted fill. Artificial fill, topsoil, alluvium, highly weathered terrace deposits and highly weathered Otay Formation, Tertiary Fanglomerate and Santiago Peak

Volcanics should be removed in areas planned to receive fill or where exposed at final grade. The resulting undercuts should be replaced with engineered fill. Estimated depths of removals based upon the geologic unit are presented in Table 4-1, it should be noted that local variations can be expected requiring an increase in the depth of removal for unsuitable and weathered deposits. The extent of removals can best be determined in the field during grading when observation and evaluation can be performed by the soil engineer and/or engineering geologist. Removals should expose competent terrace deposits, Otay Formation, Tertiary Fanglomerate or Santiago Peak Volcanics and be observed and mapped by the engineering geologist prior to fill placement. In general, soils removed during remedial grading will be suitable for reuse in compacted fills provided they are properly moisture conditioned and do not contain deleterious materials.

The northwest-trending tunnels that currently contain the large-diameter aqueduct should be properly mitigated prior to improvement construction. Mitigation methods include excavation to expose the tunnel and then infill with engineered, compacted fill or infill with lightweight sand/cement grout. A combination of these methodologies may be employed depending upon the depth of the tunnel below the design ground surface.

Table 4-1

Estimated Depth of Removal

Geologic Unit (map symbol)	Estimated Removal Depth
Undocumented Artificial Fill (afu)	3-15 feet
Topsoil (No Map Symbol)	2-5 feet
Alluvium (Qal)	4-10 feet
Terrace Deposits (Qt)	1-4 feet
Otay Formation (Oo)	3-6 feet
Tertiary Fanglomerate (Tfg)	1-3 feet
Santiago Peak Volcanics (Jsp)	1-3 feet

4.2 Slope Stability Remediation

4.2.1 Cut Slopes

Cut slopes have been designed at slope ratios of 2: 1 (horizontal to vertical) to heights of one hundred thirty five (135) feet. Stability calculations are presented on Plates D-1 through D- 2. The engineering geologist should observe all cut slopes during grading. Based on our analysis of the subsurface data and review of the proposed design, it is possible that flat lying bentonitic claystone beds may be exposed on finished slope faces. Additional evaluation for this condition should be conducted once 40-scale plans become available. At that time more detailed recommendations can be presented. A skin fill slope and a fill over cut slope-requiring stabilization fills have been identified on Sheet 4.

Upon completion of 40-scale grading plans, these areas should be evaluated for the appropriate remedial measure. At that time a more detailed analysis can be provided that can be based on detailed slope dimensions and allow for accurate keyway determinations. Ultimately, all final remedial cut slope recommendations should be based upon conditions exposed during grading to confirm that assumptions developed during this and future grading plan reviews are consistent with those observed in the field.

All buttress and stabilization fills will require backdrain systems as shown on Detail 3 (Appendix E). Upper tier backdrains are recommended in stabilization and buttress fills where geologic contacts and/or claystones daylight in the backcut or where backcut heights exceed thirty (30) feet.

4.2.2 Fill Slopes

Fill slopes are designed at ratios of 2:1 (horizontal to vertical) or flatter up to heights approaching seventy (70) feet. Fill slopes, when properly constructed with onsite materials, are expected to be grossly stable as designed. Stability calculations are presented on Plates D-3 through D-5.

4.2.3 Natural Slopes

Within the project limits, natural slopes are either very low relief or present below proposed developed areas consisting of relatively stable Santiago Peak Volcanic terrain. An example is at the south end of the project south of Neighborhoods P and V. Accordingly, natural slopes are considered relatively stable.

4.3 Overexcavation of Building Pads and Streets

4.3.1 Building Pads

It is recommended that overexcavation of "cut" lots in hard rock, well cemented sandstones and/or cemented breccia (Tertiary Fanglomerate) be performed. The cut and any shallow fill portions of these lots should be overexcavated a minimum of three (3) feet and replaced to design grade with select compacted fill. The undercut should be excavated such that a gradient of at least one percent be maintained toward the front of the pad. Replacement fill should be eight inch minus in particle size and compacted to project specifications. Preliminarily, anticipated rock undercuts are indicated by a "circled R" (see legend, Sheet 3). Final determination of pad undercut for hard rock at grade should be determined when more detailed plans are available. It is possible that relatively thin (i.e. less than one (1) foot) bentonitic claystone beds may be exposed at pad grade. Review of the data and design indicate that most of the recognized beds will not be exposed at pad grades. This includes the single family lots and larger pads areas. Accordingly, no undercuts to mitigate the effects of claystone beds are formulated at this time; however should such beds occur in the near-surface, undercutting to depths of 5 to 10 feet and replacement with compacted fill may be warranted. When grading plans are available, a thorough evaluation should be performed for this condition.

Where design or remedial grading activities create a cut/fill transition in areas of the Otay or other formations that do not require blasting, excavation of the cut or shallow fill portion should be performed such that at least three (3) feet of compacted fill exits over the pad. The undercut

overexcavation should maintain a minimum one (1) percent gradient to the front of the lot. In addition, where steep cut/fill transitions are created, additional overexcavation and flattening of the transitions are recommended.

Undercuts for the larger sheet graded pads should be deferred until actual product types and finished grades are determined.

4.3.2 Streets

Street undercuts in hard rock areas should be based on depth of utilities within "public right of way". The depth of undercut for streets should be at least one (1) feet below the deepest utility. Final determination of undercut depths should be dependent upon review of more detailed plans once they become available.

4.4 Subsurface Drainage

Six- (6) and eight- (8) inch canyon subdrains are recommended onsite in canyon areas that will receive compacted fill. The drains should be placed along the lowest alignment of canyon removals. Final locations of subdrains should be assessed during preliminary investigations and plan analyses. Preliminary subdrain locations are depicted on Plates 3 through 5 and 7. Final determination of drain locations will be made in the field, based on exposed conditions. All drains should be constructed in accordance with the details shown on Detail 1 and 2 (Appendix E).

In some instances post-grading irrigation practices and rainfall patterns can create seepage in cut and fill slopes. This seepage is more prevalent in cut slopes excavated in Santiago Peak Volcanics or fill slopes constructed out of shot rock. Where nuisance seepage is observed, drains are typically installed to collect this water and outlet it into suitable surface or subsurface drainage devices. These drains, if required, should be installed on a case by case basis per the geotechnical consultant's recommendations.

The infiltration of standing water into all BMP's could potentially be detrimental to improvements such as slopes, foundations, utility trenches, retaining walls and pavement sections. Geotechnical review of grading plans should be performed when available to determine which storm drain infiltration devices may require mitigation such as collecting and discharging accumulated subsurface water away from improvements.

4.5 Construction Staking and Survey

Removal bottoms, keyways, sub drains and backdrains should be surveyed by the civil engineer after observation by the geotechnical engineer/engineering geologist and prior to the placement of fill. Toe stakes should be provided by the civil engineer in order to verify required key dimensions and locations. Survey support will also be required to monitor settlement as discussed in Section 4.6.

4.6 Settlement Monitoring

Fills are subject to post-grading settlement. It is recommended that all fills greater than fifty (50) feet in thickness be monitored prior to release for construction. The monitoring can be accomplished by installation of surface monuments as detailed on Detail 12 (Appendix E). Tentative settlement monument locations should be determined once more detailed 40-scale plans become available.

Surface monuments should be surveyed every two (2) weeks for two (2) months and monthly thereafter until data warrants release of the area for utility or residential construction. It is likely that infrastructure development can be initiated in advance of completion of the primary settlement process, depending upon the sensitivity of improvements to the anticipated settlement.

4.7 Earthwork Considerations

4.7.1 Compaction Standards

Fill and processed natural ground shall be compacted to a minimum relative compaction of 90 percent as determined by ASTM Test Method: D 1557. All fill to be placed below fifty (50) feet from ultimate grade and/or below subdrains should be compacted to at least 93 percent of maximum dry density. Care should be taken that the ultimate grade be considered when determining the compaction requirements for disposal fill and "super pad" areas. Compaction shall be achieved at slightly above the optimum moisture content, and as generally discussed in the attached Earthwork Specifications (Appendix E).

4.7.2 Documentation of Removals and Drains

Removal bottoms, canyon subdrains, fill keys, backcuts, backdrains and their outlets should be observed by the engineering geologist and/or geotechnical engineer and documented by the civil engineer prior to fill placement.

4.7.3 Treatment of Removal Bottoms

At the completion of removals, the exposed bottom should be scarified to a depth of approximately 8 to 12 inches, moisture conditioned to above optimum conditions, and compacted in-place to the standards set forth in this report.

4.7.4 Fill Placement

After removals, scarification, and compaction 'of in-place materials are completed, additional fill may be placed. Fill should be placed in thin lifts [eight- (8) inch bulk], moisture conditioned to slightly above the optimum moisture content, mixed, compacted, and tested as grading progresses until final grades are attained.

4.7.5 Benching

Where the natural slope is steeper than 5-horizontal to 1-vertical, and where designed by the project geotechnical engineer or geologist, compacted fill material should be keyed and benched into competent bedrock or firm natural soil.

4.7.6 Mixing

In order to provide thorough moisture conditioning and proper compaction, processing (mixing) of materials is necessary. Mixing should be accomplished prior to, and as part of the compaction of each fill lift.

4.7.7 Fill Slope Construction

Fill slopes shall be overfilled to an extent determined by the contractor, but not less than two (2) feet measured perpendicular to the slope face, so that when trimmed back to the compacted core, the required compaction is achieved.

Compaction of each fill lift should extend out to the temporary slope face. Backrolling during mass filling at intervals not exceeding four (4) feet in height is recommended unless more extensive overfill is undertaken.

As an alternative to overfilling, fill slopes may be built to the finish slope face in accordance with the following recommendations:

- Compaction of each fill lift shall extend to the face of the slopes.
- Backrolling during mass grading shall be undertaken at intervals not exceeding four (4) feet in height. Backrolling at more frequent intervals may be required.
- Care should be taken to avoid spillage of loose materials down the face of the slopes during grading.
- At completion of mass filling, the slope surface shall be watered, shaped and compacted first with a sheepsfoot roller, then with a grid roller operated from a side boom Cat, or equivalent, such that compaction to project standards is achieved to the slope face.

Proper seeding and planting of the slopes should follow as soon as practical, to inhibit erosion and deterioration of the slope surfaces. Proper moisture control will enhance the long-term stability of the finished slope surface.

4.7.8 Oversized Materials

Oversized rock material [i.e., rock fragments greater than eight (8) inches] will be produced during the excavation of the design cuts and undercuts. Provided that the procedure is acceptable to the developer and governing agency, this rock may be incorporated into the compacted fill section to within three (3) feet of finish grade within residential areas and to two (2) foot below the deepest utility in street and house utility connection areas. Maximum rock size in the upper portion of the hold-down zone is restricted to eight (8) inches. Disclosure of the above rock hold-down zone should be made to prospective homebuyers explaining that excavations to accommodate swimming pools, spas, and other appurtenances will likely encounter oversize rock [i.e., rocks greater than eight (8) inches] below three (3) feet. Rock disposal details are presented on Detail 10, Appendix E. Rocks in excess of eight (8) inches in maximum dimension may be placed within the deeper fills, provided rock fills are handled in a manner described below. In order to separate oversized materials from the rock hold-down zones, the use of a rock rake may be necessary.

4.7.8.1 Rock Blankets

Rock blankets consisting of a mixture of gravel, sand and rock to a maximum dimension of two (2) feet may be constructed. The rocks should be placed on prepared grade, mixed with sand and gravel, watered and worked forward with bulldozers and pneumatic compaction equipment such that the resulting fill is comprised of a mixture of the various particle sizes, contains no significant voids, and forms a dense, compact, fill matrix.

Rock blankets may be extended to the slope face provided the following additional conditions are met: 1) no rocks greater than twelve (12) inches in diameter are allowed within six (6) horizontal feet of the slope face; 2) 50 percent (by volume) of the material is three-quarter- (3/4) inch minus; and 3) backrolling of the slope face is conducted at four- (4) foot vertical intervals and satisfies project compaction specifications (See Section 4.1.7).

4.7.8.2 Rock Windrows

Rocks to maximum dimension of four (4) feet may be placed in windrows in deeper fill areas in accordance with the details on Detail 10 (Appendix E). The base of the windrow should be excavated an equipment-width into the compacted fill core with rocks placed in single file within the excavation. Sands and gravels should be added and thoroughly flooded and tracked until voids are filled. Windrows should be separated horizontally by at least fifteen (15) feet of compacted fill, be staggered vertically, and separated by at least four (4) vertical feet of compacted fill. Windrows should not be placed within ten (10) feet of finish grade, within two (2) vertical feet of the lowest buried utility conduit in structural fills, or within fifteen (15) feet of the finish slope surface unless specifically approved by the developer, geotechnical consultant, and governing agency.

4.7.8.3 Individual Rock Burial

Rocks in excess of four (4) feet, but no greater than eight (8) feet may be buried in the compacted fill mass on an individual basis. Rocks of this size may be buried separately within the compacted fill by excavating a trench and covering the rock with sand/gravel, and compacting the fines surrounding the rock. Distances from slope face, utilities, and building pad areas (i.e., hold-down depth) should be the same as windrows.

4.7.8.4 Rock Disposal Logistics

The grading contractor should consider the amount of available rock disposal volume afforded by the design when excavation techniques and grading logistics are formulated. Rock disposal techniques should be discussed and approved by the geotechnical consultant and developer prior to implementation.

4.8 Haul Roads

Haul roads, ramp fills, and tailing areas should be removed prior to placement of fill.

4.9 Import Materials

Import materials, if required, should have similar engineering characteristics as the onsite soils and should be approved by the soil engineer at the source prior to importation to the site.

5.0 DESIGN RECOMMENDATIONS

5.1 Structural Design – Residential

It's our understanding that the site will be graded and lots will be ultimately sold to merchant builders; thus precise building products, loading conditions, and locations are not currently available. It is expected that for typical one to three story residential products and loading conditions (1 to 3 ksf for spread and continuous footings), conventional shallow slab-on-grade foundations will be utilized in areas with low expansive and shallow fill areas (<50 feet) and where the as-graded differential fill depth meets h/3 criteria (where h is the maximum depth of fill). Post-tensioned slab/foundations may also be used for all of the residential lots. Typically post-tensioned slab/foundations will be used for lots which exhibit expansion potentials ranging from "moderate" to "very high", for lots in areas where the fill depth exceeds fifty (50) feet, and where the as-graded differential fill depth exceeds h/3 criteria (where h is the maximum depth of fill).

Upon the completion of rough grading, finish grade samples should be collected and tested to develop specific recommendations as they relate to final foundation design recommendations for individual lots. These test results and corresponding design recommendations should be presented in a Final Rough Grading Report.

It is anticipated that the as-graded near-surface soils could vary from "low" to "very high" in expansion potential when tested in accordance with UBC Table 18-1- B.

5.1.1 Foundation Design

Residential structures can be supported on conventional shallow foundations and slab-on-grade or post-tensioned slab/foundation systems, as discussed above. The design of foundation systems should be based on as-graded conditions as determined after grading completion. The following values may be used in preliminary foundation design:

Allowable Bearing:	2000 psf.
Lateral Bearing:	250 psf. per foot of depth to a maximum of 2000 psf. for level conditions. Reduced values may be appropriate for descending slope conditions.
Sliding Coefficient:	0.35

The above values may be increased as allowed by Code to resist transient loads such as wind or seismic. Building code and structural design considerations may govern. Depth and reinforcement requirements and should be evaluated by a qualified engineer.

5.1.2 Post-Tensioned Slab Foundation System Design Recommendations

Preliminary geotechnical engineering design and construction parameters for post-tensioned slab foundations are as follows:

- Post-tensioned slabs should incorporate a perimeter-thickened edge to reduce the potential for moisture infiltration, seasonal moisture fluctuation and associated differential movement around the slab perimeter. Deeper embedment will be required for "very high" expansion conditions, if existent. The minimum depth of the thickened edge could vary from 12-inches for "low" expansion to 24-inches for "high" expansion potential.
- Design and construction of the post-tensioned foundations should be undertaken by firms experienced in the field. It is the responsibility of the foundation design engineer to select the design methodology and properly design the foundation system for the onsite soils conditions. The slab designer should provide deflection potential to the project architect/structural engineer for incorporation into the design of the structure.
- The project foundation design engineer should use the Post-Tensioning Institute (PTI) foundation design procedures as described in UBC, based upon appropriate soil design parameters relating to edge moisture variation and differential swell provided by the geotechnical consultant at the completion of rough grading operations.
- A vapor/moisture barrier is recommended below all moisture sensitive areas.

5.1.3 Conventional Slab Recommendations

Conventional foundations and slabs-on grade can be considered for very low and low expansion conditions on shallow fill areas (<50 feet). Final foundation design should be provided by the project geotechnical engineer.

5.1.4 Total and Differential Settlement

In addition to the potential effects of expansive soils, the proposed residential structures should be designed in anticipation of total and differential settlements. The following lot categories are presented based upon anticipated settlement, fill thickness and expansion potential.

Category I

"Very low to low" expansion potential and fill depths less than 50 feet. Minimum fill depth meets h/3 criteria where h is the maximum fill thickness.

Total = 3/4 inch

Differential = 3/8 inch in 20 feet

Category II

"Medium" expansion potential and/or fill depths less than 50 feet. Minimum fill depth meets h/5 criteria where h is the maximum fill thickness.

Total = 3/4 inch

Differential = 1/2 inch in 20 feet

Category III

High expansion potential and/or fill depths greater than 50 feet.

Total = 1 inch

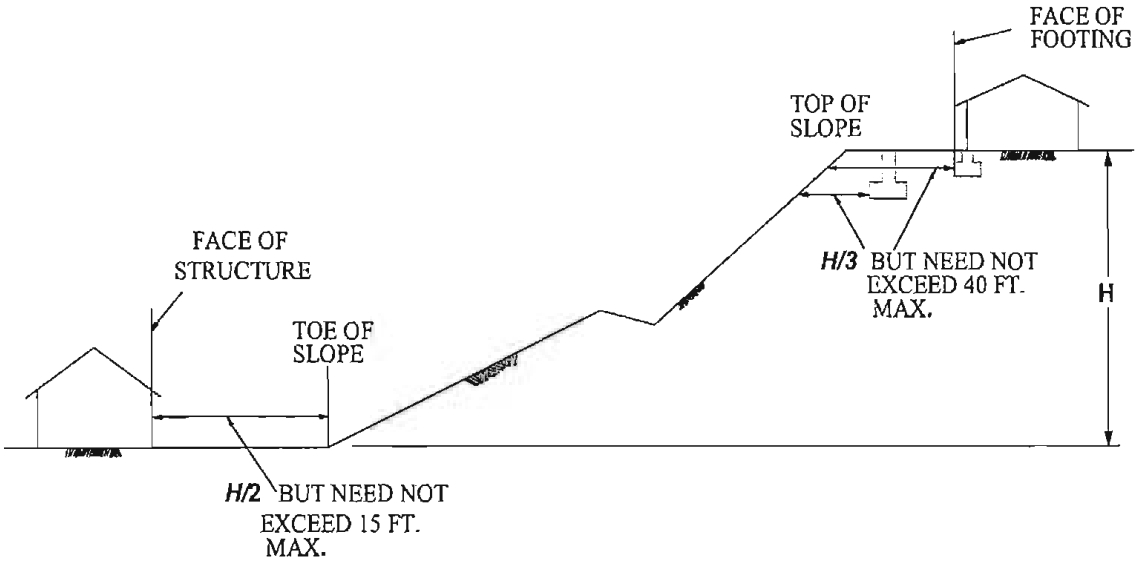
Differential = 1/2 inch in 20 feet

5.1.5 Deepened Footings and Structural Setbacks

It is generally recognized that improvements constructed in proximity to natural slopes or properly-constructed, manufactured slopes can, over a period of time, be affected by natural processes including gravity forces, weathering of surficial soils, and long-term (secondary) settlement. Most building codes, including the Uniform Building Code (UBC), require that structures be set back or footings deepened, where subject to the influence of these natural processes.

For the subject site, where foundations for residential structures are to exist in proximity to slopes, the footings should be embedded to satisfy the requirements presented in Figure 5.1.

FIGURE 5.1



5.1.6 Miscellaneous Foundation Recommendations

Soils from the footing excavations should not be placed in slab-on-grade areas unless properly compacted and tested. The excavations should be cleaned of all loose/sloughed materials and be neatly trimmed at the time of concrete placement.

5.2 Retaining Wall Design

For preliminary design of retaining walls the values presented in section 5.1.1 and the following recommendations can be utilized:

5.2.1 Earth Pressure Coefficients - Select Backfill

Level Backfill	2:1 Sloping Backfill
Ka = 0.31	Ka = 0.47
Kp = 3.25	$Kp^{(+)} = 8.61$
Ko = 0.47	$Kp^{(+)} = 1.24$ (Ascending Slope)
	$K_o^{(-)} = 0.85$ (Descending Slope)

Equivalent fluid pressure can be calculated utilizing a soil unit weight *(γ)* of 130 pcf. Restrained retaining walls should be designed for "at-rest" conditions, utilizing Ko'

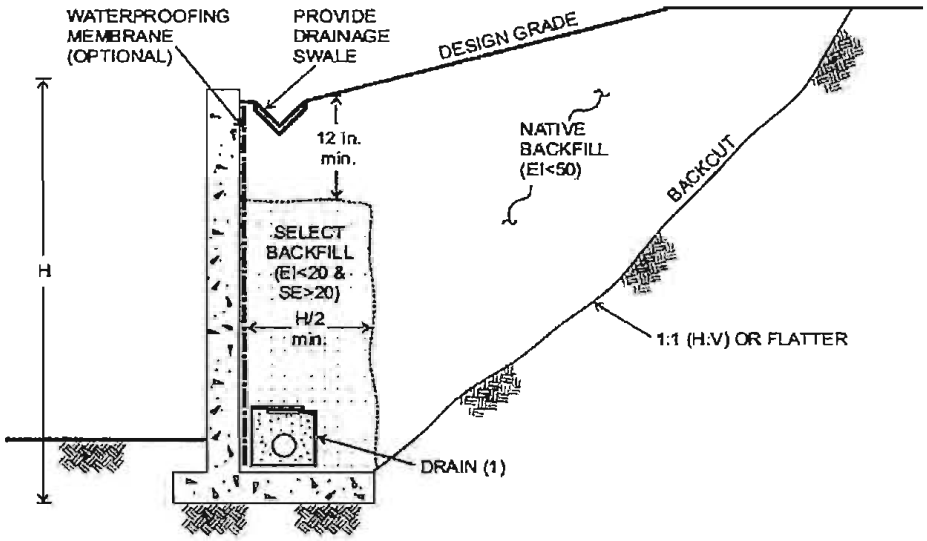
5.2.2 Other Design Considerations

Passive earth pressure coefficients used in the design of retaining walls should consider descending slopes as presented in section 5.2.1 as Kp (-) when retaining walls are positioned at the top of slopes and/or on the face of slopes. Retaining wall design should consider the additional surcharge loads for superjacent slopes and/or footings, where appropriate.

5.2.3 Waterproofing and Drainage System

Retaining walls should be waterproofed to minimize water staining. The walls should be backfilled with free draining material (SE≥20) to within twelve (12) inches of grade extending horizontally one-half (1/2) the wall height compacted to project specifications. Native soils shall be utilized in the upper eighteen (18) inches. Drainage systems including, as a minimum, a four-(4) inch diameter perforated drain line surrounded by four (4) cubic feet per lineal foot of three-quarter- (3/4) inch to one (1) inch crushed rock wrapped with a suitable filter fabric, should be provided to cantilever and restrained retaining walls to relieve hydrostatic pressure (see Figure 5.2).

FIGURE 5.2



NOTES: (1) DRAIN: 4-INCH PERFORATED ABS OR PVC PIPE OR APPROVED EQUIVALENT SUBSTITUTE PLACED PERFORATIONS DOWN AND SURROUNDED BY A MINIMUM OF 1 CUBIC FEET OF 3/4 INCH ROCK OR APPROVED EQUIVALENT SUBSTITUTE AND WRAPPED IN MIRAFI 140 FILTER FABRIC OR APPROVED EQUIVALENT SUBSTITUTE

5.3 Other Design and Construction Recommendations

5.3.1 Site Drainage

Positive drainage away from structures should be provided and maintained.

5.3.2 Concrete Flatwork and Lot Improvements

- In an effort to minimize shrinkage cracking, concrete flatwork should be constructed of uniformly cured, low-slump concrete and should contain sufficient control/contraction joints (typically spaced at 8 to 10 feet, maximum).
- Additional provisions need to be incorporated into the design and construction of all improvements exterior to the proposed structures (pools, spas, walls, patios, walkways, planters, etc.) to account for the hillside nature of the project, as well as being designed to account for potential expansive soil conditions. Design considerations on any given lot may need to include provisions for differential bearing materials (bedrock vs. compacted fill), ascending/descending slope conditions, bedrock structure, perched (irrigation) water, special surcharge loading conditions, potential expansive soil pressure, and differential settlement/heave.

- All exterior improvements should be designed and constructed by qualified professionals using appropriate design methodologies that account for the onsite soils and geologic conditions. The aforementioned considerations should be used when designing, constructing, and evaluating long-term performance of the exterior improvements on the lots.
- The homeowners should be advised of their maintenance responsibilities as well as geotechnical issues that could affect design and construction of future homeowner improvements. The information presented in Appendix F should be considered for inclusion in homeowner packages in order to inform the homeowner of issues relative to drainage, expansive soils, landscaping, irrigation, sulfate exposure, and slope maintenance.

5.3.3 Utility Trench Excavation

All utility trenches should be shored or laid back in accordance with applicable OSHA standards. Excavations in bedrock areas should be made in consideration of underlying geologic structure. The project geotechnical consultant should be consulted on these issues during construction.

5.3.4 Utility Trench Backfill

Mainline and lateral utility trench backfill should be compacted to at least 90 percent of maximum dry density as determined by ASTM D- 1557. Onsite soils will not be suitable for use as bedding material but will be suitable for use in backfill, provided oversized materials are removed. No surcharge loads should be imposed above excavations. This includes spoil piles, lumber, concrete trucks, or other construction materials and equipment. Drainage above excavations should be directed away from the banks. Care should be taken to avoid saturation of the soils.

Compaction should be accomplished by mechanical means. Jetting of native soils will not be acceptable. Under-slab trenches should also be compacted to project specifications. If native soils are used, mechanical compaction is recommended. If select granular backfill (SE> 30) is used, compaction by flooding will be acceptable. The soil engineer should be notified for inspection prior to placement of the membrane and slab reinforcement.

5.4 Preliminary Pavement Design

Final pavement design should be made based upon sampling and testing of post-grading conditions. For preliminary design and estimating purposes the pavement structural sections presented in Table 5-1 can be used for the range of likely traffic indices. The structural sections are based upon an assumed R - Value of 30.

Table 5-1
Preliminary Pavement Sections

Traffic Index (TI)	Asphaltic Concrete (AC) Inches	Aggregate Base (AB) Inches
5.0	3	6
6.0	4	9
7.0	4	10
8.0	5	13

Subgrade soils should be compacted to at least 95 percent of maximum density as determined by ASTM D-1557. Aggregate base materials should be compacted to at least 95 percent of maximum density as determined by California Test 216. Final determination of pavement sections will be provided by the City of Chula Vista based upon sampling and testing of the subgrade soils.

6.0 FUTURE STUDY NEEDS

This report represents a "Tentative Tract" map level review of Otay Land Company - Village 8 West. As the project design progresses, additional site specific geologic and geotechnical issues will need to be considered in the ultimate design and construction of the project. Consequently, future geotechnical reviews are necessary. These reviews may include reviews of:

- Rough grading plans.
- Precise grading plans.
- Foundation plans.
- Retaining wall plans.

These plans should be forwarded to the project geotechnical engineer/geologist for evaluation and comment, as necessary.

7.0 LIMITATIONS

This report is based on the project as described and the information obtained from referenced reports. The findings are based on the review of the field and laboratory data provided combined with an interpolation and extrapolation of conditions between and beyond the reviewed exploratory excavations. The results reflect an interpretation of the direct evidence obtained. Services performed by AGS have been conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. No other representation, either expressed or implied, and no warranty or guarantee is included or intended.

The recommendations presented in this report are based on the assumption that an appropriate level of field review will be provided by geotechnical engineers and engineering geologists who are familiar with the design and site geologic conditions. That field review shall be sufficient to confirm that geotechnical and geologic conditions exposed during grading are consistent with the geologic representations and corresponding recommendations presented in this report. AGS should be notified of any pertinent changes in the project plans or if subsurface conditions are found to vary from those described herein. Such changes or variations may require a re-evaluation of the recommendations contained in this report.

The data, opinions, and recommendations of this report are applicable to the specific design of this project as discussed in this report. They have no applicability to any other project or to any other location, and any and all subsequent users accept any and all liability resulting from any use or reuse of the data, opinions, and recommendations without the prior written consent of AGS.

AGS has no responsibility for construction means, methods, techniques, sequences, or procedures, or for safety precautions or programs in connection with the construction, for the acts or omissions of the CONTRACTOR, or any other person performing any of the construction, or for the failure of any of them to carry out the construction in accordance with the final design drawings and specifications.

APPENDIX A

REFERENCES

REFERENCES

Anderson, lC., Rockwell, T.K., and Agnew, D.C., 1989, Past and possible future earthquakes of significance to the San Diego region: Earthquake Spectra, vol. 5, no. 2, p. 299-335.

Blake, T.F., 2000, *FRISKSP:* A computer program for the probabilistic estimation of peak acceleration and uniform hazard spectra using 3-D faults as earthquake sources, v.4.00: Thomas F. Blake, Newbury Park, California, 199 p.

Boore, D.M., Joyner, W.B., and Fumal, T.E., 1997, Equations for estimating horizontal response spectra and peak acceleration from western North American earthquakes: A summary of recent work: Seis. Res. Let. v. 68, n. 1, p. 128-153.

California Department of Conservation, Division of Mines and Geology, 1998, Maps of known active fault near source zones in California and adjacent portions of Nevada, published by ICBO February 1998.

California Division of Mines and Geology, 1999, Fault rupture hazard zones in California: Special Publication 42.

California Division of Mines and Geology, 1997, Guidelines for evaluating and mitigating seismic hazards in California: Department of Conservation, special publication 117, 74 p.

California Division of Mines and Geology, 1993, The Rose Canyon Fault Zone, southern California: Department of Conservation, Open File Report 93-02, 45 pp.

California Division of Mines and Geology, 1962, Geologic Map of California, San Diego-El Centro Sheet, California Department of Conservation, Scale 1 :250,000.

Campbell, K.W., 1997, Empirical near-source attenuation relationships for horizontal and vertical components of peak ground acceleration, peak ground velocity, and pseudo-absolute acceleration response spectra: Seis. Res. Let. v. 68, n. 1, p. 154-179.

Hart, E. W., 1994, Fault-rupture hazard zones in California: California Division of Mines and Geology, special publication 42, 1992 revised edition, 34 p.

Jennings, C. W., 1994, Fault activity map of California and adjacent areas: California Division of Mines and Geology, California geologic map data series, map no. 6, scale 1:750,000.

Jennings, C. W., 1994, An explanatory text to accompany the fault activity map of California and adjacent areas: California Division of Mines and Geology, 92 p.

Kennedy, M. P., and Tan, S.S., 1977, Geology of National City, Imperial Beach and Otay Mesa Quadrangles, southern San Diego metropolitan area, California: California Division of Mines and Geology, Map Sheet 29.

REFERENCES continued

Kennedy, M.P., 1975, Character and Recency of Faulting, San Diego Metropolitan Area, California: California Division of Mines and Geology, Special Report 123, 33p.

Legg, M. R., 1989, Faulting and seismotectonics ofthe inner continental borderland west of San Diego: in Roquemore, G. (ed.), Proceedings workshop on the Seismic Risk in the San Diego Region: Special Focus on the Rose Canyon Fault System, p. 50-70.

Martin, G.R. and Lew, M., 1999, Recommended procedures for implementing of DMG special publication 117, Guidelines for analyzing and mitigating liquefaction hazards in California: Southern California Earthquake Center, University of Southern California, March, 1999.

Neblitt and Associates, Inc., 2003, Results of Geologic Field Mapping, Portions of Otay Ranch Parcel B, Along 48" Diameter Water Line Trench Excavation, City of Chula Vista, County of San Diego, California dated October 16, 2003 (Proj. No. 328001-03) .

Pacific Soils Engineering, Inc 2010, Revised Geotechnical Investigation for Village 8 West, Otay Ranch, Chula Vista, California, dated May 26, 2010 (Work Order 400948B4).

Pacific Soils Engineering, Inc 2006, Geotechnical Investigation for EIR Purposes, Parcel "B" Otay Ranch, Chula Vista, California, dated June 2, 2006 (Work Order 400948B4).

Pacific Soils Engineering, Inc., 2003, Feasibility-Level Geotechnical Report, Parcels A, B and C, Otay Ranch, Chula Vista, California, dated August 22, 2003 (Work Order 400948).

Petersen, M. D., Bryant, W. A., Cramer, C. H., Cao, T., Reichle, M. S., Frankel, A. D., Lienkaemper, J. J., McCrory, P. A., and Schwartz, D. P., 1996, Probabilistic seismic hazard assessment for the State of California: California Division of Mines and Geology, open file report 96-08,59 p.

Sadigh, K., Chang, Y., Egan, J.A., Makdisi, F., and Youngs, R.R., 1997, Attenuation relationships for shallow crustal earthquakes based on California strong motion data: Seis. Res. Let. v. 68, n.l.

Tan, S. S., 1995, Landslide hazards in the southern part of the San Diego metropolitan area, San Diego, California, landslide identification map no. 33: California Department of Conservation, Division of Mines and Geology, open file report 95-03.

REFERENCES continued

United States Department of Agriculture, 1953, Vertical black and white aerial photographs (photo nos. AXN-9M-162, -163, -164, -165, and AXM 10M-4, -5) scale 1 :20,000; dated April 14, 1953.

Uniform Building Code, 1997, International Conference of Building Officials (ICBO), Volume 2, structural engineering design provisions: p. 2-30-2-35.

Walsh, S.L., and Derriere, T.A., 1991, Age and stratigraphy of the Sweetwater and Otay Formations, San Diego County, California, in Abbott, P.L. and May, J.A. (eds.), Eocene geologic history of the San Diego region: Society of Economic Paleontologists and Mineralogists, Pacific Section, v. 68, p. 131-148.

