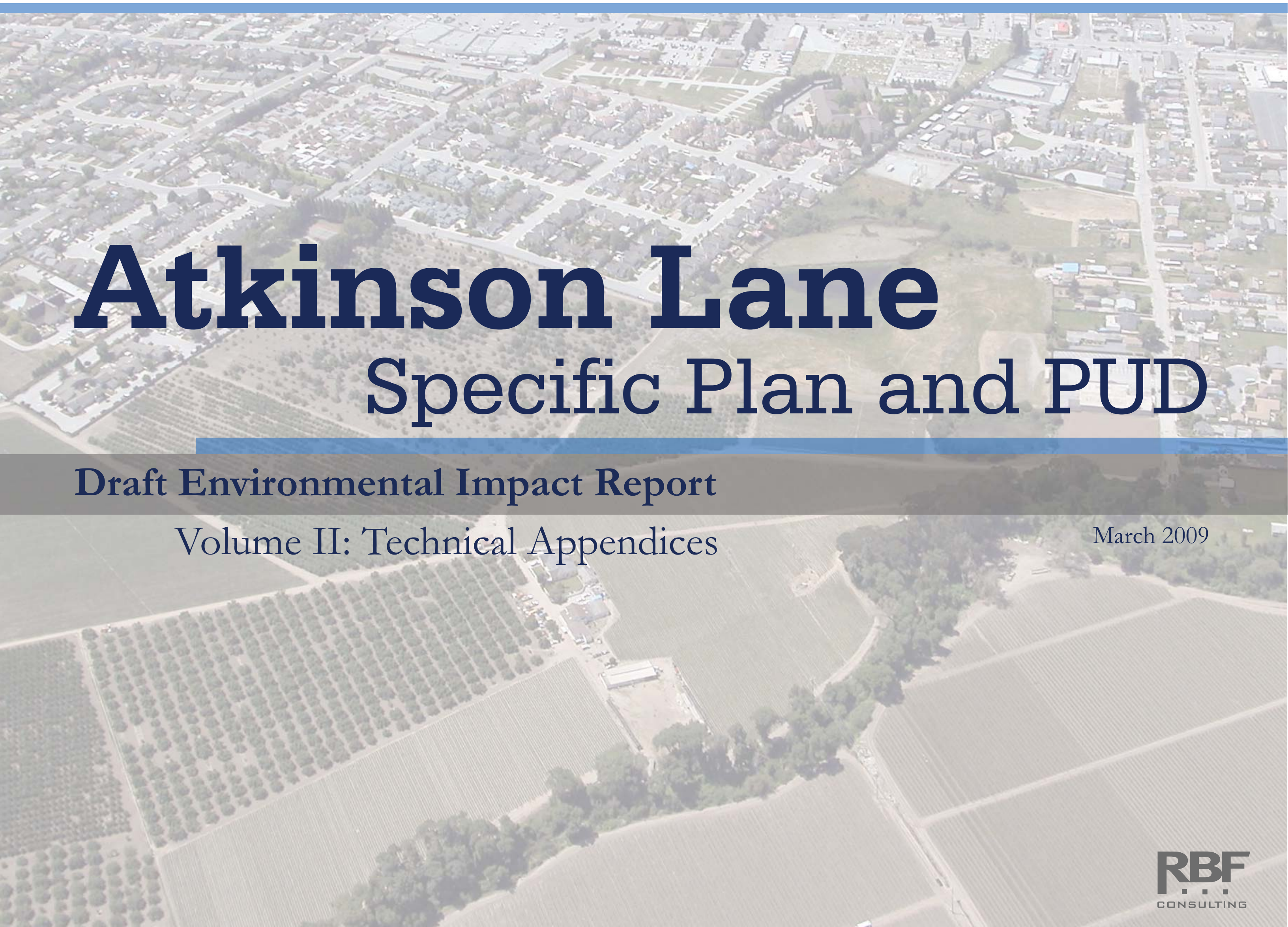
County of Santa Cruz



Atkinson Lane

Specific Plan and PUD

Draft Environmental Impact Report

Volume II: Technical Appendices

March 2009

RBF CONSULTING






SCH #: 2008082042

Draft Environmental Impact Report

Atkinson Lane Specific Plan and PUD

Technical Appendices Volume II

SCH# 2008082042

Lead Agency:
County of Santa Cruz

Prepared For:
County of Santa Cruz
Planning Department
Mr. Todd Sexauer, Environmental Planner
701 Ocean Street, 4th Floor
Santa Cruz, CA 95060

Prepared By:
RBF Consulting

March 2009

T A B L E O F C O N T E N T S

TECHNICAL APPENDICES VOLUME II

APPENDIX B
AIR QUALITY

AMBAG. Consistency Determination for the Atkinson Lane Specific Plan. December 2008.

RBF Consulting. URBEMIS 2007, Air Quality Modeling. December 2008.

RBF Consulting. BREEZE, CO Hot Spots Air Quality Modeling. December 2008.

AMBAG
ASSOCIATION OF MONTEREY BAY AREA GOVERNMENTS

October 22, 2008

Erika Spencer
RBF Consulting
3180 Imjin Road, Suite 110
Marina, CA 93933

Dear Ms. Spencer:

This letter is in response to your October 2, 2008 request for a determination of consistency for the Atkinson Lane Specific Plan/Master Plan (Proposed Project) with the *Air Quality Management Plan for the Monterey Bay Region* (AQMP). Atkinson Lane Specific Plan/Master Plan is in the City of Watsonville.

Consistency of housing projects with the AQMP is analyzed by comparing the total potential population growth accommodated by the project with the forecasted growth for the City of Watsonville. The *2008 Population, Housing Unit, and Employment Forecasts* adopted by the AMBAG Board of Directors on June 11, 2008 has been incorporated into the 2008 Air Quality Management Plan for the North Central Coast Air Basin (August 2008), which is the document used project consistency.

The California Department of Finance estimates there were 14,066 housing units in the City of Watsonville as of 1/01/08. AMBAG staff surveyed the City of Watsonville to determine the number of housing units that have received a building permit since 1/01/08. A total of 7 housing units have received building permits between January 2008 and September 2008. Combined, there are 14,073 existing, and or permitted housing units in the City of Watsonville as of September 1, 2008. The California Department of Finance as of 1/1/08 estimates there to be 3.73 persons per housing unit giving the City of Watsonville a total population of 52,492. Using this figure as the county plus the housing units added and permitted since then raises the estimated population of the City of Watsonville by 26 for a total of 52,518.

SERVING OUR REGIONAL COMMUNITY SINCE 1968
445 RESERVATION ROAD, SUITE G ✦ P. O. BOX 809 ✦ MARINA, CA 93933-0809
(831) 883-3750 ✦ FAX (831) 883-3755 ✦ www.ambag.org

The Atkinson Lane Specific Plan/Master Plan consists of a potential total of 498 residential units. Because the time for these units be built has not been established a built by date of 2030 has been used for this determination. At the Department of Finance average of 3.73 persons per housing unit the Atkinson Lane Specific Plan/Master Plan will add 1,858 people to the city population giving a total of 54,376. Occupancy of the housing units is estimated to take place by 2030. The *2008 Population, Housing Unit, and Employment Forecast,* puts the total population of City of Watsonville by the year 2030 to be 61,245.

The population from the combination of the existing and permitted housing units in the City of Watsonville (14,073) plus the 498 housing units in the Atkinson Lane Specific Plan/Master Plan is less then the regional forecasts for the City of Watsonville. Therefore the Atkinson Lane Specific Plan/Master Plan is **consistent** with the 2008 regional forecasts and the Air Quality Management Plan.

Please feel free to contact me if you have any questions about this determination.

Sincerely,

David Roemer
Associate Planner

cc: Jean Getchell, MBUAPCD

1/13/2009 10:35:23 AM

Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\ESPENCER\Desktop\Atkinson\Atkinson Lane - Phase 1.urb924

Project Name: Atkinson Lane Specific Plan - Phase 1 - Unmitigated

Project Location: Monterey Bay Air District

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
Time Slice 12/1/2008-12/26/2008 Active Days: 20	3.39	28.15	15.34	0.00	31.81	1.42	33.22	6.64	1.30	7.95	2,353.04
Fine Grading 11/30/2008-01/11/2009	3.39	28.15	15.34	0.00	31.81	1.42	33.22	6.64	1.30	7.95	2,353.04
Fine Grading Dust	0.00	0.00	0.00	0.00	31.80	0.00	31.80	6.64	0.00	6.64	0.00
Fine Grading Off Road Diesel	3.31	28.00	13.56	0.00	0.00	1.41	1.41	0.00	1.30	1.30	2,247.32
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.08	0.15	1.78	0.00	0.01	0.00	0.01	0.00	0.00	0.01	105.72

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Time Slice 12/29/2008-12/31/2008 Active Days: 3	6.98	**47.20**	28.66	0.00	**31.82**	**3.00**	**34.82**	**6.65**	**2.76**	**9.41**	**3,945.24**
Asphalt 12/28/2008-01/11/2009	3.59	19.05	13.32	0.00	0.01	1.58	1.60	0.01	1.46	1.46	1,592.20
Paving Off-Gas	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.99	17.76	9.40	0.00	0.00	1.54	1.54	0.00	1.41	1.41	1,272.04
Paving On Road Diesel	0.07	0.99	0.35	0.00	0.00	0.04	0.04	0.00	0.04	0.04	108.72
Paving Worker Trips	0.16	0.30	3.56	0.00	0.01	0.01	0.02	0.00	0.01	0.01	211.44
Fine Grading 11/30/2008-01/11/2009	3.39	28.15	15.34	0.00	31.81	1.42	33.22	6.64	1.30	7.95	2,353.04
Fine Grading Dust	0.00	0.00	0.00	0.00	31.80	0.00	31.80	6.64	0.00	6.64	0.00
Fine Grading Off Road Diesel	3.31	28.00	13.56	0.00	0.00	1.41	1.41	0.00	1.30	1.30	2,247.32
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.08	0.15	1.78	0.00	0.01	0.00	0.01	0.00	0.00	0.01	105.72
Time Slice 1/1/2009-1/9/2009 Active Days: 7	6.65	44.64	27.58	0.00	**31.82**	2.84	34.66	**6.65**	2.61	9.26	3,944.92
Asphalt 12/28/2008-01/11/2009	3.40	18.05	12.94	0.00	0.01	1.50	1.52	0.01	1.38	1.39	1,591.99
Paving Off-Gas	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.81	16.83	9.27	0.00	0.00	1.46	1.46	0.00	1.34	1.34	1,272.04
Paving On Road Diesel	0.06	0.93	0.33	0.00	0.00	0.04	0.04	0.00	0.03	0.03	108.72
Paving Worker Trips	0.14	0.28	3.33	0.00	0.01	0.01	0.02	0.00	0.01	0.01	211.23
Fine Grading 11/30/2008-01/11/2009	3.25	26.60	14.64	0.00	31.81	1.34	33.14	6.64	1.23	7.87	2,352.93
Fine Grading Dust	0.00	0.00	0.00	0.00	31.80	0.00	31.80	6.64	0.00	6.64	0.00
Fine Grading Off Road Diesel	3.18	26.46	12.98	0.00	0.00	1.33	1.33	0.00	1.23	1.23	2,247.32
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.07	0.14	1.67	0.00	0.01	0.00	0.01	0.00	0.00	0.01	105.62

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Time Slice 1/12/2009-8/7/2009 Active Days: 150	4.82	20.89	30.83	0.01	0.07	1.40	1.47	0.02	1.28	1.31	3,042.41
Building 01/11/2009-08/22/2009	4.82	20.89	30.83	0.01	0.07	1.40	1.47	0.02	1.28	1.31	3,042.41
Building Off Road Diesel	3.87	17.35	11.50	0.00	0.00	1.28	1.28	0.00	1.17	1.17	1,621.20
Building Vendor Trips	0.19	2.08	1.80	0.00	0.01	0.08	0.09	0.00	0.07	0.08	310.99
Building Worker Trips	0.76	1.46	17.53	0.01	0.06	0.04	0.10	0.02	0.04	0.06	1,110.23
Time Slice 8/10/2009-8/21/2009 Active Days: 10	**101.73**	21.17	**34.18**	**0.01**	0.08	1.41	1.49	0.03	1.29	1.32	3,254.59
Building 01/11/2009-08/22/2009	4.82	20.89	30.83	0.01	0.07	1.40	1.47	0.02	1.28	1.31	3,042.41
Building Off Road Diesel	3.87	17.35	11.50	0.00	0.00	1.28	1.28	0.00	1.17	1.17	1,621.20
Building Vendor Trips	0.19	2.08	1.80	0.00	0.01	0.08	0.09	0.00	0.07	0.08	310.99
Building Worker Trips	0.76	1.46	17.53	0.01	0.06	0.04	0.10	0.02	0.04	0.06	1,110.23
Coating 08/08/2009-09/05/2009	96.91	0.28	3.35	0.00	0.01	0.01	0.02	0.00	0.01	0.01	212.17
Architectural Coating	96.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.14	0.28	3.35	0.00	0.01	0.01	0.02	0.00	0.01	0.01	212.17
Time Slice 8/24/2009-9/4/2009 Active Days: 10	96.91	0.28	3.35	0.00	0.01	0.01	0.02	0.00	0.01	0.01	212.17
Coating 08/08/2009-09/05/2009	96.91	0.28	3.35	0.00	0.01	0.01	0.02	0.00	0.01	0.01	212.17
Architectural Coating	96.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.14	0.28	3.35	0.00	0.01	0.01	0.02	0.00	0.01	0.01	212.17

Phase Assumptions

Phase: Fine Grading 11/30/2008 - 1/11/2009 - Default Fine Site Grading Description

Total Acres Disturbed: 6.37

Maximum Daily Acreage Disturbed: 1.59

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 6 hours per day

1 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 6 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Phase: Paving 12/28/2008 - 1/11/2009 - Default Paving Description

Acres to be Paved: 1.59

Off-Road Equipment:

4 Cement and Mortar Mixers (10 hp) operating at a 0.56 load factor for 6 hours per day

1 Pavers (100 hp) operating at a 0.62 load factor for 7 hours per day

1 Paving Equipment (104 hp) operating at a 0.53 load factor for 8 hours per day

1 Rollers (95 hp) operating at a 0.56 load factor for 7 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

Phase: Building Construction 1/11/2009 - 8/22/2009 - Default Building Construction Description

Off-Road Equipment:

1 Cranes (399 hp) operating at a 0.43 load factor for 6 hours per day

2 Forklifts (145 hp) operating at a 0.3 load factor for 6 hours per day

1 Generator Sets (49 hp) operating at a 0.74 load factor for 8 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

3 Welders (45 hp) operating at a 0.45 load factor for 8 hours per day

Phase: Architectural Coating 8/8/2009 - 9/5/2009 - Default Architectural Coating Description

Rule: Residential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 100

Rule: Residential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.08	1.08	0.46	0.00	0.00	0.00	1,376.30
Hearth	23.18	2.36	105.46	0.32	16.83	16.20	3,261.60
Landscaping - No Winter Emissions							
Consumer Products	6.70						
Architectural Coatings	0.56						
TOTALS (lbs/day, unmitigated)	30.52	3.44	105.92	0.32	16.83	16.20	4,637.90

Area Source Changes to Defaults

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Single family housing	1.24	1.87	13.83	0.01	1.39	0.28	757.42
Apartments mid rise	10.22	15.30	113.35	0.06	11.40	2.29	6,209.31
TOTALS (lbs/day, unmitigated)	11.46	17.17	127.18	0.07	12.79	2.57	6,966.73

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

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Analysis Year: 2010 Temperature (F): 50 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Single family housing	3.00	10.01	dwelling units	9.00	90.09	798.40
Apartments mid rise	3.37	5.77	dwelling units	128.00	738.56	6,545.34
					828.65	7,343.74

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	44.3	1.8	97.5	0.7
Light Truck < 3750 lbs	17.3	2.3	92.5	5.2
Light Truck 3751-5750 lbs	20.0	1.0	98.5	0.5
Med Truck 5751-8500 lbs	8.3	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.4	0.0	71.4	28.6
Lite-Heavy Truck 10,001-14,000 lbs	0.9	0.0	55.6	44.4
Med-Heavy Truck 14,001-33,000 lbs	1.2	8.3	16.7	75.0
Heavy-Heavy Truck 33,001-60,000 lbs	0.7	0.0	0.0	100.0
Other Bus	0.1	0.0	100.0	0.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	4.5	68.9	31.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	1.1	9.1	81.8	9.1

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Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.8	8.3	7.1	11.8	4.4	4.4
Rural Trip Length (miles)	11.8	8.3	7.1	11.8	4.4	4.4
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			

% of Trips - Commercial (by land use)

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\ESPENCER\Desktop\Atkinson\Atkinson Lane - Phase 1.urb924

Project Name: Atkinson Lane Specific Plan - Phase 1 – Mitigated

Project Location: Monterey Bay Air District

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

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Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2008 TOTALS (lbs/day unmitigated)	6.98	47.20	28.66	0.00	31.82	3.00	34.82	6.65	2.76	9.41	3,945.24
2009 TOTALS (lbs/day unmitigated)	101.73	44.64	34.18	0.01	31.82	2.84	34.66	6.65	2.61	9.26	3,944.92

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	7.54	1.11	2.41	0.00	0.01	0.01	1,379.75

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	10.13	13.99	112.07	0.07	12.79	2.57	7,057.53

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	17.67	15.10	114.48	0.07	12.80	2.58	8,437.28

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\ESPENCER\Desktop\Atkinson\Atkinson Lane - Phase 1 (Mitigated).urb924

Project Name: Atkinson Lane Specific Plan - Phase 1

Project Location: Monterey Bay Air District

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

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Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2008 TOTALS (lbs/day unmitigated)	6.98	47.20	28.66	0.00	31.82	3.00	34.82	6.65	2.76	9.41	3,945.24
2009 TOTALS (lbs/day unmitigated)	101.73	44.64	34.18	0.01	31.82	2.84	34.66	6.65	2.61	9.26	3,944.92

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	7.54	1.11	2.41	0.00	0.01	0.01	1,379.75

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	10.13	13.99	112.07	0.07	12.79	2.57	7,057.53

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	17.67	15.10	114.48	0.07	12.80	2.58	8,437.28

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\ESPENCER\Desktop\Atkinson\Atkinson Lane - Phase 1 (Mitigated).urb924

Project Name: Atkinson Lane Specific Plan - Phase 1

Project Location: Monterey Bay Air District

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
Time Slice 12/1/2008-12/26/2008 Active Days: 20	3.39	28.15	15.34	0.00	31.81	1.42	33.22	6.64	1.30	7.95	2,353.04
Fine Grading 11/30/2008-01/11/2009	3.39	28.15	15.34	0.00	31.81	1.42	33.22	6.64	1.30	7.95	2,353.04
Fine Grading Dust	0.00	0.00	0.00	0.00	31.80	0.00	31.80	6.64	0.00	6.64	0.00
Fine Grading Off Road Diesel	3.31	28.00	13.56	0.00	0.00	1.41	1.41	0.00	1.30	1.30	2,247.32
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.08	0.15	1.78	0.00	0.01	0.00	0.01	0.00	0.00	0.01	105.72

1/13/2009 10:38:08 AM

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Asphalt 12/28/2008-01/11/2009	3.59	19.05	13.32	0.00	0.01	1.58	1.60	0.01	1.46	1.46	1,592.20
Paving Off-Gas	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.99	17.76	9.40	0.00	0.00	1.54	1.54	0.00	1.41	1.41	1,272.04
Paving On Road Diesel	0.07	0.99	0.35	0.00	0.00	0.04	0.04	0.00	0.04	0.04	108.72
Paving Worker Trips	0.16	0.30	3.56	0.00	0.01	0.01	0.02	0.00	0.01	0.01	211.44
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Fine Grading Dust	0.00	0.00	0.00	0.00	31.80	0.00	31.80	6.64	0.00	6.64	0.00
Fine Grading Off Road Diesel	3.31	28.00	13.56	0.00	0.00	1.41	1.41	0.00	1.30	1.30	2,247.32
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.08	0.15	1.78	0.00	0.01	0.00	0.01	0.00	0.00	0.01	105.72
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Asphalt 12/28/2008-01/11/2009	3.40	18.05	12.94	0.00	0.01	1.50	1.52	0.01	1.38	1.39	1,591.99
Paving Off-Gas	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.81	16.83	9.27	0.00	0.00	1.46	1.46	0.00	1.34	1.34	1,272.04
Paving On Road Diesel	0.06	0.93	0.33	0.00	0.00	0.04	0.04	0.00	0.03	0.03	108.72
Paving Worker Trips	0.14	0.28	3.33	0.00	0.01	0.01	0.02	0.00	0.01	0.01	211.23
Fine Grading 11/30/2008-01/11/2009	3.25	26.60	14.64	0.00	31.81	1.34	33.14	6.64	1.23	7.87	2,352.93
Fine Grading Dust	0.00	0.00	0.00	0.00	31.80	0.00	31.80	6.64	0.00	6.64	0.00
Fine Grading Off Road Diesel	3.18	26.46	12.98	0.00	0.00	1.33	1.33	0.00	1.23	1.23	2,247.32
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.07	0.14	1.67	0.00	0.01	0.00	0.01	0.00	0.00	0.01	105.62

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Time Slice 1/12/2009-8/7/2009 Active Days: 150	4.82	20.89	30.83	0.01	0.07	1.40	1.47	0.02	1.28	1.31	3,042.41
Building 01/11/2009-08/22/2009	4.82	20.89	30.83	0.01	0.07	1.40	1.47	0.02	1.28	1.31	3,042.41
Building Off Road Diesel	3.87	17.35	11.50	0.00	0.00	1.28	1.28	0.00	1.17	1.17	1,621.20
Building Vendor Trips	0.19	2.08	1.80	0.00	0.01	0.08	0.09	0.00	0.07	0.08	310.99
Building Worker Trips	0.76	1.46	17.53	0.01	0.06	0.04	0.10	0.02	0.04	0.06	1,110.23
Time Slice 8/10/2009-8/21/2009 Active Days: 10	**101.73**	21.17	**34.18**	**0.01**	0.08	1.41	1.49	0.03	1.29	1.32	3,254.59
Building 01/11/2009-08/22/2009	4.82	20.89	30.83	0.01	0.07	1.40	1.47	0.02	1.28	1.31	3,042.41
Building Off Road Diesel	3.87	17.35	11.50	0.00	0.00	1.28	1.28	0.00	1.17	1.17	1,621.20
Building Vendor Trips	0.19	2.08	1.80	0.00	0.01	0.08	0.09	0.00	0.07	0.08	310.99
Building Worker Trips	0.76	1.46	17.53	0.01	0.06	0.04	0.10	0.02	0.04	0.06	1,110.23
Coating 08/08/2009-09/05/2009	96.91	0.28	3.35	0.00	0.01	0.01	0.02	0.00	0.01	0.01	212.17
Architectural Coating	96.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.14	0.28	3.35	0.00	0.01	0.01	0.02	0.00	0.01	0.01	212.17
Time Slice 8/24/2009-9/4/2009 Active Days: 10	96.91	0.28	3.35	0.00	0.01	0.01	0.02	0.00	0.01	0.01	212.17
Coating 08/08/2009-09/05/2009	96.91	0.28	3.35	0.00	0.01	0.01	0.02	0.00	0.01	0.01	212.17
Architectural Coating	96.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.14	0.28	3.35	0.00	0.01	0.01	0.02	0.00	0.01	0.01	212.17

Phase Assumptions

Phase: Fine Grading 11/30/2008 - 1/11/2009 - Default Fine Site Grading Description

Total Acres Disturbed: 6.37

Maximum Daily Acreage Disturbed: 1.59

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 6 hours per day

1 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 6 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Phase: Paving 12/28/2008 - 1/11/2009 - Default Paving Description

Acres to be Paved: 1.59

Off-Road Equipment:

4 Cement and Mortar Mixers (10 hp) operating at a 0.56 load factor for 6 hours per day

1 Pavers (100 hp) operating at a 0.62 load factor for 7 hours per day

1 Paving Equipment (104 hp) operating at a 0.53 load factor for 8 hours per day

1 Rollers (95 hp) operating at a 0.56 load factor for 7 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

Phase: Building Construction 1/11/2009 - 8/22/2009 - Default Building Construction Description

Off-Road Equipment:

1 Cranes (399 hp) operating at a 0.43 load factor for 6 hours per day

2 Forklifts (145 hp) operating at a 0.3 load factor for 6 hours per day

1 Generator Sets (49 hp) operating at a 0.74 load factor for 8 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

3 Welders (45 hp) operating at a 0.45 load factor for 8 hours per day

Phase: Architectural Coating 8/8/2009 - 9/5/2009 - Default Architectural Coating Description

Rule: Residential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 100

Rule: Residential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.08	1.08	0.46	0.00	0.00	0.00	1,376.30
Hearth	0.05	0.78	0.33	0.00	0.06	0.06	998.82
Landscaping - No Winter Emissions							
Consumer Products	6.70						
Architectural Coatings	0.56						
TOTALS (lbs/day, unmitigated)	7.39	1.86	0.79	0.00	0.06	0.06	2,375.12

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 35% to 0%

Percentage of residences with wood fireplaces changed from 10% to 0%

Percentage of residences with natural gas fireplaces changed from 55% to 100%

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Single family housing	1.24	1.87	13.83	0.01	1.39	0.28	757.42
Apartments mid rise	10.22	15.30	113.35	0.06	11.40	2.29	6,209.31
TOTALS (lbs/day, unmitigated)	11.46	17.17	127.18	0.07	12.79	2.57	6,966.73

Operational Settings:

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Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 50 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Single family housing	3.00	10.01	dwelling units	9.00	90.09	798.40
Apartments mid rise	3.37	5.77	dwelling units	128.00	738.56	6,545.34
					828.65	7,343.74

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	44.3	1.8	97.5	0.7
Light Truck < 3750 lbs	17.3	2.3	92.5	5.2
Light Truck 3751-5750 lbs	20.0	1.0	98.5	0.5
Med Truck 5751-8500 lbs	8.3	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.4	0.0	71.4	28.6
Lite-Heavy Truck 10,001-14,000 lbs	0.9	0.0	55.6	44.4
Med-Heavy Truck 14,001-33,000 lbs	1.2	8.3	16.7	75.0
Heavy-Heavy Truck 33,001-60,000 lbs	0.7	0.0	0.0	100.0
Other Bus	0.1	0.0	100.0	0.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	4.5	68.9	31.1	0.0
School Bus	0.1	0.0	0.0	100.0

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Motor Home	1.1	9.1	81.8	9.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.8	8.3	7.1	11.8	4.4	4.4
Rural Trip Length (miles)	11.8	8.3	7.1	11.8	4.4	4.4
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			

% of Trips - Commercial (by land use)

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\ESPENCER\Desktop\Atkinson\Atkinson Lane - Phase 2.urb924

Project Name: Atkinson Lane Specific Plan - Phase 2- Unmitigated

Project Location: Monterey Bay Air District

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

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Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2010 TOTALS (lbs/day unmitigated)	4.25	33.83	19.43	0.00	196.61	1.80	198.41	41.06	1.65	42.71	3,139.39
2011 TOTALS (lbs/day unmitigated)	5.16	31.75	18.63	0.01	196.61	1.69	198.30	41.06	1.55	42.61	3,139.30
2012 TOTALS (lbs/day unmitigated)	270.89	39.55	64.10	0.04	0.21	2.62	2.83	0.08	2.40	2.48	7,336.43

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	70.01	8.24	242.15	0.74	38.47	37.03	11,098.28

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	31.59	47.44	351.36	0.18	35.35	7.08	19,248.81

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	101.60	55.68	593.51	0.92	73.82	44.11	30,347.09