APPENDIX B

SUBSURFACE INVESTIGATION

DESCRIPTION OF PSE's SUBSURFACE INVESTIGATION

Pacific Soils Engineering, Inc. performed a subsurface field investigation for Otay Ranch Parcel "B" in June of 2004. Sixteen (16) borings were excavated utilizing a bucket auger drill rig (Plates A-1 through A-16). In addition, seventy-three (73) backhoe test pits were excavated (Table I). Boring and test pit excavations ranged from three (3) to eighty (80) feet below existing grades. All excavations were logged and sampled by representatives of PSE.

Representative bulk and "undisturbed" samples were obtained from the exploratory excavations and delivered to PSE's laboratory for testing and analysis.

Undisturbed samples were obtained from the bucket auger borings by driving a sampling spoon into the material. A split barrel type spoon, having an inside diameter of 2.50 inches, with a tapered cutting tip at the lower end, was used. The barrel is lined with thin brass rings, each 1 inch in height. The spoons penetrated into the soil approximately 12 inches. The lower portion of the sample (6 inches) was retained for testing. All samples in the natural field condition were sealed in airtight containers and transported to PSE's laboratory.

Blow counts were noted for each "undisturbed" sample and are presented in the logs of the borings (Plates A-1 through A-16).

The approximate locations of all exploratory excavations are shown on the enclosed plans (Sheets 3 through 5 and 7).

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B", Village 7		
DATE STARTED	06/01/04	GROUND ELEV.	547.0	BORING DESIG.	BA-01
DATE FINISHED	06/01/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500 #; 27'-55'=2400#; 55'-85'=1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
					SM	TOPSOIL: SILTY SAND, fine- to medium-grained, gray-brown, dry, moderately dense; planted.				
						@ 1 ft. becomes slightly moist; some carbonate nodules.				
	545					OTAY FORMATION (Oo): SILTY SANDSTONE, fine- to medium-grained, light brown, dry, soft; highly weathered.				
						@ 4 ft. becomes slightly moist, moderately hard; some carbonate filled fractures; slightly micaceous. Joint: N60W;47SW				
5		D	4				24.9	96	89	
	540					@ 7 ft. becomes medium brown.				
						@ 8 ft. becomes moist.				
10		D	3				32.1	90	99	
	535					@ 11 ft. becomes SANDY SILTSTONE, medium brown, moist, moderately hard; sand portion is fine-grained; some medium brown clay. Joint: N2W; 65SW				
						@ 12 ft. CLAYSTONE, 0.2' thick white, slightly moist, hard. @12.2 ft. 0.2' thick zone of very discontinuous zone of BENTONITE rip up clasts; maximum dimensions of clasts is 1/2".				
15		B				@ 12.4 ft. becomes SANDY SILTSTONE, medium brown, moist, moderately hard; sand portion is fine-grained; some medium brown clay.				MAX HY EI DSR CHEM
	530					@ 17 ft. grades into SILTY SANDSTONE, fine-grained, light brown, slightly moist, moderately hard.				
20		D	8 for 9" (Partial)				12.4	106	57	
	525									

Continued.

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court. San Diego, CA 92111
(858) 560-1713

PLATE A-1

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B", Village 7		
DATE STARTED	06/01/04	GROUND ELEV.	547.0	BORING DESIG.	BA-01
DATE FINISHED	06/01/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500 #; 27'-55'=2400#; 55'-85'=1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		B								
	520									
						@ 29 ft. increase in silt content.				
30		D	12			@ 30 ft. becomes moist; some mica.	25.5	97	94	
	515					@ 32 ft. grades into SANDY SILTSTONE, medium brown to olive brown, moist, moderately hard; sand portion is fine-grained.				
						@ 34 ft. SILTY SANDSTONE, fine-grained, light brown, moist, moderately hard.				
35		B								
	510									
40		D	15			@ 40 ft. becomes light brown to medium brown, slightly moist.	23.2	101	93	
	505									
45		B								
	500					TOTAL DEPTH = 47 FT. NO WATER NO CAVING Backfilled according to the County of San Diego, Department of Environmental Health, SAM Division, Permit Waiver, dated May 21, 2004.				

SAMPLE TYPES:

D DRIVE (RING) SAMPLE ▼ GROUNDWATER

S SPT (SPLIT SPOON) SAMPLE

B BULK SAMPLE T TUBE SAMPLE

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-1

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B", Village 7		
DATE STARTED	06/02/04	GROUND ELEV.	555.0	BORING DESIG.	BA-02
DATE FINISHED	06/02/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500 #; 27'-55'=2400#; 55'-85'=1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	555				SC	TOPSOIL: CLAYEY SAND, fine- to medium-grained; brown, dry, loose; planted; rare krotovina @ 1' becomes slightly moist, some carbonate nodules.				
						OTAY FORMATION (Oo): SILTY SANDSTONE, fine-grained, gray-brown, dry, loose; highly weathered; some medium-grained sand.				
						@ 4 ft. becomes slightly moist, moderately hard, unweathered; some carbonate filled fractures: N10W;22SW				
5	550	D	6 for 6" (Partial)				8.5	106	39	
						@ 7 ft. concretion-lenticular 1/2 thick in middle; 2 ft. long				
						@ 8 ft. becomes light gray.				
10	545	D	8 for 9" (Partial),			@ 9.5 ft. 0.3' thick zone of rare bentonite rip up clasts up to 2 in. diameter (5% of total volume), moist, moderately hard; some mica.	13.1	106	60	
						@ 14 ft. becomes SANDY SILTSTONE, olive-gray, moist, moderately hard; sand portion is fine-grained; horizontal contact with underlying bed.				
15	540	D	8 for 11"			@ 15 ft. becomes light gray, moist, moderately hard; sand portion is fine-grained; some medium-grained sand; some mica; some clay.	17.4	106	80	HY DS
						@ 18 ft. 1 1/2 ft. thick SANDY SILTSTONE, olive-gray, moist, moderately hard; sand portion is fine-grained; horizontal contact with both overlying and underlying beds.				
20	535	B				@ 19.5 ft. SILTY SANDSTONE to SANDY SILTSTONE, fine-grained, gray-brown, moist, moderately hard; micaceous.				
						@ 21 ft. 1.5' thick SANDY SILTSTONE, olive-gray, moist, moderately hard; sand portion is fine-grained; horizontal contact with both overlying and underlying beds.				
						@ 22.5 ft. SILTY SANDSTONE to SANDY SILTSTONE, fine-grained, gray-brown, moist, moderately hard; micaceous.				
						@ 23.5 ft. 1.0' thick SANDY SILTSTONE, olive-gray, moist, moderately hard; sand portion is fine-grained; horizontal contact with both overlying and underlying beds.				
	530									

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court. San Diego. CA 92111
(858) 560-1713

PLATE A-2

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B", Village 7	BORING DESIG.	BA-02
DATE STARTED	06/02/04	GROUND ELEV.	555.0	LOGGED BY	PDT
DATE FINISHED	06/02/04	GW DEPTH (FT)		NOTES	
DRILLER	Larive Drilling	DROP	12"		
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500 #; 27'-55'=2400#; 55'-85'=1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	530	D	8			@ 24.5 ft. SILTY SANDSTONE to SANDY SILTSTONE, fine-grained, gray-brown, moist, moderately hard; micaceous. @ 25 ft. becomes SILTY SANDSTONE, fine- to medium-grained, light gray, moist, moderately hard; micaceous.	15.8	112	85	
						@ 27.5 ft. becomes SANDY SILTSTONE to SILTY SANDSTONE, fine-grained, medium brown, moist, moderately hard; micaceous.				
30	525	B								
						@ 34 ft. SILTSTONE, olive-brown; laminated; horizontal; 1/2' thick.				
35	520	D	12			@ 35 ft. becomes SANDY SILTSTONE, medium brown, moist, moderately hard; sand portions is fine-grained; some medium-grained sand; some mica; some clay.	20.3	106	92	HY DS
						@ 38 ft. becomes medium brown, moist, moderately hard; sand portion is fine-grained; trace of mica; massive to faintly laminated.				
40	515	B								
45	510	D	12				25.9	98	96	
	505					@ 49 ft. becomes SILTY SANDSTONE. fine-grained. light gray brown, moist. moderately hard; some mica: massive.				

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court. San Diego. CA 92111
(858) 560-1713

PLATE A-2

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Olay Parcel "B", Village 7		
DATE STARTED	06/02/04	GROUND ELEV.	555.0	BORING DESIG.	BA-02
DATE FINISHED	06/02/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500 #: 27'-55'=2400#: 55'-85'=1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	505	B								
		D	15 for 9" (Partial)				12.0	106	55	
						TOTAL DEPTH = 55.5 FT. NO WATER NO CAVING Backfilled according to the County of San Diego, Department of Environmental Health, SAM Division, Permit Waiver, dated May 21, 2004.				

SAMPLE TYPES:
D. DRIVE (RING) SAMPLE
S. SPT (SPLIT SPOON) SAMPLE
B. BULK SAMPLE
T. TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court. San Diego. CA 92111
(858) 560-1713

PLATE A-2

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B", Village 7		
DATE STARTED	06/02/04	GROUND ELEV.	540.0	BORING DESIG.	BA-03
DATE FINISHED	06/02/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500 #; 27'-55'=2400#; 55'-85'=1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	540				SM	TOPSOIL: SILTY SAND, fine- to medium-grained, brown, dry, loose, planted; some clay.				
						@ 1 ft. becomes slightly moist, some carbonate nodules.				
						OTAY FORMATION (Oo): SILTY SANDSTONE, fine-grained, light gray-light brown, dry, soft; weathered.				
						@ 4 ft. becomes slightly moist, moderately hard; unweathered.				
5	535	D	8 for 11"			@ 5 ft becomes moist.	9.6	114	54	
10	530	D	8			@ 10.4 ft. 0.3' thick SILTSTONE, olive, moist, moderately hard, horizontal contact with overlying and underlying beds; Joint: N34W;72SW	18.2	103	77	
						@ 10.7 ft. becomes SILTY SANDSTONE, fine-grained, light gray-light brown, moist, moderately hard; some mica.				
						@ 12.5 ft. Increase in silt content.				
						@ 14 ft. 0.4' thick SILTSTONE, olive, moist, moderately hard; horizontal bedding.				
15	525					@ 14.4 ft. becomes SILTY SANDSTONE, fine-grained, light gray-light brown, moist, moderately hard; some mica; increase in silt content.				
						@ 16 ft. SANDY SILTSTONE, fine-grained, light gray, moist, moderately hard; trace of mica.				
						@17 ft. Joint: N30W;66NE				
20	520	D	3				30.3	91	97	
	515					Continued.				

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-3

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B", Village 7		
DATE STARTED	06/02/04	GROUND ELEV.	540.0	BORING DESIG.	BA-03
DATE FINISHED	06/02/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500 #; 27'-55'=2400#; 55'-85'=1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	515	B				@ 25 ft. Bedding: N50W;3SW				
						@ 26 ft. becomes SILTY SANDSTONE, fine-grained, light gray, moist, moderately hard; micaceous.				
						@ 27 ft. Joint: N78W;12NE				
30	510	D	11 for 6" (Partial)				8.9	110	45	
						@ 33 ft. increase in silt content; becomes light brown.				
35	505									
40	500	D	14 for 10"				14.1	108	68	
						@ 43 ft. well cemented; some secondary orange staining.				
45	495	B								
						@ 49 ft. 1/2' thick concretion; hard, light gray.				
	490					Continued.				

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-3

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B", Village 7		
DATE STARTED	06/02/04	GROUND ELEV.	540.0	BORING DESIG.	BA-03
DATE FINISHED	06/02/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500 #; 27'-55'=2400#; 55'-85'=1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	490						12.0	109	59	
		D	10 for 6"							
						TOTAL DEPTH = 52 FT. NO WATER NO CAVING Backfilled according to the County of San Diego, Department of Environmental Health, SAM Division, Permit Waiver, dated May 21, 2004.				

SAMPLE TYPES:

D DRIVE (RING) SAMPLE ▼ GROUNDWATER

S SPT (SPLIT SPOON) SAMPLE

B BULK SAMPLE T TUBE SAMPLE

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-3

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B", Village 7		
DATE STARTED	06/03/04	GROUND ELEV.		BORING DESIG.	BA-04
DATE FINISHED	06/03/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500 #; 27'-55'=2400#; 55'-85'=1300#		

DEPTH (Feet)	SAMPLE TYPE	BLOW COUNT	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	D	push 6" 1 for 6"	SC	TOPSOIL: CLAYEY SAND, fine- to medium-grained, brown, dry, loose; planted; trace carbonates, visible porosity. @ 0.5 ft. becomes slightly moist.	17.6	102	73	
5				OTAY FORMATION (Oo): SILTY SANDSTONE, fine-grained, light gray, slightly moist, soft; weathered; common carbonates. @ 5 ft. becomes moderately hard; unweathered. @ 6.5 ft. becomes moist, medium brown; rare carbonate-filled fractures. @ 8 ft. horizontal concretion; hard, gray .3 ft. thick. @ 8.3 ft. 1/2 ft. thick SANDY SILTSTONE, olive-gray, moist, moderately hard; sand portion is fine-grained. @ 8.8 grades into SILTY SANDSTONE, fine-grained, light brown, moist, moderately hard.				
10	D	8 for 9"			14.2	104	62	
15	B			@ 14 ft. 0.2' thick SANDY SILTSTONE, olive-gray, moist, moderately hard; laminated. @14.4 ft. SILTY SANDSTONE, fine-grained, light brown, moist, moderately hard; sharp sub-horizontal contact with overlying siltstone.				
20	D	8 for 11"		@ 18 ft. SANDY SILTSTONE, light brown, moist, moderately hard; sand portion is fine-grained. @ 19 ft. some secondary orange staining; minor concretion (2" diameter)	18.6	100	74	HY DS
				@ 21 ft. SILTY SANDSTONE, fine-grained, gray-brown, moist, moderately hard.				

Continued.

SAMPLE TYPES:
D. DRIVE (RING) SAMPLE
S. SPT (SPLIT SPOON) SAMPLE
B. BULK SAMPLE T. TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court. San Diego. CA 92111
(858) 560-1713

PLATE A-4

GEOTECHNICAL BORING LOG

PROJECT NO.	4009488	PROJECT NAME	Otay Parcel "B", Village 7		
DATE STARTED	06/03/04	GROUND ELEV.		BORING DESIG.	BA-04
DATE FINISHED	06/03/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500 #; 27'-55'=2400#; 55'-85'=1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		B				@ 26 ft. becomes orangish medium brown, trace of mica.				
						@ 28 ft. increase in silt content.				
30		D	20 for 10"			@ 30 ft. becomes light gray-light brown, moist, moderately hard; micaceous; some medium-grained sand.	11.1	110	56	
						@ 31 ft. decrease in silt content.				
35						@ 35 ft. began using crowds; increase in silt content.				
40		D	20 for 11"			@ 40 ft. becomes medium brown, moist, moderately hard; micacous; some medium-grained sand; moderately well cemented.	17.2	106	79	
						TOTAL DEPTH = 41 FT. NO WATER NO CAVING Backfilled according to County of San Diego, Department of Environmental Health, SAM Division, Permit Waiver, dated May 21, 2004.				

SAMPLE TYPES:
D. DRIVE (RING) SAMPLE
S. SPT (SPLIT SPOON) SAMPLE
B. BULK SAMPLE T. TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-4

GEOTECHNICAL BORING LOG

PROJECT NO.	4009488	PROJECT NAME	Otay Parcel "B", Village 7		
DATE STARTED	06/03/04	GROUND ELEV.	509.0	BORING DESIG.	BA-05
DATE FINISHED	06/03/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500 #; 27'-55'=2400#: 55'-85'=1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
					SC	TOPSOIL: CLAYEY SAND, fine- to medium-grained, brown, dry, loose; some prorosity; some carbonates; planted.				
						@ 1 ft. becomes slightly moist.				
						OTAY FORMATION (Oo): SILTY SANDSTONE, fine-grained, light gray-light brown, slightly moist, soft; weathered; common carbonates.				
	505									
5						@ 5 ft. becomes moderately hard; unweathered.				
						@ 7 ft. rare concretion (3" diameter)				
	500					@ 9 ft. becomes SILTSTONE, olive gray, moist, moderately hard; laminated; horizontal bedding.				
10		D	8 for 11"			@ 9.5 ft. becomes SILTY SANDSTONE, fine-grained, light gray-light brown, moist, moderately hard.	16.2	110	83	
	495					@ 13 ft. 0.2' thick SILTSTONE, olive, gradational contact with overlying bed; sharp contact with lower bed: N50W;4-5SW				
						@ 13.2 ft. SANDY SILTSTONE, light gray, moist, moderately hard; sand portion is fine-grained; some clay; micaceous.				
15		B				@ 15 ft. Joint: N15W;55SW				MAX HY EI DSR CHEM
	490									
20			8 for 9"				9.4	111	49	
						@ 22 ft. concretion 0.3' thick 2.0 ' long.				
	485									
						Continued.				

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court. San Diego, CA 92111
(858) 560-1713

PLATE A-5

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B", Village 7		
DATE STARTED	06/03/04	GROUND ELEV.	509.0	BORING DESIG.	BA-05
DATE FINISHED	06/03/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500 #; 27'-55'=2400#; 55'-85'=1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						@ 25 ft. Joint: N26W;85NE				
	480									
30		D	10			@ 30 ft. becomes olive-brown, moist, moderately hard; sand portion is fine-grained.	8.2	106	37	
						TOTAL DEPTH = 31 FT. NO WATER NO CAVING Backfilled according to the County of San Diego, Department of Environmental Health, SAM Division, Permit Waiver, dated May 21, 2004.				

SAMPLE TYPES:

D DRIVE (RING) SAMPLE ▼ GROUNDWATER

S SPT (SPLIT SPOON) SAMPLE

B BULK SAMPLE T TUBE SAMPLE

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court. San Diego. CA 92111
(858) 560-1713

PLATE A-5

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B", Village 7	BORING DESIG.	BA-06
DATE STARTED	06/03/04	GROUND ELEV.		LOGGED BY	PDT
DATE FINISHED	06/03/04	GW DEPTH (FT)		NOTES	
DRILLER	Larive Drilling	DROP	12"		
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500 #; 27'-55'=2400#; 55'-85'=1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
					SC	TOPSOIL: CLAYEY SAND, fine-grained, brown, dry, loose; planted; porous; carbonates.				
						@ 1 ft. becomes slightly moist.				
						OTAY FORMATION (Oo): SILTY SANDSTONE, fine-grained, whitish light brown, slightly moist, soft; weathered; carbonates.				
5						@ 5.5 ft. becomes light gray-light brown, moist, moderately hard; unweathered; rare carbonate filled fractures.				
						@ 6 ft. 1/2' thick well cemented layer (horizontal).				
10		D	6 for 6" (Partial)			@ 10 ft. becomes gray-brown, some medium-grained sand; some mica.	8.2	106	37	
						@ 11 ft. zone = 3.0' thick zone of concretions; individual concretions 3.0" thick.				
15						@ 15 ft. grades into SILTSTONE, olive, moist, moderately hard; sharp sub-horizontal contact with underlying silty sandstone.				
						@ 16 ft. SILTY SANDSTONE, fine-grained, gray-brown, moist, moderately hard; some mica.				
		B				@ 18 ft. rare concretions = 2" thick.				
20		D	8 for 10"				13.9	111	73	
						@ 22 ft. SANDY SILTSTONE olive, moist, moderately hard; sand portion is fine-grained.				
						@ 24.5 ft. SILTY SANDSTONE, fine-grained, gray brown, moist,				

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-6

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B", Village 7		
DATE STARTED	06/03/04	GROUND ELEV.		BORING DESIG.	BA-06
DATE FINISHED	06/03/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500 #; 27'-55'=2400#; 55'-85'=1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						moderately hard; some mica.				
						TOTAL DEPTH = 25 FT. NO WATER NO CAVING Backfilled according to the County of San Diego, Department of Environmental Health, SAM Division, Permit Waiver, dated May 21, 2004.				

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE; T TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-6

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/07/04	GROUND ELEV.	490.0	BORING DESIG.	BA-07
DATE FINISHED	06/07/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	490				SC	TOPSOIL: CLAYEY SAND, fine- to medium-grained, dark brown, dry, loose; planted; porous; trace of coarse-grained sand.				
						@ 0.5 ft. becomes slightly moist; some carbonate nodules.				
						OTAY FORMATION (Oo): SILTY SANDSTONE, fine-grained, whitish light gray, slightly moist, soft; weathered; some carbonates.				
5	485					@ 5 ft. becomes fine- to medium- grained, light gray-light brown, moist, moderately hard; unweathered; micaceous.				
						@ 6.5 ft. carbonate filled fracture EW;54N				
						@ 9 ft. increase in sand content.				
10	480					@ 13 ft. becomes light gray.				
						@ 13.5 ft. very well cemented zone 0.3' thick; horizontal bedding.				
						@ 13.8 ft. becomes fine-grained, light gray brown.				
15	475	D	6				16.6	109	81	
						@ 16 ft. 0.1' thick well cemented zone.				
						@ 17 ft. becomes soft; decrease in silt content.				
20	470					@ 19.5 ft. becomes SANDSTONE, fine- to medium-grained, light brown, moist, soft; some silt; trace of bentonite rip-up clasts (up to 1.0").				
						@ 20 ft. becomes SANDY SILTSTONE, light gray, moist, soft; common clay; sand portion is fine-grained.				
	465									

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-7

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/07/04	GROUND ELEV.	490.0	BORING DESIG.	BA-07
DATE FINISHED	06/07/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	465	B				@ 25 ft.becomes light brown, moderately hard.				HY EI
						@ 26.1 ft. 0.4 ' thick BENTONITE, olive-gray, moist, soft; upper contact is horizontal; lower contact EW;18S.				
						@ 26.5 ft. SANDY SILTSTONE, olive, moist, soft to moderately hard; sand portion is fine-grained; bedding is horizontal.				
30	460	D	14				20.8	106	94	
						@ 34 ft. some orange staining.				
35	455					@ 36 ft. increase in silt content; moderately well cemented.				
40	450	B				@ 40 ft. becomes SILTY SANDSTONE, fine-grained, light brown, moist, moderately hard; some medium-grained sand.				
						@ 43 ft. increase in silt content.				
45	445					@ 44.5 ft. decrease in silt content.				
						@ 46 ft. 2" mafic concretion; hard.				
						@ 48 ft. increase in silt content.				
	440									

SAMPLE TYPES:

D DRIVE (RING) SAMPLE ▼ GROUNDWATER

S SPT (SPLIT SPOON) SAMPLE

B BULK SAMPLE T TUBE SAMPLE

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-7

GEOTECHNICAL BORING LOG

PROJECT NO.	4009488	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/07/04	GROUND ELEV.	490.0	BORING DESIG.	BA-07
DATE FINISHED	06/07/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	440									
55	435	D	16			@ 55 ft. becomes fine- to medium-grained, light gray, moist, moderately hard; some coarse-grained sand.	10.8	121	75	
						TOTAL DEPTH = 56 FT. NO WATER NO CAVING Backfilled according to the County of San Diego, Department of Environmental Health, SAM Division, Permit Waiver, dated May 21, 2004.				

SAMPLE TYPES:
D. DRIVE (RING) SAMPLE
S. SPT (SPLIT SPOON) SAMPLE
B. BULK SAMPLE T. TUBE SAMPLE
▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-7

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/07/04	GROUND ELEV.	515.0	BORING DESIG.	BA-08
DATE FINISHED	06/07/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	515				SC	TOPSOIL: CLAYEY SAND, fine- to medium-grained, dark brown, dry, loose; planted; porous.				
						@ 2 ft. slightly moist, increase in clay content; carbonate nodules.				
5	510					OTAY FORMATION (Oo): SILTY SANDSTONE, fine-grained, light brown, slightly moist, soft; weathered; some carbonates.				
						@ 5 ft. some orange staining (0.5' thick)				
						@ 6 ft. becomes moist, moderately hard; unweathered. 1.5' thick zone of minor (up to 6") concretions.				
						@ 7 ft. becomes SANDY SILTSTONE, purple-brown, soft; sand portion is fine-grained, some carbonate filled fractures; N25E;80SE.				
						@ 7.7 ft. 1/2' thick CLAYSTONE, brown, moist, moderately hard; slightly waxy; horizontal.				
						@ 8.2 ft. becomes SANDY SILTSTONE.				
10	505					@ 9 ft. SILTY SANDSTONE, fine-grained, lighty gray, moist, moderately hard.				
						@ 12.5 ft. grades into SANDY SILTSTONE, olive-gray, moist, moderately hard; sand portion is fine-grained; contact with underlying bed: N55W;3SW.				
						@13.3 ft. becomes light orange-light brown.				
15	500	D	5 for 6" (Partial)				10.6	104	46	
						@ 17.5 becomes SILTY SANDSTONE, fine-grained, light gray, moist, soft.				
						@ 18.2 ft. becomes hard; well cemented; horizontal contact with overlying bed.				
20	495					@ 20 ft. becomes olive-light brown.				
		B								
	490									

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-8

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/07/04	GROUND ELEV.	515.0	BORING DESIG.	BA-08
DATE FINISHED	06/07/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	490					@ 25 ft. Joint: N38E;86NW.				
						@ 26 ft. SILTSTONE, olive, moist, moderately hard to hard; sand portion is fine-grained; horizontal contact with overlying bed.				
30	485	D	18			@ 30 ft. SILTY SANDSTONE to SANDY SILTSTONE, fine-grained, light gray-light brown, moist, moderatley hard to hard; micaceous.	16.7	115	96	
35	480					@ 36 ft. SANDY SILTSTONE, purple, moist, moderately hard; sand protion is fine-grained; horizontal contact with overlying bed.				
		B				@ 38 ft. SILTY SANDSTONE, fine-grained, light gray-light brown, moist, moderately hard; micaceous; some clay; sharp contact with underlying bed: N20E;4SE.				MAX HY EI DSR CHEM
40	475					@ 40 ft. 5.0' thick zone of cemented beds (1/2' thick; 1/2' spacing); sub horizontal.				
45	470	D	10 for 6"			@ 45 ft. becomes SILTY SANDSTONE, fine- to medium-grained, whitish light gray, moist, moderately hard; micaceous.	7.1	123	52	
						@ 46 ft. becomes wet.				
						@ 46.5 ft. SANDY SILTSTONE, olive-brown, moist, moderately hard; sand portion is fine-grained; contact with overlying bed: N34W;5SW.				
	465									

SAMPLE TYPES:

D DRIVE (RING) SAMPLE ▼ GROUNDWATER

S SPT (SPLIT SPOON) SAMPLE

B BULK SAMPLE T TUBE SAMPLE

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-8

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/07/04	GROUND ELEV.	515.0	BORING DESIG.	BA-08
DATE FINISHED	06/07/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	465									
		B				@ 53.5 ft. SILTY SANDSTONE; fine-grained, olive-light gray, moist, moderately hard; horizontal bedding.				
55	460					@ 54 ft. SANDY SILTSTONE, olive, moist, moderately hard; sand portion is fine-grained; trace of mica. @ 55 ft. 1' thick very well cemented layer; horizontal bedding.				
						@ 56 ft. SILTY SANDSTONE to SANDY SILTSTONE, fine-grained, olive, moist, moderately hard; micaceous.				
						@ 58 ft. grades to SILTY SANDSTONE, fine-grained, light gray, moist, moderately hard; some medium-grained sand; micaceous.				
60	455	D	20 for 5" (Partial)				20.0	100	78	
						@ 63 ft. becomes hard.				
65	450									
70	445	D	20 for 6" (Partial)				13.9	104	60	
						TOTAL DEPTH = 71 FT. NO WATER NO CAVING Backfilled according to the County of San Diego, Department of Environmental Health, SAM Division, Permit Waiver, dated May 21, 2004.				

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-8

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/08/04	GROUND ELEV.	520.0	BORING DESIG.	BA-09
DATE FINISHED	06/08/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	520				SC	TOPSOIL: CLAYEY SAND, fine- to medium-grained, dark brown, dry, loose; planted; porous.				
						@ 1 ft. becomes slightly moist, increase in clay content; some carbonate nodules.				
						OTAY FORMATION (Oo): SILTY SANDSTONE, fine-grained, whitish light gray, slightly moist, soft; weathered; some carbonate filled fractures.				
5	515					@ 6 ft. becomes moist, moderately hard; unweathered.				
						@ 8 ft. SANDY CLAYSTONE, purple-brown, moist, moderately hard; sand portion is fine-grained; horizontal bedding.				
						@ 9 ft. SILTY SANDSTONE, fine-grained, light gray, moist, moderately hard.				
10	510					@ 10 ft. 1/2' thick concretions; bedding is horizontal.				
						@ 10.5 ft. SANDY SILTSTONE, purple-brown, moist, soft; sand portion is fine-grained.				
						@ 12 ft. SILTY SANDSTONE, fine-grained, light brown, moist, moderately hard.				
						@ 14 ft. Joint: N35E;V				
15	505	D	8 for 9"				13.1	108	63	
						@ 18 ft. Joint: N48E;85NW				
20	500					@ 21 ft. SANDY SILTSTONE, olive, moist, moderately hard; sand portion is fine-grained; bedding N58N;5SW				
		B				@ 23 ft. SILTY SANDSTONE, fine-grained, light brown, moist, moderately hard; some clay.				
	495									

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-9

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/08/04	GROUND ELEV.	520.0	BORING DESIG.	BA-09
DATE FINISHED	06/08/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	495					@ 25 ft. increase in silt content.				
						@ 28 ft. decrease in silt content.				
30	490	D	10 for 7"			@ 30 ft. becomes light gray.	14.0	115	82	HY DS
35	485					@ 35 ft. 1/2' thick concretion; hard; horizontal. @ 35.5 ft. increase in silt content, becomes olive-light brown.				
						@ 37 ft. becomes light gray.				
40	480					@ 41 ft. becomes fine- to medium-grained.				
45	475	D	10 for 6" (Partial)				10.4	109	51	
						@ 49 ft. trace of seepage at contact with underlying bed.				
	470					@ 49.5 ft. SILTSTONE, olive, moist, moderately hard to hard.				

SAMPLE TYPES:

D DRIVE RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-9

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/08/04	GROUND ELEV.	520.0	BORING DESIG.	BA-09
DATE FINISHED	06/08/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	470									
		B				@ 52 ft. becomes SANDY SILTSTONE, purple-brown, well cemented; sand portion is fine-grained.				
55	465					@ 57 ft. becomes light gray, moist, hard; well cemented; horizontal contact with overlying bed.				
60	460	D	20 for 6" (Partial)				15.9	106	73	HY
						@ 61 ft. SANDY SILTSTONE, olive-light gray, moist, moderately hard to hard; sand portion is fine-grained.				
65	455					@ 64 ft. increase in fine-grained sand.				
						@ 67 ft. grades into SILTY SANDSTONE, fine-grained, light gray, moist, moderately hard.				
70	450					@ 72 ft. 2.0' thick SANDY SILTSTONE, olive, moist, moderately hard.				
						@ 74 ft. SILTY SANDSTONE, fine-to medium-grained, light gray, moist, moderately hard.				
	445									

SAMPLE TYPES:

D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-9

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/08/04	GROUND ELEV.	520.0	BORING DESIG.	BA-09
DATE FINISHED	06/08/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	445	D	20 for 6" (Partial)				12.3	109	61	
80	440					TOTAL DEPTH = 80 FT. SEEPAGE AS NOTED NO CAVING Backfilled according to the County of San Diego, Department of Environmental Health, SAM Division, Permit Waiver, dated May 21, 2004.				

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-9

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/04/04	GROUND ELEV.	530.0	BORING DESIG.	8A-10
DATE FINISHED	06/04/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	530				SC	TOPSOIL: CLAYEY SAND, fine-grained, brown, dry, loose; some medium-grained sand, planted; visible porosity up to 1/8".				
						@ 1 ft. becomes slighlly moist; some carbonate nodules.				
						OTAY FORMATION (Oo): SILTY SANDSTONE, fine-grained, light gray-light brown, slightly moist, soft; weathered.				
5	525					@ 5.5 ft. becomes moist, moderately hard; unweathered.				
						@ 9 ft. 0.3' thick SANDY CLAYSTONE, purple-brown, moderately hard; sharp horizontal contact with overlying and underlying beds.				
10	520	D	8			@ 9.3 ft. SANDY SILTSTONE, olive-brown, moist, moderately hard; sand portion is fine-grained.	16.1	111	83	
						@ 10 ft. grades into SILTY SANDSTONE, fine-grained, light brown, moist, moderately hard; micaceous.				
						@ 14 ft. grades into SANDY SILTSTONE, olive, moist, moderately hard; sand portion is fine-grained.				
15	515					Joint; N40E;V				
						@ 16 ft. grades into SILTY SANDSTONE, fine-grained, light gray, moist, moderately hard.				
						@ 17.5 ft. decrease in silt content.				
						@ 19.5 ft. 1/2' thick SANDY SILTSTONE, olive, moist, moderately hard; sand portion is fine-grained.				
20	510					@ 20 ft. grades into SILTY SANDSTONE, fine-grained, light gray, moist, moderately hard.				
						@ 21 ft. 1' thick SANDY SILTSTONE, olive, moist, moderately hard; sand portion is fine-grained.				
						@ 22 ft. grades into SILTY SANDSTONE, fine-grained, light gray, moist, moderately hard.				
	505									

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-10

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/04/04	GROUND ELEV.	530.0	BORING DESIG.	BA-10
DATE FINISHED	06/04/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	505	D	8 for 10"				13.1	105	59	
						@ 28 ft. 1' thick SANDY SILTSTONE, olive, moist, moderately hard; sand portion is fine-grained.				
30	500	B								
						@ 33 ft. becomes light gray.				
35	495					@ 35 ft. began using crowds; well cemented.				
						@ 35.5 ft. 1/2' thick SILTY SANDSTONE, fine- to medium-grained, gray, moist, moderately hard; sharp horizontal upper contact; gradational lower contact.				
						@ 36 ft. SANDY SILTSTONE, light gray, moist, moderately hard; sand portion is fine-grained.				
						@ 38 ft. grades into SILTY SANDSTONE, fine-grained, light gray-light brown, moist, moderately hard; some medium-grained sand.				
						@ 39.5 ft. 0.3' thick sharp contact, horizontal bedding, well cemented CLAYSTONE, gray.				
40	490	D	15			@ 39.8 ft. SANDY SILTSTONE, medium brown, moist, moderately hard; sand portion is fine-grained; trace of mica.	21.0	107	99	
45	485	B								
						@ 46.5 ft. 1/2' thick SILTY SANDSTONE, fine- to medium-grained, light gray, moist, moderately hard; horizontal bedding.				
	480									

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court. San Diego, CA 92111
(858) 560-1713

PLATE A-10

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/04/04	GROUND ELEV.	530.0	BORING DESIG.	BA-10
DATE FINISHED	06/04/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	480					@ 50 ft. SANDY SILTSTONE, medium brown, moist, moderately hard; sand portion is fine-grained; trace of mica.				
						@ 52.5 ft. SILTY SANDSTONE, fine- to medium-grained, light gray, moist, moderately hard; bedding is horizontal.				
55	475	D	15 for 9"			@ 55.5 ft. becomes fine-grained, gray, moist, hard; well cemented; some medium-grained sand.	22.6	104	99	
						TOTAL DEPTH = 56 FT. NO WATER NO CAVING Backfilled according to the County of San Diego, Department of Environmental Health, SAM Division, Permit Waiver, dated May 21, 2004.				