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2

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Time Slice 11/30/2010-12/31/2010 Active Days: 24	4.25	33.83	19.43	0.00	**196.61**	1.80	**198.41**	**41.06**	1.65	**42.71**	3,139.39
Fine Grading 11/30/2010-01/11/2011	4.25	33.83	19.43	0.00	196.61	1.80	198.41	41.06	1.65	42.71	3,139.39
Fine Grading Dust	0.00	0.00	0.00	0.00	196.60	0.00	196.60	41.06	0.00	41.06	0.00
Fine Grading Off Road Diesel	4.16	33.67	17.48	0.00	0.00	1.79	1.79	0.00	1.65	1.65	3,007.48
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.08	0.16	1.94	0.00	0.01	0.01	0.01	0.00	0.00	0.01	131.91
Time Slice 1/3/2011-1/11/2011 Active Days: 7	3.98	31.75	18.63	0.00	**196.61**	1.69	198.30	**41.06**	1.55	42.61	3,139.30
Fine Grading 11/30/2010-01/11/2011	3.98	31.75	18.63	0.00	196.61	1.69	198.30	41.06	1.55	42.61	3,139.30
Fine Grading Dust	0.00	0.00	0.00	0.00	196.60	0.00	196.60	41.06	0.00	41.06	0.00
Fine Grading Off Road Diesel	3.91	31.61	16.82	0.00	0.00	1.68	1.68	0.00	1.55	1.55	3,007.48
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.08	0.15	1.80	0.00	0.01	0.01	0.01	0.00	0.00	0.01	131.82
Time Slice 12/28/2011-12/30/2011 Active Days: 3	5.16	19.24	12.77	0.01	0.03	1.42	1.46	0.01	1.31	1.32	2,015.00
Asphalt 12/28/2011-01/11/2012	5.16	19.24	12.77	0.01	0.03	1.42	1.46	0.01	1.31	1.32	2,015.00
Paving Off-Gas	2.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.34	14.17	8.17	0.00	0.00	1.24	1.24	0.00	1.14	1.14	1,131.92
Paving On Road Diesel	0.35	4.83	1.71	0.01	0.02	0.18	0.20	0.01	0.17	0.17	672.17
Paving Worker Trips	0.12	0.24	2.89	0.00	0.01	0.01	0.02	0.00	0.01	0.01	210.91

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Time Slice 1/2/2012-1/10/2012 Active Days: 7	5.00	18.04	12.31	0.01	0.03	1.33	1.37	0.01	1.23	1.24	2,014.88
Asphalt 12/28/2011-01/11/2012	5.00	18.04	12.31	0.01	0.03	1.33	1.37	0.01	1.23	1.24	2,014.88
Paving Off-Gas	2.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.23	13.48	8.10	0.00	0.00	1.17	1.17	0.00	1.07	1.07	1,131.92
Paving On Road Diesel	0.32	4.34	1.54	0.01	0.02	0.16	0.18	0.01	0.15	0.15	672.17
Paving Worker Trips	0.11	0.22	2.67	0.00	0.01	0.01	0.02	0.00	0.01	0.01	210.79
Time Slice 1/11/2012-1/11/2012 Active Days: 1	10.06	**39.55**	**64.10**	**0.04**	0.21	**2.62**	2.83	0.08	**2.40**	2.48	**7,336.43**
Asphalt 12/28/2011-01/11/2012	5.00	18.04	12.31	0.01	0.03	1.33	1.37	0.01	1.23	1.24	2,014.88
Paving Off-Gas	2.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.23	13.48	8.10	0.00	0.00	1.17	1.17	0.00	1.07	1.07	1,131.92
Paving On Road Diesel	0.32	4.34	1.54	0.01	0.02	0.16	0.18	0.01	0.15	0.15	672.17
Paving Worker Trips	0.11	0.22	2.67	0.00	0.01	0.01	0.02	0.00	0.01	0.01	210.79
Building 01/11/2012-08/22/2012	5.06	21.51	51.79	0.03	0.18	1.29	1.47	0.06	1.17	1.24	5,321.56
Building Off Road Diesel	3.14	14.81	10.52	0.00	0.00	1.04	1.04	0.00	0.95	0.95	1,621.20
Building Vendor Trips	0.35	3.61	3.36	0.01	0.03	0.13	0.16	0.01	0.12	0.13	710.52
Building Worker Trips	1.57	3.09	37.92	0.03	0.15	0.11	0.27	0.06	0.10	0.15	2,989.83
Time Slice 1/12/2012-8/7/2012 Active Days: 149	5.06	21.51	51.79	0.03	0.18	1.29	1.47	0.06	1.17	1.24	5,321.56
Building 01/11/2012-08/22/2012	5.06	21.51	51.79	0.03	0.18	1.29	1.47	0.06	1.17	1.24	5,321.56
Building Off Road Diesel	3.14	14.81	10.52	0.00	0.00	1.04	1.04	0.00	0.95	0.95	1,621.20
Building Vendor Trips	0.35	3.61	3.36	0.01	0.03	0.13	0.16	0.01	0.12	0.13	710.52
Building Worker Trips	1.57	3.09	37.92	0.03	0.15	0.11	0.27	0.06	0.10	0.15	2,989.83

Time Slice 8/8/2012-8/22/2012 Active Days: 11	**270.89**	22.11	59.16	0.04	0.21	1.31	1.52	0.08	1.19	1.27	5,902.54
Building 01/11/2012-08/22/2012	5.06	21.51	51.79	0.03	0.18	1.29	1.47	0.06	1.17	1.24	5,321.56
Building Off Road Diesel	3.14	14.81	10.52	0.00	0.00	1.04	1.04	0.00	0.95	0.95	1,621.20
Building Vendor Trips	0.35	3.61	3.36	0.01	0.03	0.13	0.16	0.01	0.12	0.13	710.52
Building Worker Trips	1.57	3.09	37.92	0.03	0.15	0.11	0.27	0.06	0.10	0.15	2,989.83
Coating 08/08/2012-09/05/2012	265.84	0.60	7.37	0.01	0.03	0.02	0.05	0.01	0.02	0.03	580.99
Architectural Coating	265.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.31	0.60	7.37	0.01	0.03	0.02	0.05	0.01	0.02	0.03	580.99
Time Slice 8/23/2012-9/5/2012 Active Days: 10	265.84	0.60	7.37	0.01	0.03	0.02	0.05	0.01	0.02	0.03	580.99
Coating 08/08/2012-09/05/2012	265.84	0.60	7.37	0.01	0.03	0.02	0.05	0.01	0.02	0.03	580.99
Architectural Coating	265.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.31	0.60	7.37	0.01	0.03	0.02	0.05	0.01	0.02	0.03	580.99

Phase Assumptions

Phase: Fine Grading 11/30/2010 - 1/11/2011 - Default Fine Site Grading Description

Total Acres Disturbed: 39.33

Maximum Daily Acreage Disturbed: 9.83

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

1 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 8 hours per day

2 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

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Phase: Paving 12/28/2011 - 1/11/2012 - Default Paving Description

Acres to be Paved: 9.83

Off-Road Equipment:

4 Cement and Mortar Mixers (10 hp) operating at a 0.56 load factor for 6 hours per day

1 Pavers (100 hp) operating at a 0.62 load factor for 7 hours per day

2 Paving Equipment (104 hp) operating at a 0.53 load factor for 6 hours per day

1 Rollers (95 hp) operating at a 0.56 load factor for 7 hours per day

Phase: Building Construction 1/11/2012 - 8/22/2012 - Default Building Construction Description

Off-Road Equipment:

1 Cranes (399 hp) operating at a 0.43 load factor for 6 hours per day

2 Forklifts (145 hp) operating at a 0.3 load factor for 6 hours per day

1 Generator Sets (49 hp) operating at a 0.74 load factor for 8 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

3 Welders (45 hp) operating at a 0.45 load factor for 8 hours per day

Phase: Architectural Coating 8/8/2012 - 9/5/2012 - Default Architectural Coating Description

Rule: Residential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 100

Rule: Residential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.21	2.76	1.18	0.00	0.01	0.01	3,529.28
Hearth	52.97	5.48	240.97	0.74	38.46	37.02	7,569.00
Landscaping - No Winter Emissions							
Consumer Products	15.31						
Architectural Coatings	1.52						
TOTALS (lbs/day, unmitigated)	70.01	8.24	242.15	0.74	38.47	37.03	11,098.28

Area Source Changes to Defaults

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Single family housing	11.16	16.80	124.43	0.06	12.52	2.51	6,816.74
Apartments mid rise	5.55	8.33	61.69	0.03	6.21	1.24	3,379.74
Condo/townhouse general	14.88	22.31	165.24	0.09	16.62	3.33	9,052.33
TOTALS (lbs/day, unmitigated)	31.59	47.44	351.36	0.18	35.35	7.08	19,248.81

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

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Analysis Year: 2010 Temperature (F): 50 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Single family housing	27.00	10.01	dwelling units	81.00	810.81	7,185.64
Apartments mid rise	1.58	6.70	dwelling units	60.00	402.00	3,562.64
Condo/townhouse general	10.75	6.26	dwelling units	172.00	1,076.72	9,542.22
					2,289.53	20,290.50

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	44.3	1.8	97.5	0.7
Light Truck < 3750 lbs	17.3	2.3	92.5	5.2
Light Truck 3751-5750 lbs	20.0	1.0	98.5	0.5
Med Truck 5751-8500 lbs	8.3	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.4	0.0	71.4	28.6
Lite-Heavy Truck 10,001-14,000 lbs	0.9	0.0	55.6	44.4
Med-Heavy Truck 14,001-33,000 lbs	1.2	8.3	16.7	75.0
Heavy-Heavy Truck 33,001-60,000 lbs	0.7	0.0	0.0	100.0
Other Bus	0.1	0.0	100.0	0.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	4.5	68.9	31.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	1.1	9.1	81.8	9.1

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Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.8	8.3	7.1	11.8	4.4	4.4
Rural Trip Length (miles)	11.8	8.3	7.1	11.8	4.4	4.4
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			

% of Trips - Commercial (by land use)

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\ESPENCER\Desktop\Atkinson\Atkinson Lane - Phase 2.urb924

Project Name: Atkinson Lane Specific Plan - Phase 2-Mitigated

Project Location: Monterey Bay Air District

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

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Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2010 TOTALS (lbs/day unmitigated)	4.25	33.83	19.43	0.00	196.61	1.80	198.41	41.06	1.65	42.71	3,139.39
2011 TOTALS (lbs/day unmitigated)	5.16	31.75	18.63	0.01	196.61	1.69	198.30	41.06	1.55	42.61	3,139.30
2012 TOTALS (lbs/day unmitigated)	270.89	39.55	64.10	0.04	0.21	2.62	2.83	0.08	2.40	2.48	7,336.43

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	17.94	2.84	7.89	0.00	0.03	0.03	3,540.70

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	27.59	38.66	309.65	0.18	35.35	7.08	19,499.70

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	45.53	41.50	317.54	0.18	35.38	7.11	23,040.40

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2

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Time Slice 11/30/2010-12/31/2010 Active Days: 24	4.25	33.83	19.43	0.00	**196.61**	1.80	**198.41**	**41.06**	1.65	**42.71**	3,139.39
Fine Grading 11/30/2010-01/11/2011	4.25	33.83	19.43	0.00	196.61	1.80	198.41	41.06	1.65	42.71	3,139.39
Fine Grading Dust	0.00	0.00	0.00	0.00	196.60	0.00	196.60	41.06	0.00	41.06	0.00
Fine Grading Off Road Diesel	4.16	33.67	17.48	0.00	0.00	1.79	1.79	0.00	1.65	1.65	3,007.48
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.08	0.16	1.94	0.00	0.01	0.01	0.01	0.00	0.00	0.01	131.91
Time Slice 1/3/2011-1/11/2011 Active Days: 7	3.98	31.75	18.63	0.00	**196.61**	1.69	198.30	**41.06**	1.55	42.61	3,139.30
Fine Grading 11/30/2010-01/11/2011	3.98	31.75	18.63	0.00	196.61	1.69	198.30	41.06	1.55	42.61	3,139.30
Fine Grading Dust	0.00	0.00	0.00	0.00	196.60	0.00	196.60	41.06	0.00	41.06	0.00
Fine Grading Off Road Diesel	3.91	31.61	16.82	0.00	0.00	1.68	1.68	0.00	1.55	1.55	3,007.48
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.08	0.15	1.80	0.00	0.01	0.01	0.01	0.00	0.00	0.01	131.82
Time Slice 12/28/2011-12/30/2011 Active Days: 3	5.16	19.24	12.77	0.01	0.03	1.42	1.46	0.01	1.31	1.32	2,015.00
Asphalt 12/28/2011-01/11/2012	5.16	19.24	12.77	0.01	0.03	1.42	1.46	0.01	1.31	1.32	2,015.00
Paving Off-Gas	2.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.34	14.17	8.17	0.00	0.00	1.24	1.24	0.00	1.14	1.14	1,131.92
Paving On Road Diesel	0.35	4.83	1.71	0.01	0.02	0.18	0.20	0.01	0.17	0.17	672.17
Paving Worker Trips	0.12	0.24	2.89	0.00	0.01	0.01	0.02	0.00	0.01	0.01	210.91

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Time Slice 1/2/2012-1/10/2012 Active Days: 7	5.00	18.04	12.31	0.01	0.03	1.33	1.37	0.01	1.23	1.24	2,014.88
Asphalt 12/28/2011-01/11/2012	5.00	18.04	12.31	0.01	0.03	1.33	1.37	0.01	1.23	1.24	2,014.88
Paving Off-Gas	2.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.23	13.48	8.10	0.00	0.00	1.17	1.17	0.00	1.07	1.07	1,131.92
Paving On Road Diesel	0.32	4.34	1.54	0.01	0.02	0.16	0.18	0.01	0.15	0.15	672.17
Paving Worker Trips	0.11	0.22	2.67	0.00	0.01	0.01	0.02	0.00	0.01	0.01	210.79
Time Slice 1/11/2012-1/11/2012 Active Days: 1	10.06	**39.55**	**64.10**	**0.04**	0.21	**2.62**	2.83	0.08	**2.40**	2.48	**7,336.43**
Asphalt 12/28/2011-01/11/2012	5.00	18.04	12.31	0.01	0.03	1.33	1.37	0.01	1.23	1.24	2,014.88
Paving Off-Gas	2.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.23	13.48	8.10	0.00	0.00	1.17	1.17	0.00	1.07	1.07	1,131.92
Paving On Road Diesel	0.32	4.34	1.54	0.01	0.02	0.16	0.18	0.01	0.15	0.15	672.17
Paving Worker Trips	0.11	0.22	2.67	0.00	0.01	0.01	0.02	0.00	0.01	0.01	210.79
Building 01/11/2012-08/22/2012	5.06	21.51	51.79	0.03	0.18	1.29	1.47	0.06	1.17	1.24	5,321.56
Building Off Road Diesel	3.14	14.81	10.52	0.00	0.00	1.04	1.04	0.00	0.95	0.95	1,621.20
Building Vendor Trips	0.35	3.61	3.36	0.01	0.03	0.13	0.16	0.01	0.12	0.13	710.52
Building Worker Trips	1.57	3.09	37.92	0.03	0.15	0.11	0.27	0.06	0.10	0.15	2,989.83
Time Slice 1/12/2012-8/7/2012 Active Days: 149	5.06	21.51	51.79	0.03	0.18	1.29	1.47	0.06	1.17	1.24	5,321.56
Building 01/11/2012-08/22/2012	5.06	21.51	51.79	0.03	0.18	1.29	1.47	0.06	1.17	1.24	5,321.56
Building Off Road Diesel	3.14	14.81	10.52	0.00	0.00	1.04	1.04	0.00	0.95	0.95	1,621.20
Building Vendor Trips	0.35	3.61	3.36	0.01	0.03	0.13	0.16	0.01	0.12	0.13	710.52
Building Worker Trips	1.57	3.09	37.92	0.03	0.15	0.11	0.27	0.06	0.10	0.15	2,989.83

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Time Slice 8/8/2012-8/22/2012 Active Days: 11	**270.89**	22.11	59.16	0.04	0.21	1.31	1.52	0.08	1.19	1.27	5,902.54
Building 01/11/2012-08/22/2012	5.06	21.51	51.79	0.03	0.18	1.29	1.47	0.06	1.17	1.24	5,321.56
Building Off Road Diesel	3.14	14.81	10.52	0.00	0.00	1.04	1.04	0.00	0.95	0.95	1,621.20
Building Vendor Trips	0.35	3.61	3.36	0.01	0.03	0.13	0.16	0.01	0.12	0.13	710.52
Building Worker Trips	1.57	3.09	37.92	0.03	0.15	0.11	0.27	0.06	0.10	0.15	2,989.83
Coating 08/08/2012-09/05/2012	265.84	0.60	7.37	0.01	0.03	0.02	0.05	0.01	0.02	0.03	580.99
Architectural Coating	265.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.31	0.60	7.37	0.01	0.03	0.02	0.05	0.01	0.02	0.03	580.99
Time Slice 8/23/2012-9/5/2012 Active Days: 10	265.84	0.60	7.37	0.01	0.03	0.02	0.05	0.01	0.02	0.03	580.99
Coating 08/08/2012-09/05/2012	265.84	0.60	7.37	0.01	0.03	0.02	0.05	0.01	0.02	0.03	580.99
Architectural Coating	265.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.31	0.60	7.37	0.01	0.03	0.02	0.05	0.01	0.02	0.03	580.99

Phase Assumptions

Phase: Fine Grading 11/30/2010 - 1/11/2011 - Default Fine Site Grading Description

Total Acres Disturbed: 39.33

Maximum Daily Acreage Disturbed: 9.83

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

1 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 8 hours per day

2 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

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Phase: Paving 12/28/2011 - 1/11/2012 - Default Paving Description

Acres to be Paved: 9.83

Off-Road Equipment:

4 Cement and Mortar Mixers (10 hp) operating at a 0.56 load factor for 6 hours per day

1 Pavers (100 hp) operating at a 0.62 load factor for 7 hours per day

2 Paving Equipment (104 hp) operating at a 0.53 load factor for 6 hours per day

1 Rollers (95 hp) operating at a 0.56 load factor for 7 hours per day

Phase: Building Construction 1/11/2012 - 8/22/2012 - Default Building Construction Description

Off-Road Equipment:

1 Cranes (399 hp) operating at a 0.43 load factor for 6 hours per day

2 Forklifts (145 hp) operating at a 0.3 load factor for 6 hours per day

1 Generator Sets (49 hp) operating at a 0.74 load factor for 8 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

3 Welders (45 hp) operating at a 0.45 load factor for 8 hours per day

Phase: Architectural Coating 8/8/2012 - 9/5/2012 - Default Architectural Coating Description

Rule: Residential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 100

Rule: Residential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.21	2.76	1.18	0.00	0.01	0.01	3,529.28
Hearth - No Summer Emissions							
Landscape	0.90	0.08	6.71	0.00	0.02	0.02	11.42
Consumer Products	15.31						
Architectural Coatings	1.52						
TOTALS (lbs/day, unmitigated)	17.94	2.84	7.89	0.00	0.03	0.03	3,540.70

Area Source Changes to Defaults

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Single family housing	9.58	13.69	109.66	0.06	12.52	2.51	6,905.59
Apartments mid rise	4.88	6.79	54.37	0.03	6.21	1.24	3,423.79
Condo/townhouse general	13.13	18.18	145.62	0.09	16.62	3.33	9,170.32
TOTALS (lbs/day, unmitigated)	27.59	38.66	309.65	0.18	35.35	7.08	19,499.70

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

1/13/2009 10:41:12 AM

Analysis Year: 2010 Temperature (F): 70 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Single family housing	27.00	10.01	dwelling units	81.00	810.81	7,185.64
Apartments mid rise	1.58	6.70	dwelling units	60.00	402.00	3,562.64
Condo/townhouse general	10.75	6.26	dwelling units	172.00	1,076.72	9,542.22
					2,289.53	20,290.50

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	44.3	1.8	97.5	0.7
Light Truck < 3750 lbs	17.3	2.3	92.5	5.2
Light Truck 3751-5750 lbs	20.0	1.0	98.5	0.5
Med Truck 5751-8500 lbs	8.3	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.4	0.0	71.4	28.6
Lite-Heavy Truck 10,001-14,000 lbs	0.9	0.0	55.6	44.4
Med-Heavy Truck 14,001-33,000 lbs	1.2	8.3	16.7	75.0
Heavy-Heavy Truck 33,001-60,000 lbs	0.7	0.0	0.0	100.0
Other Bus	0.1	0.0	100.0	0.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	4.5	68.9	31.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	1.1	9.1	81.8	9.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.8	8.3	7.1	11.8	4.4	4.4
Rural Trip Length (miles)	11.8	8.3	7.1	11.8	4.4	4.4
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			

% of Trips - Commercial (by land use)

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\ESPENCER\Desktop\Atkinson\Atkinson Lane - Phase 2 (Mitigated).urb924

Project Name: Atkinson Lane Specific Plan - Phase 1

Project Location: Monterey Bay Air District

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

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Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2009 TOTALS (lbs/day unmitigated)	6.65	44.64	27.58	0.00	31.82	2.84	34.66	6.65	2.61	9.26	3,944.92
2010 TOTALS (lbs/day unmitigated)	101.43	62.02	55.83	0.02	31.89	3.99	35.88	6.67	3.66	10.34	6,986.16

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	7.54	1.11	2.41	0.00	0.01	0.01	1,379.75

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	10.13	13.99	112.07	0.07	12.79	2.57	7,057.53

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	17.67	15.10	114.48	0.07	12.80	2.58	8,437.28

1/13/2009 10:39:28 AM

Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\ESPENCER\Desktop\Atkinson\Atkinson Lane - Phase 2 (Mitigated).urb924

Project Name: Atkinson Lane Specific Plan - Phase 1

Project Location: Monterey Bay Air District

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
Time Slice 11/30/2009-12/25/2009 Active Days: 20	3.25	26.60	14.64	0.00	31.81	1.34	33.14	6.64	1.23	7.87	2,352.93
Fine Grading 11/30/2009-01/11/2010	3.25	26.60	14.64	0.00	31.81	1.34	33.14	6.64	1.23	7.87	2,352.93
Fine Grading Dust	0.00	0.00	0.00	0.00	31.80	0.00	31.80	6.64	0.00	6.64	0.00
Fine Grading Off Road Diesel	3.18	26.46	12.98	0.00	0.00	1.33	1.33	0.00	1.23	1.23	2,247.32
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.07	0.14	1.67	0.00	0.01	0.00	0.01	0.00	0.00	0.01	105.62

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Time Slice 12/28/2009-12/31/2009 Active Days: 4	6.65	44.64	27.58	0.00	31.82	2.84	34.66	6.65	2.61	9.26	3,944.92
Asphalt 12/28/2009-01/11/2010	3.40	18.05	12.94	0.00	0.01	1.50	1.52	0.01	1.38	1.39	1,591.99
Paving Off-Gas	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.81	16.83	9.27	0.00	0.00	1.46	1.46	0.00	1.34	1.34	1,272.04
Paving On Road Diesel	0.06	0.93	0.33	0.00	0.00	0.04	0.04	0.00	0.03	0.03	108.72
Paving Worker Trips	0.14	0.28	3.33	0.00	0.01	0.01	0.02	0.00	0.01	0.01	211.23
Fine Grading 11/30/2009-01/11/2010	3.25	26.60	14.64	0.00	31.81	1.34	33.14	6.64	1.23	7.87	2,352.93
Fine Grading Dust	0.00	0.00	0.00	0.00	31.80	0.00	31.80	6.64	0.00	6.64	0.00
Fine Grading Off Road Diesel	3.18	26.46	12.98	0.00	0.00	1.33	1.33	0.00	1.23	1.23	2,247.32
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.07	0.14	1.67	0.00	0.01	0.00	0.01	0.00	0.00	0.01	105.62
Time Slice 1/1/2010-1/8/2010 Active Days: 6	6.28	42.20	26.60	0.00	31.82	2.68	34.50	6.65	2.46	9.11	3,944.66
Asphalt 12/28/2009-01/11/2010	3.21	17.09	12.59	0.00	0.01	1.43	1.44	0.01	1.31	1.32	1,591.82
Paving Off-Gas	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.64	15.97	9.18	0.00	0.00	1.39	1.39	0.00	1.27	1.27	1,272.04
Paving On Road Diesel	0.06	0.86	0.30	0.00	0.00	0.03	0.04	0.00	0.03	0.03	108.72
Paving Worker Trips	0.13	0.26	3.11	0.00	0.01	0.01	0.02	0.00	0.01	0.01	211.06
Fine Grading 11/30/2009-01/11/2010	3.07	25.12	14.01	0.00	31.81	1.25	33.06	6.64	1.15	7.80	2,352.85
Fine Grading Dust	0.00	0.00	0.00	0.00	31.80	0.00	31.80	6.64	0.00	6.64	0.00
Fine Grading Off Road Diesel	3.00	24.99	12.46	0.00	0.00	1.25	1.25	0.00	1.15	1.15	2,247.32
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.07	0.13	1.55	0.00	0.01	0.00	0.01	0.00	0.00	0.01	105.53

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Time Slice 1/11/2010-1/11/2010 Active Days: 1	10.81	62.02	55.83	0.02	31.89	3.99	35.88	6.67	3.66	10.34	6,986.16
Asphalt 12/28/2009-01/11/2010	3.21	17.09	12.59	0.00	0.01	1.43	1.44	0.01	1.31	1.32	1,591.82
Paving Off-Gas	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.64	15.97	9.18	0.00	0.00	1.39	1.39	0.00	1.27	1.27	1,272.04
Paving On Road Diesel	0.06	0.86	0.30	0.00	0.00	0.03	0.04	0.00	0.03	0.03	108.72
Paving Worker Trips	0.13	0.26	3.11	0.00	0.01	0.01	0.02	0.00	0.01	0.01	211.06
Building 01/11/2010-08/22/2010	4.52	19.82	29.23	0.01	0.07	1.31	1.38	0.02	1.20	1.22	3,041.50
Building Off Road Diesel	3.65	16.55	11.20	0.00	0.00	1.19	1.19	0.00	1.10	1.10	1,621.20
Building Vendor Trips	0.18	1.92	1.69	0.00	0.01	0.07	0.08	0.00	0.07	0.07	311.00
Building Worker Trips	0.70	1.35	16.34	0.01	0.06	0.04	0.10	0.02	0.04	0.06	1,109.31
Fine Grading 11/30/2009-01/11/2010	3.07	25.12	14.01	0.00	31.81	1.25	33.06	6.64	1.15	7.80	2,352.85
Fine Grading Dust	0.00	0.00	0.00	0.00	31.80	0.00	31.80	6.64	0.00	6.64	0.00
Fine Grading Off Road Diesel	3.00	24.99	12.46	0.00	0.00	1.25	1.25	0.00	1.15	1.15	2,247.32
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.07	0.13	1.55	0.00	0.01	0.00	0.01	0.00	0.00	0.01	105.53
Time Slice 1/12/2010-8/6/2010 Active Days: 149	4.52	19.82	29.23	0.01	0.07	1.31	1.38	0.02	1.20	1.22	3,041.50
Building 01/11/2010-08/22/2010	4.52	19.82	29.23	0.01	0.07	1.31	1.38	0.02	1.20	1.22	3,041.50
Building Off Road Diesel	3.65	16.55	11.20	0.00	0.00	1.19	1.19	0.00	1.10	1.10	1,621.20
Building Vendor Trips	0.18	1.92	1.69	0.00	0.01	0.07	0.08	0.00	0.07	0.07	311.00
Building Worker Trips	0.70	1.35	16.34	0.01	0.06	0.04	0.10	0.02	0.04	0.06	1,109.31