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-10

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/04/04	GROUND ELEV.	512.0	BORING DESIG.	BA-11
DATE FINISHED	06/04/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
					CL	TOPSOIL: SANDY CLAY, dark brown, dry, soft; sand portion is fine-grained; some carbonate nodules; planted; visible porosity up to 1/8"; rare fine-gravel.				
	510					@ 2 ft. becomes slightly moist; stiff.				
5						OTAY FORMATION (Oo): SILTY SANDSTONE, fine- to medium-grained, light gray-light brown, moist, soft; weathered.				
	505					@ 7 ft. unweathered; moderately hard.				
						@ 8 ft. rare clay rip up clasts to 8 1/2'; approximate maximum dimension 4".				
10						@ 10 ft. becomes SANDY SILTSTONE, olive, moist, moderately hard; sand portion is fine-grained; horizontal contact with overlying bed.				
	500									
15										
	495					@ 18 ft. becomes SILTY SANDSTONE, fine-grained, light gray, moist, moderately hard; some medium-grained sand; micaceous.				
20		D	8 for 10				16.7	111	88	
	490					@ 23 ft. increase in silt content.				

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court. San Diego, CA 92111
(858) 560-1713

PLATE A-11

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/04/04	GROUND ELEV.	512.0	BORING DESIG.	BA-11
DATE FINISHED	06/04/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	485									
						@ 28 ft. becomes SANDY SILTSTONE, olive, moist, moderately hard; gradational contact with overlying bed.				
30		B				@ 30 ft. SANDY SILTSTONE to SILTY SANDSTONE, fine-grained, brown, moist, moderatley hard; well cemented; some mica; some clay.				MAX HY EI CHEM
	480					@ 31 ft. SILTY SANDSTONE. fine-grained, light brown, moist, moderately hard.				
35						@ 35 ft. SANDY SILTSTONE, olive-brown, moist, moderately hard; sand portion is fine-grained; faintly laminated.				
	475					@ 37 ft. SILTY SANDSTONE, fine-grained, light brown, moist, moderately hard; trace of medium-grained sand.				
40		D	12			@ 40 ft. becomes fine-to medium-grained, light gray, moist to wet; micaceous.	16.2	117	99	
						TOTAL DEPTH = 41 FT. WATER AS NOTED NO CAVING Backfilled according to the County of San Diego, Department of Environmental Health, SAM Division, Permit Waiver, dated May 21, 2004.				

SAMPLE TYPES:
D. DRIVE (RING) SAMPLE
S. SPT (SPLIT SPOON) SAMPLE
B. BULK SAMPLE T. TUBE SAMPLE

GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-11

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/08/04	GROUND ELEV.	483.0	BORING DESIG.	BA-12
DATE FINISHED	06/08/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
					CL	TOPSOIL: SANDY CLAY, dark brown, dry, soft; rooted; porous; some carbonates; some gravel.				
						@ 1 ft. becomes moist; firm.				
	480					OTAY FORMATION (Oo): SANDY SILTSTONE, light gray, slightly moist, soft; weathered; sand portion is fine-grained.				
5						@ 5 ft. becomes moist.				
						@ 6 ft. 0.1' thick white carbonate-rich zone; horizontal.				
	475					@ 7.5 ft. 1/2' thick white carbonate-rich zone; horizontal.				
10		D	2			@ 10 ft. unweathered; rare carbonates; moist to wet; moderately hard.	29.4	91	94	
						@ 10.5 ft. SILTSTONE, olive, moist, soft; trace of fine-grained sand.				
	470					@ 12.5 ft. SANDY SILTSTONE, light gray, slightly moist, moderately hard.				
15						@ 15 ft. SILTY SANDSTONE, light gray, moist, fine- to medium-grained, moderately hard; well cemented.				
	465					@ 18 ft. SANDSTONE, fine-grained, light gray, moist, soft; horizontal contact with overlying bed.				
20		D	5			@ 20 ft. becomes fine- to medium-grained; micaceous.	14.3	120	94	
						@ 21 ft. BRECCIA, fine- to medium-grained sandstone with angular clasts up to 10.0", light orange-brown, moist, hard.				
	460					@ 24 ft. GRITSTONE, fine- to coarse-grained sandstone in a siltstone matrix, light orange-light brown, moist, hard; rare				

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-12

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/08/04	GROUND ELEV.	483.0	BORING DESIG.	BA-12
DATE FINISHED	06/08/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT. URATION (%)	OTHER TESTS
		B				fractures.				
	455					@ 27 ft. **SANTIAGO PEAK VOLCANICS** (Jsp): METAVOLCANIC ROCK, orange, moist, hard; highly weathered to sand and gravel size material; undulatory contact with overlying Otay Formation.				
30										
		B				@ 32 ft. Joint: N65E;77SE				MAX HY EI CHEM
	450									
35										
						@ 37 ft. Joint: N7W;V				
	445									
						@ 39 ft. becomes very hard.				
40										
						REFUSAL @ 41 ft. WATER AS NOTED NO CAVING Backfilled according to the County of San Diego, Department of Environmental Health, SAM Division, Permit Waiver, dated May 21, 2004.				

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-12

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/08/04	GROUND ELEV.	453.0	BORING DESIG.	BA-13
DATE FINISHED	06/08/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
					CL	**TOPSOIL**: SANDY CLAY, dark brown, dry, soft; planted; porosity up to 1/8"; some carbonate nodules.				
						@ 1 ft. becomes slightly moist; firm.				
						OTAY FORMATION (Oo): GRITSTONE, fine- to coarse-grained sandstone in a siltstone matrix, whitish light brown, slightly moist, soft; common carbonates; weathered; some fine-gravel.				
	450									
5						@ 6 ft. becomes unweathered; light gray-light brown, moist, moderately hard.				
	445					@ 8.5 increase in silt content.				
10						@ 10 ft. some angular cobble up to 6"; decrease in silt content.				
	440					@ 13.5 ft. decrease in cobble content.				
15		D	5 for 6"				7.4	119	48	
	435									
20										
	430									MAX HY EI DSR CHEM
		B								

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE
▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-13

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/08/04	GROUND ELEV.	453.0	BORING DESIG.	BA-13
DATE FINISHED	06/08/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						@ 25 ft. concretion 1/2' thick, whitish light gray, hard; horizontal.				
	425									
30		D	14 for 6" (Partial)				9.7	124	73	
	420									
35						TOTAL DEPTH = 35 FT. NO WATER NO CAVING Backfilled according to the County of San Diego, Department of Environmental Health, SAM Division, Permit Waiver, dated May 21, 2004.				

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-13

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/09/04	GROUND ELEV.	421.0	BORING DESIG.	BA-14
DATE FINISHED	06/09/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	420				CL	TOPSOIL: SANDY CLAY, dark brown, dry, soft; planted; porosity up to 1/8"; some carbonates; sand portion is fine-grained; some medium- to coarse-grained sand. @ 0.5 ft. becomes slightly moist, firm.				
5		D	5 for 6" (Partial)			OTAY FORMATION (Oo): GRITSTONE, fine- to coarse-grained sandstone in a siltstone matrix, whitish light brown, slightly moist, soft; weathered; abundant carbonates; massive; some clay; some fine gravel. @ 5 ft. becomes moderately hard; unweathered; pale brown.	5.8	109	29	
	415					@ 7 ft. becomes pale orange-pale brown; hard; some fine-gravel.				
10	410									
						@ 13 ft. some clay in matrix.				
15	405	B								MAX HY DSR CHEM
20	400									

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court. San Diego. CA 92111
(858) 560-1713

PLATE A-14

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/09/04	GROUND ELEV.	421.0	BORING DESIG.	BA-14
DATE FINISHED	06/09/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	395	D	6 for 6" (Partial)			@ 25 ft. decrease in coarse-grained sand.	8.3	123	61	HY DS
						TOTAL DEPTH = 26 FT. NO WATER NO CAVING Backfilled according to the County of San Diego, Department of Environmental Health, SAM Division, Permit Waiver, dated May 21, 2004				

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-14

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/09/04	GROUND ELEV.	400.0	BORING DESIG.	BA-15
DATE FINISHED	06/09/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	400				CL	TOPSOIL: SANDY CLAY, dark brown, dry, soft; planted; porosity up to 1/8"; carbonates; sand is fine-grained; some medium- to coarse-grained sand. @ 1 ft. slightly moist, stiff.				
						OTAY FORMATION (Oo): GRITSTONE, fine- to coarse-grained sandstone in a claystone matrix, orange, moist, soft; weathered; some carbonates. @ 3 ft. becomes pale brown, moist, moderately hard; some fine-grained gravel; massive; rare carbonates.				
5	395									
10	390	D	6 for 6"			@ 10 ft. becomes brown, matrix is siltstone; hard; some fine-grained gravel; some clay.	5.8	123	43	HY DS
15	385					@ 15 ft. rare cobbles up to 4" maximum diameter.				
						TOTAL DEPTH = 16 FT. NO WATER NO CAVING Backfilled according to the County of San Diego, Department of Environmental Health, SAM Division, Permit Waiver, dated May 21, 2004.				

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-15

GEOTECHNICAL BORING LOG

PROJECT NO.	400948B	PROJECT NAME	Otay Parcel "B" Village 4		
DATE STARTED	06/09/04	GROUND ELEV.	421.0	BORING DESIG.	BA-16
DATE FINISHED	06/09/04	GW DEPTH (FT)		LOGGED BY	PDT
DRILLER	Larive Drilling	DROP	12"	NOTES	
TYPE OF DRILL RIG	Bucket Auger	DRIVE WT.	0'-27' = 3500#, 27'-55' = 2400#, 55'-85' = 1300#		

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOW COUNT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	420				CL	TOPSOIL: SANDY CLAY, dark brown, dry, soft; porous; planted; carbonates; sand portion is fine- to medium-grained.				
						@ 0.5 ft. becomes slightly moist, stiff.				
						OTAY FORMATION (Oo): GRITSTONE, fine- to coarse-grained sandstone in a claystone matrix, light orange, slightly moist, soft; weathered.				
						@ 2 ft. becomes whitish pale orange, some carbonates.				
5	415					@ 4 ft. becomes pale brown; hard; some fine-gravel; moderately well cemented.				
10	410	B				@ 11 ft. slow advance; well cemented; some silt.				MAX HY EI DSR CHEM
15	405									
20	400	D	8 for 5"				5.6	115	32	HY DS
						TOTAL DEPTH = 21 FT. NO WATER NO CAVING Backfilled according to the County of San Diego, Department of Environmental Health, SAM Division, Permit Waiver, dated May 21, 2004				

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, San Diego, CA 92111
(858) 560-1713

PLATE A-16

Work Order 400948B
Date Excavated 6/3/04 – 6/7/04
Excavated by SDH
Equipment J. Deere 310SG w/24" Bucket

TABLE I

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-1	0.0 – 3.0	ML	**ALLUVIUM** (Map Symbol Qal): SANDY SILT to CLAYEY SILT, dark brown, slightly moist, firm; small roots throughout; small carbonate nodules throughout; sand portion is fine-grained.
	3.0 – 10.0		**OTAY FORMATION** (Map Symbol Oo): SANDY SILTSTONE to SILTY SANDSTONE, fine-grained, light gray to light brown, slightly moist, moderately hard; highly weathered; calcium carbonate fill fracturing; pinhole porosity; small rootlets; small claystone rip-up clasts. @ 8.0 ft. becomes SANDY SILTSTONE, brown, moderately hard; unweathered.
			TOTAL DEPTH 10.0 FT. NO WATER, NO CAVING
TP-2	0.0 – 4.0	ML	**ALLUVIUM** (Map Symbol Qal): SANDY SILT to CLAYEY SILT, dark brown, slightly moist, soft to firm; small roots throughout; white calcium carbonate nodules throughout.
	4.0 – 11.0		**OTAY FORMATION** (Map Symbol Oo): SANDY SILTSTONE to CLAYEY SILTSTONE, light brown, slightly moist, moderately hard; rootlets to 6.0 ft.; highly porous (pinhole) to 8.0 ft.; highly weathered. @ 9.0 ft. becomes SANDY SILTSTONE, light brown, moderately hard.
			TOTAL DEPTH 11.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-3	0.0 – 2.5	ML	**TOPSOIL** (No Map Symbol): CLAYEY SILT, dark brown, dry to slightly moist, firm; rootlets throughout.
	2.5 – 10.5		**OTAY FORMATION** (Map Symbol Oo): SANDSTONE, fine-grained, light gray-tan to light rusty orange, slightly moist, moderately hard. @ 5.0 ft. krotovina; near horizontal bedding; highly weathered to 5.5 ft. @ 10.0 ft. cemented zone; slow excavating. TOTAL DEPTH 10.5 FT. NO WATER, NO CAVING
TP-4	0.0 – 2.0	ML	**TOPSOIL** (No Map Symbol): SANDY SILT to CLAYEY SILT, brown, dry, soft; rootlets throughout.
	2.0 – 11.0		**OTAY FORMATION** (Map Symbol Oo): SANDY SILTSTONE, CLAYSTONE and CLAYEY SILTSTONE, fine-grained, light gray-white to dark gray, slightly moist, moderately hard; highly weathered to 5.0 ft. @ 2.0 ft. becomes SANDY SILTSTONE; highly weathered. @ 4.0 ft. becomes CLAYSTONE, light gray with banded red beds 1/4" thick; near horizontal. @ 8.0 ft. becomes CLAYEY SILTSTONE; dark gray. TOTAL DEPTH 11.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-5	0.0 – 1.0	ML-SM	**TOPSOIL** (No Map Symbol): SANDY SILT to SILTY SAND, light brown, dry, soft to loose; rootlets throughout.
	1.0 – 11.5		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE, and CLAYSTONE, light gray to gray brown-olive brown, slightly moist, moderately hard; highly weathered to 3.5 ft. @ 1.0 ft. becomes SILTY SANDSTONE; highly weathered; calcium carbonate fill fractures. @ 3.0 ft. becomes CLAYSTONE, dark gray with orange oxidation stains. @ 3.5 ft. becomes SILTY SANDSTONE, fine-grained, light brown; N30E; 4W bedding surface. @ 8.0 ft. 1 ft. thick SANDY CLAYSTONE, gray, moist, moderately hard; sand portion is fine- to coarse-grained. @ 11.5 ft. slow excavating.
			TOTAL DEPTH 11.5 FT. NO WATER, NO CAVING
TP-6	0.0 – 2.0	ML	**TOPSOIL** (No Map Symbol): SANDY SILT o CLAYEY SILT, medium brown, slightly moist, soft to firm; rootlets throughout.
	2.0 – 12.0		**OTAY FORMATION** (Map Symbol Oo): SANDY SILTSTONE and CLAYEY SILTSTONE, light gray/pink, slightly moist, moderately hard; highly weathered; highly fractured; rootlets to 5.0 ft. @ 2.0 ft. becomes SILTY SILTSTONE; fine-grained, gray-tan, blocky, unweathered; approximately horizontal to approximately 3° westerly dip.

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-6 continued			@ 6.0 ft. Joint: N10E; 72W. @ 9.0 ft. grades into CLAYEY SILTSTONE, dense; few fractures. @ 11.0 ft. becomes SILTY SANDSTONE, tan-gray; very dense; slow excavating. TOTAL DEPTH 12.0 FT. NO WATER, NO CAVING
TP-7	0.0 – 1.5	ML	**TOPSOIL** (No Map Symbol): SANDY SILT to CLAYEY SILT, medium brown, dry, soft; rootlets throughout; some clay zones.
	1.5 – 7.0		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE, and CLAYEY SILTSTONE, white-light gray, slightly moist, moderately hard; slightly weathered to 4.0 ft. @ 6.0 ft. CLAYEY SILTSTONE bed; N15E; 6W; moderately hard. @ 7.0 ft. refusal. REFUSAL @ 7.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-8	0.0 – 4.0	ML	**ALLUVIUM** (Map Symbol Qal): CLAYEY SILT, brown, dry to slightly moist, soft to firm; rootlets throughout; some sand.
	4.0 – 7.0		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE, fine-grained, light gray, white, slightly moist, moderately hard. @ 6.5 ft. cemented; uniform. @ 7.0 ft. refusal. REFUSAL @ 7.0 FT. NO WATER, NO CAVING
TP-9	0.0 – 2.5	ML	**TOPSOIL** (No Map Symbol): SANDY SILT to CLAYEY SILT, medium brown, dry to slightly moist, soft to firm; calcium carbonate nodules throughout; rootlets throughout.
	2.5 – 10.0		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE, white-light gray, slightly moist, moderately hard; uniform; few 1" pink BENTONITE rip-up clasts. @ 10.0 ft. slow excavation. TOTAL DEPTH 10.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-10	0.0 – 2.0	ML	**TOPSOIL** (No Map Symbol): SANDY SILT to CLAYEY SILT, dark brown, dry, soft to firm; rootlets throughout; some calcium carbonate nodules.
	2.0 – 9.0		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE, light gray, slightly moist, moderately hard; rootlets to 4.0 ft. @ 7.0 ft. slow excavation (uniform). Approximate horizontal contact between beds. @ 7.5 ft. coarser-grained sand component (moderate cementation); moderately hard. TOTAL DEPTH 9.0 FT. NO WATER, NO CAVING
TP-11	0.0 – 2.0	ML	**TOPSOIL** (No Map Symbol): SANDY SILT to CLAYEY SILT, fine-grained, medium brown, dry, soft; roots throughout.
	2.5 – 12.5		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE, fine-grained, light to medium gray, slightly moist, moderately hard to hard; highly weathered to 5.0 ft. @ 12.0 ft. becomes SANDSTONE, white; cemented bed. @ 12.5 ft. refusal REFUSAL @ 12.5 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-12	0.0 – 2.5	ML	**TOPSOIL** (No Map Symbol): SANDY SILT to CLAYEY SILT, medium brown, dry, soft; roots throughout; calcium carbonate nodules throughout.
	2.5 – 11.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE to SILTY SANDSTONE, tan to olive brown, slightly moist, moderately hard; rootlets to 4.0 ft. @ 6.0 ft. some SANDSTONE, coarse; lenses; brown-pink CLAYSTONE to 8.0 ft.; rip-up clasts to 8" diameter. @ 9.0 ft. SILTY SANDSTONE, light brown; uniform. @ 11.0 ft. becomes hard; refusal REFUSAL @ 11.0 FT. NO WATER, NO CAVING
TP-13	0.0 – 3.0	ML	**ALLUVIUM** (Map Symbol Qal): SANDY SILT to CLAYEY SILT, dark brown, dry, slightly moist, soft to firm; rootlets throughout.
	3.0 – 10.0		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE, light gray-white, slightly moist, moderately hard; highly weathered to 5.0 ft. @ 8.0 ft. changes to a poorly graded GRITSTONE, white with coarse-grained clasts to gravel-size; bulk sample taken. @ 10.0 ft. refusal REFUSAL @ 10.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-14	0.0 – 2.5	ML	**ALLUVIUM** (Map Symbol Qal): SANDY SILT to CLAYEY SILT, dark brown, dry, soft; roots throughout; minor clay.
	2.5 – 10.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine- to coarse-grained, white to light gray, poorly graded, slightly moist, moderately hard; rootlets to 4.5 ft.; krotovina to 5.0 ft.; uniform to depth. TOTAL DEPTH 10.0 FT. NO WATER, NO CAVING
TP-15	0.0 – 5.5	CL	**ALLUVIUM** (Map Symbol Qal): SANDY CLAY slightly moist, firm; sand portion is fine- to coarse-grained; rootlets to 5.5 ft.
	5.5 – 14.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine- to coarse-grained light gray-tan, moist, moderately hard; subrounded and angular clasts to 3/4"; poorly graded; highly weathered. @ 12.0 ft. GRITSTONE, fine- to coarse-grained, light gray, moist, moderately hard; less weathered; well consolidated; subrounded and angular clasts. @ 14.0 practical refusal. REFUSAL @ 14.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-16	0.0 – 6.0	ML	**ALLUVIUM** (Map Symbol Qal): CLAYEY SILT, medium brown, slightly moist, soft to firm; rootlets throughout.
	6.0 – 12.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, light gray, slightly moist, moderately hard; sub-angular rock clasts; highly weathered to 10.0 ft. @ 10.0 ft. becomes hard; (unweathered). @ 12.0 ft. practical refusal; (slow excavating). REFUSAL @ 12.0 FT. NO WATER, NO CAVING
TP-17	0.0 – 2.0	ML	**TOPSOIL** (No Map Symbol): CLAYEY SILT, medium brown, dry to slightly moist, soft to firm; rootlets throughout.
	2.0 – 9.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine-grained, light gray-tan, slightly moist, moderately hard; krotovina to 5.0 ft.; moderately weathered; uniform throughout. @ 9.0 ft. slow excavating. TOTAL DEPTH 9.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-18	0.0 – 2.5	ML	**TOPSOIL** (No Map Symbol): SANDY SILT to CLAYEY SILT, medium brown, dry, loose; rootlets throughout.
	2.5 – 10.0		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE, light tan-gray, slightly moist, moderately hard; highly weathered to 6.5 ft.; calcium carbonate filled fractures to 4.5 ft.; roots to 4.5 ft. @ 9.0 ft. slow excavation. TOTAL DEPTH 10.0 FT. NO WATER, NO CAVING
TP-19	0.0 – 4.0	CL	**ALLUVIUM** (Map Symbol Qal): SANDY CLAY, dark brown, slightly moist, firm; roots throughout; calcium carbonate nodules.
	4.0 – 9.5		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine- to coarse-grained, light gray-tan, slightly moist, moderately hard; subrounded clasts to 3/4" inches in diameter; roots to 5.0 ft. @ 9.5 ft. slow excavating. TOTAL DEPTH 9.5 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-20	0.0 – 10.0	CL-ML	**ALLUVIUM** (Map Symbol Qal): SANDY CLAY to CLAYEY SILT, dark brown, slightly moist, firm; rootlets throughout to 8.0 ft.; pinhole porosity; calcium carbonate nodules.
	10.0 – 14.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine- to coarse-grained, light gray-tan, moist, moderately hard; sub-angular coarse sand-sized clasts suspended in a fine SILTY SANDSTONE to SANDY SILTSTONE matrix. @ 10.0 – 13.0 ft. highly weathered; some clays. @ 13.0 ft. slow excavating. TOTAL DEPTH 14.0 FT. NO WATER, NO CAVING
TP-21	0.0 – 5.5	CL	**ALLUVIUM** (Map Symbol Qal): SANDY CLAY, medium dark brown, slightly moist, firm; roots throughout; calcium carbonate nodules throughout.
	5.5 – 10.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine-grained, tan, moist, moderately hard. @ 5.5 – 10.0 ft. highly weathered; coarse sand and sub-angular gravel in a fine matrix. @ 10.0 ft. slow excavating. TOTAL DEPTH 10.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-22	0.0 – 3.0	ML	**ALLUVIUM** (Map Symbol Qal): SANDY SILT to CLAYEY SILT, dry to slightly moist, soft to firm; rootlets throughout.
	3.0 – 9.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine- to coarse-grained, light tan-gray, slightly moist, moderately hard; krotovina to 5.0 ft.; coarse sand to gravel clasts – sub-angular. @ 3.0 ft. rip-up clasts of pink BENTONITE; few (4-6) pieces total. @ 9.0 ft. slow excavation. TOTAL DEPTH 9.0 FT. NO WATER, NO CAVING
TP-23	0.0 – 2.0	ML	**TOPSOIL** (No Map Symbol): SANDY SILT to CLAYEY SILT, fine-grained, medium brown, dry, soft; rootlets throughout.
	2.0 – 8.0		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE to SANDY SILTSTONE, light gray-tan to white, slightly moist, moderately hard; cemented concretions within fine sandstone lenses. @ 8.0 ft. refusal on concretion. REFUSAL @ 8.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-24	0.0 – 2.0	ML-CL	**TOPSOIL** (No Map Symbol): SANDY SILT to SILTY CLAY, medium brown, dry, soft; rootlets throughout.
	2.0 – 8.5		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE to CLAYEY SILTSTONE, light tan gray to brown (CLAYEY SILTSTONE), slightly moist, moderately hard; moderately weathered. @ 4.5 ft. N20W; 5SW strike and dip on CLAYSTONE bed. @ 8.5 ft. slow excavation. TOTAL DEPTH 8.5 FT. NO WATER, NO CAVING
TP-25	0.0 – 2.5	ML	**ALLUVIUM** (Map Symbol Qal): SANDY SILT to CLAYEY SILT, medium brown, dry to slightly moist, soft to firm; rootlets throughout.
	2.5 – 9.5		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE, (white-light gray) SILTY CLAYSTONE (olive-gray), slightly moist, moderately hard; highly weathered to 6.0 ft. @ 6.0 ft SILTY CLAYSTONE (olive-gray), moderately hard; highly fractured. N10W; 5W. @ 9.0 ft. slow excavation. REFUSAL AT 9.5F TOTAL DEPTH 9.5 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-26	0.0 – 2.5	ML	**ALLUVIUM** (Map Symbol Qal): CLAYEY SILT, fine-grained, medium brown, slightly moist, firm; rootlets throughout.
	2.5 – 9.5		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE, fine-grained, light gray-tan, slightly moist, moderately hard; well-cemented concretions 2.0 – 4.0 ft. wide; krotovina to 4.5 ft. TOTAL DEPTH 9.5 FT. NO WATER, NO CAVING
TP-27	0.0 – 4.0	ML	**ALLUVIUM** (Map Symbol Qal): SANDY SILT to CLAYEY SILT, medium brown, dry to slightly moist, loose to moderately dense; rootlets throughout.
	4.0 – 11.0		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE to SILTY CLAYSTONE, fine-grained, light gray-tan, slightly moist, moderately hard; rootlets and krotovina to 5.0 ft.; highly weathered to 8.0 ft. @ 8.0 ft. becomes SILTY CLAYSTONE, brown – orange brown, well consolidated, N15E; 5W bedding surface. @ 11.0 ft. white concretion; hard; refusal. REFUSAL @ 11.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-28	0.0 – 4.0	ML	**ALLUVIUM** (Map Symbol Qal): CLAYEY SILT, fine-grained, medium brown, slightly moist, firm; rootlets throughout.
	4.0 – 14.0		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE to CLAYSTONE (BENTONITE) to GRITSTONE, fine- to coarse-grained, light tan, slightly moist, moderately hard; highly weathered to 11.0 ft. @ 4.0 ft. becomes SILTY SANDSTONE. @ 9.0 ft. BENTONITE, transparent white, pink, light gray; highly fractured; interbedded with SILTY SANDSTONE, N-S; 3-6W (approximate bedding). @ 11.0 ft. GRITSTONE, light brown-olive; angular grains to gravel-size with a CLAYEY SILTSTONE matrix; well consolidated. @ 14.0 ft. slow excavation. TOTAL DEPTH 14.0 FT. NO WATER, NO CAVING
TP-29	0.0 – 3.0	ML	**ALLUVIUM** (Map Symbol Qal): CLAYEY SILT, dark brown, slightly moist, firm; rootlets and calcium carbonate nodules throughout.
	3.0 – 10.0		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE, fine-grained, light gray-brown, slightly moist, moderately hard; highly weathered to 5.0 ft.; some clay; rootlets to 4.0 ft. @ 5.0 ft. krotovina. @ 8.0 ft. SANDSTONE, fine-grained, olive gray, 1/4" pink BENTONITE rip-up clasts throughout. @ 8.5 ft. cemented zone (discontinuous). @ 10.0 ft. slow excavation. TOTAL DEPTH 10.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-30	0.0 – 2.0	ML	**TOPSOIL** (No Map Symbol: SANDY to CLAYEY SILT, fine-grained, medium brown, dry to slightly moist, soft; roots throughout.
	2.0 – 10.0		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE (light olive gray) and CLAYSTONE (light brown), fine-grained, slightly moist, moderately hard. @ 2.0 ft. SILTY SANDSTONE (light olive gray); rootlets to 4.0 ft.; krotovina to 4.0 ft.; approximately horizontal contact. @ 7.0 ft. SILTY CLAYSTONE; uniform. @ 10.0 ft. slow excavating. TOTAL DEPTH 10.0 FT. NO WATER, NO CAVING
TP-31	0.0 – 2.0	ML	**TOPSOIL** (No Map Symbol): SANDY SILT to CLAYEY SILT, medium brown, dry to slightly moist, soft to firm; rootlets throughout.
	2.0 – 11.0		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE, fine-grained, white-light-gray, slightly moist, moderately hard; highly weathered to 5.0 ft.; few concretion lenses; krotovina to 4.5 ft. @ 10.5 ft. moderate cementation; slow excavating. TOTAL DEPTH 11.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-32	0.0 – 3.5	ML	**ALLUVIUM** (Map Symbol Qal): SANDY SILT to CLAYEY SILT, fine-grained, dark brown, slightly moist, firm; rootlets throughout.
	3.5 – 5.5	ML	**OTAY FORMATION** (Map Symbol Oo): SANDY SILT, fine-grained, light brown, moist, firm; angular rocks; pinhole porosity; discontinuous lenses of fine sand 2" thick; probes to 1.0 ft. Terminated pit ≈ close to unmarked large diameter waterlines. TOTAL DEPTH 5.5 FT. NO WATER, NO CAVING
TP-33	0.0 – 8.5	ML	**ALLUVIUM** (Map Symbol Qal): SANDY SILT to CLAYEY SILT, medium brown, slightly moist, firm; rootlets to 6.0 ft.
	8.5 – 12.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, light tan-gray, slightly moist to moist, moderately hard; angular sand to gravel suspended in matrix. @ 8.5 ft. some CLAY; highly weathered. @ 12.0 ft. slow excavating. TOTAL DEPTH 12.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-34	0.0 – 2.0	ML	**TOPSOIL** (No Map Symbol): SANDY SILT to CLAYEY SILT, medium brown, dry to slightly moist, soft to firm; rootlets throughout.
	2.0 – 10.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine- to coarse-grained with gravel, light gray-tan, slightly moist, moderately hard; highly weathered with CLAY to 6.0 ft.; sub-angular clasts to 3/4".
			TOTAL DEPTH 10.0 FT. NO WATER, NO CAVING
TP-35	0.0 – 3.5	ML	**TOPSOIL** (No Map Symbol): SANDY SILT to CLAYEY SILT, medium to dark brown, dry to slightly moist, soft to firm.
	3.5 – 8.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine- to coarse-grained, light tan-gray, slightly moist, moderately hard; highly weathered to 6.0 ft.; some CLAY rip-up clasts (pink BENTONITE); rootlets to 4.5 ft. @ 8.0 ft. slow excavating.
			TOTAL DEPTH 8.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-36	0.0 – 6.0	ML	**ALLUVIUM** (Map Symbol Qal): SANDY SILT to CLAYEY SILT, medium brown, moist, firm; rootlets; calcium carbonate nodules throughout.
	6.0 – 11.0		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE to GRITSTONE, fine- to coarse-grained, light brown-gray, moist, moderately hard; few cobble-sized clasts. @ 6.0 ft. some CLAY; highly weathered. @ 11.0 ft. slow excavating. TOTAL DEPTH 11.0 FT. NO WATER, NO CAVING
TP-37	0.0 – 1.0	ML	**TOPSOIL** (No Map Symbol): SANDY SILT, fine-grained, medium brown, dry, soft; rootlets throughout.
	1.0 – 6.0		**OTAY FORMATION** (Map Symbol Oo): SANDY SILTSTONE to SILTY SANDSTONE, fine-grained, white-light gray, slightly moist, moderately hard; few carbonate filled fractures; moderately weathered to 3.0 ft.; few coarse SAND grains. @ 3.0 ft. changes to GRITSTONE with gravel-sized angular clasts; hard; moderate cementation. @ 6.0 ft. refusal. REFUSAL @ 6.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-38	0.0 – 2.0	ML	**TOPSOIL** (No Map Symbol): SANDY SILT, fine-grained, medium brown, dry, soft; roots throughout; some clay.
	2.0 – 7.0		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE to SANDY SILTSTONE, to fine- to coarse-grained, light gray-tan, slightly moist, moderately hard; moderately weathered. @ 7.0 ft. becomes hard; calcium carbonate cemented concretion; refusal. REFUSAL @ 7.0 FT. NO WATER, NO CAVING
TP-39	0.0 – 2.5	ML	**TOPSOIL** (No Map Symbol): CLAYEY SILT, medium brown, dry, slightly moist, soft to firm; rootlets throughout; few lenses of coarse sand at the Otay Formation contact.
	2.5 – 6.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine- to coarse-grained, light gray-tan, slightly moist, moderately hard; gravel to cobble-size clasts to 3"; angular to subrounded; highly weathered to 4.5 ft. @ 6.0 ft. refusal. REFUSAL @ 6.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-40	0.0 – 3.5	CL	**ALLUVIUM** (Map Symbol Qal): SANDY CLAY, black, dry, soft; sand portion is fine- to medium-grained; some coarse-grained sand; planted. @ 0.5 ft becomes slightly moist; some carbonate nodules.
	3.5 – 10.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine- to coarse-grained SANDSTONE in a CLAYSTONE matrix, white, moist, soft; rare krotovina; abundant carbonates. @ 4.5 ft. some cobbles. @ 5.5 ft. becomes pale orange-pale brown, moderately hard. @ 8.0 ft. becomes slow excavating. TOTAL DEPTH 10.0 FT. NO WATER, NO CAVING
TP-41	0.0 – 3.5	CL-ML	**ALLUVIUM** (Map Symbol Qal): SANDY CLAY to SANDY SILT, dark brown, slightly moist, soft to firm; roots throughout; calcium carbonate nodules.
	3.5 – 8.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine- to coarse-grained to gravel to 3/4" diameter, light tan-gray, white; highly weathered to 6.0 ft. @ 6.0 ft. higher concentration of coarser angular gravel-sized clast to 3/4" diameter. @ 8.0 ft. slow excavating. TOTAL DEPTH 8.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-42	0.0 – 12.0	SM	**ARTIFICIAL FILL UNDOCUMENTED** (Map Symbol afu): SILTY SAND, fine-grained, dry to slightly moist, loose; caving (entire depth).
	12.0 – 16.0	ML	**ALLUVIUM** (Map Symbol Qal): CLAYEY SILT, medium dark brown, moist, firm; rootlets.
	16.0 – 18.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine- to coarse-grained, moist, moderately dense; highly weathered. @ 18.0 ft. terminated pit due to caving. TOTAL DEPTH 18.0 FT. NO WATER, CAVING AS NOTED
TP-43	0.0 – 3.0	CL	**ALLUVIUM** (Map Symbol Qal): SILTY CLAY, dark brown, moist, soft to firm; roots throughout.
	3.0 – 4.0		**SANTIAGO PEAK VOLCANICS** (Map Symbol Jsp): METAVOLCANIC ROCK, slightly moist, very hard; fine crystalline. @ 4.0 ft. refusal. REFUSAL @ 4.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-44	0.0 – 2.5	ML	**TOPSOIL** (No Map Symbol): SANDY SILT to CLAYEY SILT, dark brown, slightly moist, soft to firm; rootlets throughout; calcium carbonate nodules throughout.
	2.5 – 7.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, light gray-tan, slightly moist, moderately hard; highly weathered to 4.5 ft.; some CLAY. @ 4.5 ft. krotovina; angular and sub-angular clasts to 1" diameter. @ 7.0 ft. slow excavating. TOTAL DEPTH 7.0 FT. NO WATER, NO CAVING
TP-45	0.0 – 2.0	ML	**TOPSOIL** (No Map Symbol): SANDY SILT to CLAYEY SILT; medium dark brown, dry to slightly moist, soft to firm; rootlets throughout.
	2.0 – 9.5		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE, fine-grained, light olive brown, slightly moist, moderately hard; rootlets and krotovina to 4.5 ft.; moderately weathered. TOTAL DEPTH 9.5 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-46	0.0 – 3.0	CL	**ALLUVIUM** (Map Symbol Qal): SANDY CLAY, fine-grained, medium brown, slightly moist, firm; common SILT; calcium carbonate nodules throughout; rootlets throughout; few metavolcanic angular rocks to 6" diameter.
	3.0 – 6.0		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE, fine-grained, light tan, slightly moist, moderately hard; few metavolcanic angular rocks to 8" diameter.
	6.0 – 7.0		**SANTIAGO PEAK VOLCANICS** (Map Symbol Jsp): METAVOLANIC ROCK, olive gray, slightly moist, hard; some CLAY in joints. @ 7.0 ft. refusal. REFUSAL @ 7.0 FT. NO WATER, NO CAVING
TP-47	0.0 – 4.0	CL-ML	**TOPSOIL** (No Map Symbol): SANDY CLAY to CLAYEY SILT, fine-grained, dark brown, slightly moist, firm; rootlets throughout to 8.0 ft., pinhole porosity; calcium carbonate nodules.
	4.0 – 11.0		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE, fine-grained, light tan, slightly moist, moderately hard. @ 4.0 ft. highly weathered; pinhole porosity. @ 8.0 ft. moderately hard; uniform. @ 11.0 ft. slow excavation. TOTAL DEPTH 11.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-48	0.0 – 4.0	ML	**TOPSOIL** (No Map Symbol): CLAYEY SILT fine-grained, brown, slightly moist, firm; rootlets throughout; few subrounded METAVOLCANIC ROCK clasts.
	4.0 – 7.0		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE, fine-grained, light gray brown, slightly moist, moderately hard; highly weathered to 6.0 ft. with some CLAY; krotovina to 6.0 ft. @ 7.0 ft. less weathered; slow excavation. TOTAL DEPTH 7.0 FT. NO WATER, NO CAVING
TP-49	0.0 – 1.5	ML	**TOPSOIL** (No Map Symbol): SANDY SILT to CLAYEY SILT, fine-grained, brown, dry, soft; rootlets throughout.
	1.5 – 8.0		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE, fine-grained, light gray to brown-gray, slightly moist, moderately hard; highly weathered with pinhole porosity to 4.0 ft.; krotovina to 4.5 ft. @ 8.0 ft. slow excavating. TOTAL DEPTH 8.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-50	0.0 – 1.0	ML	**TOPSOIL** (No Map Symbol): SANDY SILT, fine-grained, brown, dry, soft; rootlets throughout.
	1.0 – 8.0		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE, fine-grained, light gray-tan to light pink, slightly moist, moderately hard; highly weathered to 4.0 ft.; pinhole porosity to 4.0 ft.; calcium carbonate filled fractures to 4.0 ft. @ 8.0 ft. concretion; well-cemented; practical refusal. REFUSAL @ 8.0 FT. NO WATER, NO CAVING
TP-51	0.0 – 2.5	ML	**ALLUVIUM** (Map Symbol Qal): SANDY SILT to CLAYEY SILT, fine-grained, medium brown, slightly moist, firm; calcium carbonate nodules throughout.
	2.5 – 8.0		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE, SILTY CLAYSTONE, fine-grained, white to light brown to olive brown, moderately hard; highly weathered to 4.0 ft.; calcium carbonate filled fractures. @ 6.0 ft. discontinuous BENTONITE lenses [white with black staining (speckled)]. @ 7.0 ft. bedding contact SANDSTONE to CLAYSTONE; N10E; 8W bedding surface. @ 8.0 ft. practical refusal; (slow excavating). REFUSAL @ 8.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-52	0.0 – 3.0	ML	**TOPSOIL** (No Map Symbol): SANDY to CLAYEY SILT, fine-grained, brown, slightly moist, firm; rootlets throughout.
	3.0 – 11.5		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE, fine-grained, light gray to light tan, slightly moist, moderately hard; highly weathered to 8.0 ft.; calcium carbonate filled fractures; some CLAY; roots to 5.0 ft. @ 11.5 ft. slow excavating. TOTAL DEPTH 11.5 FT. NO WATER, NO CAVING
TP-53	0.0 – 2.5	ML	**TOPSOIL** (No Map Symbol): CLAYEY SILT, fine-grained, brown, dry to slightly moist, firm; rootlets throughout; few clasts to 2" diameter.
	2.5 – 8.5		**SANTIAGO PEAK VOLCANICS** (Map Symbol Jsp): METAVOLCANIC ROCK, light olive brown, slightly moist, moderately hard to hard; highly weathered; CLAY to depth within fractures. @ 8.5 ft. refusal. REFUSAL @ 8.5 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-54	0.0 – 3.0	ML	**ALLUVIUM** (Map Symbol Qal): CLAYEY SILT, fine-grained, brown, dry to slightly moist, firm; rootlets throughout.
	3.0 – 13.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine-grained matrix with angular clasts from coarse SAND to 3" rock, light brown, slightly moist, moderately hard; rootlets to 6.0 ft.; highly weathered; pinhole porosity. @ 13.0 ft. GRITSTONE, uniform, moderately hard; angular clasts to 1/4" maximum within a CLAYEY SILT matrix; slow excavating. TOTAL DEPTH 13.0 FT. NO WATER, NO CAVING
TP-55	0.0 – 2.0	ML	**TOPSOIL** (No Map Symbol): CLAYEY SILT, fine-grained, brown, slightly moist, firm; rootlets throughout.
	2.0 – 7.0		**OTAY FORMATION** (Map Symbol Oo): SILTY SANDSTONE, light tan, slightly moist, moderately hard; highly weathered to 5.0 ft. with calcium carbonate filled fractures. @ 5.0 ft. moderately cemented concretions. @ 7.0 ft. slow excavating. TOTAL DEPTH 7.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-56	0.0 – 5.0	ML	**ALLUVIUM** (Map Symbol Qal): SANDY SILT to CLAYEY SILT, dark brown, slightly moist, firm; rootlets throughout. @ 2.0 ft. southern edge of pit – abandoned 4" steel pipe running east to west; few angular metavolcanic rocks.
	5.0 – 10.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine- to coarse grained, light brown, slightly moist, moderately hard; highly weathered to 8.0 ft.; subrounded grains. @ 10.0 ft. refusal. REFUSAL @ 10.0 FT. NO WATER, NO CAVING
TP-57	0.0 – 2.0	ML	**TOPSOIL** (No Map Symbol): SANDY SILT to CLAYEY SILT, fine-grained, brown, dry to slightly moist, firm; rootlets and calcium carbonate nodules throughout.
	2.0 – 9.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, light brown-gray, slightly moist, moderately hard, fine-grained CLAY-SILT matrix with suspended coarse sand to gravel; rootlets and krotovina to 4.5 ft.; highly weathered to 7.0 ft. @ 9.0 ft. slow excavation; (practical refusal). REFUSAL @ 9.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-58	0.0 – 4.0	ML	**ALLUVIUM** (Map Symbol Qal): SANDY SILT to CLAYEY SILT, fine-grained, dark brown, slightly moist, firm; rootlets throughout.
	4.0 – 5.5		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine- to coarse-grained, light tan-gray, slightly moist, moderately hard; well consolidated. @ 5.5 ft. refusal. REFUSAL @ 5.5 FT. NO WATER, NO CAVING
TP-59	0.0 – 1.0	ML	**TOPSOIL** (No Map Symbol): SANDY SILT to CLAYEY SILT, fine-grained, medium to dark brown, dry, firm; rootlets throughout.
	1.0 – 9.0		**OTAY FORMATION** (Map Symbol Oo): SANDSTONE, fine- to coarse-grained, light brown, slightly moist, moderately hard; well consolidated; highly weathered to 6.0 ft.; krotovina to 4.5 ft.; few lenses of gravel. @ 9.0 ft. refusal. REFUSAL @ 9.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-60	0.0 – 1.0	ML	**TOPSOIL** (No Map Symbol): SANDY SILT to CLAYEY SILT, orange brown, slightly moist, moderately dense; roots throughout.
	1.0 – 8.5	SC	**TERRACE DEPOSIT** (Map Symbol Qt): CLAYEY SAND with cobble; fine-grained, orange brown, slightly moist, dense; rounded cobble to 6". @ 7.0 ft. high concentration of granitic- and SANTIAGO PEAK VOLCANIC-derived cobble; slow excavation. TOTAL DEPTH 8.5 FT. NO WATER, NO CAVING
TP-61	0.0 – 3.5	SM-SC	**TERRACE DEPOSIT** (Map Symbol Qt): SILTY SAND to CLAYEY SAND with cobble, fine-grained, orange brown, slightly moist, dense; top 1.5 ft. CLAY and roots (disturbed with disk); some calcium carbonate nodules throughout. @ 3.5 ft. well consolidated; cobble to 8" diameter (subround to round); refusal. REFUSAL @ 3.5 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-62	0.0 – 1.5	ML	**TOPSOIL** (No Map Symbol): CLAYEY SILT, fine-grained, medium brown, dry to slightly moist, firm; rootlets throughout; cobble throughout.
	1.5 – 3.0	SM-SC	**TERRACE DEPOSIT** (Map Symbol Qt): SILTY SAND to CLAYEY SAND with cobble; fine-grained, orange brown, slightly moist, dense; high concentration subrounded cobble. @ 3.0 ft. refusal on cobble. REFUSAL @ 3.0 FT. NO WATER, NO CAVING
TP-63	0.0 – 1.5	ML	**TOPSOIL** (No Map Symbol): CLAYEY SILT to SANDY SILT, fine-grained, dark, brown, dry to slightly moist, firm; rootlets and calcium carbonate nodules throughout.
	1.5 – 15.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, light olive brown to orange brown, slightly moist, moderately hard, coarse-grained SAND to gravel-sized clasts within a CLAYEY SILT matrix; highly weathered to 9.0 ft.; calcium carbonate filled fracturing to 9.0 ft. @ 15.0 ft. excavatable to depth. TOTAL DEPTH 15.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-64	0.0 – 3.0	ML-CL	**TOPSOIL** (No Map Symbol): CLAYEY SILT to SILTY CLAY, fine-grained, dark brown, slightly moist, firm; rootlets and calcium carbonate nodules throughout.
	3.0 – 10.0	SM-SP	**TERRACE DEPOSIT** (Map Symbol Qt): SILTY SAND to GRAVELLY SAND with cobble; orange brown, slightly moist, dense; well consolidated; 2 – 4" cobble; discontinuous lenses of gravel. @ 10.0 ft. well consolidated with high concentration of cobble; ≈ slow excavating. TOTAL DEPTH 10.0 FT. NO WATER, NO CAVING
TP-65	0.0 – 2.0	ML	**TOPSOIL** (No Map Symbol): CLAYEY SILT, dark, brown, dry to slightly moist, soft to firm; rootlets throughout.
	2.0 – 8.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine- to coarse-grained, white-light tan, slightly moist, moderately hard; angular grains to gravel-size (≈ 1/4") calcium carbonate filled fractures and joints. @ 2.0 ft. orange weathered zone. @ 8.0 ft. well consolidated; slow excavation. TOTAL DEPTH 8.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-66	0.0 – 3.0	ML	**ALLUVIUM** (Map Symbol Qal): CLAYEY SILT, fine-grained, dark brown, slightly moist, firm; rootlets throughout; few subrounded rocks to 6" diameter.
	3.0 – 8.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine- to coarse-grained SAND and GRAVEL component, white-light tan, slightly moist, moderately hard; uniform; highly weathered to 6.0 ft. with calcium carbonate staining. @ 8.0 ft. well consolidated; refusal. REFUSAL @ 8.0 FT. NO WATER, NO CAVING
TP-67	0.0 – 2.0	CL	**TOPSOIL** (No Map Symbol): SANDY CLAY, dark brown, dry, firm; sand portion is fine- to medium-grained; some coarse-grained sand; planted. @ 1.5 ft. becomes slightly moist; some carbonate nodules; rare cobbles; rare rootlets.
	2.0 – 7.0		**TERRACE DEPOSIT** (Map Symbol Qt): GRITSTONE, fine- to coarse-grained SANDSTONE in a SILTSTONE matrix, light orange-light brown, slightly moist, soft; weathered; some fine-grained gravel. @ 4.5 ft. becomes pale orange to pale brown, moist, moderately hard. @ 6.0 ft. becomes difficult excavating. @ 7.0 ft. refusal. REFUSAL @ 7.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-68	0.0 – 1.5	SM	**TOPSOIL** (No Map Symbol): COBBLEY SILTY SAND, fine- to coarse-grained, medium brown, dry, loose; planted; cobbles up to 10". @ 1.0 ft. becomes slightly moist.
	1.5 – 5.5	SM-SP	**TERRACE DEPOSIT** (Map Symbol Qt): SILTY SAND to GRAVELLY SAND with cobble; fine- to coarse-grained, pale orange-pale brown, slightly moist, medium dense; weathered; some carbonates. @ 3.0 ft. becomes moist, dense; increase in fine- and coarse-grained gravel; some cobble (up to 4"); becomes difficult excavating. @ 5.5 ft. refusal on cobbles. REFUSAL @ 5.5 FT. NO WATER, NO CAVING
TP-69	0.0 – 3.5	SC	**TOPSOIL** (No Map Symbol): CLAYEY SAND, fine- to medium-grained, some coarse-grained sand, dark brown, dry, loose; rooted; common porosity up to 1/8". @ 1.0 ft. becomes slightly moist, moderately dense; some carbonate nodules; increase in clay content.
		CL	@ 1.5 ft. becomes SANDY CLAY, dark brown, moist, firm; sand portion is fine- to coarse-grained. @ 2.0 ft. rare cobbles up to 4".
	3.5 – 13.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine- to coarse-grained SANDSTONE in a CLAYSTONE matrix, light orange, moist, soft; highly weathered; some carbonates. @ 6.5 ft. becomes light orange to light brown, moderately hard; unweathered. @ 12.0 ft. becomes difficult excavating. TOTAL DEPTH 13.0 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-70	0.0 – 3.5	CL	**ALLUVIUM** (Map Symbol Qal): SANDY CLAY, dark brown, dry, loose; rooted; some porosity up to 1/8"; sand portion is fine- to medium-grained. @ 2.0 ft. becomes slightly moist; some carbonate nodules.
	3.5 – 4.5		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine- to coarse-grained SANDSTONE in a CLAYSTONE matrix, pale brown, moist, hard. @ 4.5 ft. refusal. REFUSAL @ 4.5 FT. NO WATER, NO CAVING
TP-71	0.0 – 3.5	SM	**TOPSOIL** (No Map Symbol): SILTY SAND, fine- to medium-grained, some coarse-grained SAND, dark brown, dry, loose; planted.
		CL	@ 1.5 ft. becomes SANDY CLAY, dark brown, moist, stiff; sand portion is fine- to medium-grained. @ 2.0 ft. some fine- and coarse-grained gravel. @ 2.5 ft. some cobbles at contact with underlying OTAY FORMATION.
	3.5 – 5.5		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine- to coarse-grained SANDSTONE in a SILTSTONE matrix, pale orange to pale brown, moist, moderately hard. @ 4.0 ft. becomes hard; difficult excavating. @ 5.5 ft. refusal. REFUSAL @ 5.5 FT. NO WATER, NO CAVING