Time Slice 8/9/2010-8/20/2010 Active Days: 10	**101.43**	20.08	32.35	0.01	0.08	1.32	1.40	0.03	1.21	1.23	3,253.50
Building 01/11/2010-08/22/2010	4.52	19.82	29.23	0.01	0.07	1.31	1.38	0.02	1.20	1.22	3,041.50
Building Off Road Diesel	3.65	16.55	11.20	0.00	0.00	1.19	1.19	0.00	1.10	1.10	1,621.20
Building Vendor Trips	0.18	1.92	1.69	0.00	0.01	0.07	0.08	0.00	0.07	0.07	311.00
Building Worker Trips	0.70	1.35	16.34	0.01	0.06	0.04	0.10	0.02	0.04	0.06	1,109.31
Coating 08/08/2010-09/05/2010	96.90	0.26	3.12	0.00	0.01	0.01	0.02	0.00	0.01	0.01	212.00
Architectural Coating	96.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.13	0.26	3.12	0.00	0.01	0.01	0.02	0.00	0.01	0.01	212.00
Time Slice 8/23/2010-9/3/2010 Active Days: 10	96.90	0.26	3.12	0.00	0.01	0.01	0.02	0.00	0.01	0.01	212.00
Coating 08/08/2010-09/05/2010	96.90	0.26	3.12	0.00	0.01	0.01	0.02	0.00	0.01	0.01	212.00
Architectural Coating	96.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.13	0.26	3.12	0.00	0.01	0.01	0.02	0.00	0.01	0.01	212.00

Phase Assumptions

Phase: Fine Grading 11/30/2009 - 1/11/2010 - Default Fine Site Grading Description

Total Acres Disturbed: 9

Maximum Daily Acreage Disturbed: 1.59

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 6 hours per day

1 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 6 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

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Phase: Paving 12/28/2009 - 1/11/2010 - Default Paving Description

Acres to be Paved: 1.59

Off-Road Equipment:

4 Cement and Mortar Mixers (10 hp) operating at a 0.56 load factor for 6 hours per day

1 Pavers (100 hp) operating at a 0.62 load factor for 7 hours per day

1 Paving Equipment (104 hp) operating at a 0.53 load factor for 8 hours per day

1 Rollers (95 hp) operating at a 0.56 load factor for 7 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

Phase: Building Construction 1/11/2010 - 8/22/2010 - Default Building Construction Description

Off-Road Equipment:

1 Cranes (399 hp) operating at a 0.43 load factor for 6 hours per day

2 Forklifts (145 hp) operating at a 0.3 load factor for 6 hours per day

1 Generator Sets (49 hp) operating at a 0.74 load factor for 8 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

3 Welders (45 hp) operating at a 0.45 load factor for 8 hours per day

Phase: Architectural Coating 8/8/2010 - 9/5/2010 - Default Architectural Coating Description

Rule: Residential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 100

Rule: Residential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.08	1.08	0.46	0.00	0.00	0.00	1,376.30
Hearth	23.18	2.36	105.46	0.32	16.83	16.20	3,261.60
Landscaping - No Winter Emissions							
Consumer Products	6.70						
Architectural Coatings	0.56						
TOTALS (lbs/day, unmitigated)	30.52	3.44	105.92	0.32	16.83	16.20	4,637.90

Area Source Changes to Defaults

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Single family housing	1.24	1.87	13.83	0.01	1.39	0.28	757.42
Apartments mid rise	10.22	15.30	113.35	0.06	11.40	2.29	6,209.31
TOTALS (lbs/day, unmitigated)	11.46	17.17	127.18	0.07	12.79	2.57	6,966.73

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 50 Season: Winter

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Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Single family housing	3.00	10.01	dwelling units	9.00	90.09	798.40
Apartments mid rise	3.37	5.77	dwelling units	128.00	738.56	6,545.34
					828.65	7,343.74

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	44.3	1.8	97.5	0.7
Light Truck < 3750 lbs	17.3	2.3	92.5	5.2
Light Truck 3751-5750 lbs	20.0	1.0	98.5	0.5
Med Truck 5751-8500 lbs	8.3	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.4	0.0	71.4	28.6
Lite-Heavy Truck 10,001-14,000 lbs	0.9	0.0	55.6	44.4
Med-Heavy Truck 14,001-33,000 lbs	1.2	8.3	16.7	75.0
Heavy-Heavy Truck 33,001-60,000 lbs	0.7	0.0	0.0	100.0
Other Bus	0.1	0.0	100.0	0.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	4.5	68.9	31.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	1.1	9.1	81.8	9.1

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Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.8	8.3	7.1	11.8	4.4	4.4
Rural Trip Length (miles)	11.8	8.3	7.1	11.8	4.4	4.4
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			

% of Trips - Commercial (by land use)

Scenario Report

Scenario:	Default Scenario
Command:	Default Command
Volume:	Default Volume
Geometry:	Default Geometry
Impact Fee:	Default Impact Fee
Trip Generation:	Default Trip Generation
Trip Distribution:	Default Trip Distribution
Paths:	Default Path
Routes:	Default Route
Configuration:	Default Configuration

Level Of Service Computation Report
2000 HCM 4-Way Stop Method (Base Volume Alternative)

Intersection #3 San Antonio & Ocean

Cycle (sec):	100	Critical Vol./Cap.(X):	0.622
Loss Time (sec):	0 (Y+R=4.0 sec)	Average Delay (sec/veh):	12.7
Optimal Cycle:	0	Level Of Service:	B

Street Name:	San Antonio						Ocean Ave					
Approach:	North Bound			South Bound			East Bound			West Bound		
Movement:	L	T	R	L	T	R	L	T	R	L	T	R
Control:	Stop Sign			Stop Sign			Stop Sign			Stop Sign		
Rights:	Include			Include			Include			Include		
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	0 0 1! 0 0			0 0 1! 0 0			0 0 1! 0 0			0 0 1! 0 0		
Volume Module:Afternoon Peak												
Base Vol:	19	56	48	48	52	27	19	160	9	64	238	72
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Initial Bse:	19	56	48	48	52	27	19	160	9	64	238	72
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PHF Adj:	0.74	0.74	0.74	0.90	0.90	0.90	0.90	0.90	0.90	0.86	0.86	0.86
PHF Volume:	26	76	65	53	58	30	21	178	10	75	278	84
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0
Reduced Vol:	26	76	65	53	58	30	21	178	10	75	278	84
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FinalVolume:	26	76	65	53	58	30	21	178	10	75	278	84
Saturation Flow Module:												
Adjustment:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lanes:	0.15	0.46	0.39	0.38	0.41	0.21	0.10	0.85	0.05	0.17	0.64	0.19
Final Sat.:	91	268	230	214	232	120	64	539	30	120	447	135
Capacity Analysis Module:												
Vol/Sat:	0.28	0.28	0.28	0.25	0.25	0.25	0.33	0.33	0.33	0.62	0.62	0.62
Crit Moves:	****				****		****				****	
Delay/Veh:	10.4	10.4	10.4	10.4	10.4	10.4	10.7	10.7	10.7	15.3	15.3	15.3
Delay Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AdjDel/Veh:	10.4	10.4	10.4	10.4	10.4	10.4	10.7	10.7	10.7	15.3	15.3	15.3
LOS by Move:	B	B	B	B	B	B	B	B	B	C	C	C
ApproachDel:		10.4			10.4			10.7			15.3	
Delay Adj:		1.00			1.00			1.00			1.00	
ApprAdjDel:		10.4			10.4			10.7			15.3	
LOS by Appr:		B			B			B			C	
AllWayAvgQ:	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	1.4	1.4	1.4

Note: Queue reported is the number of cars per lane.

Level Of Service Computation Report
2000 HCM 4-Way Stop Method (Base Volume Alternative)

Intersection #4 Ocean & Scenic

Cycle (sec):	100	Critical Vol./Cap.(X):	0.413
Loss Time (sec):	0 (Y+R=4.0 sec)	Average Delay (sec/veh):	9.5
Optimal Cycle:	0	Level Of Service:	A

Street Name:	Scenic Rd						Ocean Ave					
Approach:	North Bound			South Bound			East Bound			West Bound		
Movement:	L	T	R	L	T	R	L	T	R	L	T	R
Control:	Stop Sign			Stop Sign			Stop Sign			Stop Sign		
Rights:	Include			Include			Include			Include		
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	0 0 1! 0 0			0 0 1! 0 0			0 0 1! 0 0			0 1 0 0 0		
Volume Module:Afternoon Peak												
Base Vol:	4	0	44	0	0	0	8	144	28	112	172	0
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Initial Bse:	4	0	44	0	0	0	8	144	28	112	172	0
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PHF Adj:	0.30	1.00	0.75	1.00	1.00	1.00	0.92	0.92	0.92	0.84	0.84	0.84
PHF Volume:	13	0	59	0	0	0	9	157	30	133	205	0
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0
Reduced Vol:	13	0	59	0	0	0	9	157	30	133	205	0
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FinalVolume:	13	0	59	0	0	0	9	157	30	133	205	0
Saturation Flow Module:												
Adjustment:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lanes:	0.19	0.00	0.81	0.00	1.00	0.00	0.04	0.80	0.16	0.39	0.61	0.00
Final Sat.:	133	0	586	0	635	0	36	651	127	323	495	0
Capacity Analysis Module:												
Vol/Sat:	0.10	xxxx	0.10	xxxx	0.00	xxxx	0.24	0.24	0.24	0.41	0.41	xxxx
Crit Moves:	****				****			****			****	
Delay/Veh:	8.0	0.0	8.0	0.0	0.0	0.0	8.6	8.6	8.6	10.3	10.3	0.0
Delay Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AdjDel/Veh:	8.0	0.0	8.0	0.0	0.0	0.0	8.6	8.6	8.6	10.3	10.3	0.0
LOS by Move:	A	*	A	*	*	*	A	A	A	B	B	*
ApproachDel:		8.0			xxxxxx			8.6			10.3	
Delay Adj:		1.00			xxxxx			1.00			1.00	
ApprAdjDel:		8.0			xxxxxx			8.6			10.3	
LOS by Appr:		A			*			A			B	
AllWayAvgQ:	0.1	0.1	0.1	0.0	0.0	0.0	0.3	0.3	0.3	0.7	0.7	0.7

Note: Queue reported is the number of cars per lane.

Scenario Report

Scenario:	Default Scenario
Command:	Default Command
Volume:	Default Volume
Geometry:	Default Geometry
Impact Fee:	Default Impact Fee
Trip Generation:	Default Trip Generation
Trip Distribution:	Default Trip Distribution
Paths:	Default Path
Routes:	Default Route
Configuration:	Default Configuration

Level Of Service Computation Report
2000 HCM 4-Way Stop Method (Base Volume Alternative)

Intersection #3 San Antonio & Ocean

Cycle (sec):	100	Critical Vol./Cap.(X):	0.622
Loss Time (sec):	0 (Y+R=4.0 sec)	Average Delay (sec/veh):	12.7
Optimal Cycle:	0	Level Of Service:	B

Street Name:	San Antonio						Ocean Ave					
Approach:	North Bound			South Bound			East Bound			West Bound		
Movement:	L	T	R	L	T	R	L	T	R	L	T	R
Control:		Stop Sign			Stop Sign			Stop Sign			Stop Sign	
Rights:		Include			Include			Include			Include	
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:		0 0 1! 0 0			0 0 1! 0 0			0 0 1! 0 0			0 0 1! 0 0	
Volume Module:Afternoon Peak												
Base Vol:	19	56	48	48	52	27	19	160	9	64	238	72
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Initial Bse:	19	56	48	48	52	27	19	160	9	64	238	72
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PHF Adj:	0.74	0.74	0.74	0.90	0.90	0.90	0.90	0.90	0.90	0.86	0.86	0.86
PHF Volume:	26	76	65	53	58	30	21	178	10	75	278	84
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0
Reduced Vol:	26	76	65	53	58	30	21	178	10	75	278	84
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FinalVolume:	26	76	65	53	58	30	21	178	10	75	278	84
Saturation Flow Module:												
Adjustment:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lanes:	0.15	0.46	0.39	0.38	0.41	0.21	0.10	0.85	0.05	0.17	0.64	0.19
Final Sat.:	91	268	230	214	232	120	64	539	30	120	447	135
Capacity Analysis Module:												
Vol/Sat:	0.28	0.28	0.28	0.25	0.25	0.25	0.33	0.33	0.33	0.62	0.62	0.62
Crit Moves:	****				****		****				****	
Delay/Veh:	10.4	10.4	10.4	10.4	10.4	10.4	10.7	10.7	10.7	15.3	15.3	15.3
Delay Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AdjDel/Veh:	10.4	10.4	10.4	10.4	10.4	10.4	10.7	10.7	10.7	15.3	15.3	15.3
LOS by Move:	B	B	B	B	B	B	B	B	B	C	C	C
ApproachDel:		10.4			10.4			10.7			15.3	
Delay Adj:		1.00			1.00			1.00			1.00	
ApprAdjDel:		10.4			10.4			10.7			15.3	
LOS by Appr:		B			B			B			C	
AllWayAvgQ:	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	1.4	1.4	1.4

Note: Queue reported is the number of cars per lane.

Level Of Service Computation Report
2000 HCM 4-Way Stop Method (Base Volume Alternative)

Intersection #4 Ocean & Scenic

Cycle (sec):	100	Critical Vol./Cap.(X):	0.413
Loss Time (sec):	0 (Y+R=4.0 sec)	Average Delay (sec/veh):	9.5
Optimal Cycle:	0	Level Of Service:	A

Street Name:	Scenic Rd						Ocean Ave					
Approach:	North Bound			South Bound			East Bound			West Bound		
Movement:	L	T	R	L	T	R	L	T	R	L	T	R
Control:		Stop Sign			Stop Sign			Stop Sign			Stop Sign	
Rights:		Include			Include			Include			Include	
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:		0 0 1! 0 0			0 0 1! 0 0			0 0 1! 0 0			0 1 0 0 0	
Volume Module:Afternoon Peak												
Base Vol:	4	0	44	0	0	0	8	144	28	112	172	0
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Initial Bse:	4	0	44	0	0	0	8	144	28	112	172	0
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PHF Adj:	0.30	1.00	0.75	1.00	1.00	1.00	0.92	0.92	0.92	0.84	0.84	0.84
PHF Volume:	13	0	59	0	0	0	9	157	30	133	205	0
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0
Reduced Vol:	13	0	59	0	0	0	9	157	30	133	205	0
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FinalVolume:	13	0	59	0	0	0	9	157	30	133	205	0
Saturation Flow Module:												
Adjustment:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lanes:	0.19	0.00	0.81	0.00	1.00	0.00	0.04	0.80	0.16	0.39	0.61	0.00
Final Sat.:	133	0	586	0	635	0	36	651	127	323	495	0
Capacity Analysis Module:												
Vol/Sat:	0.10	xxxx	0.10	xxxx	0.00	xxxx	0.24	0.24	0.24	0.41	0.41	xxxx
Crit Moves:	****				****			****			****	
Delay/Veh:	8.0	0.0	8.0	0.0	0.0	0.0	8.6	8.6	8.6	10.3	10.3	0.0
Delay Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AdjDel/Veh:	8.0	0.0	8.0	0.0	0.0	0.0	8.6	8.6	8.6	10.3	10.3	0.0
LOS by Move:	A	*	A	*	*	*	A	A	A	B	B	*
ApproachDel:		8.0			xxxxxx			8.6			10.3	
Delay Adj:		1.00			xxxxx			1.00			1.00	
ApprAdjDel:		8.0			xxxxxx			8.6			10.3	
LOS by Appr:		A			*			A			B	
AllWayAvgQ:	0.1	0.1	0.1	0.0	0.0	0.0	0.3	0.3	0.3	0.7	0.7	0.7

Note: Queue reported is the number of cars per lane.

Title : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season : Winter
Area : Monterey (NCC)
****
*****

Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

Monterey (NCC) Monterey (NCC) Monterey (NCC)

Table 1: Running Exhaust Emissions (grams/mile)

Pollutant Name: Reactive Org Gases Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.071	0.144	0.162	1.379	3.864	4.716	0.240
35	0.011	0.022	0.026	0.195	0.597	1.817	0.048

Pollutant Name: Carbon Monoxide Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	1.172	2.189	2.436	7.447	44.571	22.317	2.351
35	0.690	1.259	1.310	1.566	8.670	14.445	1.188

Pollutant Name: Oxides of Nitrogen Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.116	0.272	0.413	5.110	9.059	1.414	0.520
35	0.065	0.149	0.243	2.200	6.820	1.283	0.262

Pollutant Name: Carbon Dioxide Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	944.110	1187.777	1686.725	2525.441	2422.782	266.238	1209.685
35	307.140	386.938	521.956	1468.655	1495.925	139.884	428.673

Pollutant Name: Sulfur Dioxide Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.009	0.011	0.016	0.024	0.024	0.003	0.012
35	0.003	0.004	0.005	0.014	0.014	0.002	0.004

Pollutant Name: PM2.5 Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.063	0.125	0.144	0.296	0.143	0.023	0.109
35	0.010	0.021	0.024	0.110	0.031	0.011	0.021

Pollutant Name: PM2.5 - Tire Wear Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.002	0.002	0.002	0.005	0.002	0.001	0.002
35	0.002	0.002	0.002	0.005	0.002	0.001	0.002

Pollutant Name: PM2.5 - Break Wear Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.005	0.005	0.005	0.008	0.005	0.003	0.005
35	0.005	0.005	0.005	0.008	0.005	0.003	0.005

Pollutant Name: Gasoline - mi/gal Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	9.364	7.423	5.145	3.499	3.308	28.003	8.252
35	28.745	22.773	16.906	17.685	16.754	52.578	25.141

Pollutant Name: Diesel - mi/gal Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	29.156	29.156	19.479	4.916	4.297	0.000	7.235
35	29.156	29.156	19.479	6.181	4.297	0.000	8.294

Title : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season : Winter
Area : Monterey (NCC)
****
*****

Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

Monterey (NCC) Monterey (NCC) Monterey (NCC)

Table 2: Starting Emissions (grams/trip)

Pollutant Name: Reactive Org Gases Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.008	0.014	0.034	0.082	0.460	0.656	0.027
10	0.015	0.027	0.067	0.160	0.896	0.810	0.047
20	0.028	0.052	0.131	0.303	1.698	1.107	0.087
30	0.041	0.075	0.191	0.430	2.408	1.386	0.123
40	0.053	0.096	0.249	0.540	3.024	1.649	0.156
50	0.063	0.116	0.303	0.633	3.546	1.896	0.186
60	0.073	0.133	0.354	0.710	3.975	2.076	0.212
120	0.108	0.198	0.581	0.798	4.470	2.347	0.298
180	0.105	0.194	0.577	0.847	4.743	2.375	0.299
240	0.112	0.206	0.614	0.894	5.007	2.525	0.318
300	0.118	0.217	0.650	0.940	5.263	2.671	0.335
360	0.125	0.229	0.686	0.984	5.510	2.815	0.353
420	0.131	0.240	0.722	1.026	5.748	2.955	0.370
480	0.137	0.251	0.758	1.067	5.977	3.093	0.388
540	0.143	0.262	0.793	1.107	6.198	3.227	0.404
600	0.149	0.273	0.828	1.145	6.411	3.358	0.421
660	0.155	0.284	0.863	1.181	6.614	3.486	0.437
720	0.160	0.295	0.898	1.216	6.809	3.611	0.453

Pollutant Name: Carbon Monoxide Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.111	0.201	0.434	1.128	5.763	3.009	0.306
10	0.219	0.396	0.858	2.211	11.293	3.640	0.580
20	0.427	0.771	1.676	4.239	21.648	4.849	1.101
30	0.623	1.123	2.454	6.083	31.067	5.986	1.588
40	0.807	1.452	3.192	7.744	39.550	7.051	2.042
50	0.980	1.760	3.889	9.221	47.096	8.043	2.461
60	1.140	2.045	4.546	10.515	53.705	8.964	2.846
120	1.769	3.120	7.208	12.280	62.718	12.680	4.103

180	1.664	2.946	6.901	12.639	64.551	12.266	3.972
240	1.795	3.169	7.502	13.010	66.445	13.293	4.245
300	1.912	3.368	8.031	13.392	68.400	14.242	4.491
360	2.014	3.544	8.489	13.787	70.414	15.115	4.711
420	2.102	3.695	8.875	14.193	72.489	15.909	4.905
480	2.175	3.822	9.190	14.611	74.625	16.627	5.072
540	2.233	3.925	9.433	15.041	76.821	17.266	5.212
600	2.277	4.004	9.605	15.483	79.077	17.829	5.326
660	2.306	4.059	9.705	15.937	81.394	18.313	5.414
720	2.321	4.090	9.733	16.402	83.772	18.721	5.475

Pollutant Name: Oxides of Nitrogen   Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.056	0.127	0.660	0.311	2.341	0.156	0.208
10	0.061	0.137	0.692	0.468	3.527	0.196	0.231
20	0.068	0.154	0.750	0.744	5.611	0.267	0.273
30	0.075	0.169	0.800	0.970	7.308	0.326	0.308
40	0.080	0.181	0.843	1.144	8.620	0.372	0.335
50	0.085	0.191	0.878	1.266	9.546	0.406	0.356
60	0.088	0.198	0.905	1.338	10.087	0.427	0.370
120	0.094	0.213	0.988	1.348	10.160	0.430	0.394
180	0.095	0.214	0.989	1.343	10.122	0.426	0.394
240	0.094	0.212	0.981	1.335	10.065	0.419	0.391
300	0.093	0.210	0.969	1.325	9.989	0.411	0.387
360	0.091	0.206	0.951	1.312	9.892	0.401	0.381
420	0.089	0.202	0.929	1.297	9.776	0.390	0.373
480	0.087	0.196	0.902	1.279	9.640	0.376	0.364
540	0.084	0.190	0.869	1.258	9.484	0.361	0.353
600	0.081	0.183	0.832	1.235	9.309	0.344	0.341
660	0.077	0.174	0.790	1.209	9.114	0.326	0.327
720	0.073	0.165	0.743	1.181	8.899	0.305	0.311

Pollutant Name: Carbon Dioxide   Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	12.187	15.178	21.481	2.866	4.388	13.286	14.115
10	13.696	17.130	24.260	5.717	8.753	15.484	16.104
20	17.212	21.649	30.690	11.370	17.408	19.799	20.636
30	21.392	26.989	38.280	16.959	25.967	24.007	25.909
40	26.237	33.150	47.031	22.485	34.428	28.107	31.922
50	31.745	40.132	56.942	27.948	42.792	32.101	38.674
60	37.919	47.936	68.013	33.347	51.059	35.986	46.167
120	88.241	110.943	157.265	56.718	86.843	53.440	105.152
180	100.176	126.025	178.663	67.008	102.598	57.674	119.591
240	112.089	141.062	199.992	76.691	117.424	61.659	133.945
300	123.980	156.054	221.253	85.766	131.319	65.396	148.213
360	135.848	171.000	242.446	94.234	144.285	68.885	162.397
420	147.694	185.901	263.570	102.095	156.321	72.125	176.496
480	159.517	200.756	284.625	109.349	167.426	75.117	190.510
540	171.319	215.566	305.612	115.995	177.602	77.860	204.438
600	183.097	230.331	326.531	122.033	186.848	80.354	218.282
660	194.854	245.050	347.381	127.465	195.164	82.600	232.040
720	206.588	259.724	368.163	132.289	202.550	84.598	245.714

Pollutant Name: Sulfur Dioxide   Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000	0.001	0.000	0.000
30	0.000	0.000	0.000	0.000	0.001	0.000	0.000
40	0.000	0.000	0.001	0.000	0.001	0.000	0.000
50	0.000	0.000	0.001	0.000	0.001	0.000	0.000
60	0.000	0.000	0.001	0.001	0.001	0.001	0.000
120	0.001	0.001	0.002	0.001	0.002	0.001	0.001
180	0.001	0.001	0.002	0.001	0.002	0.001	0.001
240	0.001	0.001	0.002	0.001	0.002	0.001	0.001
300	0.001	0.002	0.002	0.001	0.002	0.001	0.002
360	0.001	0.002	0.002	0.001	0.003	0.001	0.002
420	0.001	0.002	0.003	0.001	0.003	0.001	0.002
480	0.002	0.002	0.003	0.001	0.003	0.001	0.002
540	0.002	0.002	0.003	0.001	0.003	0.001	0.002
600	0.002	0.002	0.003	0.001	0.003	0.001	0.002
660	0.002	0.002	0.004	0.001	0.003	0.001	0.002
720	0.002	0.003	0.004	0.002	0.003	0.001	0.002

Pollutant Name: PM2.5   Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.001	0.001	0.001	0.000	0.001	0.005	0.001
10	0.001	0.002	0.002	0.001	0.001	0.005	0.002
20	0.002	0.004	0.004	0.002	0.003	0.004	0.003
30	0.003	0.006	0.006	0.002	0.004	0.003	0.005
40	0.004	0.008	0.008	0.003	0.005	0.003	0.006
50	0.005	0.010	0.009	0.003	0.006	0.002	0.007
60	0.006	0.012	0.011	0.004	0.007	0.002	0.009
120	0.010	0.019	0.018	0.005	0.009	0.005	0.014
180	0.012	0.021	0.020	0.006	0.010	0.007	0.016
240	0.013	0.023	0.022	0.006	0.010	0.008	0.017
300	0.014	0.025	0.024	0.006	0.010	0.010	0.018
360	0.015	0.026	0.025	0.006	0.011	0.011	0.019
420	0.015	0.027	0.026	0.006	0.011	0.012	0.020
480	0.016	0.028	0.027	0.006	0.011	0.013	0.021
540	0.016	0.029	0.028	0.007	0.012	0.014	0.022
600	0.017	0.030	0.028	0.007	0.012	0.014	0.022
660	0.017	0.030	0.029	0.007	0.012	0.015	0.022
720	0.017	0.030	0.029	0.007	0.013	0.015	0.022

Title   : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title

Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season : Winter
Area : Monterey (NCC)
****
*****
Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

Monterey (NCC) Monterey (NCC) Monterey (NCC)

Table 4: Hot Soak Emissions (grams/trip)

Pollutant Name: Reactive Org Gases Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.025	0.049	0.033	0.004	0.061	0.184	0.034
10	0.046	0.092	0.061	0.007	0.113	0.344	0.063
20	0.079	0.157	0.105	0.012	0.193	0.601	0.109
30	0.102	0.204	0.136	0.016	0.248	0.793	0.141
40	0.111	0.221	0.148	0.017	0.268	0.870	0.153

Hot soak results are scaled to reflect zero emissions for trip lengths of less than 5 minutes (about 25% of in-use trips).