TABLE I continued

LOG OF TEST PITS

Test Pit No.	Depth (ft.)	USCS	Description
TP-72	0.0 – 3.0	CL	**TOPSOIL** (No Map Symbol): SANDY CLAY, dark brown, dry, soft; sand portion is fine- to medium-grained; some coarse-grained sand. @ 1.0 ft. becomes slightly moist, firm; some carbonate nodules; some fine-grained gravel.
	3.0 – 11.0		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine- to coarse-grained SANDSTONE in a SILTSTONE matrix, white, slightly moist, soft; weathered. @ 5.5 ft. becomes orange to light brown, moderately hard; unweathered. @ 7.5 ft. becomes pale brown, some fine- and coarse-grained gravel. @ 9.5 ft. some cobble up to 6"; becomes difficult excavating. TOTAL DEPTH 11.0 FT. NO WATER, NO CAVING
TP-73	0.0 – 2.0	CL	**TOPSOIL** (No Map Symbol): SANDY CLAY, fine- to medium-grained, some coarse-grained SAND, dark brown, dry, soft; trace of fine-grained gravel; rooted.
	2.0 – 6.5		**OTAY FORMATION** (Map Symbol Oo): GRITSTONE, fine- to coarse-grained SANDSTONE in a SILTSTONE matrix, white, slightly moist, soft; weathered; abundant carbonates. @ 4.5 ft. becomes pale orange to pale brown, moist, moderately hard. @ 5.5 ft. becomes hard. @ 6.5 ft. refusal. REFUSAL @ 6.5 FT. NO WATER, NO CAVING

APPENDIX C

LABORATORY TESTING

DESCRIPTION OF PSE's LABORATORY ANALYSES

Moisture Density Determinations

Moisture and density determinations were made by direct measurements on undisturbed samples to provide in-situ information of the various materials. The results of these tests are shown on the logs of borings [Plates A-1 through A-16 (Appendix B)] and Table II.

Compaction Characteristics

Maximum densities and optimum moistures were determined for selected samples in accordance with ASTM: D-1557. Results are presented in Table II.

Hydrometer Analyses

Hydrometer grain size analyses were performed on the minus No. 10 sieve portion of selected samples. These tests were used as an aid in soil classification. The results of these tests are shown on Table II.

Expansion Index Testing

Expansion index testing was performed on selected samples in accordance with the expansion index UBC Standard No. 18-2. Results are presented in Table II.

Direct Shear Tests

Direct shear tests were performed on samples, which were remolded to 90 percent of the laboratory maximum density, and on undisturbed specimens. Samples were tested after inundation and confinement for 24 hours. Tests were made under various normal loads at a constant rate of strain of 0.01 or 0.05 inches per minute. Shear test data are presented in Table II and on Plates B-1 through B-14.

Chemical/Resistivity

Chemical/resistivity testing was conducted by others and is presented on Plates C-1 through C-13.

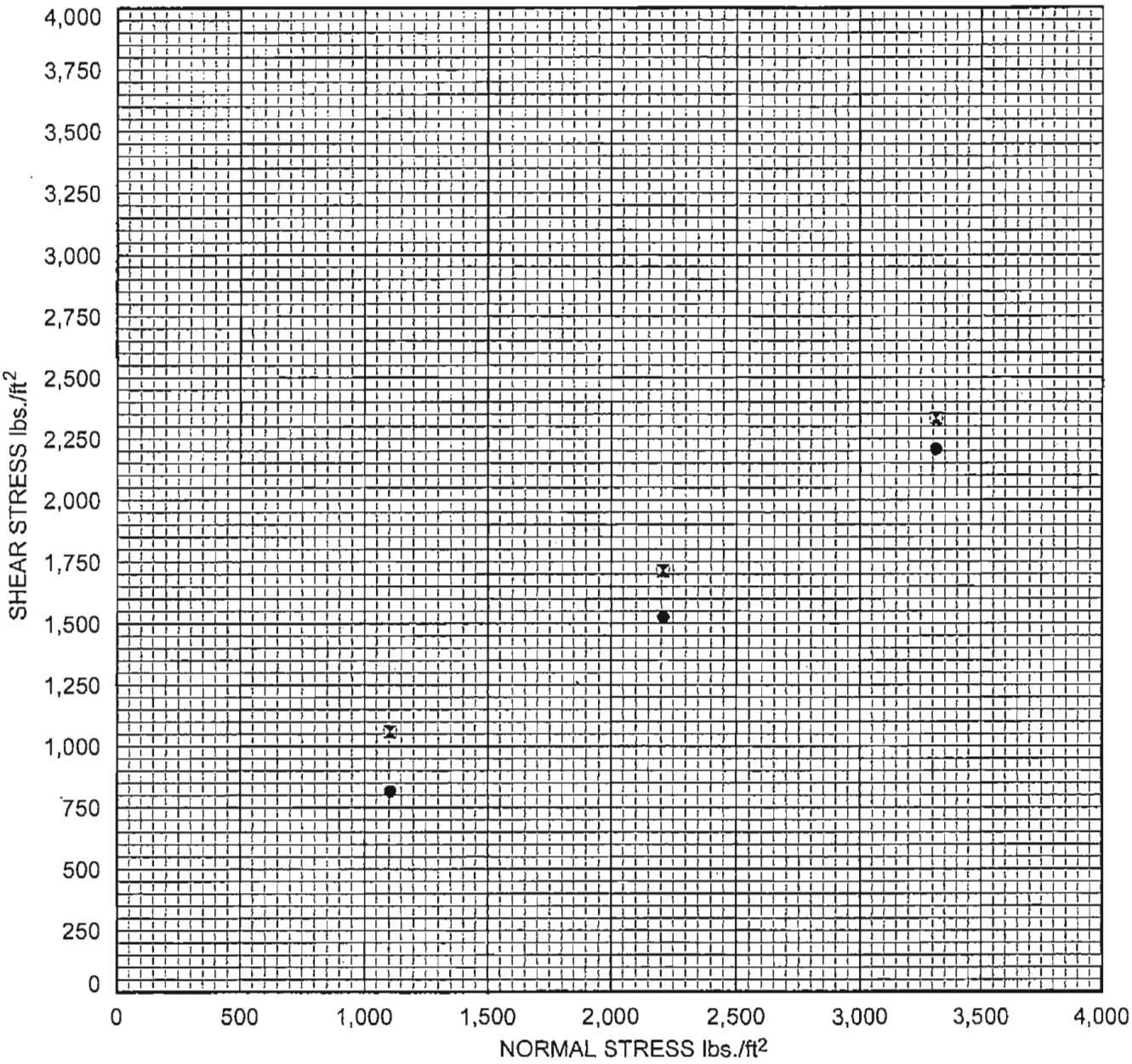
TABLE II
SUMMARY OF LABORATORY TEST DATA
W.O. 400948B

BORING	DEPTH (FEET)	SOIL DESCRIPTION	GROUP SYMBOL	MAXIMUM DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)	IN-SITU DRY DENSITY (PCF)	IN-SITU MOISTURE CONTENT (%)	DEGREE OF SATURATION (%)	PLUS NO.4 SIEVE (%)	COARSE SAND (%)	MEDIUM TO FINE SAND (%)	SILT (0.075mm - 0.005mm) (%)	CLAY (minus 0.005mm) (%)	EXPANSION INDEX UBC 18-2	COHESION (PSF)	FRICTION ANGLE (DEGREES)	OTHER TESTS REMARKS
BA-07	25	SANDY SILTSTONE (Oo)							0	3	16	49	33	72			
BA-08	36	SILTY SANDSTONE (Oo)		114.4	14.1				0	0	77	13	10	0	116	29.5	Remolded Shear, Chemical Analysis
BA-09	30	SILTY SANDSTONE (Oo)				115.4	14.0	82	0	0	52	38	10		135	34	Undisturbed Shear
BA-09	60	SANDY SILTSTONE (Oo)				106.0	15.9	73	0	0	40	47	13				
BA-11	30	SANDY SILTSTONE (Oo)		111.6	16.9				0	2	46	31	21	50			Chemical Analysis
BA-12	31	METAVOLCANIC ROCK (Jsp)		126.3	10.8				47	29	17	3	4	2			Chemical Analysis
BA-13	20	GRITSTONE (Oo)		122.5	12.4				14	23	43	11	9	12	175	35	Remolded Shear, Chemical Analysis
BA-14	15	GRITSTONE (Oo)		126.9	9.9				12	24	42	13	9		70	36.5	Remolded Shear, Chemical Analysis
BA-14	25	GRITSTONE (Oo)				123.4	8.3	61	1	24	57	10	8		0	43	Undisturbed Shear
BA-15	10	GRITSTONE (Oo)				123.3	5.8	43	11	25	43	12	9		420	33.5	Undisturbed Shear
BA-16	10	GRITSTONE (Oo)		124.9	10.6				17	19	42	11	11	0	60	36	Remolded Shear, Chemical Analysis
BA-16	20	GRITSTONE (Oo)				114.9	5.6	32	7	15	63	9	6		500	31	Undisturbed Shear
TP-46	2.5	SANDY CLAY (Qal)	CL	111.9	16.2				2	9	16	19	54				
TP-60	4.5	CLAYEY SAND with GRAVEL (Qt)	SC	137.3	7.7				62	3	32	4	9				

TABLE II
SUMMARY OF LABORATORY TEST DATA
W.O. 400948B

BORING	DEPTH (FEET)	SOIL DESCRIPTION	GROUP SYMBOL	MAXIMUM DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)	IN-SITU DRY DENSITY (PCF)	IN-SITU MOISTURE CONTENT (%)	DEGREE OF SATURATION (%)	PLUS NO.4 SIEVE (%)	COARSE SAND (%)	MEDIUM TO FINE SAND (%)	SILT (0.075mm - 0.005mm) (%)	CLAY (minus 0.005mm) (%)	EXPANSION INDEX UBC 18-2	COHESION (PSF)	FRICTION ANGLE (DEGREES)	OTHER TESTS REMARKS
BA-01	15	SANDY SILTSTONE (Oo)		96.7	23.5				0	2	21	62	15	32	125	32	Remolded Shear, Chemical Analysis
BA-02	15	SANDY SILTSTONE (Oo)				108.2	17.4	80	0	0	42	45	13		0	39	Undisturbed Shear
BA-02	35	SANDY SILTSTONE (Oo)				105.7	20.3	92	0	0	40	47	13		0	35	Undisturbed Shear
BA-04	20	SANDY SILTSTONE (Oo)				100.4	18.6	74	0	0	23	67	10		540	28	Undisturbed Shear
BA-05	15	SANDY SILTSTONE (Oo)		107.0	17.5				0	2	17	68	13	81	125	31	Remolded Shear, Chemical Analysis
TP-05	9	SANDY CLAYSTONE (Oo)		111.0	17.0				0	13	34	13	40				
TP-15	3	SANDY CLAY (Qal)	CL	112.5	15.9				0	15	32	12	41	112	560	25	Remolded Shear, Chemical Analysis
TP-28	10	BENTONITE (Oo)							0	3	9	40	48	227			

DIRECT SHEAR TEST
REMOLDED @ 90%



SANDY SILTSTONE (Oo)	COHESION	125 psf.
note: cohesion and friction angle derived from residual values	FRICTION ANGLE	32 degrees

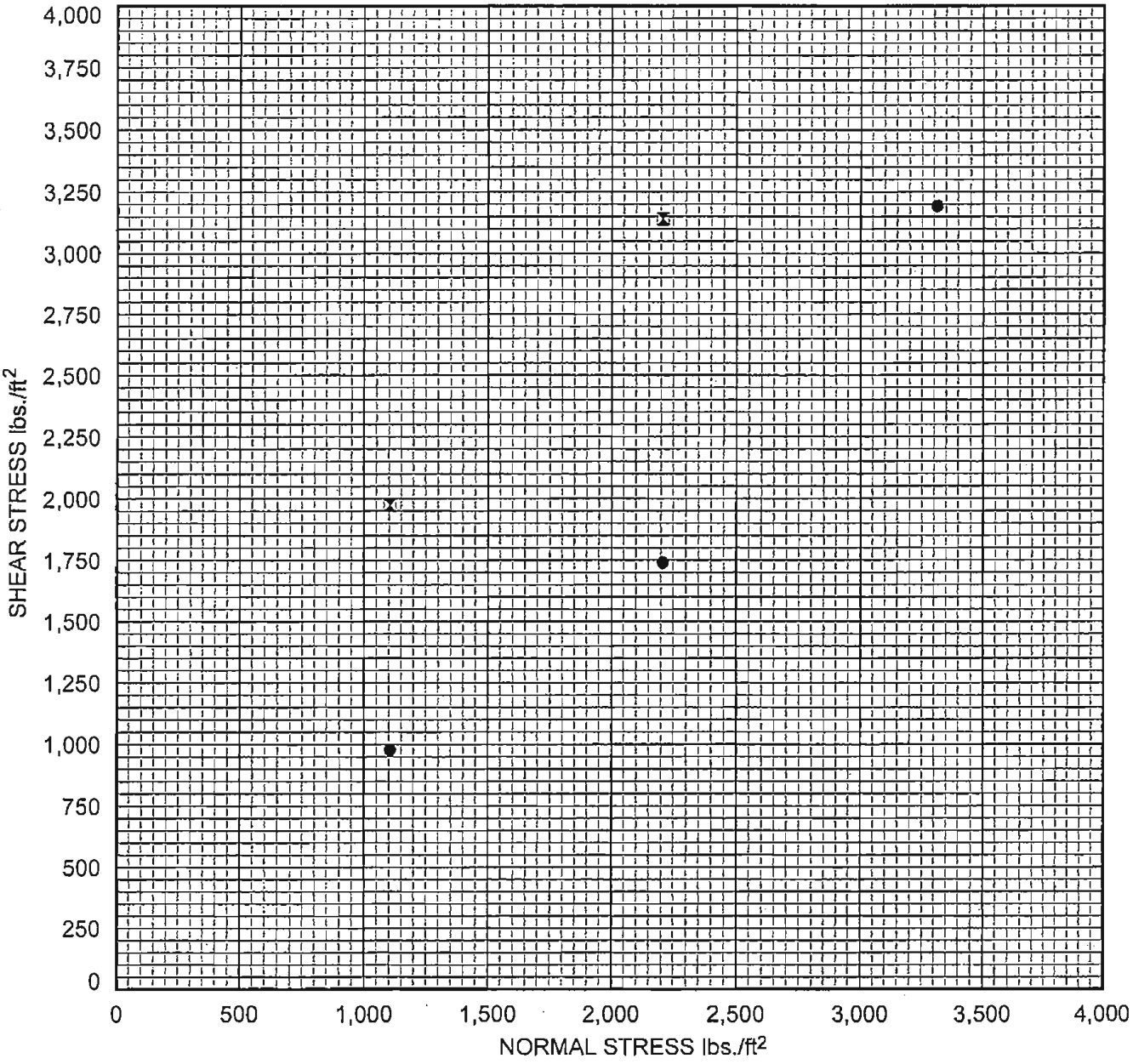
symbol	shear value	boring / soil type	depth (ft.)
●	residual	BA-01	15.0
⧗	peak	BA-01	15.0

DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court. S.D. CA 92111
(858) 560-1713

W.O.400948B PLATE B-1

DIRECT SHEAR TEST
UNDISTURBED



SANDY SILTSTONE (Oo)	COHESION	0 psf.
note: cohesion and friction angle derived from residual values	FRICTION ANGLE	39 degrees

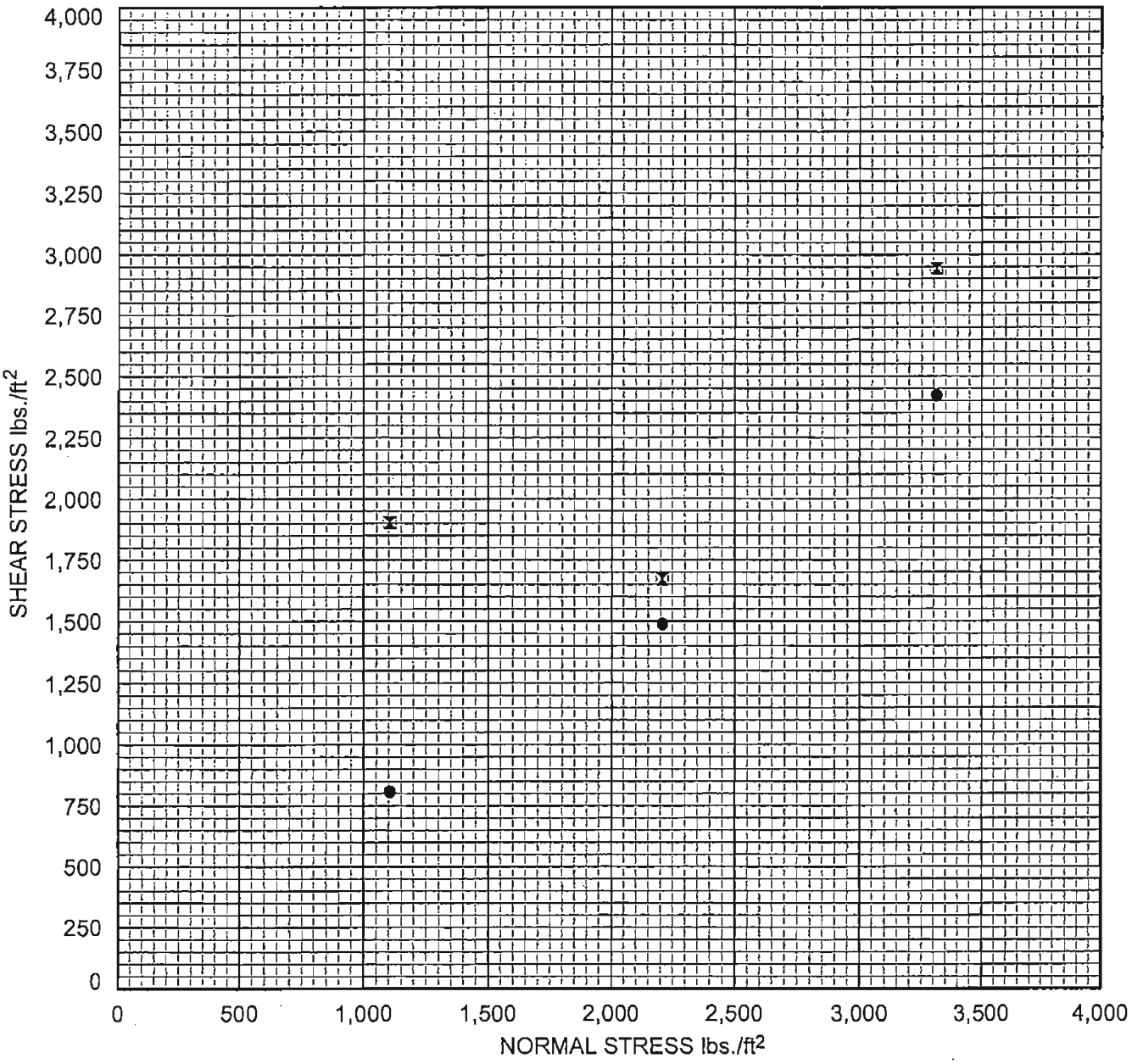
symbol	shear value	boring / soil type	depth (ft.)
●	residual	BA-02	15.0
⊠	peak	BA-02	15.0

DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, S.D. CA 92111
(858) 560-1713

W.O.400948B PLATE B-2

DIRECT SHEAR TEST
UNDISTURBED



SANDY SILTSTONE (Oo)	COHESION	0 psf.
note: cohesion and friction angle derived from residual values	FRICTION ANGLE	35 degrees

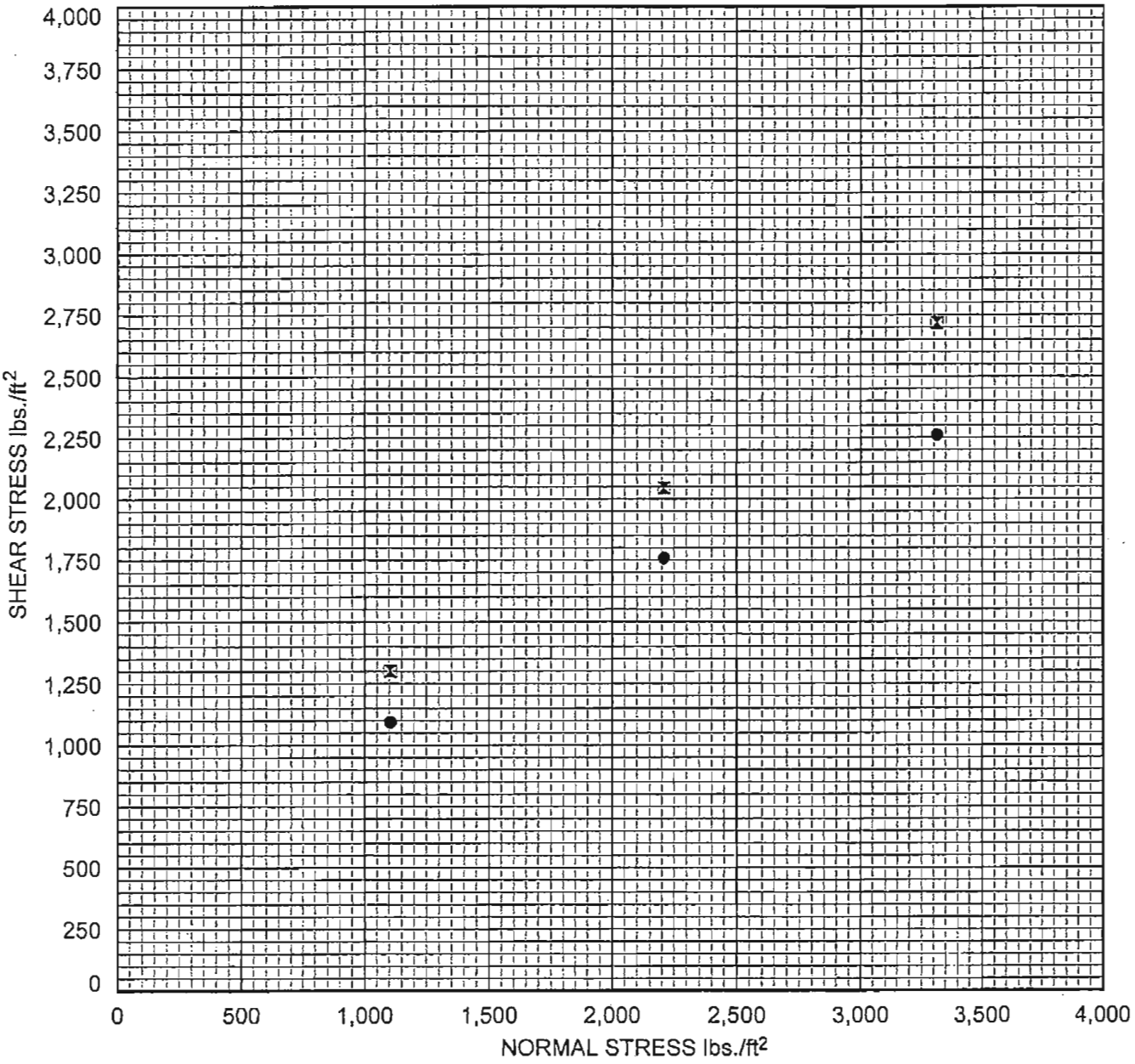
symbol	shear value	boring / soil type	depth (ft.)
●	residual	BA-02	35.0
⧗	peak	BA-02	35.0

DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, S.D. CA 92111
(858) 560-1713

W.O.400948B PLATE B-3

DIRECT SHEAR TEST
UNDISTURBED



SANDY SILTSTONE (Oo)	COHESION	540 psf.
note: cohesion and friction angle derived from residual values	FRICTION ANGLE	28 degrees

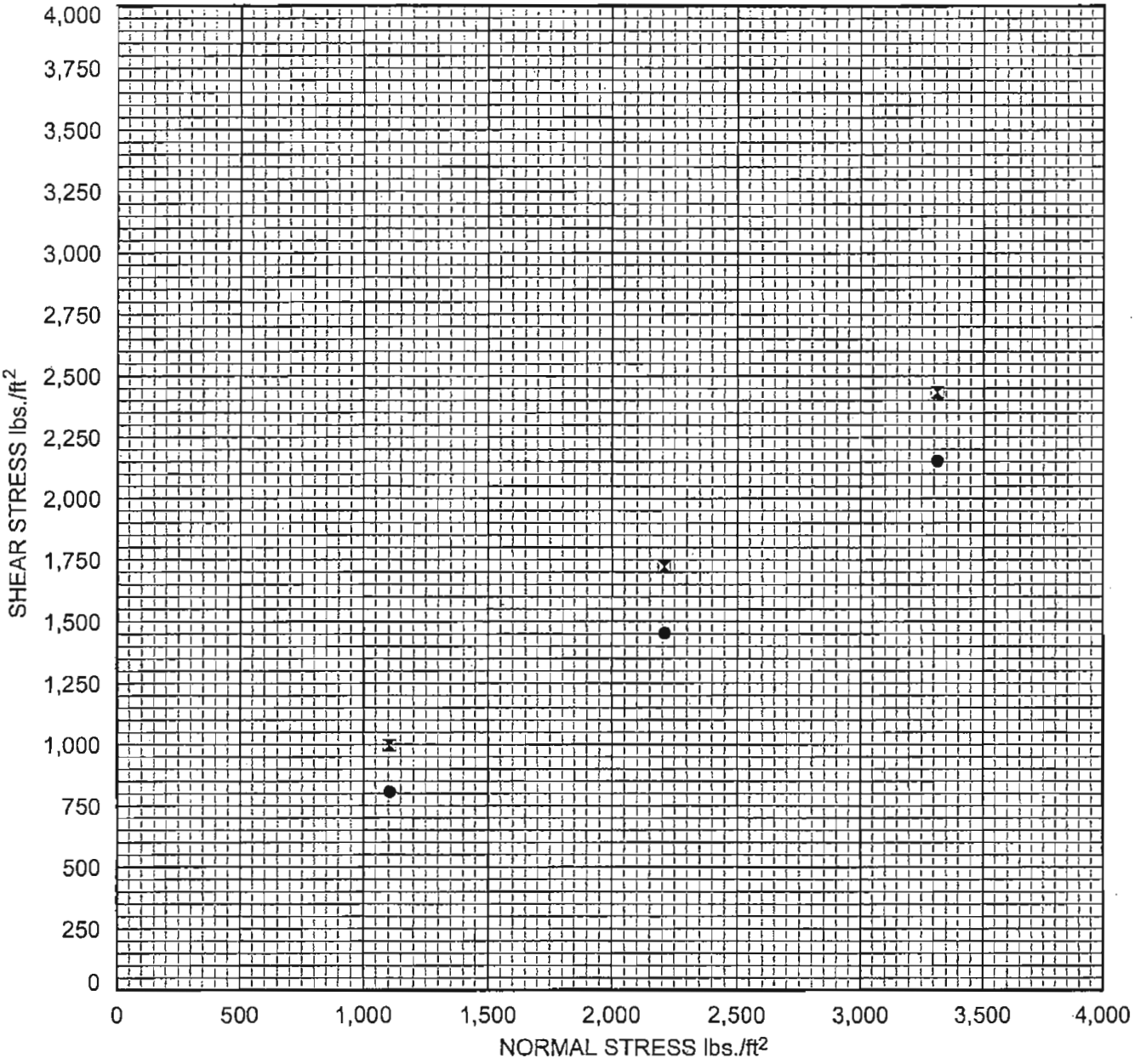
symbol	shear value	boring / soil type	depth (ft.)
●	residual	BA-04	20.0
⧗	peak	BA-04	20.0

DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, S.D. CA 92111
(858) 560-1713

W.O.400948B PLATE B-4

DIRECT SHEAR TEST
REMOLDED @ 90%



SANDY SILTSTONE (Oo)	COHESION	125 psf.
note: cohesion and friction angle derived from residual values	FRICTION ANGLE	31 degrees

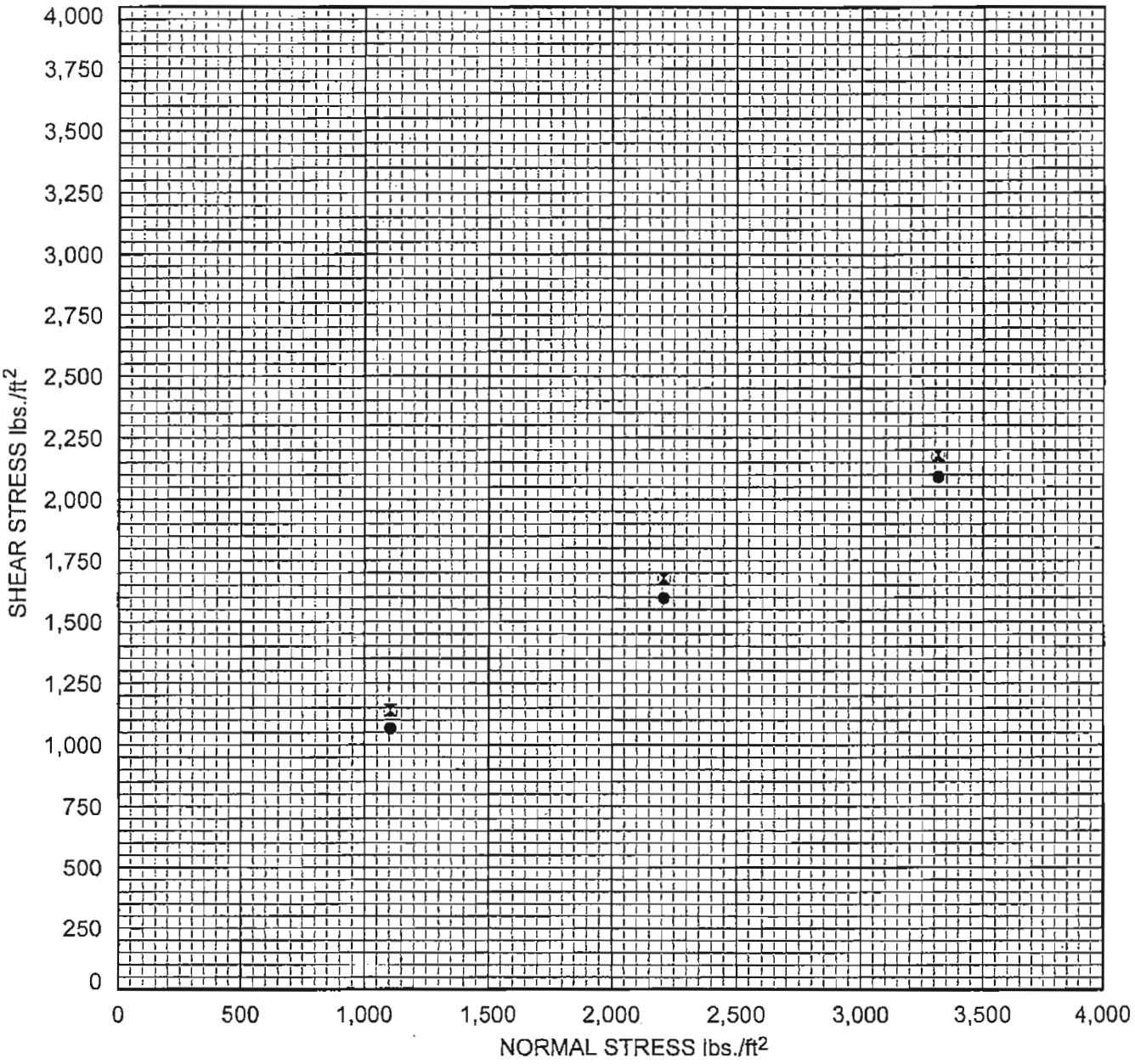
symbol	shear value	boring / soil type	depth (ft.)
●	residual	BA-05	15.0
⧓	peak	BA-05	15.0

DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, S.D. CA 92111
(858) 560-1713

W.O.400948B PLATE B-5

DIRECT SHEAR TEST
REMOLDED @ 90%



SANDY CLAY (Qal) CL	COHESION	560 psf.
note: cohesion and friction angle derived from residual values	FRICTION ANGLE	25 degrees

symbol	shear value	boring / soil type	depth (ft.)
●	residual	TP-15	3.0
⧓	peak	TP-15	3.0

DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
7715 Convoy Court, S.D. CA 92111
(858) 560-1713

W.O.400948B PLATE B-6

APPENDIX D

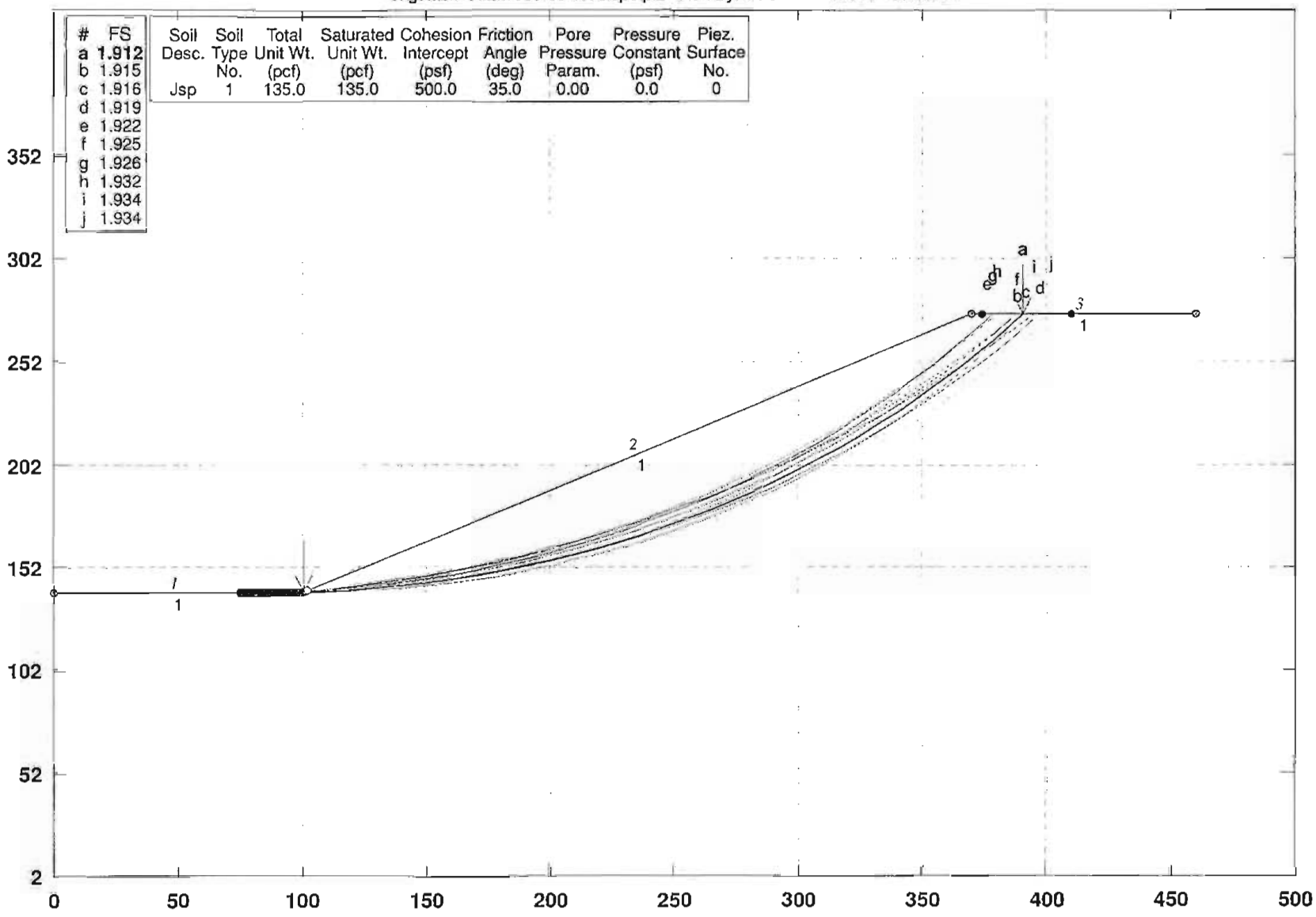
SLOPE STABILITY ANALYSIS

135 Cut Slope P/W 1009-05

c:\gstabl7 data\1009-05 cut slope.pl2 Run By: AGS 10/22/2010 09:06AM

#	FS
a	1.912
b	1.915
c	1.916
d	1.919
e	1.922
f	1.925
g	1.926
h	1.932
i	1.934
j	1.934

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Jsp	1	135.0	135.0	500.0	35.0	0.00	0.0	0



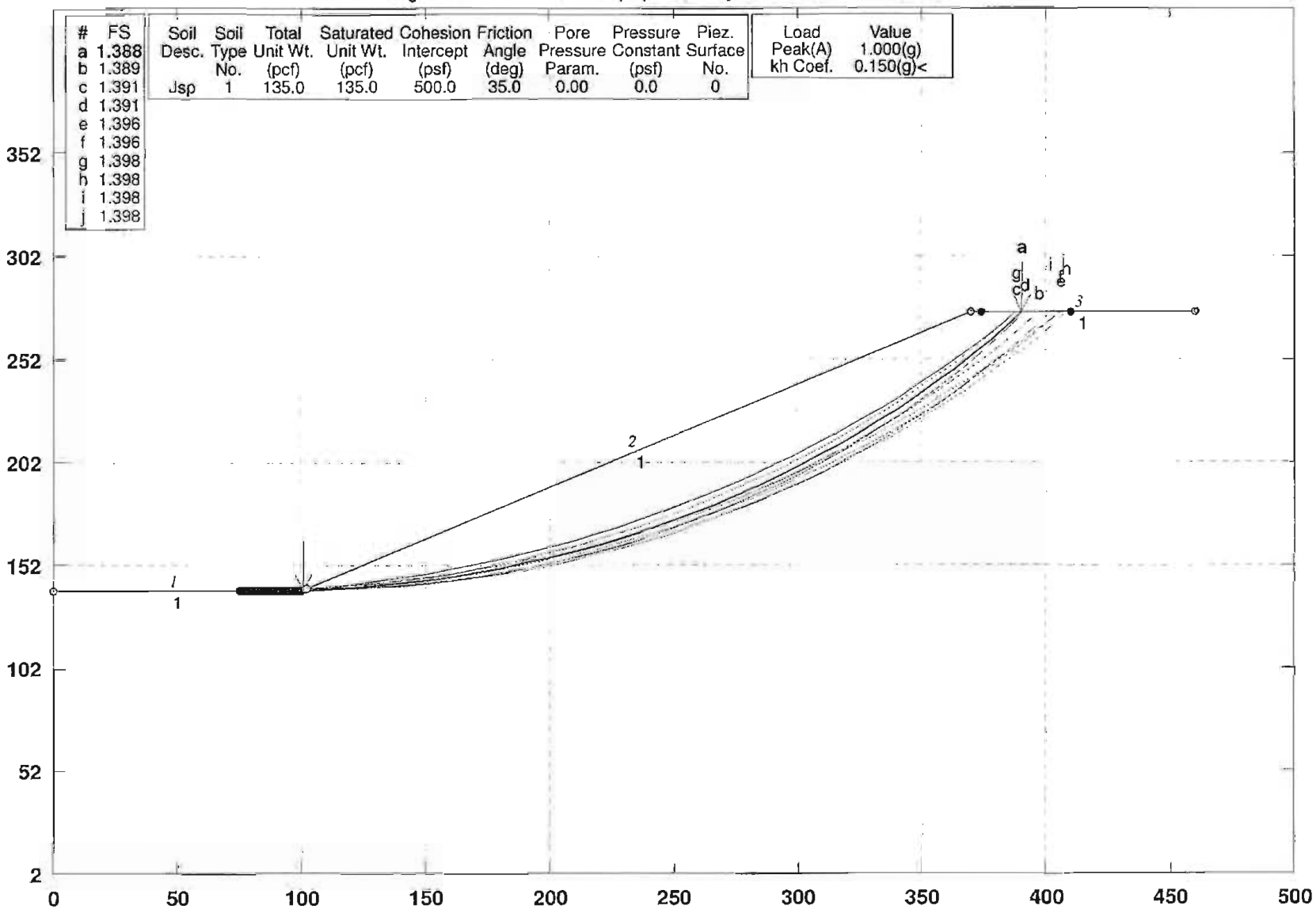
GSTABL7 v.2 FSmin=1.912

Safety Factors Are Calculated By The Modified Bishop Method

Plate D-1

135 Cut Slope P/W 1009-05

c:\gstabl7 data\1009-05 cut slope.pl2 Run By: AGS 10/22/2010 09:11AM



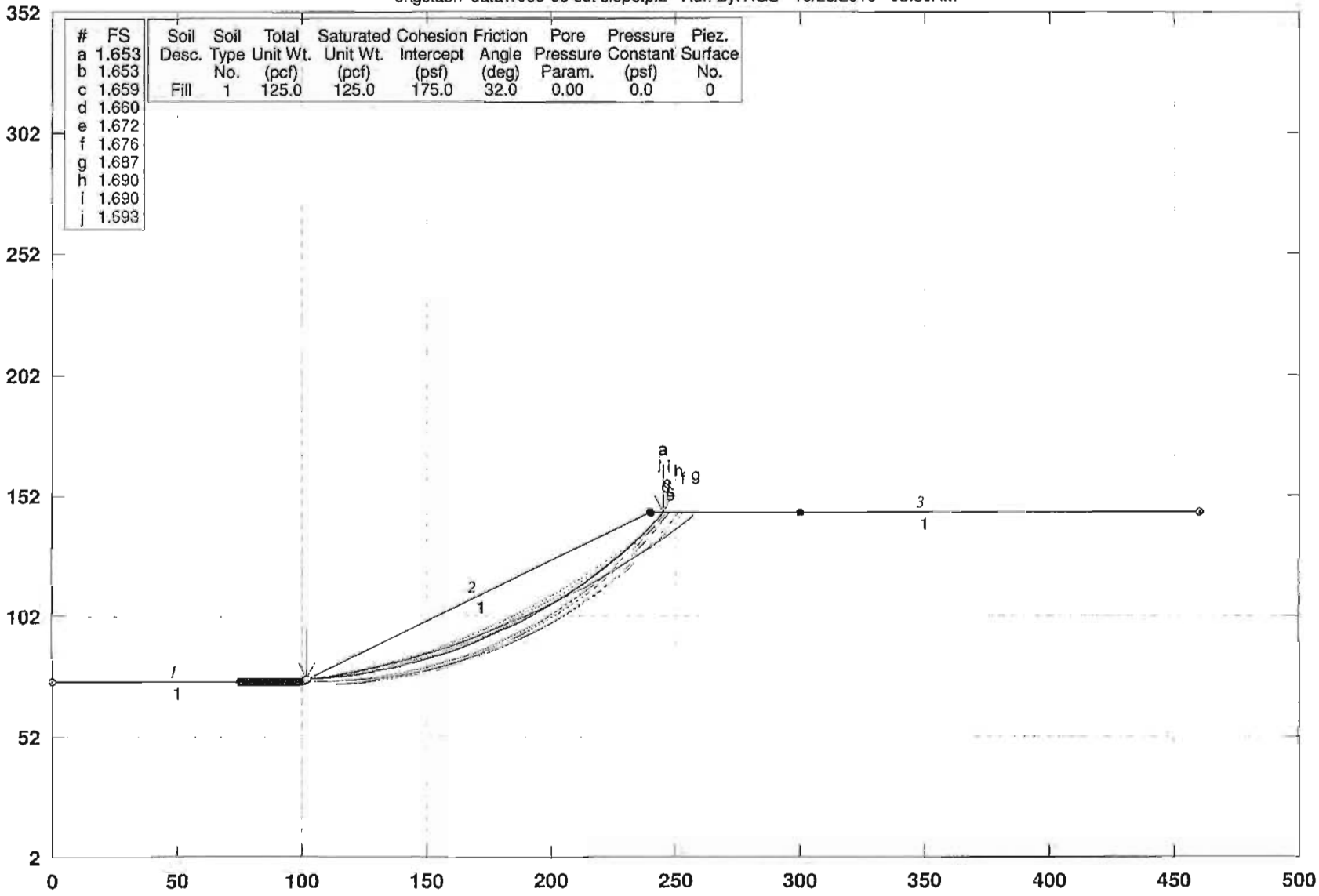
GSTABL7 v.2 FSmin=1.388

Safety Factors Are Calculated By The Modified Bishop Method

Plate D-2

70 Fill Slope P/W 1009-05

c:\gstabl7 data\1009-05 cut slope.pl2 Run By: AGS 10/23/2010 08:30AM



#	FS
a	1.653
b	1.653
c	1.659
d	1.660
e	1.672
f	1.676
g	1.687
h	1.690
i	1.690
j	1.693

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Fill	1	125.0	125.0	175.0	32.0	0.00	0.0	0

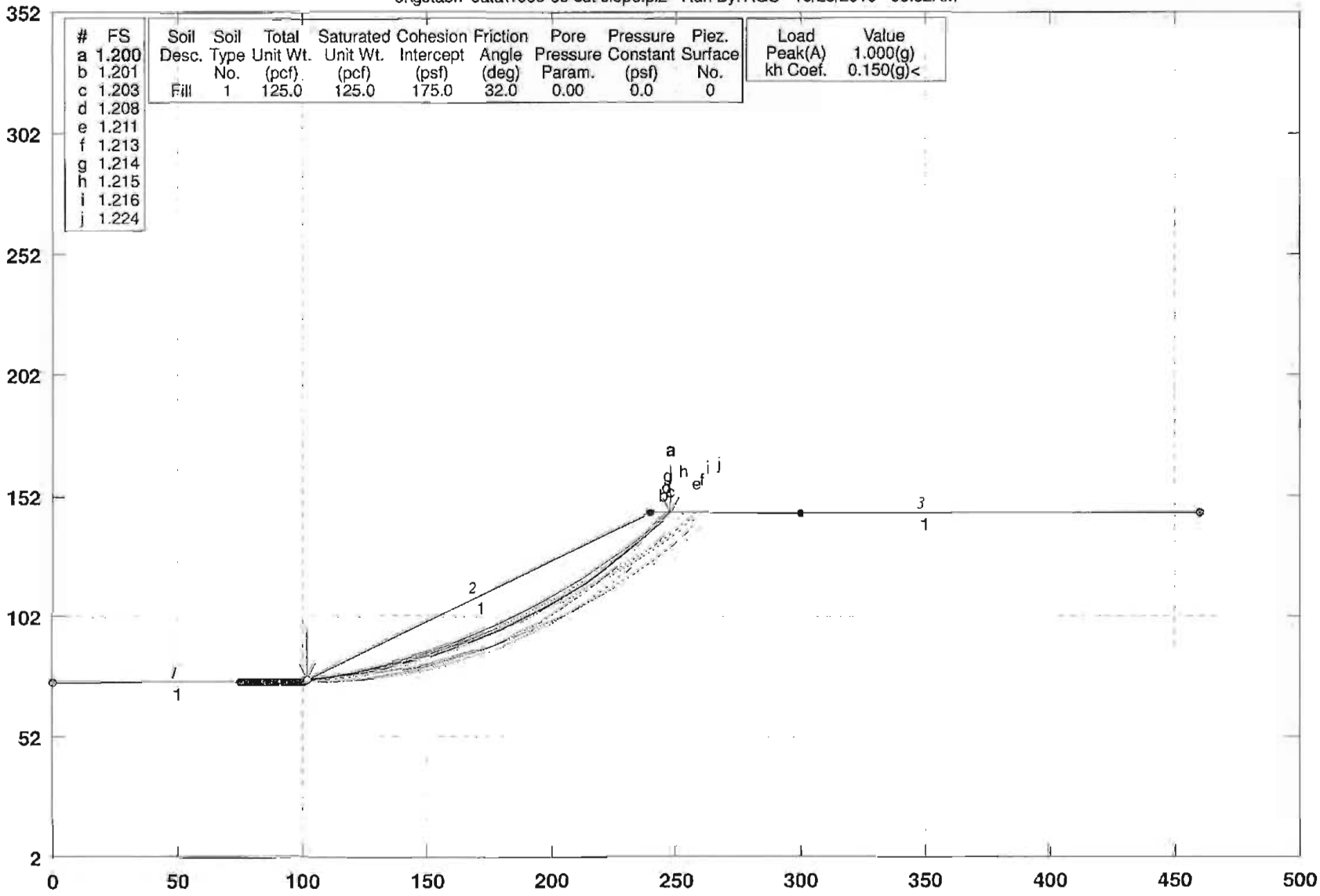
GSTABL7 v.2 FSmin=1.653

Safety Factors Are Calculated By The Modified Bishop Method

Plate D-3

70 Fill Slope P/W 1009-05

c:\gstabl7 data\1009-05 cut slope.pl2 Run By: AGS 10/23/2010 08:32AM

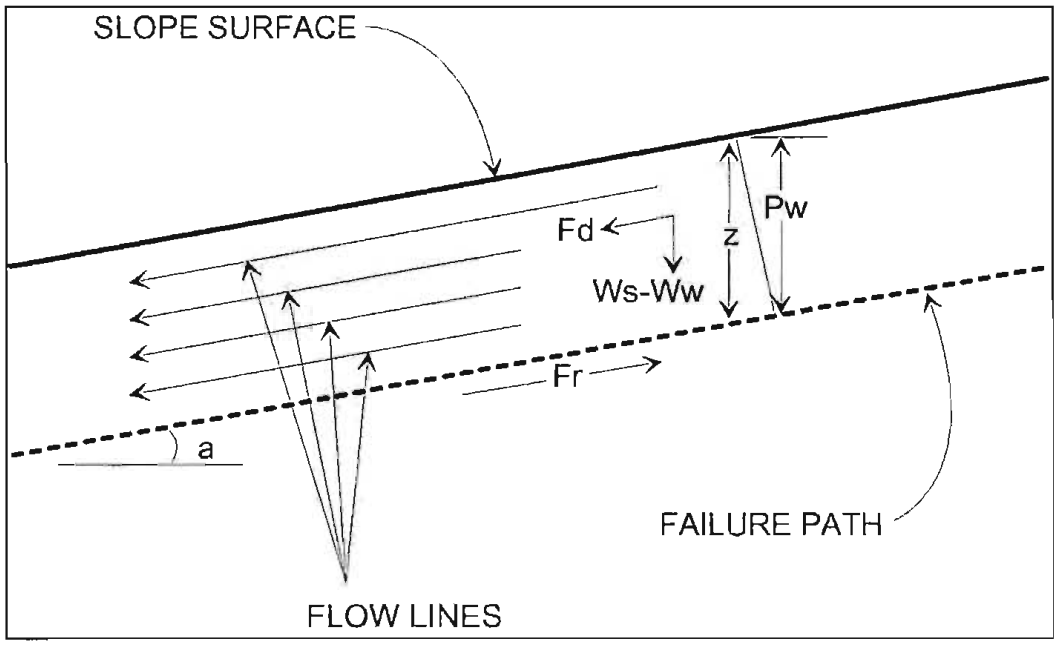


GSTABL7 v.2 FSmin=1.200

Safety Factors Are Calculated By The Modified Bishop Method

Plate D-4

SURFICIAL SLOPE STABILITY



Assume: (1) Saturation To Slope Surface
(2) Sufficient Permeability To Establish Water Flow

Pw = Water Pressure Head=(z)(cos^2(a))
Ws = Saturated Soil Unit Weight
Ww = Unit Weight of Water (62.4 lb/cu.ft.)
u = Pore Water Pressure=(Ww)(z)(cos^2(a))
z = Layer Thickness
a = Angle of Slope
phi = Angle of Friction
c = Cohesion
Fd = (0.5)(z)(Ws)(sin(2a))
Fr = (z)(Ws-Ww)(cos^2(a))(tan(phi)) + c
Factor of Safety (FS) = Fr/Fd

Given:

Ws (pcf)	z (ft)	a (degrees)	(radians)	phi (degrees)	(radians)	c (psf)
125	4	26.56505	0.4636476	32	0.5585054	175

Calculations:

Pw	u	Fd	Fr	**FS**
3.20	199.68	200.00	300.17	**1.50**

APPENDIX E

GENERAL EARTHWORK SPECIFICATIONS AND GRADING DETAILS

GENERAL EARTHWORK SPECIFICATIONS

I. General

A. General procedures and requirements for earthwork and grading are presented herein. The earthwork and grading recommendations provided in the geotechnical report are considered part of these specifications, and where the general specifications provided herein conflict with those provided in the geotechnical report, the recommendations in the geotechnical report shall govern. Recommendations provided herein and in the geotechnical report may need to be modified depending on the conditions encountered during grading.