Title : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season : Winter
Area : Monterey (NCC)
****
*****
Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

Monterey (NCC) Monterey (NCC) Monterey (NCC)

Table 5a: Partial Day Diurnal Loss Emissions (grams/hour)

Pollutant Name: Reactive Org Gases Temperature: ALL Relative Humidity: ALL

Temp degF	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
70	0.035	0.078	0.064	0.002	0.004	0.456	0.067

Title : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season : Winter
Area : Monterey (NCC)
****
*****
Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

Monterey (NCC) Monterey (NCC) Monterey (NCC)

Table 5b: Multi-Day Diurnal Loss Emissions (grams/hour)

Pollutant Name: Reactive Org Gases Temperature: ALL Relative Humidity: ALL

Temp degF	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
70	0.003	0.006	0.004	0.000	0.001	0.043	0.006

Title : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season : Winter
Area : Monterey (NCC)
****
*****
Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

Monterey (NCC) Monterey (NCC) Monterey (NCC)

Table 6a: Partial Day Resting Loss Emissions (grams/hour)

Pollutant Name: Reactive Org Gases Temperature: ALL Relative Humidity: ALL

Temp degF	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
70	0.015	0.042	0.043	0.001	0.001	0.144	0.032

```
Title    : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season   : Winter
Area     : Monterey (NCC)
***********************************************************************************
*****
     Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

     Monterey (NCC)                    Monterey (NCC)                 Monterey
(NCC)

                          Table  6b:  Multi-Day Resting Loss Emissions
(grams/hour)

     Pollutant Name: Reactive Org Gases        Temperature: ALL   Relative Humidity:
ALL
```

Temp degF	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
70	0.001	0.003	0.003	0.000	0.000	0.014	0.003

```
Title    : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season   : Winter
Area     : Monterey (NCC)
***********************************************************************************
*****
     Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

     Monterey (NCC)                    Monterey (NCC)                 Monterey
(NCC)

                          Table   7:  Estimated Travel Fractions

     Pollutant Name:                           Temperature: ALL   Relative Humidity:
ALL
```

	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
%VMT	0.442	0.365	0.125	0.057	0.001	0.011	1.000
%TRIP	0.414	0.319	0.180	0.076	0.000	0.010	1.000
%VEH	0.456	0.359	0.120	0.030	0.000	0.035	1.000


```
Title    : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season   : Winter
Area     : Monterey (NCC)
***********************************************************************************
*****
     Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

     Monterey (NCC)                    Monterey (NCC)                 Monterey
(NCC)

                          Table   8:  Evaporative Running Loss Emissions
(grams/minute)

     Pollutant Name: Reactive Org Gases        Temperature:  70F  Relative Humidity:
ALL
```

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
1	0.009	0.259	0.225	0.051	0.635	0.004	0.130
2	0.007	0.135	0.118	0.027	0.327	0.038	0.069
3	0.008	0.096	0.085	0.019	0.226	0.057	0.051
4	0.009	0.078	0.070	0.016	0.177	0.069	0.043
5	0.010	0.068	0.061	0.014	0.148	0.078	0.039
10	0.013	0.048	0.045	0.010	0.093	0.101	0.031
15	0.015	0.043	0.042	0.009	0.079	0.114	0.029
20	0.016	0.042	0.042	0.009	0.075	0.125	0.030
25	0.017	0.043	0.043	0.009	0.076	0.134	0.030
30	0.017	0.045	0.045	0.009	0.080	0.142	0.032
35	0.018	0.047	0.046	0.010	0.084	0.149	0.033
40	0.019	0.049	0.048	0.010	0.088	0.155	0.034
45	0.019	0.050	0.049	0.010	0.092	0.162	0.036
50	0.020	0.052	0.051	0.011	0.095	0.168	0.037
55	0.021	0.053	0.052	0.011	0.098	0.174	0.038
60	0.021	0.055	0.054	0.011	0.101	0.179	0.039

```
Title    : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season   : Winter
Area     : San Benito (NCC)
***********************************************************************************
*****
     Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

     San Benito (NCC)                  San Benito (NCC)               San Benito
```

(NCC)

Table 1: Running Exhaust Emissions (grams/mile)

Pollutant Name: Reactive Org Gases Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.063	0.101	0.142	2.306	6.163	4.692	0.582
35	0.010	0.015	0.024	0.241	0.925	1.809	0.090

Pollutant Name: Carbon Monoxide Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	1.071	1.663	2.099	6.423	71.088	22.160	2.855
35	0.633	0.970	1.096	1.361	13.968	14.347	1.214

Pollutant Name: Oxides of Nitrogen Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.104	0.192	0.420	7.607	9.415	1.396	1.552
35	0.059	0.107	0.249	2.765	8.836	1.270	0.617

Pollutant Name: Carbon Dioxide Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	943.803	1188.122	1708.183	3558.483	2408.991	266.249	1575.285
35	307.066	387.089	520.123	1732.693	1299.410	139.893	613.469

Pollutant Name: Sulfur Dioxide Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.009	0.011	0.016	0.034	0.024	0.003	0.015
35	0.003	0.004	0.005	0.017	0.013	0.002	0.006

Pollutant Name: PM2.5 Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.056	0.108	0.117	0.138	0.142	0.023	0.096
35	0.009	0.018	0.020	0.077	0.030	0.011	0.026

Pollutant Name: PM2.5 - Tire Wear Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.002	0.002	0.002	0.008	0.003	0.001	0.003
35	0.002	0.002	0.002	0.008	0.003	0.001	0.003

Pollutant Name: PM2.5 - Break Wear Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.005	0.005	0.005	0.011	0.005	0.003	0.006
35	0.005	0.005	0.005	0.011	0.005	0.003	0.006

Pollutant Name: Gasoline - mi/gal Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	9.368	7.426	5.031	3.459	3.229	28.030	8.321
35	28.761	22.792	16.977	17.484	16.370	52.629	25.049

Pollutant Name: Diesel - mi/gal Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	29.156	29.156	19.547	3.028	4.419	0.000	4.014
35	29.156	29.156	19.547	5.633	4.419	0.000	6.463

Title : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season : Winter
Area : San Benito (NCC)
****

*****

Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

San Benito (NCC) San Benito (NCC) San Benito (NCC)

Table 2: Starting Emissions (grams/trip)

Pollutant Name: Reactive Org Gases Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.007	0.012	0.030	0.046	0.657	0.654	0.032
10	0.013	0.023	0.060	0.089	1.280	0.806	0.051
20	0.025	0.045	0.118	0.168	2.427	1.099	0.089
30	0.037	0.065	0.173	0.239	3.441	1.376	0.124
40	0.047	0.083	0.226	0.300	4.321	1.637	0.156
50	0.057	0.100	0.277	0.351	5.068	1.882	0.186
60	0.065	0.115	0.325	0.394	5.681	2.060	0.212
120	0.099	0.175	0.554	0.443	6.387	2.328	0.303
180	0.097	0.172	0.548	0.470	6.778	2.356	0.303
240	0.102	0.182	0.583	0.496	7.155	2.505	0.322
300	0.108	0.193	0.618	0.522	7.521	2.651	0.340
360	0.114	0.203	0.653	0.546	7.873	2.793	0.358
420	0.120	0.213	0.688	0.570	8.214	2.933	0.376
480	0.125	0.223	0.722	0.592	8.542	3.069	0.394
540	0.131	0.233	0.757	0.614	8.858	3.203	0.412
600	0.137	0.243	0.791	0.635	9.161	3.333	0.429
660	0.142	0.253	0.825	0.656	9.452	3.460	0.446
720	0.147	0.262	0.859	0.675	9.731	3.584	0.463

Pollutant Name: Carbon Monoxide Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.100	0.179	0.429	1.017	9.380	2.989	0.345
10	0.197	0.353	0.848	1.993	18.378	3.607	0.627
20	0.384	0.687	1.659	3.820	35.232	4.789	1.167
30	0.561	1.002	2.432	5.483	50.561	5.901	1.673
40	0.728	1.298	3.168	6.980	64.366	6.944	2.143
50	0.884	1.575	3.867	8.311	76.646	7.917	2.580
60	1.030	1.832	4.528	9.478	87.402	8.820	2.982
120	1.612	2.826	7.287	11.068	102.071	12.482	4.325
180	1.517	2.670	6.972	11.392	105.055	12.090	4.194
240	1.640	2.880	7.600	11.726	108.137	13.111	4.492
300	1.749	3.066	8.152	12.071	111.318	14.054	4.761
360	1.844	3.229	8.628	12.427	114.597	14.920	5.001
420	1.925	3.369	9.027	12.793	117.974	15.708	5.211
480	1.992	3.486	9.349	13.170	121.450	16.419	5.391
540	2.046	3.579	9.595	13.557	125.023	17.052	5.543
600	2.085	3.650	9.765	13.955	128.696	17.608	5.664
660	2.110	3.697	9.858	14.364	132.466	18.086	5.756
720	2.122	3.721	9.875	14.784	136.335	18.487	5.819

Pollutant Name: Oxides of Nitrogen Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.053	0.115	0.678	0.200	3.450	0.154	0.222
10	0.057	0.123	0.702	0.302	5.198	0.194	0.241
20	0.063	0.138	0.748	0.480	8.268	0.264	0.276
30	0.069	0.150	0.789	0.626	10.770	0.322	0.305
40	0.074	0.160	0.824	0.738	12.703	0.367	0.329
50	0.078	0.168	0.854	0.817	14.068	0.401	0.348
60	0.080	0.174	0.879	0.863	14.864	0.422	0.360
120	0.087	0.187	0.966	0.870	14.972	0.424	0.386
180	0.087	0.188	0.967	0.866	14.917	0.421	0.386
240	0.086	0.187	0.959	0.862	14.833	0.414	0.384
300	0.085	0.185	0.947	0.855	14.720	0.406	0.379
360	0.084	0.182	0.929	0.847	14.578	0.396	0.373
420	0.082	0.178	0.906	0.837	14.406	0.384	0.365
480	0.080	0.173	0.878	0.825	14.206	0.371	0.355
540	0.077	0.167	0.846	0.812	13.977	0.356	0.344
600	0.074	0.160	0.808	0.797	13.719	0.339	0.331
660	0.071	0.153	0.765	0.780	13.431	0.321	0.316
720	0.067	0.144	0.717	0.762	13.115	0.301	0.300

Pollutant Name: Carbon Dioxide Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	12.210	15.232	21.733	2.199	5.254	13.262	14.385
10	13.707	17.154	24.466	4.385	10.478	15.459	16.365
20	17.202	21.618	30.819	8.722	20.840	19.772	20.887
30	21.364	26.909	38.352	13.010	31.086	23.978	26.158
40	26.192	33.027	47.066	17.249	41.215	28.077	32.178
50	31.687	39.973	56.961	21.440	51.228	32.069	38.947
60	37.850	47.745	68.038	25.582	61.125	35.953	46.464
120	88.200	110.806	157.972	43.511	103.963	53.400	105.880
180	100.115	125.832	179.384	51.405	122.825	57.638	120.329
240	112.010	140.821	200.746	58.833	140.573	61.627	134.702
300	123.887	155.773	222.058	65.795	157.208	65.368	148.999
360	135.745	170.688	243.320	72.291	172.730	68.860	163.219
420	147.584	185.567	264.531	78.322	187.138	72.103	177.362
480	159.404	200.409	285.692	83.886	200.433	75.098	191.429
540	171.205	215.215	306.803	88.984	212.615	77.844	205.420
600	182.988	229.984	327.863	93.617	223.684	80.341	219.334
660	194.751	244.716	348.874	97.784	233.640	82.589	233.171
720	206.495	259.411	369.834	101.484	242.482	84.588	246.932

Pollutant Name: Sulfur Dioxide Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000

20	0.000	0.000	0.000	0.000	0.001	0.000	0.000
30	0.000	0.000	0.000	0.000	0.001	0.000	0.000
40	0.000	0.000	0.001	0.000	0.001	0.000	0.000
50	0.000	0.000	0.001	0.000	0.002	0.000	0.000
60	0.000	0.000	0.001	0.000	0.002	0.001	0.000
120	0.001	0.001	0.002	0.001	0.003	0.001	0.001
180	0.001	0.001	0.002	0.001	0.003	0.001	0.001
240	0.001	0.001	0.002	0.001	0.003	0.001	0.001
300	0.001	0.002	0.002	0.001	0.003	0.001	0.002
360	0.001	0.002	0.002	0.001	0.004	0.001	0.002
420	0.001	0.002	0.003	0.001	0.004	0.001	0.002
480	0.002	0.002	0.003	0.001	0.004	0.001	0.002
540	0.002	0.002	0.003	0.001	0.004	0.001	0.002
600	0.002	0.002	0.003	0.001	0.004	0.001	0.002
660	0.002	0.002	0.004	0.001	0.005	0.001	0.002
720	0.002	0.003	0.004	0.001	0.005	0.001	0.002

Pollutant Name: PM2.5 Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.001	0.001	0.001	0.000	0.001	0.005	0.001
10	0.001	0.002	0.002	0.001	0.002	0.005	0.002
20	0.002	0.004	0.003	0.001	0.003	0.004	0.003
30	0.003	0.006	0.005	0.002	0.005	0.003	0.004
40	0.004	0.008	0.006	0.002	0.006	0.003	0.006
50	0.005	0.010	0.008	0.002	0.007	0.002	0.007
60	0.006	0.011	0.009	0.003	0.008	0.002	0.008
120	0.009	0.018	0.015	0.004	0.011	0.005	0.013
180	0.010	0.021	0.016	0.004	0.012	0.007	0.014
240	0.011	0.022	0.018	0.004	0.012	0.008	0.016
300	0.012	0.024	0.019	0.004	0.012	0.010	0.017
360	0.013	0.026	0.020	0.004	0.013	0.011	0.018
420	0.014	0.027	0.021	0.004	0.013	0.012	0.019
480	0.014	0.028	0.022	0.005	0.013	0.013	0.020
540	0.014	0.028	0.023	0.005	0.014	0.014	0.020
600	0.015	0.029	0.023	0.005	0.014	0.014	0.020
660	0.015	0.029	0.023	0.005	0.015	0.015	0.021
720	0.015	0.029	0.023	0.005	0.015	0.015	0.021

Title : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season : Winter
Area : San Benito (NCC)
****
Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

San Benito (NCC) San Benito (NCC) San Benito (NCC)

atkinsonEMFAC.rts

Table 4: Hot Soak Emissions (grams/trip)

Pollutant Name: Reactive Org Gases Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.025	0.043	0.029	0.002	0.111	0.184	0.034
10	0.046	0.080	0.053	0.004	0.206	0.344	0.062
20	0.080	0.137	0.092	0.008	0.350	0.601	0.107
30	0.103	0.177	0.119	0.010	0.449	0.792	0.139
40	0.112	0.193	0.130	0.011	0.486	0.870	0.152

Hot soak results are scaled to reflect zero emissions for trip lengths of less than 5 minutes (about 25% of in-use trips).