B. The contractor is responsible for the satisfactory completion of all earthwork in accordance with the project plans, specifications, applicable building codes, and local governing agency requirements. Where these requirements conflict, the stricter requirements shall govern.

C. It is the contractor's responsibility to read and understand the guidelines presented herein and in the geotechnical report as well as the project plans and specifications. Information presented in the geotechnical report is subject to verification during grading. The information presented on the exploration logs depict conditions at the particular time of excavation and at the location of the excavation. Subsurface conditions present at other locations may differ, and the passage of time may result in different subsurface conditions being encountered at the locations of the exploratory excavations. The contractor shall perform an independent investigation and evaluate the nature of the surface and subsurface conditions to be encountered and the procedures and equipment to be used in performing his work.

D. The contractor shall have the responsibility to provide adequate equipment and procedures to accomplish the earthwork in accordance with applicable requirements. When the quality of work is less than that required, the Geotechnical Consultant may reject the work and may recommend that the operations be suspended until the conditions are corrected.

E. Prior to the start of grading, a qualified Geotechnical Consultant should be employed to observe grading procedures and provide testing of the fills for conformance with the project specifications, approved grading plan, and guidelines presented herein. All clearing and grubbing, remedial removals, clean-outs, removal bottoms, keyways, and subdrain installations should be observed and documented by the Geotechnical Consultant prior to placing fill. It is the contractor's responsibility to apprise the Geotechnical Consultant of their schedules and notify the Geotechnical Consultant when those areas are ready for observation.

F. The contractor is responsible for providing a safe environment for the Geotechnical Consultant to observe grading and conduct tests.

II. Site Preparation

A. Clearing and Grubbing: Excessive vegetation and other deleterious material shall be sufficiently removed as required by the Geotechnical Consultant, and such materials shall be properly disposed of offsite in a method acceptable to the owner and governing agencies. Where applicable, the contractor may obtain permission from the Geotechnical Consultant, owner, and governing agencies to dispose of vegetation and other deleterious materials in designated areas onsite.

B. Unsuitable Soils Removals: Earth materials that are deemed unsuitable for the support of fill shall be removed as necessary to the satisfaction of the Geotechnical Consultant.

C. Any underground structures such as cesspools', cisterns, mining shafts, tunnels, septic tanks, wells, pipelines, other utilities, or other structures located within the limits of grading shall be removed and/or abandoned in accordance with the requirements of the governing agency and to the satisfaction of the Geotechnical Consultant. Environmental evaluation of existing conditions is not the responsibility of the Geotechnical Consultant.

D. Preparation of Areas to Receive Fill: After removals are completed, the exposed surfaces shall be processed or scarified to a depth of approximately 8 inches, watered or dried, as needed, to achieve a generally uniform moisture content that is at or near optimum moisture content. The scarified materials shall then be compacted to the project requirements and tested as specified.

E. All areas receiving fill shall be observed and approved by the Geotechnical Consultant prior to the placement of fill. A licensed surveyor shall provide survey control for determining elevations of processed areas and keyways.

III. Placement of Fill

A. Suitability of fill materials: Any materials, derived onsite or imported, may be utilized as fill provided that the materials have been determined to be suitable by the Geotechnical Consultant. Such materials shall be essentially free of organic matter and other deleterious materials, and be of a gradation, expansion potential, and/or strength that is acceptable to the Geotechnical Consultant. Fill materials shall be tested in

a laboratory approved by the Geotechnical Consultant, and import materials shall be tested and approved prior to being imported.

B. Generally, different fill materials shall be thoroughly mixed to provide a relatively uniform blend of materials and prevent abrupt changes in material type. Fill materials derived from benching should be dispersed throughout the fill area instead of placing the materials within only an equipment-width from the cut/fill contact.

C. Oversize Materials: Rocks greater than 12 inches in largest dimension shall be disposed of offsite or be placed in accordance with the recommendations by the Geotechnical Consultant in the areas that are designated as suitable for oversize rock placement. Rocks that are smaller than 8 inches in largest dimension may be utilized in the fill provided that they are not nested and are their quantity and distribution are acceptable to the Geotechnical Consultant and do not inhibit the ability to properly compact fill materials.

D. The fill materials shall be placed in thin, horizontal layers such that, when compacted, shall not exceed 6 inches. Each layer shall be spread evenly and shall be thoroughly mixed to obtain a near uniform moisture content and uniform blend of materials.

E. Moisture Content: Fill materials shall be placed at or above the optimum moisture content or as recommended by the geotechnical report. Where the moisture content of the engineered fill is less than recommended, water shall be added, and the fill materials shall be blended so that a near uniform moisture content is achieved. If the moisture content is above the limits specified by the Geotechnical Consultant, the fill materials shall be aerated by discing, blading, or other methods until the moisture content is acceptable.

F. Each layer of fill shall be compacted to the project standards in accordance to the project specifications and recommendations of the Geotechnical Consultant. Unless otherwise specified by the Geotechnical Consultant, the fill shall be compacted to a minimum of 90 percent of the maximum dry density as determined by ASTM Test Method: D1557-09.

G. Benching: Where placing fill on a slope exceeding a ratio of 5 to 1 (horizontal to vertical), the ground should be keyed or benched. The keyways and benches shall extend through all unsuitable materials into suitable materials such as firm materials or sound bedrock or as recommended by the Geotechnical Consultant. The minimum keyway width shall be 15 feet and extend into suitable materials, or as recommended by the geotechnical report and approved by the Geotechnical Consultant. The minimum keyway width for fill over cut slopes is also 15 feet, or as recommended by the geotechnical report and approved by the Geotechnical Consultant. As a general rule, unless otherwise recommended by the

Geotechnical Consultant, the minimum width of the keyway shall be equal to ½ the height of the fill slope.

H. Slope Face: The specified minimum relative compaction shall be maintained out to the finish face of fill and stabilization fill slopes. Generally, this may be achieved by overbuilding the slope and cutting back to the compacted core. The actual amount of overbuilding may vary as field conditions dictate. Alternately, this may be achieved by backrolling the slope face with suitable equipment or other methods that produce the designated result. Loose soil should not be allowed to build up on the slope face. If present, loose soils shall be trimmed to expose the compacted slope face.

I. Slope Ratio: Unless otherwise approved by the Geotechnical Consultant and governing agencies, permanent fill slopes shall be designed and constructed no steeper than 2 to 1 (horizontal to vertical).

J. Natural Ground and Cut Areas: Design grades that are in natural ground or in cuts should be evaluated by the Geotechnical Consultant to determine whether scarification and processing of the ground and/or overexcavation is needed.

K. Fill materials shall not be placed, spread, or compacted during unfavorable weather conditions. When grading is interrupted by rain, filing operations shall not resume until the Geotechnical Consultant approves the moisture and density of the previously placed compacted fill.

IV. Cut Slopes

A. The Geotechnical Consultant shall observe all cut slopes, including fill over cut slopes, and shall be notified by the contractor when cut slopes are started.

B. If adverse or potentially adverse conditions are encountered during grading, the Geotechnical Consultant shall investigate, evaluate, and make recommendations to mitigate the adverse conditions.

C. Unless otherwise stated in the geotechnical report, cut slopes shall not be excavated higher or steeper than the requirements of the local governing agencies. Short-term stability of the cut slopes and other excavations is the contractor's responsibility.

V. Drainage

A. Backdrains and Subdrains: Backdrains and subdrains shall be provided in fill as recommended by the Geotechnical Consultant and shall be constructed in accordance with the governing agency and/or recommendations of the Geotechnical Consultant. The location of subdrains, especially outlets, shall be surveyed and recorded by the Civil Engineer.

B. Top-of-slope Drainage: Positive drainage shall be established away from the top of slope. Site drainage shall not be permitted to flow over the tops of slopes.

C. Drainage terraces shall be constructed in compliance with the governing agency requirements and/or in accordance with the recommendations of the Civil Engineer.

D. Non-erodible interceptor swales shall be placed at the top of cut slopes that face the same direction as the prevailing drainage.

VI. Erosion Control

A. All finish cut and fill slopes shall be protected from erosion and/or planted in accordance with the project specifications and/or landscape architect's recommendations. Such measures to protect the slope face shall be undertaken as soon as practical after completion of grading.

B. During construction, the contractor shall maintain proper drainage and prevent the ponding of water. The contractor shall take remedial measures to prevent the erosion of graded areas until permanent drainage and erosion control measures have been installed.

VII. Trench Excavation and Backfill

A. Safety: The contractor shall follow all OSHA requirements for safety of trench excavations. Knowing and following these requirements is the contractor's responsibility. All trench excavations or open cuts in excess of 5 feet in depth shall be shored or laid back. Trench excavations and open cuts exposing adverse geologic conditions may require further evaluation by the Geotechnical Consultant. If a contractor fails to provide safe access for compaction testing, backfill not tested due to safety concerns may be subject to removal.

B. Bedding: Bedding materials shall be non-expansive and have a Sand Equivalent greater than 30. Where permitted by the Geotechnical Consultant, the bedding materials can be densified by jetting.

C. Backfill: Jetting of backfill materials to achieve compaction is generally not acceptable. Where permitted by the Geotechnical Consultant, the bedding materials can be densified by jetting provided the backfill materials are granular, free-draining and have a Sand Equivalent greater than 30.

VIII. Geotechnical Observation and Testing During Grading

A. Compaction Testing: Fill will be tested and evaluated by the Geotechnical Consultant for evaluation of general compliance with the recommended compaction and moisture conditions. The tests shall be taken in the compacted soils beneath the surface if the surficial materials are disturbed. The contractor shall assist the Geotechnical Consultant by excavating suitable test pits for testing of compacted fill.

B. Where tests indicate that the density of a layer of fill is less than required, or the moisture content is not within specifications, the Geotechnical Consultant shall notify the contractor of the unsatisfactory conditions of the fill. The portions of the fill that are not within specifications shall be reworked until the required density and/or moisture content has been attained. No additional fill shall be placed until the last lift of fill is tested and found to meet the project specifications and approved by the Geotechnical Consultant.

C. If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as adverse weather, excessive rock or deleterious materials being placed in the fill, insufficient equipment, excessive rate of fill placement, results in a quality of work that is unacceptable, the consultant shall notify the contractor, and the contractor shall rectify the conditions, and if necessary, stop work until conditions are satisfactory.

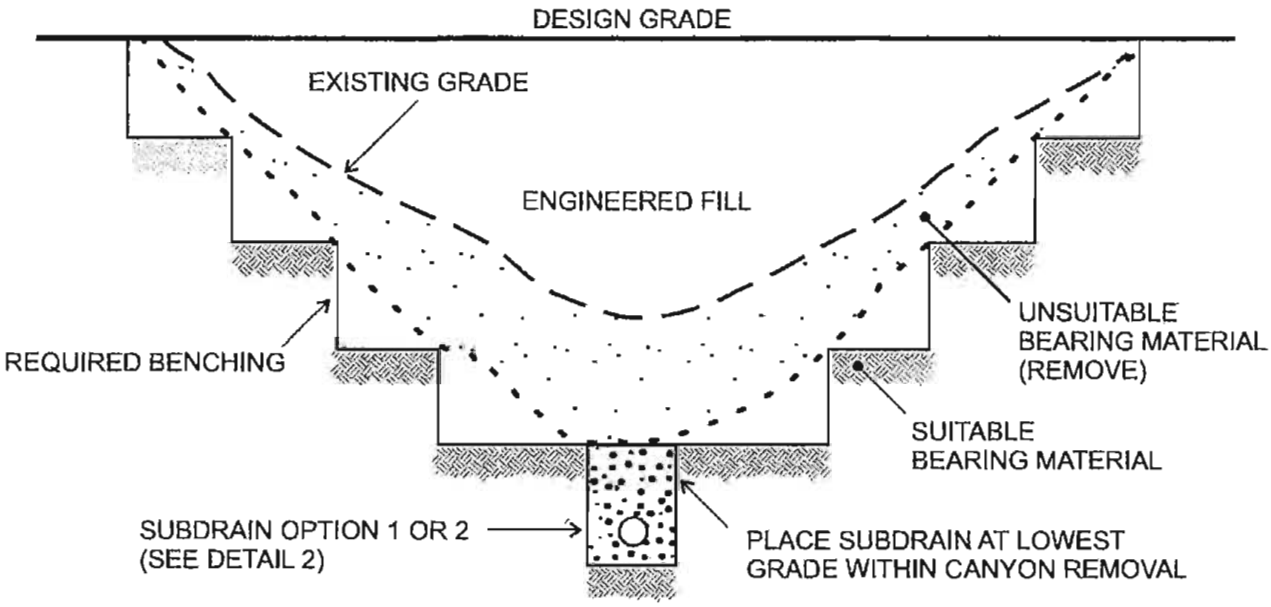
D. Frequency of Compaction Testing: The location and frequency of tests shall be at the Geotechnical Consultant's discretion. Generally, compaction tests shall be taken at intervals approximately two feet in fill height.

E. Compaction Test Locations: The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of the compaction test locations. The contractor shall coordinate with the surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations. Alternately, the test locations can be surveyed and the results provided to the Geotechnical Consultant.

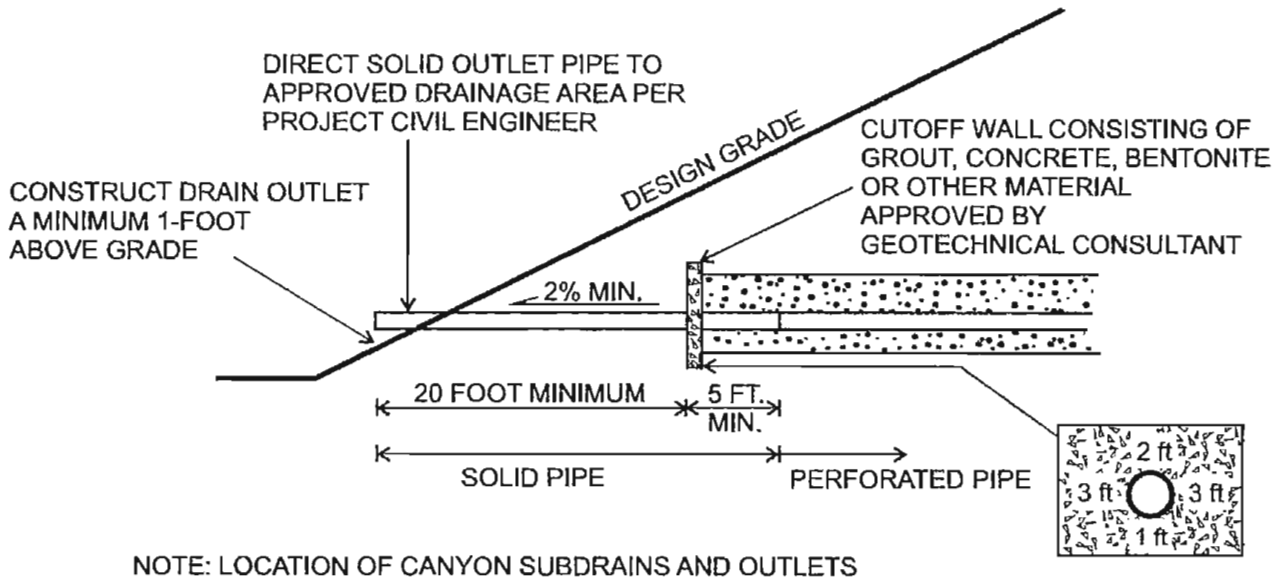
F. Areas of fill that have not been observed or tested by the Geotechnical Consultant may have to be removed and recompacted at the contractor's expense. The depth and extent of removals will be determined by the Geotechnical Consultant.

G. Observation and testing by the Geotechnical Consultant shall be conducted during grading in order for the Geotechnical Consultant to state that, in his opinion, grading has been completed in accordance with the approved geotechnical report and project specifications.

H. Reporting of Test Results: After completion of grading operations, the Geotechnical Consultant shall submit reports documenting their observations during construction and test results. These reports may be subject to review by the local governing agencies.



CANYON SUBDRAIN PROFILE



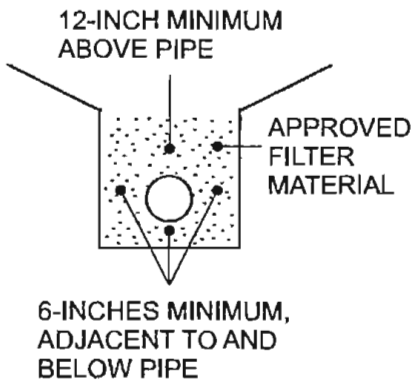
NOTE: LOCATION OF CANYON SUBDRAINS AND OUTLETS SHOULD BE DOCUMENTED BY PROJECT CIVIL ENGINEER. OUTLETS MUST BE KEPT UNOBSTRUCTED AT ALL TIMES.

CANYON SUBDRAIN TERMINUS

VER 1.0

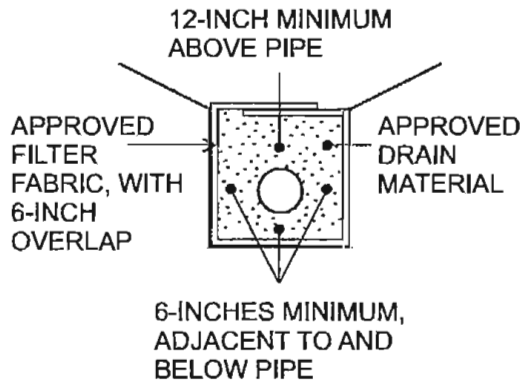
NTS

AGS ADVANCED GEOTECHNICAL SOLUTIONS	CANYON SUBDRAIN	DETAIL 1



OPTION 1

FILTER MATERIAL: MINIMUM VOLUME OF 9 CUBIC FEET PER LINEAL FOOT OF CALTRANS CLASS 2 PERMEABLE MATERIAL



OPTION 2

DRAIN MATERIAL: MINIMUM VOLUME OF 9 CUBIC FEET PER LINEAL FOOT OF 3/4-INCH MAX ROCK OR APPROVED EQUIVALENT SUBSTITUTE

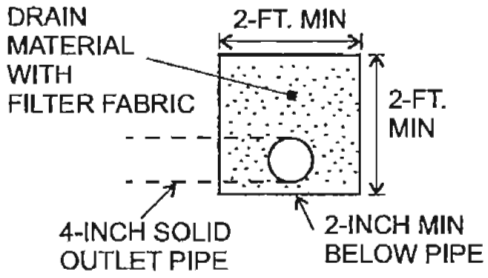
FILTER FABRIC: MIRAFI 140 FILTER FABRIC OR APPROVED EQUIVALENT SUBSTITUTE

PIPE: 6 OR 8-INCH ABS OR PVC PIPE OR APPROVED SUBSTITUTE WITH A MINIMUM OF 8 PERFORATIONS (1/4-INCH DIAMETER) PER LINEAL FOOT IN BOTTOM HALF OF PIPE

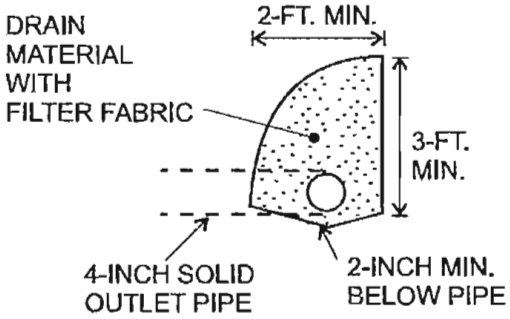
(ASTM D2751, SDR-35 OR ASTM D3034, SDR-35
ASTM D1527, SCHD. 40 OR ASTM D1785, SCHD. 40)

NOTE: CONTINUOUS RUN IN EXCESS OF 500 FEET REQUIRES 8-INCH DIAMETER PIPE (ASTM D3034, SDR-35, OR ASTM D1785, SCHD. 40)

CANYON SUBDRAIN



OPTION 1



OPTION 2

DRAIN MATERIAL: GRAVEL TRENCH TO BE FILLED WITH 3/4-INCH MAX ROCK OR APPROVED EQUIVALENT SUBSTITUTE

FILTER FABRIC: MIRAFI 140 FILTER FABRIC OR EQUIVALENT SUBSTITUTE WITH A MINIMUM 6-INCH OVERLAP

PIPE: 4-INCH ABS OR PVC PIPE OR APPROVED EQUIVALENT SUBSTITUTE WITH A MINIMUM OF 8 PERFORATIONS (1/4-INCH DIAMETER) PER LINEAL FOOT IN BOTTOM HALF OF PIPE

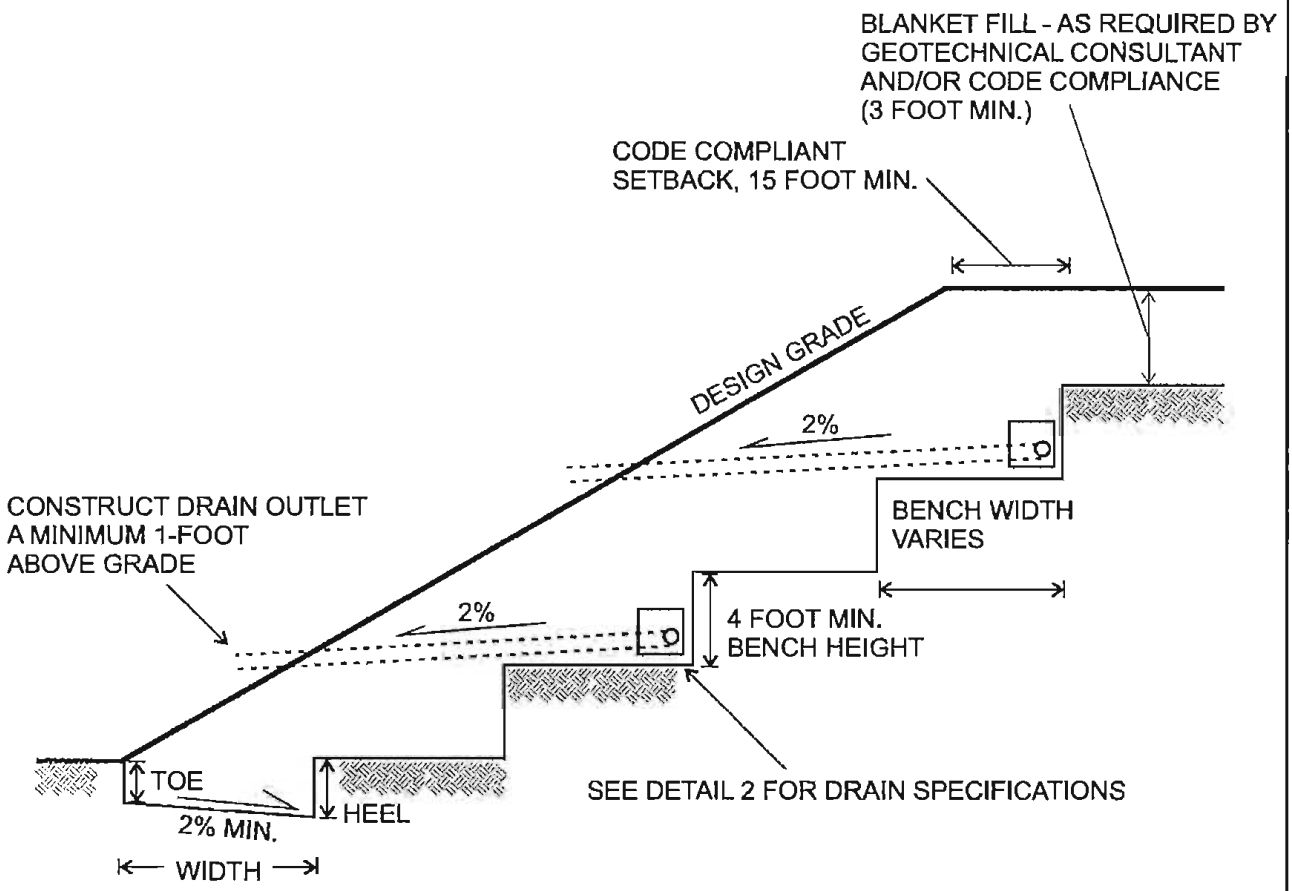
(ASTM D2751, SDR-35 OR ASTM D3034, SDR-35
ASTM D1527, SCHD. 40 OR ASTM D1785, SCHD. 40)

BUTTRESS/STABILIZATION DRAIN

VER 1.0

NTS

AGS ADVANCED GEOTECHNICAL SOLUTIONS	DRAIN SPECIFICATIONS	DETAIL 2



CODE COMPLIANT KEYWAY WITH MINIMUM DIMENSIONS:

TOE 2 FOOT MIN.
HEEL 3 FOOT MIN.
WIDTH 15 FOOT MIN.

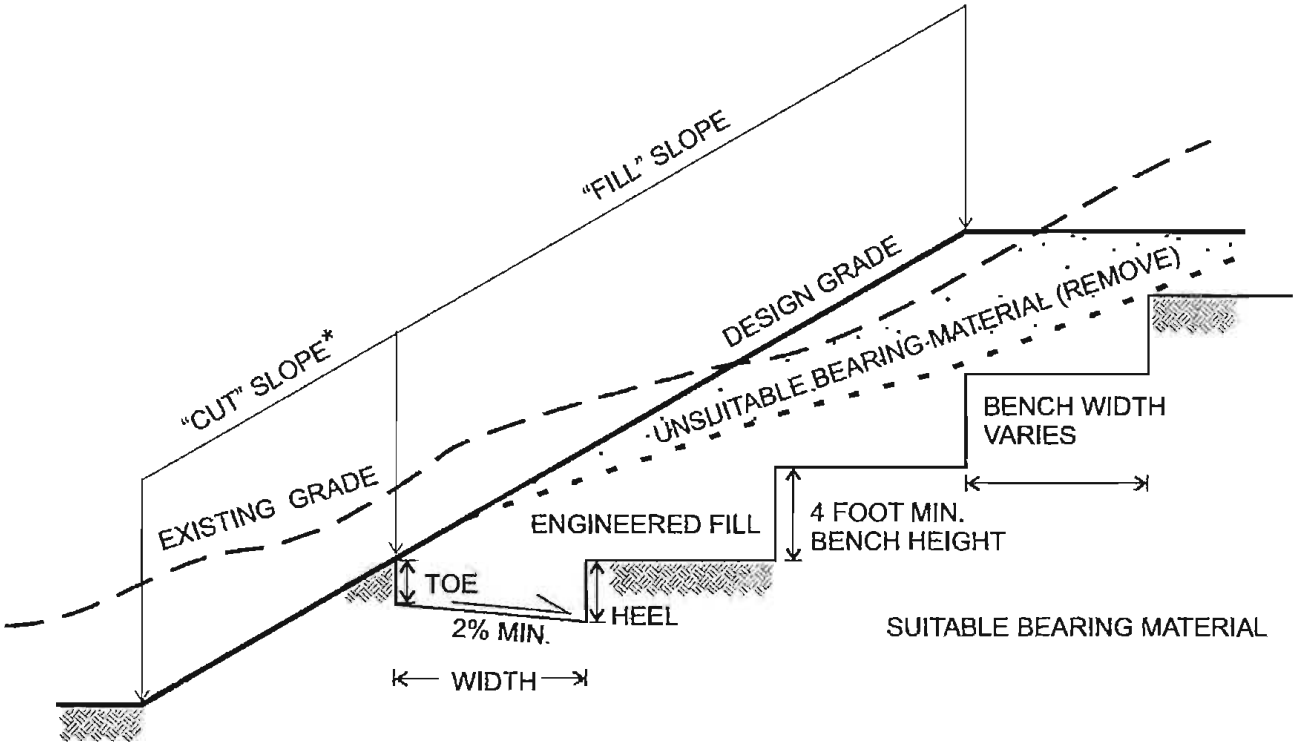
NOTES:

1. DRAIN OUTLETS TO BE PROVIDED EVERY 100 FEET CONNECT TO PERFORATED DRAIN PIPE BY "L" OR "T" AT A MINIMUM 2% GRADIENT.
2. THE NECESSITY AND LOCATION OF ADDITIONAL DRAINS SHALL BE DETERMINED IN THE FIELD BY THE GEOTECHNICAL CONSULTANT. UPPER STAGE OUTLETS SHOULD BE EMPTIED ONTO CONCRETE TERRACE DRAINS.
3. DRAIN PIPE TO EXTEND FULL LENGTH OF STABILIZATION/BUTTRESS WITH A MINIMUM GRADIENT OF 2% TO SOLID OUTLET PIPES.
4. LOCATION OF DRAINS AND OUTLETS SHOULD BE DOCUMENTED BY PROJECT CIVIL ENGINEER. OUTLETS MUST BE KEPT UNOBSTRUCTED AT ALL TIMES.

VER 1.0 NTS

AGS ADVANCED GEOTECHNICAL SOLUTIONS	STABILIZATION/BUTTRESS FILL	DETAIL 3

* THE "CUT" PORTION OF THE SLOPE SHALL BE EXCAVATED AND EVALUATED BY THE GEOTECHNICAL CONSULTANT PRIOR TO CONSTRUCTING THE "FILL" PORTION



CODE COMPLIANT KEYWAY
WITH MINIMUM DIMENSIONS:

TOE: 2 FOOT MIN.
HEEL: 3 FOOT MIN.
WIDTH: 15 FOOT MIN.

NOTES:

1. THE NECESSITY AND LOCATION OF DRAINS SHALL BE DETERMINED IN THE FIELD BY THE GEOTECHNICAL CONSULTANT

2. SEE DETAIL 2 FOR DRAIN SPECIFICATIONS

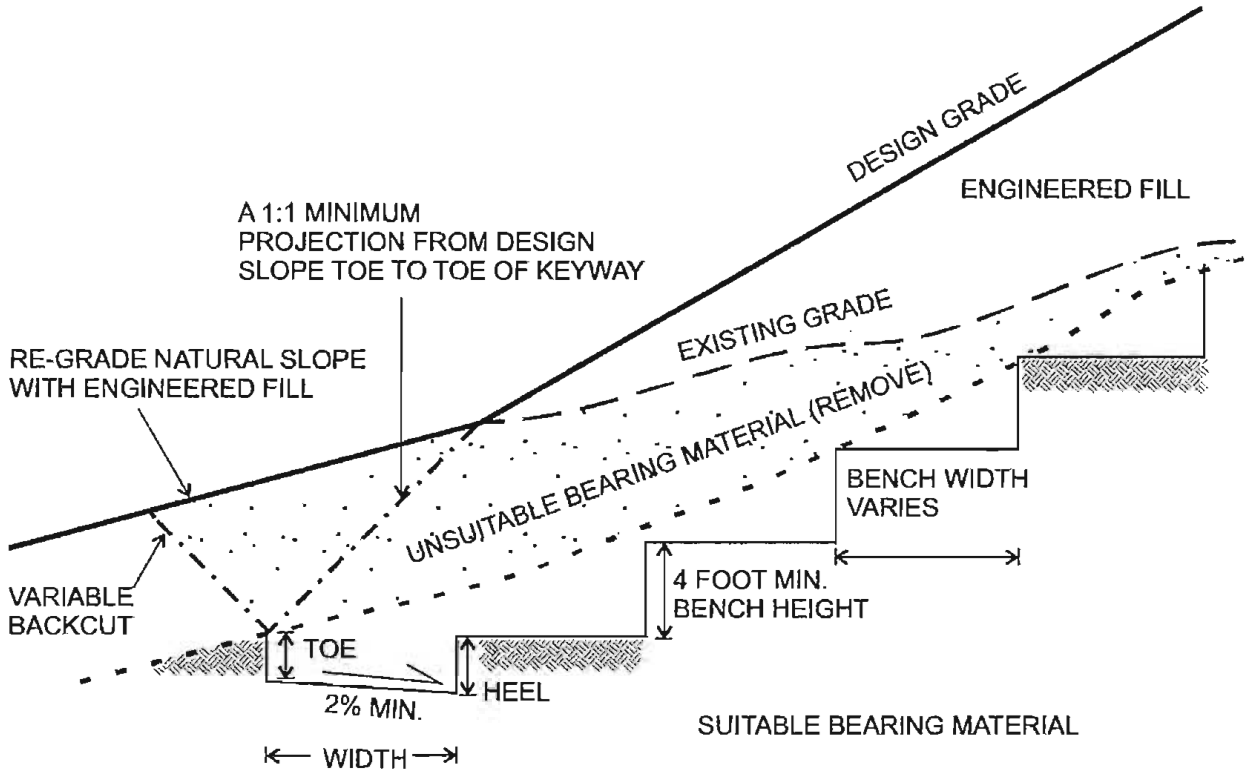
VER 1.0

NTS

AGS
ADVANCED GEOTECHNICAL SOLUTIONS

FILL OVER CUT SLOPE

DETAIL 4



CODE COMPLIANT KEYWAY
WITH MINIMUM DIMENSIONS:

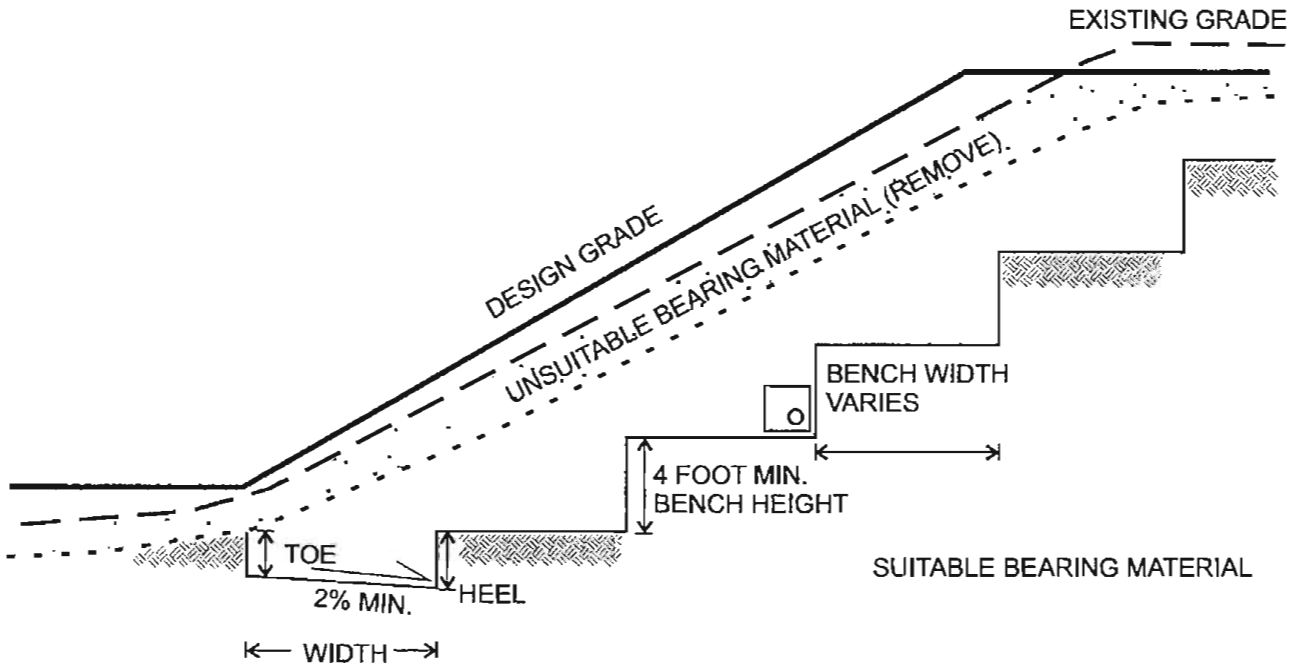
TOE: 2 FOOT MIN.
HEEL: 3 FOOT MIN.
WIDTH: 15 FOOT MIN.

NOTES:

1. WHEN THE NATURAL SLOPE APPROACHES OR EXCEEDS THE DESIGN GRADE SLOPE RATIO, SPECIAL RECOMMENDATIONS ARE NECESSARY BY THE GEOTECHNICAL CONSULTANT
2. THE GEOTECHNICAL CONSULTANT WILL DETERMINE THE REQUIREMENT FOR AND LOCATION OF SUBSURFACE DRAINAGE SYSTEMS.
3. MAINTAIN MINIMUM 15 FOOT HORIZONTAL WIDTH FROM FACE OF SLOPE TO BENCH/BACKCUT

VER 1.0 NTS

AGS ADVANCED GEOTECHNICAL SOLUTIONS	FILL OVER NATURAL SLOPE	DETAIL 5



CODE COMPLIANT KEYWAY
WITH MINIMUM DIMENSIONS:

TOE: 2 FOOT MIN.
HEEL: 3 FOOT MIN.
WIDTH: 15 FOOT MIN.

NOTES:

1. MAINTAIN MINIMUM 15 FOOT HORIZONTAL WIDTH FROM FACE OF SLOPE TO BENCH/BACKCUT
2. SEE DETAIL 2 FOR DRAIN SPECIFICATIONS

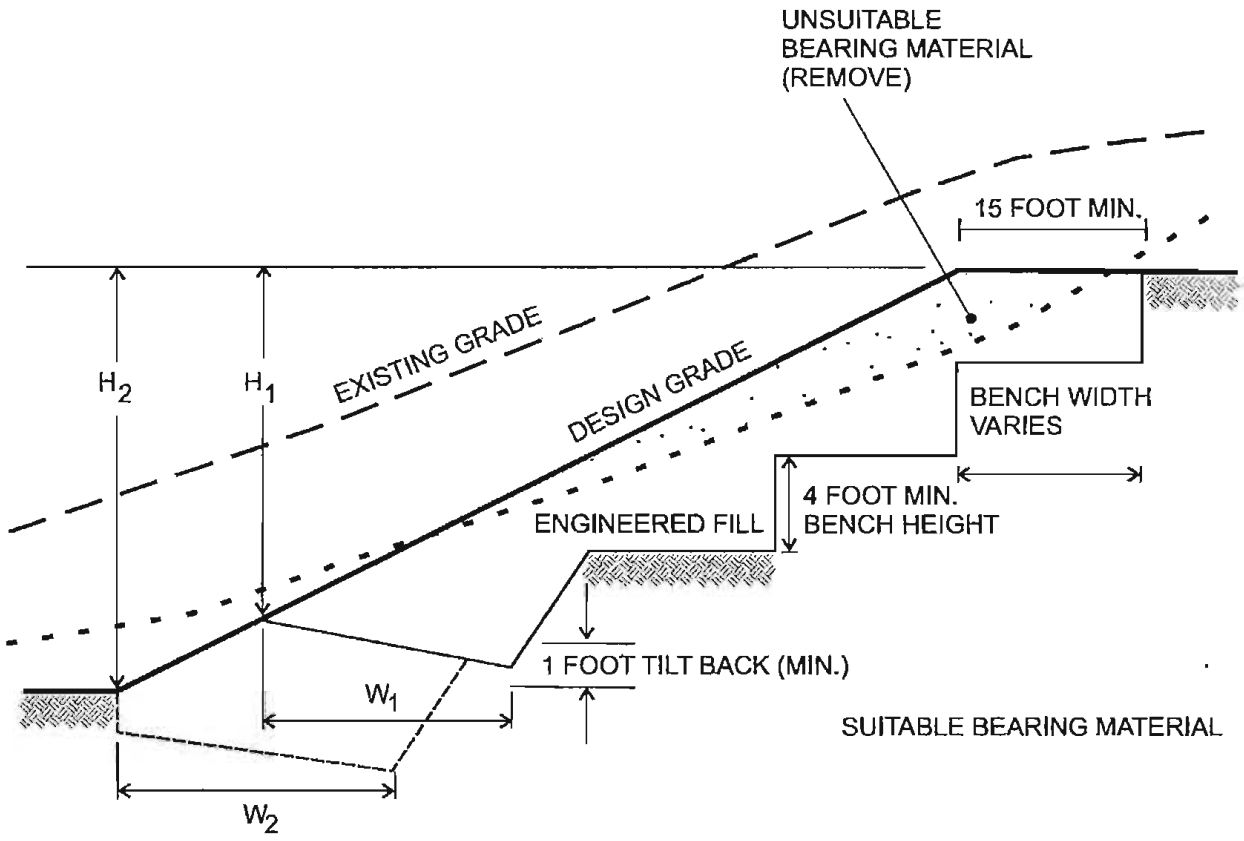
VER 1.0

NTS

AGS
ADVANCED GEOTECHNICAL SOLUTIONS

SKIN FILL CONDITION

DETAIL 6



NOTES:

1. IF RECOMMENDED BY THE GEOTECHNICAL CONSULTANT, THE REMAINING CUT PORTION OF THE SLOPE MAY REQUIRE REMOVAL AND REPLACEMENT WITH AN ENGINEERED FILL

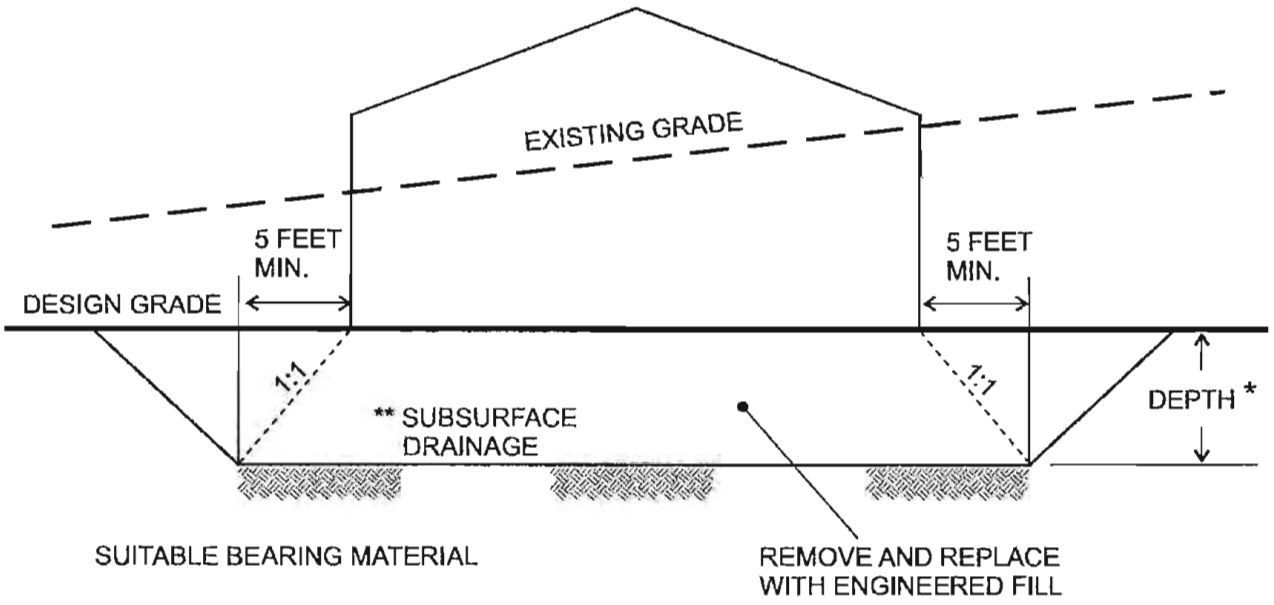
2. "W" SHALL BE EQUIPMENT WIDTH (15 FEET) FOR SLOPE HEIGHT LESS THAN 25 FEET. FOR SLOPES GREATER THAN 25 FEET, "W" SHALL BE DETERMINED BY THE GEOTECHNICAL CONSULTANT. AT NO TIME SHALL "W" BE LESS THAN H/2

3. DRAINS WILL BE REQUIRED (SEE DETAIL 2)

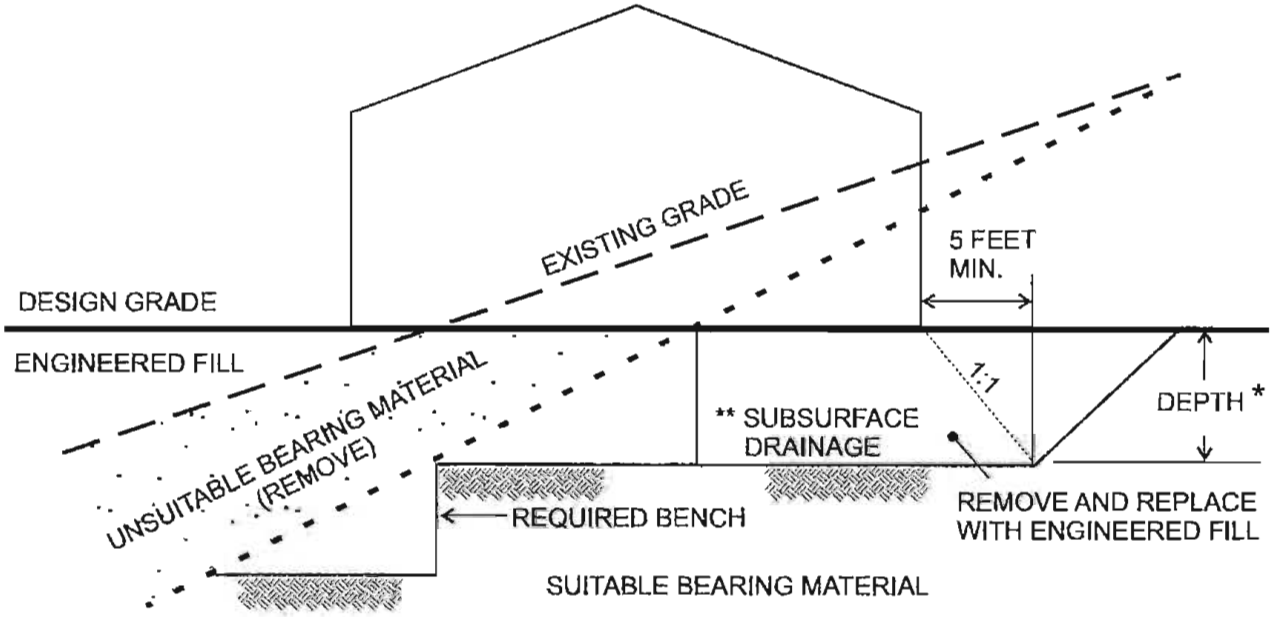
VER 1.0

NTS

AGS ADVANCED GEOTECHNICAL SOLUTIONS	PARTIAL CUT SLOPE STABILIZATION	DETAIL 7



CUT LOT OVEREXCAVATION



CUT-FILL LOT OVEREXCAVATION

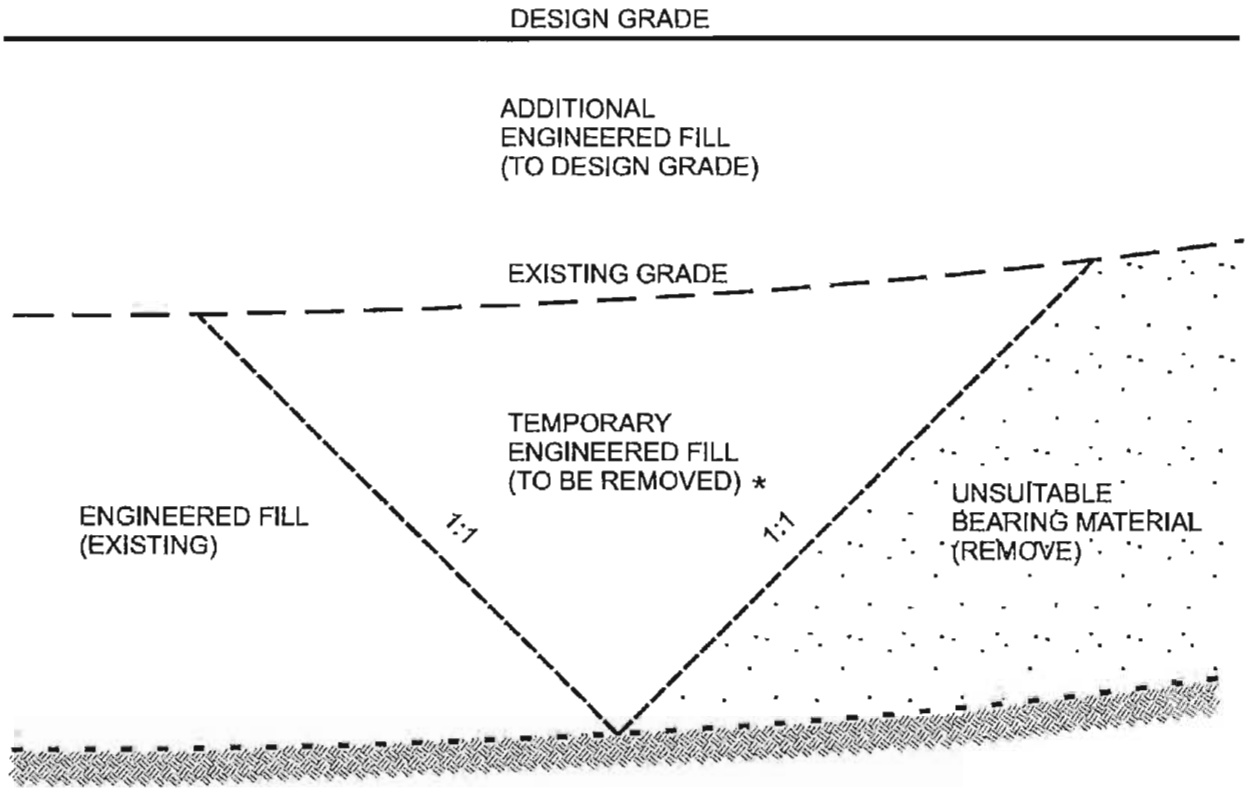
NOTES:

* SEE REPORT FOR RECOMMENDED DEPTHS, DEEPER OVEREXCAVATION MAY BE REQUIRED BY THE GEOTECHNICAL CONSULTANT BASED ON EXPOSED FIELD CONDITIONS

** CONSTRUCT EXCAVATION TO PROVIDE FOR POSITIVE DRAINAGE TOWARDS STREETS, DEEPER FILL AREAS OR APPROVED DRAINAGE DEVICES BASED ON FIELD CONDITIONS

VER 1.0 NTS

AGS ADVANCED GEOTECHNICAL SOLUTIONS	CUT & CUT-FILL LOT OVEREXCAVATION	DETAIL 8



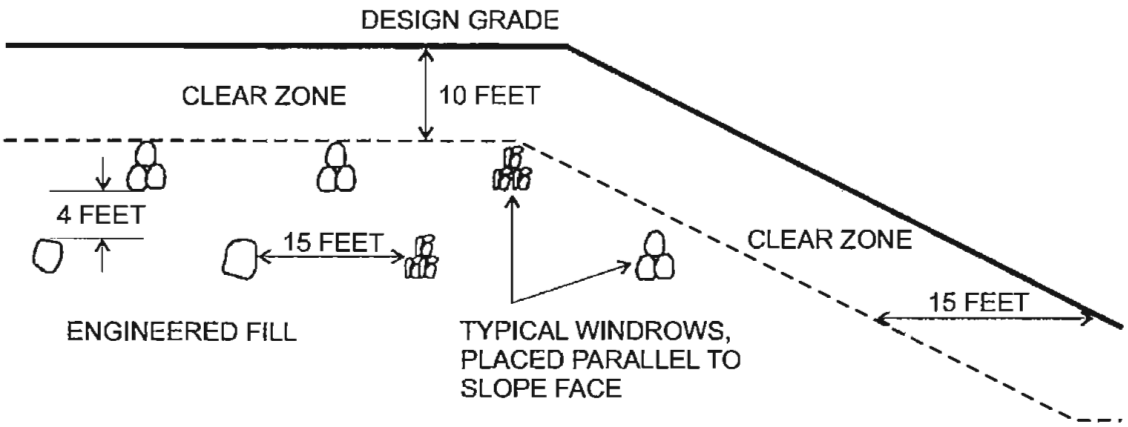
* REMOVE BEFORE PLACING ADDITIONAL ENGINEERED FILL

TYPICAL UP-CANYON PROFILE

VER 1.0

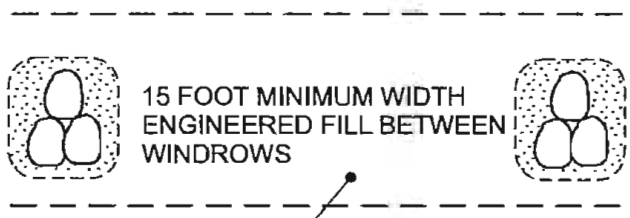
NTS

AGS ADVANCED GEOTECHNICAL SOLUTIONS	REMOVAL ADJACENT TO EXISTING FILL	DETAIL 9



CLEAR ZONE DIMENSIONS FOR REFERENCE ONLY, ACTUAL DEPTH, WIDTH, WINDROW LENGTH, ETC. TO BE BASED ON ELEVATIONS OF FOUNDATIONS, UTILITIES OR OTHER STRUCTURES PER THE GEOTECHNICAL CONSULTANT OR GOVERNING AGENCY APPROVAL

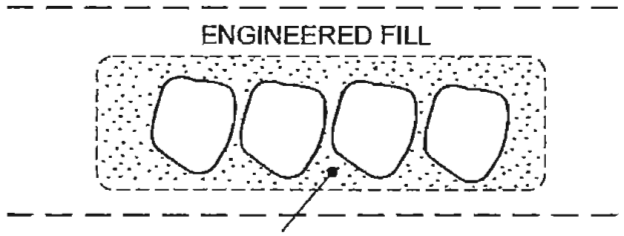
OVERSIZED MATERIAL DISPOSAL PROFILE



HORIZONTALLY PLACED ENGINEERED FILL, FREE OF OVERSIZED MATERIALS AND COMPACTED TO MINIMUM PROJECT STANDARDS

COMPACT ENGINEERED FILL ABOVE OVERSIZED MATERIALS TO FACILITATE "TRENCH" CONDITION PRIOR TO FLOODING GRANULAR MATERIALS

WINDROW CROSS-SECTION



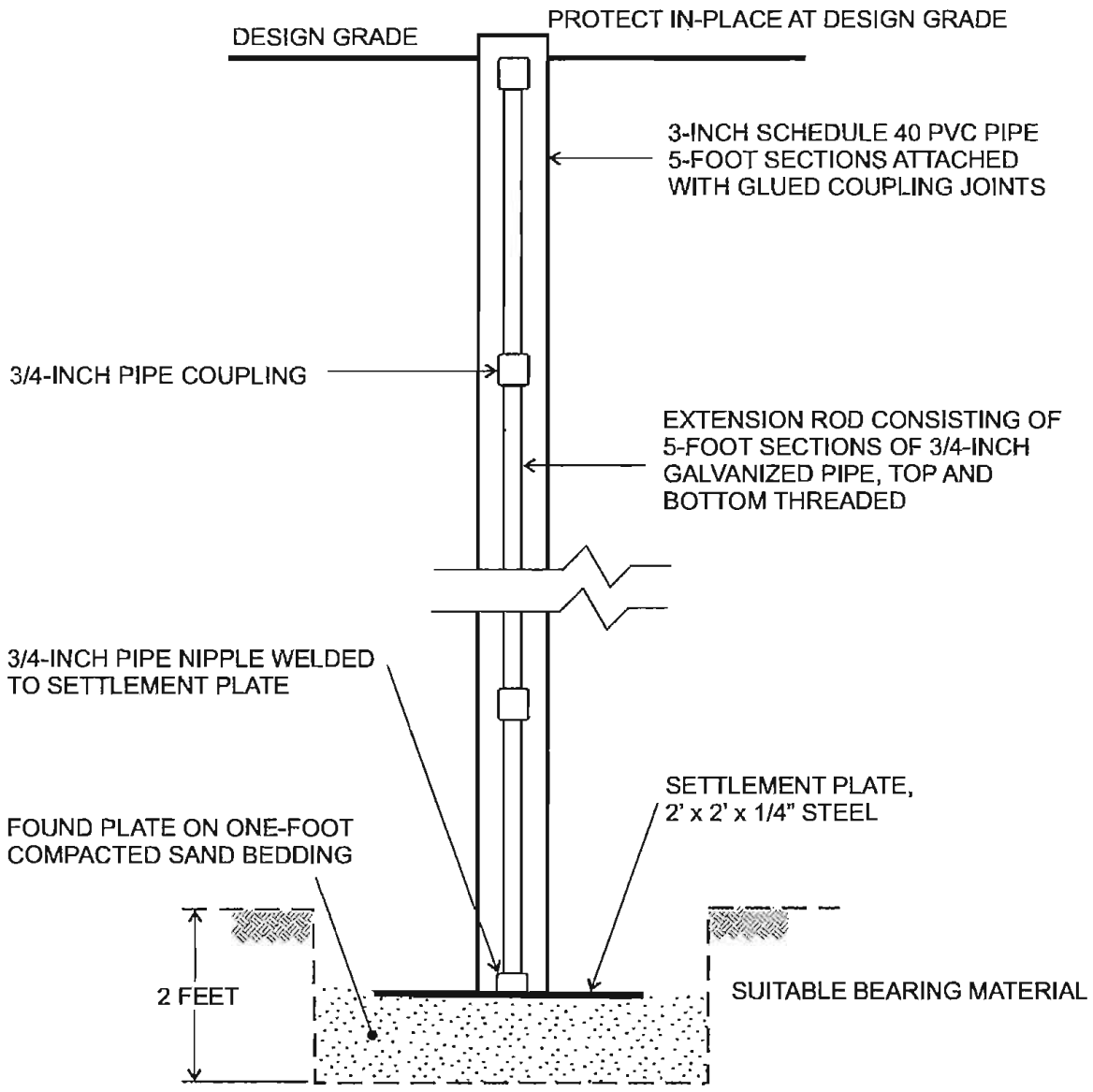
GRANULAR MATERIAL APPROVED BY THE GEOTECHNICAL CONSULTANT AND CONSOLIDATED IN-PLACE BY FLOODING

WINDROW PROFILE

VER 1.0

NTS

AGS ADVANCED GEOTECHNICAL SOLUTIONS	OVERSIZED MATERIAL DISPOSAL CRITERIA	DETAIL 10

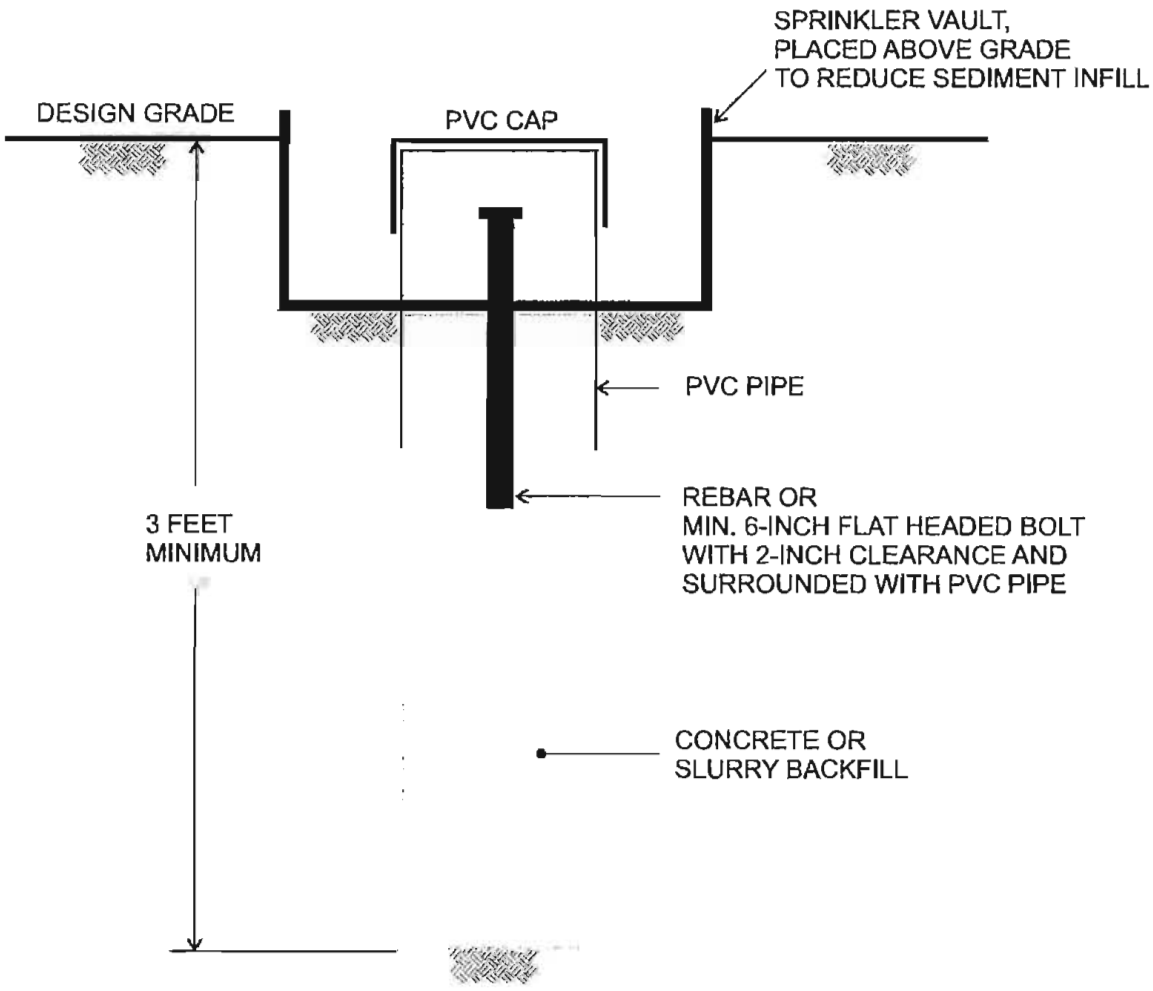


NOTES:

1. SETTLEMENT PLATE LOCATIONS SHALL BE SUFFICIENTLY IDENTIFIED BY THE CONTRACTOR AND BE READILY VISIBLE TO EQUIPMENT OPERATORS.
2. CONTRACTOR SHALL MAINTAIN ADEQUATE HORIZONTAL CLEARANCE FOR EQUIPMENT OPERATION AND SHALL BE RESPONSIBLE FOR REPAIRING ANY DAMAGE TO SETTLEMENT PLATE DURING SITE CONSTRUCTION.
3. A MINIMUM 5-FOOT ZONE ADJACENT TO SETTLEMENT PLATE/EXTENSION RODS SHALL BE ESTABLISHED FOR HAND-HELD MECHANICAL COMPACTION OF ENGINEERED FILL. ENGINEERED FILL SHALL BE COMPACTED TO MINIMUM PROJECT STANDARD.
4. ELEVATIONS OF SETTLEMENT PLATE AND ALL EXTENSION ROD PLACEMENT SHALL BE DOCUMENTED BY PROJECT CIVIL ENGINEER OR SURVEYOR.

VER 1.0 NTS

AGS ADVANCED GEOTECHNICAL SOLUTIONS	SETTLEMENT PLATE	DETAIL 11



NOTES:

1. SETTLEMENT MONUMENT LOCATIONS SHALL BE SUFFICIENTLY IDENTIFIED AND BE READILY VISIBLE TO EQUIPMENT OPERATORS.

2. ELEVATIONS OF SURFACE MONUMENTS SHALL BE DOCUMENTED BY PROJECT CIVIL ENGINEER OR SURVEYOR.

APPENDIX F

HOMEOWNERS MAINTENANCE GUIDELINES

HOMEOWNERS MAINTENANCE GUIDELINES

Homeowners are accustomed to maintaining their homes. They expect to paint their houses periodically, replace wiring, clean out clogged plumbing, and repair roofs. Maintenance of the home site, particularly on hillsides, should be considered on the same basis, or even on a more serious basis because neglect can result in serious consequences. In most cases, lot and site maintenance can be taken care of along with landscaping, and can be carried out more economically than repair after neglect.

Most slope and hillside lot problems are associated with water. Uncontrolled water from a broken pipe, cesspool, or wet weather causes most damage. Wet weather is the largest cause of slope problems, particularly in California where rain is intermittent, but may be torrential. Therefore, drainage and erosion control are the most important aspects of home site stability; these provisions must not be altered without competent professional advice. Further, maintenance must be carried out to assure their continued operation.

As geotechnical engineers concerned with the problems of building sites in hillside developments, we offer the following list of recommended home protection measures as a guide to homeowners.

Expansive Soils

Some of the earth materials on site have been identified as being expansive in nature. As such, these materials are susceptible to volume changes with variations in their moisture content. These soils will swell upon the introduction of water and shrink upon drying. The forces associated with these volume changes can have significant negative impacts (in the form of differential movement) on foundations, walkways, patios, and other lot improvements. In recognition of this, the project developer has constructed homes on these lots on post-tensioned or mat slabs with pier and grade beam foundation systems, intended to help reduce the potential adverse effects of these expansive materials on the residential structures within the project. Such foundation systems are not intended to offset the forces (and associated movement) related to expansive soil, but are intended to help soften their effects on the structures constructed thereon.

Homeowners purchasing property and living in an area containing expansive soils must assume a certain degree of responsibility for homeowner improvements as well as for maintaining conditions around their home. Provisions should be incorporated into the design and construction of homeowner improvements to account for the expansive nature of the onsite soils material. Lot maintenance and landscaping should also be conducted in consideration of the expansive soil characteristics. Of primary importance is minimizing the moisture variation below all lot improvements. Such design, construction and homeowner maintenance provisions should include:

- Employing contractors for homeowner improvements who design and build in recognition of local building code and site specific soils conditions.
- Establishing and maintaining positive drainage away from all foundations, walkways, driveways, patios, and other hardscape improvements.

- Avoiding the construction of planters adjacent to structural improvements. Alternatively, planter sides/bottoms can be sealed with an impermeable membrane and drained away from the improvements via subdrains into approved disposal areas.
- Sealing and maintaining construction/control joints within concrete slabs and walkways to reduce the potential for moisture infiltration into the subgrade soils.
- Utilizing landscaping schemes with vegetation that requires minimal watering. Alternatively, watering should be done in a uniform manner as equally as possible on all sides of the foundation, keeping the soil "moist" but not allowing the soil to become saturated.
- Maintaining positive drainage away from structures and providing roof gutters on all structures with downspouts installed to carry roof runoff directly into area drains or discharged well away from the structures.
- Avoiding the placement of trees closer to the proposed structures than a distance of one-half the mature height of the tree.
- Observation of the soil conditions around the perimeter of the structure during extremely hot/dry or unusually wet weather conditions so that modifications can be made in irrigation programs to maintain relatively constant moisture conditions.

Sulfates

On site soils were tested for the presence of soluble sulfates. Based on the results of that testing, the soluble sulfate exposure level was determined to be "negligible" to "moderate" when classified in accordance with the ACI 318-05 Table 4.3.1 (per 2007 CBC). As such, a concrete mix design should be based on a "moderate" sulfate exposure (4,000 psi concrete with a water to cement ratio of 0.50).

Homeowners should be cautioned against the import and use of certain fertilizers, soil amendments, and/or other soils from offsite sources in the absence of specific information relating to their chemical composition. Some fertilizers have been known to leach sulfate compounds into soils otherwise containing "negligible" sulfate concentrations and increase the sulfate concentrations in near-surface soils to "moderate" or "severe" levels. In some cases, concrete improvements constructed in soils containing high levels of soluble sulfates may be affected by deterioration and loss of strength.

Water - Natural and Man Induced

Water in concert with the reaction of various natural and man-made elements, can cause detrimental effects to your structure and surrounding property. Rain water and flowing water erodes and saturates the ground and changes the engineering characteristics of the underlying earth materials upon saturation. Excessive irrigation in concert with a rainy period is commonly associated with shallow slope failures and deep scated landslides, saturation of near structure soils, local ponding of water, and transportation of water soluble substances that are deleterious to building materials including concrete, steel, wood, and stucco.

Water interacting with the near surface and subsurface soils can initiate several other potentially detrimental phenomena other then slope stability issues. These may include expansion/contraction cycles,

liquefaction potential increase, hydro-collapse of soils, ground surface settlement, earth material consolidation, and introduction of deleterious substances.

The homeowners should be made aware of the potential problems which may develop when drainage is altered through construction of retaining walls, swimming pools, paved walkways and patios. Ponded water, drainage over the slope face, leaking irrigation systems, over-watering or other conditions which could lead to ground saturation must be avoided.

- Before the rainy season arrives, check and clear roof drains, gutters and down spouts of all accumulated debris. Roof gutters are an important element in your arsenal against rain damage. If you do not have roof gutters and down spouts, you may elect to install them. Roofs, with their, wide, flat area can shed tremendous quantities of water. Without gutters or other adequate drainage, water falling from the eaves collects against foundation and basement walls.
- Make sure to clear surface and terrace drainage ditches, and check them frequently during the rainy season. This task is a community responsibility.
- Test all drainage ditches for functioning outlet drains. This should be tested with a hose and done before the rainy season. All blockages should be removed.
- Check all drains at top of slopes to be sure they are clear and that water will not overflow the slope itself, causing crosion.
- Keep subsurface drain openings (weep-holes) clear of debris and other material which could block them in a storm.
- Check for loose fill above and below your property if you live on a slope or terrace.
- Monitor hoses and sprinklers. During the rainy season, little, if any, irrigation is required. Oversaturation of the ground is unnecessary, increases watering costs, and can cause subsurface drainage.
- Watch for water backup of drains inside the house and toilets during the rainy season, as this may indicate drain or sewer blockage.
- Never block terrace drains and brow ditches on slopes or at the tops of cut or fill slopes. These are designed to carry away runoff to a place where it can be safely distributed.
- Maintain the ground surface upslope of lined ditches to ensure that surface water is collected in the ditch and is not permitted to be trapped behind or under the lining.
- Do not permit water to collect or pond on your home site. Water gathering here will tend to either seep into the ground (loosening or expanding fill or natural ground), or will overflow into the slope and begin erosion. Once erosion is started, it is difficult to control and severe damage may result rather quickly.
- Never connect roof drains, gutters, or down spouts to subsurface drains. Rather, arrange them so that water either flows off your property in a specially designed pipe or flows out into a paved driveway or street. The water then may be dissipated over a wide surface or, preferably, may be carried away in a paved gutter or storm drain. Subdrains are constructed to take care of ordinary subsurface water and cannot handle the overload from roofs during a heavy rain.

- Never permit water to spill over slopes, even where this may seem to be a good way to prevent ponding. This tends to cause erosion and, in the case of fill slopes, can eat away carefully designed and constructed sites.
- Do not cast loose soil or debris over slopes. Loose soil soaks up water more readily than compacted fill. It is not compacted to the same strength as the slope itself and will tend to slide when laden with water; this may even affect the soil beneath the loose soil. The sliding may clog terrace drains below or may cause additional damage in weakening the slope. If you live below a slope, try to be sure that loose fill is not dumped above your property.
- Never discharge water into subsurface blanket drains close to slopes. Trench drains are sometimes used to get rid of excess water when other means of disposing of water are not readily available. Overloading these drains saturates the ground and, if located close to slopes, may cause slope failure in their vicinity.
- Do not discharge surface water into septic tanks or leaching fields. Not only are septic tanks constructed for a different purpose, but they will tend, because of their construction, to naturally accumulate additional water from the ground during a heavy rain. Overloading them artificially during the rainy season is bad for the same reason as subsurface subdrains, and is doubly dangerous since their overflow can pose a serious health hazard. In many areas, the use of septic tanks should be discontinued as soon as sewers are made available.
- Practice responsible irrigation practices and do not over-irrigate slopes. Naturally, ground cover of ice plant and other vegetation will require some moisture during the hot summer months, but during the wet season, irrigation can cause ice plant and other heavy ground cover to pull loose. This not only destroys the cover, but also starts serious erosion. In some areas, ice plant and other heavy cover can cause surface sloughing when saturated due to the increase in weight and weakening of the near-surface soil. Planted slopes should be planned where possible to acquire sufficient moisture when it rains.
- Do not let water gather against foundations, retaining walls, and basement walls. These walls are built to withstand the ordinary moisture in the ground and are, where necessary, accompanied by subdrains to carry off the excess. If water is permitted to pond against them, it may seep through the wall, causing dampness and leakage inside the basement. Further, it may cause the foundation to swell up, or the water pressure could cause structural damage to walls.
- Do not try to compact soil behind walls or in trenches by flooding with water. Not only is flooding the least efficient way of compacting fine-grained soil, but it could damage the wall foundation or saturate the subsoil.
- Never leave a hose and sprinkler running on or near a slope, particularly during the rainy season. This will enhance ground saturation which may cause damage.
- Never block ditches which have been graded around your house or the lot pad. These shallow ditches have been put there for the purpose of quickly removing water toward the driveway, street or other positive outlet. By all means, do not let water become ponded above slopes by blocked ditches.

- Seeding and planting of the slopes should be planned to achieve, as rapidly as possible, a well-established and deep-rooted vegetal cover requiring minimal watering.
- It should be the responsibility of the landscape architect to provide such plants initially and of the residents to maintain such planting. Alteration of such a planting scheme is at the resident's risk.
- The resident is responsible for proper irrigation and for maintenance and repair of properly installed irrigation systems. Leaks should be fixed immediately. Residents must undertake a program to eliminate burrowing animals. This must be an ongoing program in order to promote slope stability. The burrowing animal control program should be conducted by a licensed exterminator and/or landscape professional with expertise in hill side maintenance.

Geotechnical Review

Due to the presence of expansive soils on site and the fact that soil types may vary with depth, it is recommended that plans for the construction of rear yard improvements (swimming pools, spas, barbecue pits, patios, etc.), be reviewed by a geotechnical engineer who is familiar with local conditions and the current standard of practice in the vicinity of your home.

In conclusion, your neighbor's slope, above or below your property, is as important to you as the slope that is within your property lines. For this reason, it is desirable to develop a cooperative attitude regarding hillside maintenance, and we recommend developing a "good neighbor" policy. Should conditions develop off your property, which are undesirable from indications given above, necessary action should be taken by you to insure that prompt remedial measures are taken. Landscaping of your property is important to enhance slope and foundation stability and to prevent erosion of the near surface soils. In addition, landscape improvements should provide for efficient drainage to a controlled discharge location downhill of residential improvements and soil slopes.

Additionally, recommendations contained in the Geotechnical Engineering Study report apply to all future residential site improvements, and we advise that you include consultation with a qualified professional in planning, design, and construction of any improvements. Such improvements include patios, swimming pools, decks, etc., as well as building structures and all changes in the site configuration requiring earth cut or fill construction.

Appendix F

Inspection, Operation, and Maintenance Plan

Otay Ranch

Village 8 West

Chula Vista Tract No. 09-xx

Prepared By
Hale Engineering
7910 Convoy Court
San Diego, CA 92111
(858) 715-1420

Prepared For
Otay Land Company, LLC
1903 Wright Place, Suite 220
Carlsbad, CA 92008
(760) 602-3777

Original Date: March 26, 2009

Revised: February 3, 2011

Table of Contents

1 Introduction 1
2 Designated Responsible Part 1
3 Employee Training 1
4 Inspection and Maintenance 2
4.1 Swale Bioretention BMPs 2
4.2 Tree Well Bioretention BMPs 3
4.3 Landscaping 4
4.4 Miscellaneous Activities 5
5 Record Keeping 5

Appendix

Appendix A Sample Maintenance Agreement
Appendix B Sample Inspection and Maintenance Forms

1 Introduction

Per Section 3.VI.3 of the City of Chula Vista Development Storm Water Manual, this Inspection, Operation, and Maintenance Plan (IOMP) describes responsibilities and actions necessary to ensure the proper function of the proposed project BMPs.

2 Designated Responsible Part

The provision of the fiscal resources necessary to ensure the proper adherence to this Inspection, Operation, and Maintenance Plan and to ensure the water quality of the storm water discharged from the project site shall be the responsibility of:

Otay Land Company, LLC
1903 Wright Place, Suite 220
Carlsbad, CA 92008
(760) 602-3777

Otay Land Company, LLC shall create a Landscape Maintenance District (LMD). Maintenance of the project BMPs shall be amongst the responsibilities of the LMD. The LMD shall ensure ongoing long-term maintenance of all structural BMPs and provide verification of maintenance requirements through such means as may be appropriate, at the discretion of the City of Chula Vista.

3 Employee Training

Responsible persons shall be trained within a month of hire, and shall receive a minimum of one review session annually. A training log shall be provided and shall be filled out at each training session. The records of training shall be kept a minimum of five (5) years.

A sample inspection log is included in Appendix B. The Inspection Log provides a list of the specific inspection tasks to be carried out. Copies of the Inspection Log shall be provided and filled out after each inspection. The inspection records shall be kept a minimum of five (5) years.

A maintenance log shall be provided and filled out for all maintenance activities. The records shall be kept for a minimum of five (5) years. A sample of the maintenance log sheet is shown in Appendix B.

4 Inspection and Maintenance

Proper inspection and maintenance is imperative for BMP effectiveness and longevity. All BMPs shall be maintained to provide optimum effectiveness in accordance with industry standards, with annual maintenance to be conducted prior to October 1st. The maintenance program for site BMPs is as follows:

4.1 Swale Bioretention BMPs

Inspection

Bioretention BMPS shall be inspected monthly, or after large storm events, and after removal of accumulated debris or material. Based upon the conditions observed in the inspection, corrective maintenance shall be performed in accordance with the guidelines set forth below.

Inspection of the bioretention BMPs shall include a visual inspection of the general condition of the vegetation and irrigation operation interval.

Preventative Maintenance

The BMP shall be maintained and irrigated in a manner that promotes plant health and good coverage. The health of the vegetation shall be evaluated twice annually; all dead and diseased vegetation shall be removed and replaced. Weeding of vegetation shall be done as needed to promote a neat and orderly appearance.

Trash and debris shall be removed and properly disposed of before the wet season and as needed.

The use of fertilizers, herbicides and pesticides shall be done in accordance with all applicable federal, state and local regulations as well as the manufacturer's specifications. Landscape waste shall be disposed of by use of a solid waste container and shall be transported off-site to the appropriate facility.

Corrective Maintenance

If it is determined, based on site conditions or the condition of the bioretention BMPs, that the maintenance interval is infrequent enough for proper operation as a BMP, the inspection schedule shall be reevaluated and a revised schedule shall be implemented.

Any dead or diseased plants shall be removed and replaced with an appropriate equal as needed, to ensure the proper operation as a BMP.

Sediment shall be removed such that there is no clogging or blockage of the filter material as soon as is practical.

Faulty operation of storm drain overflow pipes resulting in a condition detrimental to the water quality environment shall be corrected as soon as is practical.

Faulty operation of irrigation appurtenances resulting in a condition detrimental to the water quality environment shall be corrected as soon as is practical.

Irrigation run-off shall not be allowed. Irrigation controllers shall be regulated in a manner that does not allow for significant landscape irrigation water run-off.

4.2 Tree Well Bioretention BMPs

Inspection

Tree wells shall be inspected monthly, or after large storm events, and after removal of accumulated debris or material. Based upon the conditions observed in the inspection, corrective maintenance shall be performed in accordance with the guidelines set forth below.

Inspection of the tree wells shall include a visual inspection of the general condition of the vegetation, mulch, planting mix, and irrigation operation interval.

Preventative Maintenance

The tree well shall be maintained and irrigated in a manner that promotes tree health and good coverage. The health of the tree and vegetation shall be evaluated twice annually; all dead and diseased vegetation and/or trees shall be removed and replaced. Weeding of vegetation and tree pruning shall be done as needed to promote a neat and orderly appearance. Mulch shall be replaced as needed to provide an even appearance and a depth of 3 inches. Planting mix shall be replenished before the wet season and as needed.

Trash and debris shall be removed and properly disposed of before the wet season and as needed.

The use of fertilizers, herbicides and pesticides shall be done in accordance with all applicable federal, state and local regulations as well as the manufacturer's specifications. Landscape waste shall be disposed of by use of a solid waste container and shall be transported off-site to the appropriate facility.

Corrective Maintenance

If it is determined, based on site conditions or the condition of the tree well, that the maintenance interval is infrequent enough for proper operation as a BMP, the inspection schedule shall be reevaluated and a revised schedule shall be implemented.

Any dead or diseased plants shall be removed and replaced with an appropriate equal as needed, to ensure the proper operation as a BMP.

Sediment shall be removed such that there is no clogging or blockage of the drainage system.

Faulty operation of storm drain overflow pipes resulting in a condition detrimental to the water quality environment shall be corrected as soon as is practical.

Faulty operation of irrigation appurtenances resulting in a condition detrimental to the water quality environment shall be corrected as soon as is practical.

Irrigation run-off shall not be allowed. Irrigation controllers shall be regulated in a manner that does not allow for significant landscape irrigation water run-off.

4.3 Landscaping

Inspection

Landscaping shall be inspected monthly, or after large storm events, and after removal of accumulated debris or material. Based upon the conditions observed in the inspection, corrective maintenance shall be performed in accordance with the guidelines set forth below.

Inspection of the landscaping shall include a visual inspection of the general condition of the vegetation and irrigation operation interval.

Preventative Maintenance

All vegetated areas are to be maintained and irrigated in a manner that promotes plant health and good coverage. The health of the vegetation shall be evaluated twice annually; all dead and diseased vegetation shall be removed and replaced. In the event that erosion becomes evident, the maintenance activity shall include stabilization of the area, a reevaluation of the design and the formulation of a solution for the proper performance of the BMP.

Trash and debris shall be removed and properly disposed of before the wet season and as needed.

The use of fertilizers, herbicides and pesticides shall be done in accordance with all applicable federal, state and local regulations as well as the manufacturer's specifications. Landscape waste shall be disposed of by use of a solid waste container and shall be transported off-site to the appropriate facility.

Landscape irrigation run-off shall not be allowed. Irrigation controllers shall be regulated in a manner that does not allow for significant landscape irrigation water run-off.

Corrective Maintenance

If it is determined, based on site conditions or the condition of the landscaping, that the inspection interval is infrequent enough for proper operation as a BMP, the maintenance schedule shall be reevaluated and a revised schedule shall be implemented.

Any dead or diseased plants shall be removed and replaced with an appropriate equal as needed, to ensure the proper operation as a BMP.

Faulty operation of irrigation appurtenances resulting in a condition detrimental to the

4.4 Miscellaneous Activities

Storm Drain Stenciling and Signage- Storm drain stencils shall be inspected annually at a minimum for legibility. In the event that stencils and/or signs become illegible, they shall be repainted or replaced as soon as is practical.

5 Record Keeping

The LMD shall complete and maintain all necessary IOMP forms to document all maintenance requirements. All records shall be retained for at least 5 years and shall be available to the City for inspection upon request at any time.

Appendix A

RECORDING REQUESTED BY,
AND WHEN RECORDED
MAIL TO:

CITY OF CHULA VISTA
CITY CLERK
276 FOURTH AVENUE
CHULA VISTA, CA 91910

No transfer tax is due as this is a conveyance to a public agency of less than a fee interest for which no cash consideration has been paid or received

For Recorder's Use Only

File No. _____

STORM WATER MANAGEMENT FACILITIES MAINTENANCE
AGREEMENT WITH GRANT OF ACCESS AND COVENANTS

(Insert Project Reference Numbers)

DEFINITIONS

"Agreement" means this Storm Water Facilities Maintenance Agreement with Grant of Access and Covenants.

"Best Management Practices, or BMPs" means structural or non-structural pollution prevention measures, such as site design, source control, and treatment control methods required to minimize polluted runoff from the development during the post-development phase of the project. BMPs include, but are not limited to, Storm Water Management Facilities.

"City" means the City of Chula Vista, an official of the City, or any designated staff member acting on behalf of the City. The City Council, in Resolution No. _____ dated _____, has authorized the City Engineer to sign this Agreement on behalf of the City.

"Inspection, Operation, and Maintenance Plan, or IOMP" means a description of inspection, operation, and maintenance activities and schedules required to ensure proper operation and effectiveness of the SWMFs into perpetuity, as required in the Chula Vista Development Storm Water Manual. A copy of the IOMP, as amended from time-to-time, shall be included in the Water Quality Technical Report for the project before issuance of a construction permit, and a copy shall be maintained on file with the office of the City Engineer. City may require amendments to the IOMP at its sole discretion.

"Owner" means the owner of Property signatory to this Agreement applying for a development or redevelopment project that includes permanent BMPs, and all Owner's successors in interest in Property, jointly (such as a Home Owners' Association) and/or individually.

"Property" means the property on which development is proposed, a legal description of which is attached herewith as Exhibit B.

"Responsible Party" means Owner and any other person, corporation, or legal entity accepting, in writing and in City approved form, responsibility on behalf of Owner.

"Security" means any Bond, Cash Deposit, or Letter of Credit that City may require from Owner as a result of Owner's failure to effectively maintain development's SWMFs, and is to assure the faithful performance of the obligations of this Agreement.

"Storm Water Management Facilities" ("SWMFs") means all onsite and offsite structural facilities constructed for the treatment of project's storm water runoff, proposed as part of the development project submittals, as approved by City prior to the issuance of a development permit, or as amended with City's approval after the development is complete.

AGREEMENT

This Agreement for the inspection, maintenance, and repair of certain Storm Water Management Facilities is entered into between _____ ("Owner") and City for the benefit of City, Owner, successors in interest to City or Owner, and the public generally.

Pursuant to City's urban runoff regulations, including Chula Vista Municipal Code, Chapter 14.20 (the "Storm Water Management and Discharge Control Ordinance) and the Chula Vista Development Storm Water Manual, Owner has prepared and submitted to City a Water Quality Technical Report ("WQTR"), which is on file in the office of the City Engineer. The WQTR proposes that storm water runoff from Property be detained and treated by the use of permanent SWMFs which are identified in the WQTR as Treatment Control BMPs.

The WQTR specifies the manner and standards by which the SWMFs must be inspected, maintained, and repaired in order to retain their effectiveness. City requires Owner to enter into Agreement for the installation, inspection, maintenance, and repair of permanent SWMFs prior to the issuance of construction permits by City for work on Property (Improvements). It is the purpose of this Agreement to assure that the SWMFs are inspected, maintained, and repaired by creating obligations which are enforceable against Owner. Owner hereby covenants and agrees with City as follows:

1. Maintenance of Storm Water Management Facilities. Owner shall install, inspect, maintain, repair, and replace all SWMFs for the Improvements as required by the Director of Public Works, or his/her designated representative ("Director). Maintenance shall include inspection and servicing of SWMFs on the

schedule determined necessary to ensure the SWMFs retain their effectiveness. Owner shall maintain, repair and replace the SWMFs until all obligations under this Agreement are transferred to, and assumed by, another owner or entity, satisfactory to City. Owner shall grant Responsible Party assuming any obligation under this Agreement all necessary access right. Owner shall include a copy of the Inspection, Operation, and Maintenance Plan ("IOMP") for the SWMFs in the WQTR for the project and submit a copy to City, at the time this Agreement is executed.

The IOMP shall describe employee training programs and duties, routine inspection, service and operating schedules, maintenance frequency, and specific maintenance activities. Through the IOMP, Owner may also designate a Responsible Party, satisfactory to City, to maintain the BMPs. The IOMP may be amended from time-to-time by Owner, subject to City approval. Owner shall also be responsible for amending the IOMP upon City's direction.

2. Record Keeping. The designation of a Responsible Party to maintain the SWMFs does not relieve Owner of any of the obligations or duties under this Agreement. Owner, its successors, or a designated Responsible Party, shall retain records of the IOMP and maintenance and inspection activities for at least five years. Said records shall be made available within 5 days, upon request by City.

3. Defense and Indemnity. Owner agrees to defend, indemnify, protect, and hold harmless City, its agents, officers and employees, from and against all claims, demands, causes of action, liability or loss asserted or established for damages or injuries to any person or property arising out of the installation, inspection, maintenance, repair, or replacement of the BMPs. Claims, demands, causes of action, liability or loss that arise from, are connected with, or are caused or claimed to be caused by the acts or omission of Owner, Owner's agents, officers and employees are covered.

Also covered are the claims, demands, causes of action, liability or loss arising from, connected with, caused by, or claimed to be caused by the active or passive negligent acts or omissions of City, its agents, officers, or employees which may be in combination with the negligence of Owner, its employees, agents or officers, or any third party. Owner's duty to defend, indemnify, protect and hold harmless shall not include any claims or liabilities arising from the established sole negligence or sole willful misconduct of City, its agents, officers or employees.

Owner further agrees that indemnification referred to above and the duty to defend City requires Owner to pay any costs City incurs that are associated with enforcing the indemnification provision, and defending any claims arising from the installation, inspection, maintenance, repair, or replacement of the SWMFs. If City elects, at its sole discretion, to conduct its own defense, participate in its own defense, or obtain independent legal counsel in defense on any claim related to the installation, inspection, maintenance, repair or replacement of the SWMFs, Owner agrees to pay the reasonable value of attorney's fees and all of City's reasonable costs.

4. Insurance. Owner shall maintain a policy of liability insurance, as required by and in an amount approved by, City. This policy, with City named as an

additional insured, will protect City from any potential claims, which may arise from the installation, inspection, maintenance, repair or replacement of the SWMFs.

5. Notices. Owner agrees that it shall, prior to transferring ownership of any land on which any of the SWMFs covered by this Agreement are located, and also prior to transferring ownership of any such SWMFs, provide clear written notice of the above maintenance obligations associated with that SWMF to the transferee. Owner further agrees to provide evidence that Owner has requested the California Department of Real Estate to include in the public report issued for the development of Property, a notification regarding the SWMF maintenance requirements described in this Agreement.

6. CITY's Right to Perform Maintenance. It is agreed that City shall have the right, but not the obligation, to elect to perform any or all of the maintenance activities if, in City's sole judgment, Owner has failed, after a five-day written notice (from the date of postmark or personal delivery) has been provided by City to Owner, to perform the maintenance as agreed. In cases where immediate threat to water quality is imminent, a five-day notice will not be required. If City performs any of the maintenance activities, after City has first (1) served notice to Owner in accordance with the provisions of Chula Vista Municipal Code Chapter 1.40 to perform the maintenance activities and (2) Owner has failed to do so within the reasonable time stated in City's notice, then Owner shall pay all City costs incurred in performing said maintenance activities. Owner's obligation to pay City's costs of performing maintenance activities is a continuing obligation and shall apply whether or not City has required or used all or any portion of Security provided pursuant to Paragraph 8.

7. Grant of Access. City will conduct inspections of the SWMFs from time-to-time as required by the National Pollutant Discharge Elimination System Municipal Permit, Order No. R9-2007-0001 and any re-issuances thereof, to ensure adequate maintenance and effectiveness of the SWMFs. Owner grants to City a perpetual access to the SWMFs for performing inspections or any of the maintenance activities specified in paragraph 1. City shall have the right, at any time and without prior notice to Owner, to enter upon any part of Property as may be necessary or convenient for inspection purposes. Owner shall at all times maintain Property so as to make City's access clear and unobstructed. Owner agrees to pay all inspection fees as may be established by City.

8. Security. If upon two inspections within any five-year period, City inspectors determine that Owner has failed to effectively operate, maintain, or repair the SWMFs, City may require Owner to provide City with Security to assure the faithful performance of the obligations of this Agreement. Security may be in the form of a Bond, a Cash Deposit, or a Letter of Credit in an amount equal to two-years' cost of maintaining the SWMFs, as determined in the project WQTR and adjusted at 5% per annum. City may use Security to provide funding for the cost to City to perform any of the maintenance activities for the development's SWMFs. City may use all or any part of Security at any time pursuant to this Agreement. Should any portion of Security be used by City, Owner shall deposit additional funds or provide an additional Letter of Credit to City within thirty (30) days in the amount used by City to bring the amount available back up to the amount specified. If Security is a Cash Deposit, and a

Substitute Cash Deposit or Letter of Credit is provided that is acceptable to City, any amount of the Cash Deposit not used by City shall be returned to Owner in accordance with City's accounting procedures. The Letter of Credit shall be submitted on bank letterhead using City-approved form. Once Owner has demonstrated effective operation, maintenance, and repair, as determined by City, the Security shall be kept for one year for the first occurrence, and two years for the second occurrence, after which time the Security shall be cancelled and any unused funds returned to Owner.

9. Agreement Binds Successors and Runs with PROPERTY. It is understood and agreed that the terms, covenants and conditions contained in this Agreement shall constitute covenants running with the land and shall be binding upon the heirs, executors, administrators, successors and assigns of Owner and City and shall be deemed to be for the benefit of all persons owning any interest in Property. It is the intent of the parties that this Agreement be recorded and be binding upon all persons purchasing or otherwise acquiring all or any lot, unit or other portion of Property, who shall be deemed to have consented to and become bound by all the provisions of this Agreement. This Agreement shall commence upon execution of this Agreement by all parties named in the Agreement.

10. Enforcement. Failure to comply with the terms of this Agreement constitutes a violation of the Chula Vista Municipal Code Chapter 14.20 "Storm Water Management and Discharge Control" and may result in enforcement action pursuant to City's storm water regulations and administrative procedures.

11. Governing Law and Severability. This Agreement shall be governed by the laws of the State of California. Venue in any action related to this Agreement shall be in the Superior Court of the State of California, County of San Diego, South County Division. In the event that any of the provisions of this Agreement are held to be unenforceable or invalid by any court of competent jurisdiction, the validity, and enforceability of the remaining provisions shall not be affected by the judgment.

SIGNATURE PAGE FOR
STORM WATER MANAGEMENT FACILITIES MAINTENANCE
AGREEMENT WITH GRANT OF ACCESS AND COVENANTS
(Insert Project Reference Numbers)

IN WITNESS WHEREOF, the parties have executed this Agreement on the _____ day of _____, 20__.

OWNER:

_____

By: _____

Its: _____

By: _____

Its: _____

CITY OF CHULA VISTA:

_____
City Engineer

APPROVED AS TO FORM:

_____
City Attorney

ATTEST:

_____
City Clerk

Dated: _____

(Notary to attach acknowledgment for each signature.)
(Corporate Authority required for each Signatory, if applicable.)

Attachments:

Exhibit A: Legal Description for Property

Appendix B

Storm Water BMP Maintenance Log

Maintenance Engineer/ Company	Maintenance Type	Date	Comments

Employee Training Log

Training Type: _____

_____

Instructor: _____ **Date:** _____

Company: _____

Attendees

Name	Signature	Name	Signature

Site Inspection Log

Maintenance Engineer/Company:	
Date:	
Reason for Inspection:	

Inspection Item	A	M	U	N/A	Corrective Action Required
I. Landscaping					
Are grounds in good condition, clean and free of debris?					
Are lawn areas mowed and trimmed?					
Are plant beds and/or planter boxes well maintained?					
Are shrubs trimmed and maintained?					
Are dead trees or shrubs evident?					
Are lawn sprinkler systems operable?					
Are areas around trash receptacles clean?					
Do a sufficient quantity of receptacles exist?					
II. Hardscape					
Are sidewalks and trails in good condition, clean, and free of debris?					
III. Storm Drain System					
Are all stencils in good condition, visible and legible?					
Are all drains clean and free of obstructions?					
IV. Bioretention BMPs					
Is the BMP in good condition, clean and free of debris?					
Is the BMP free of burrows?					
Is the BMP free of sediment accumulation?					
Is the BMP free of standing water					
V. Tree Wells					
Is the Tree Well in good condition, clean and free of debris?					
Is the vegetation healthy and the planter mix at a proper depth?					
Is the BMP free of sediment accumulation?					
Is the BMP free of standing water?					

Comments:

A Acceptable **M** Marginal **U** Unacceptable **N/A** Not Applicable

PRE PROJECT DRAINAGE MAP
OTAY RANCH, VILLAGE 8 WEST
CITY OF CHULA VISTA, CALIFORNIA, TRACT NO. 09-___

BASIN C-OS
89.6 ACRES

94.0 ACRES

BASIN C
183.6 TOTAL ACRES
94.0 ON SITE ACRES
C=0.45

107.0 ACRES

BASIN B
127.1 TOTAL ACRES
107.0 ON SITE ACRES
C=0.45

BASIN A
83.9 ACRES
C=0.45

BASIN A-OS
17.2 ACRES
C=0.45

MSCP BOUNDARY

VILLAGE 8 WEST BOUNDARY

SEE LEFT

SEE RIGHT

OTAY RIVER

PARCEL B

OFFSITE DRAINAGE

SCALE: 1" = 150'

150 0 150 300 450

SCALE 1" = 150'

POST-PROJECT DRAINAGE OTAY RANCH, VILLAGE 8 WEST

CITY OF CHULA VISTA, CALIFORNIA

OFF SITE 89.6 AC

BASIN P
16.3 AC

BASIN 4
ON SITE 54.0 AC
TOTAL 143.6 AC

BASIN 5
59.0 AC

BASIN 3
ON SITE 82.7 AC
TOTAL 100.3 AC
EXISTING RESERVOIR
7.63 AC

BASIN 1
36.7 AC

BASIN 2
42.3 AC

OFF SITE 20.1 AC

WOLF CANYON

OTAY RIVER

ROCK MTN. ROAD

MAIN STREET

EXISTING NATURAL DRAINAGE

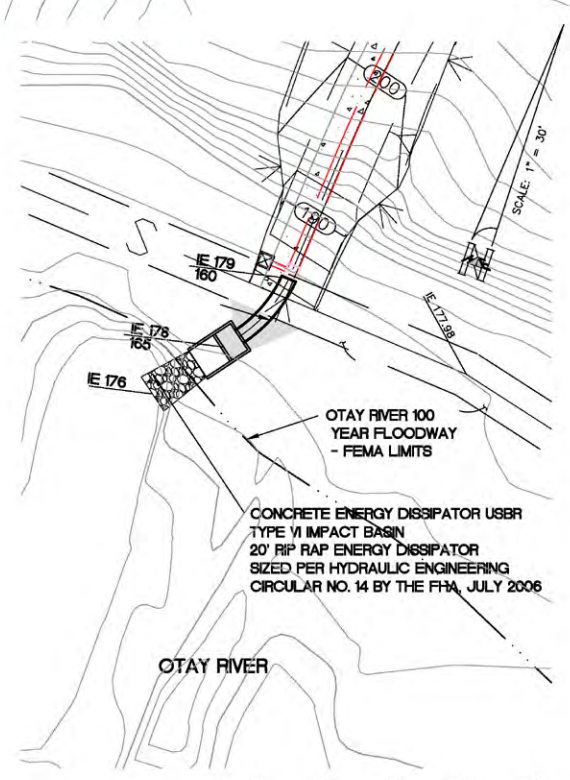
CONCRETE ENERGY DISSIPATOR USBR TYPE VI IMPACT BASIN
20' RIP RAP ENERGY DISSIPATOR

MSCP LIMIT

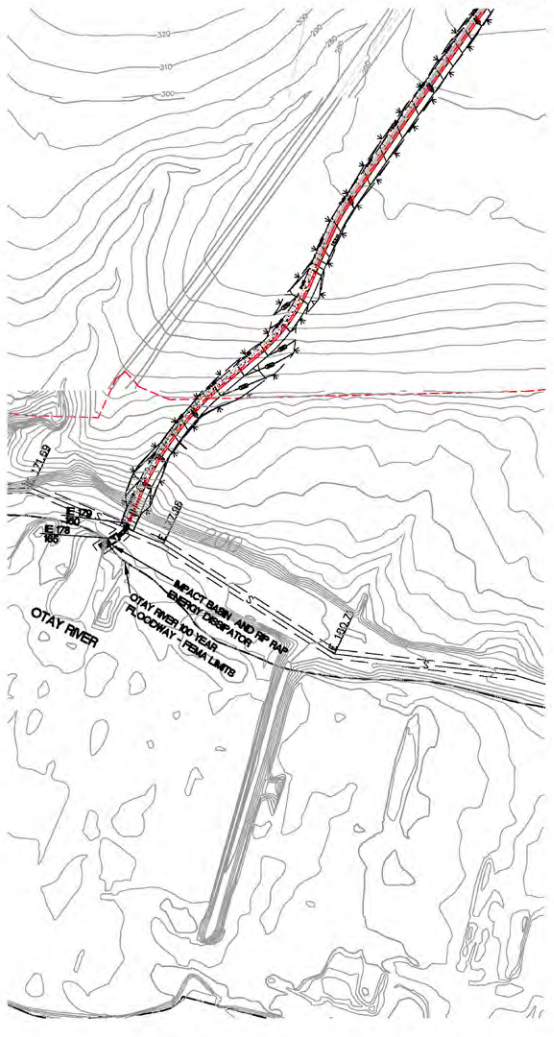
SEE RIGHT

SCALE 1" = 150'

POST-PROJECT DRAINAGE PLAN
1"=150'



ENERGY DISSIPATOR DETAIL



UTILITY ACCESS ROAD

HYDRO-MODIFCATION PREDEVELOPED LAND USE EXHIBIT

OTAY RANCH, VILLAGE 8 WEST

CITY OF CHULA VISTA, CALIFORNIA, TRACT NO. 09-___



LAND USE	COLOR/TOTAL AREA
C,D, GRASS, STE(10-20%)	31.4 AC
C,D, DIRT, ST(10-20%)	78.3 AC
C,D, DIRT, ST(10-20%) PROPORTIONED FOR FUTURE PARK	15.7 AC
C,D, URBAN, FLAT(0-5%)	20.0 AC
ROADS, MOD(5-10%)	14.3 AC
ROOF AREA	5.0 AC
HARDSCAPE, FLAT(0-5%)	18.9 AC
TOTAL:	183.6 AC

SCALE: 1" = 300'

300 0 300 600 900

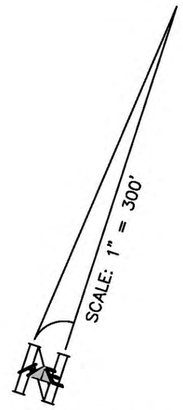
SCALE 1" = 300'

HYDRO-MODIFCATION DEVELOPED LAND USE EXHIBIT

OTAY RANCH, VILLAGE 8 WEST

CITY OF CHULA VISTA, CALIFORNIA, TRACT NO. 09-___





LAND USE	COLOR/TOTAL AREA
C,D, GRASS, FLAT(0-5%)	2.5 AC
C,D, GRASS, STE(10-20%)	32.4 AC
C,D, GRASS, STE()20%)	12.0 AC
C,D, URBAN, FLAT(0-5%)	37.0 AC
ROADS, MOD(5-10%)	36.2 AC
ROOF AREA	12.6 AC
HARDSCAPE, FLAT(0-5%)	18.9 AC
PARKING, FLAT(0-5%)	51.0 AC
TOTAL:	202.6 AC

ON-SITE AREA CONTRIBUTION

ROADS, MOD(5-10%)=20.9 AC

C,D, GRASS, STE()20%)-SLOPES= 11.9 AC

TC PAD AREAS=63.8 AC (80% IMPERVIOUS)=

- PARKING, FLAT(0-5%)=51.0 AC
- C,D, URBAN, FLAT(0-5%)=12.8 AC

SF LOTS AREA=15.2 AC (50% IMPERVIOUS)

- ROOF=7.6 AC
- C,D, URBAN, FLAT(0-5%)=7.6 AC

PARKS=C,D, GRASS, FLAT(0-5%)=2.5 AC