Title : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season : Winter
Area : San Benito (NCC)
****
Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

San Benito (NCC) San Benito (NCC) San Benito (NCC)

Table 5a: Partial Day Diurnal Loss Emissions (grams/hour)

Pollutant Name: Reactive Org Gases Temperature: ALL Relative Humidity: ALL

Temp degF	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
70	0.033	0.064	0.057	0.001	0.007	0.456	0.078

Title : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season : Winter
Area : San Benito (NCC)
****

*****
Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

San Benito (NCC) San Benito (NCC) San Benito (NCC)

Table 5b: Multi-Day Diurnal Loss Emissions (grams/hour)

Pollutant Name: Reactive Org Gases Temperature: ALL Relative Humidity: ALL

Temp degF	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
70	0.003	0.005	0.004	0.000	0.002	0.043	0.007

Title : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season : Winter
Area : San Benito (NCC)
****
*****
Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

San Benito (NCC) San Benito (NCC) San Benito (NCC)

Table 6a: Partial Day Resting Loss Emissions (grams/hour)

Pollutant Name: Reactive Org Gases Temperature: ALL Relative Humidity: ALL

Temp degF	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
70	0.014	0.036	0.039	0.001	0.002	0.144	0.035

Title : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season : Winter
Area : San Benito (NCC)
****
*****

Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

San Benito (NCC) San Benito (NCC) San Benito (NCC)

Table 6b: Multi-Day Resting Loss Emissions (grams/hour)

Pollutant Name: Reactive Org Gases Temperature: ALL Relative Humidity: ALL

Temp degF	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
70	0.001	0.003	0.003	0.000	0.001	0.014	0.003

Title : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season : Winter
Area : San Benito (NCC)
****
*****
Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

San Benito (NCC) San Benito (NCC) San Benito (NCC)

Table 7: Estimated Travel Fractions

Pollutant Name: Temperature: ALL Relative Humidity: ALL

	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
%VMT	0.323	0.368	0.110	0.179	0.001	0.019	1.000
%TRIP	0.336	0.342	0.210	0.088	0.000	0.023	1.000
%VEH	0.364	0.377	0.121	0.062	0.000	0.076	1.000

Title : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season : Winter
Area : San Benito (NCC)
****

*****
Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

San Benito (NCC) San Benito (NCC) San Benito (NCC)

Table 8: Evaporative Running Loss Emissions (grams/minute)

Pollutant Name: Reactive Org Gases Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
1	0.008	0.219	0.216	0.016	1.090	0.004	0.111
2	0.007	0.115	0.113	0.008	0.560	0.038	0.060
3	0.007	0.082	0.082	0.006	0.386	0.057	0.044
4	0.009	0.067	0.067	0.005	0.301	0.069	0.037
5	0.010	0.058	0.059	0.004	0.251	0.078	0.034
10	0.013	0.042	0.044	0.003	0.154	0.100	0.027
15	0.014	0.039	0.040	0.003	0.128	0.114	0.026
20	0.016	0.038	0.040	0.003	0.120	0.125	0.026
25	0.017	0.039	0.041	0.003	0.120	0.134	0.027
30	0.017	0.040	0.043	0.003	0.126	0.142	0.029
35	0.018	0.042	0.044	0.003	0.132	0.149	0.030
40	0.019	0.044	0.046	0.003	0.138	0.155	0.031
45	0.019	0.045	0.047	0.003	0.144	0.162	0.032
50	0.020	0.047	0.049	0.003	0.149	0.168	0.033
55	0.020	0.048	0.050	0.003	0.154	0.173	0.034
60	0.021	0.049	0.052	0.004	0.159	0.179	0.035

Title : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season : Winter
Area : Santa Cruz (NCC)
****
*****
Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

Santa Cruz (NCC) Santa Cruz (NCC) Santa Cruz (NCC)

Table 1: Running Exhaust Emissions (grams/mile)

Pollutant Name: Reactive Org Gases Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.072	0.136	0.166	0.671	1.680	4.679	0.189

35	0.011	0.021	0.028	0.111	0.372	1.804	0.044

Pollutant Name: Carbon Monoxide Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	1.121	1.997	2.315	4.832	14.345	22.077	2.007
35	0.658	1.143	1.218	1.013	2.419	14.296	1.098

Pollutant Name: Oxides of Nitrogen Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.113	0.249	0.440	3.064	27.334	1.386	0.386
35	0.063	0.136	0.259	1.503	12.042	1.263	0.206

Pollutant Name: Carbon Dioxide Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	944.165	1187.726	1693.522	2151.627	2567.920	266.242	1148.307
35	307.198	386.914	521.235	1280.960	2099.057	139.887	392.230

Pollutant Name: Sulfur Dioxide Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.009	0.011	0.016	0.021	0.025	0.003	0.011
35	0.003	0.004	0.005	0.012	0.020	0.002	0.004

Pollutant Name: PM2.5 Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.051	0.097	0.120	0.216	0.576	0.023	0.082
35	0.008	0.016	0.020	0.075	0.140	0.011	0.015

Pollutant Name: PM2.5 - Tire Wear Temperature: 70F Relative Humidity: 0%

Speed

MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.002	0.002	0.002	0.004	0.002	0.001	0.002
35	0.002	0.002	0.002	0.004	0.002	0.001	0.002

Pollutant Name: PM2.5 - Break Wear Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.005	0.005	0.005	0.006	0.005	0.003	0.005
35	0.005	0.005	0.005	0.006	0.005	0.003	0.005

Pollutant Name: Gasoline - mi/gal Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	9.363	7.425	5.096	3.514	3.471	28.046	8.356
35	28.745	22.785	16.935	17.761	17.549	52.660	25.392

Pollutant Name: Diesel - mi/gal Temperature: 70F Relative Humidity: 0%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	29.156	29.156	19.466	5.808	3.900	0.000	9.630
35	29.156	29.156	19.466	6.439	3.900	0.000	10.046

Title : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season : Winter
Area : Santa Cruz (NCC)
****
*****
Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

Santa Cruz (NCC) Santa Cruz (NCC) Santa Cruz (NCC)

Table 2: Starting Emissions (grams/trip)

Pollutant Name: Reactive Org Gases Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.008	0.015	0.035	0.066	0.113	0.653	0.028
10	0.017	0.029	0.069	0.129	0.220	0.805	0.048
20	0.032	0.057	0.134	0.245	0.418	1.096	0.085
30	0.046	0.082	0.195	0.347	0.592	1.371	0.120
40	0.059	0.105	0.253	0.436	0.744	1.630	0.151
50	0.070	0.125	0.308	0.512	0.872	1.874	0.180
60	0.081	0.144	0.359	0.574	0.978	2.051	0.205
120	0.117	0.209	0.581	0.645	1.100	2.317	0.285
180	0.114	0.205	0.578	0.684	1.167	2.346	0.285
240	0.121	0.217	0.614	0.723	1.232	2.494	0.302
300	0.128	0.230	0.650	0.759	1.295	2.639	0.319
360	0.135	0.242	0.686	0.795	1.355	2.781	0.336
420	0.141	0.254	0.722	0.830	1.414	2.920	0.353
480	0.148	0.265	0.757	0.863	1.470	3.056	0.369
540	0.154	0.277	0.792	0.895	1.525	3.189	0.385
600	0.161	0.288	0.827	0.925	1.577	3.319	0.401
660	0.167	0.299	0.862	0.955	1.627	3.446	0.416
720	0.173	0.310	0.896	0.983	1.675	3.569	0.432

Pollutant Name: Carbon Monoxide Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.112	0.203	0.454	0.981	0.983	2.982	0.292
10	0.222	0.400	0.897	1.923	1.926	3.590	0.539
20	0.430	0.776	1.751	3.686	3.693	4.755	1.010
30	0.627	1.129	2.561	5.290	5.300	5.851	1.451
40	0.811	1.457	3.328	6.734	6.746	6.880	1.861
50	0.982	1.762	4.051	8.019	8.034	7.840	2.240
60	1.140	2.044	4.730	9.144	9.161	8.732	2.589
120	1.744	3.065	7.421	10.679	10.698	12.362	3.758
180	1.635	2.888	7.117	10.991	11.011	11.986	3.616
240	1.757	3.095	7.723	11.313	11.334	13.004	3.866
300	1.866	3.280	8.257	11.646	11.668	13.945	4.093
360	1.962	3.444	8.721	11.989	12.011	14.808	4.295
420	2.045	3.587	9.113	12.342	12.365	15.594	4.473
480	2.116	3.709	9.435	12.706	12.730	16.302	4.626
540	2.173	3.809	9.685	13.080	13.104	16.932	4.756
600	2.217	3.889	9.865	13.464	13.489	17.484	4.861
660	2.248	3.948	9.973	13.858	13.884	17.959	4.941
720	2.266	3.985	10.010	14.263	14.290	18.356	4.998

Pollutant Name: Oxides of Nitrogen Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.054	0.117	0.653	0.254	0.524	0.154	0.180
10	0.059	0.128	0.687	0.383	0.790	0.193	0.200
20	0.068	0.147	0.749	0.609	1.256	0.262	0.234
30	0.075	0.163	0.802	0.793	1.636	0.320	0.263
40	0.081	0.176	0.847	0.935	1.930	0.365	0.286

50	0.086	0.186	0.884	1.036	2.138	0.398	0.303
60	0.089	0.193	0.912	1.094	2.259	0.419	0.315
120	0.095	0.206	0.993	1.102	2.275	0.421	0.335
180	0.096	0.207	0.994	1.098	2.267	0.418	0.335
240	0.095	0.206	0.986	1.092	2.254	0.411	0.333
300	0.094	0.203	0.974	1.084	2.237	0.403	0.329
360	0.092	0.200	0.956	1.073	2.215	0.393	0.324
420	0.090	0.196	0.934	1.061	2.189	0.382	0.317
480	0.088	0.191	0.907	1.046	2.159	0.368	0.310
540	0.085	0.185	0.875	1.029	2.124	0.353	0.300
600	0.082	0.178	0.838	1.010	2.085	0.337	0.290
660	0.079	0.170	0.797	0.989	2.041	0.318	0.277
720	0.075	0.162	0.750	0.966	1.993	0.298	0.264

Pollutant Name: Carbon Dioxide Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	12.142	15.089	21.350	2.975	2.220	13.274	14.050
10	13.668	17.071	24.182	5.934	4.428	15.471	16.028
20	17.215	21.644	30.705	11.803	8.806	19.785	20.533
30	21.423	27.030	38.375	17.606	13.136	23.992	25.771
40	26.290	33.229	47.193	23.343	17.416	28.091	31.742
50	31.817	40.240	57.158	29.014	21.647	32.084	38.445
60	38.004	48.063	68.270	34.619	25.829	35.969	45.882
120	88.245	110.893	157.297	58.881	43.931	53.418	104.375
180	100.205	126.012	178.770	69.563	51.901	57.654	118.687
240	112.137	141.076	200.159	79.615	59.400	61.641	132.915
300	124.042	156.084	221.463	89.037	66.430	65.379	147.058
360	135.919	171.038	242.682	97.828	72.988	68.869	161.116
420	147.767	185.936	263.817	105.988	79.077	72.111	175.089
480	159.588	200.779	284.868	113.518	84.695	75.104	188.977
540	171.381	215.567	305.833	120.418	89.842	77.848	202.781
600	183.146	230.299	326.715	126.687	94.520	80.343	216.500
660	194.884	244.976	347.511	132.325	98.726	82.590	230.135
720	206.593	259.598	368.224	137.333	102.463	84.588	243.684

Pollutant Name: Sulfur Dioxide Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000
40	0.000	0.000	0.001	0.000	0.000	0.000	0.000
50	0.000	0.000	0.001	0.000	0.000	0.000	0.000
60	0.000	0.000	0.001	0.000	0.000	0.001	0.000
120	0.001	0.001	0.002	0.001	0.001	0.001	0.001
180	0.001	0.001	0.002	0.001	0.001	0.001	0.001
240	0.001	0.001	0.002	0.001	0.001	0.001	0.001
300	0.001	0.002	0.002	0.001	0.001	0.001	0.001
360	0.001	0.002	0.002	0.001	0.001	0.001	0.002
420	0.001	0.002	0.003	0.001	0.001	0.001	0.002
480	0.002	0.002	0.003	0.001	0.001	0.001	0.002

540	0.002	0.002	0.003	0.001	0.001	0.001	0.002
600	0.002	0.002	0.003	0.001	0.001	0.001	0.002
660	0.002	0.002	0.004	0.002	0.001	0.001	0.002
720	0.002	0.003	0.004	0.002	0.001	0.001	0.002

Pollutant Name: PM2.5 Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.000	0.001	0.001	0.000	0.000	0.005	0.001
10	0.001	0.002	0.002	0.001	0.001	0.005	0.001
20	0.002	0.004	0.003	0.001	0.001	0.004	0.003
30	0.003	0.005	0.005	0.002	0.002	0.003	0.004
40	0.004	0.007	0.007	0.003	0.002	0.003	0.005
50	0.004	0.008	0.008	0.003	0.003	0.002	0.006
60	0.005	0.010	0.009	0.003	0.003	0.002	0.007
120	0.008	0.016	0.015	0.005	0.004	0.005	0.012
180	0.009	0.018	0.017	0.005	0.005	0.007	0.013
240	0.010	0.019	0.019	0.005	0.005	0.008	0.014
300	0.011	0.021	0.020	0.005	0.005	0.010	0.015
360	0.012	0.022	0.021	0.005	0.005	0.011	0.016
420	0.012	0.023	0.022	0.005	0.005	0.012	0.017
480	0.013	0.024	0.023	0.006	0.005	0.013	0.018
540	0.013	0.024	0.024	0.006	0.005	0.014	0.018
600	0.013	0.025	0.024	0.006	0.006	0.014	0.018
660	0.013	0.025	0.024	0.006	0.006	0.015	0.019
720	0.013	0.025	0.024	0.006	0.006	0.015	0.019

Title : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season : Winter
Area : Santa Cruz (NCC)
****

Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

Santa Cruz (NCC) Santa Cruz (NCC) Santa Cruz (NCC)

Table 4: Hot Soak Emissions (grams/trip)

Pollutant Name: Reactive Org Gases Temperature: 70F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.034	0.061	0.037	0.005	0.033	0.189	0.045
10	0.062	0.114	0.068	0.009	0.061	0.353	0.082

20	0.106	0.195	0.117	0.016	0.104	0.615	0.141
30	0.137	0.251	0.151	0.021	0.133	0.811	0.183
40	0.148	0.273	0.164	0.023	0.144	0.890	0.198

Hot soak results are scaled to reflect zero emissions for trip lengths of less than 5 minutes (about 25% of in-use trips).

Title   : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season   : Winter
Area   : Santa Cruz (NCC)
****

Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

Santa Cruz (NCC)   Santa Cruz (NCC)   Santa Cruz (NCC)

Table 5a: Partial Day Diurnal Loss Emissions (grams/hour)

Pollutant Name: Reactive Org Gases   Temperature: ALL   Relative Humidity: ALL

Temp degF	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
70	0.048	0.096	0.072	0.003	0.002	0.461	0.088

Title   : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season   : Winter
Area   : Santa Cruz (NCC)
****

Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

Santa Cruz (NCC)   Santa Cruz (NCC)   Santa Cruz (NCC)

Table 5b: Multi-Day Diurnal Loss Emissions (grams/hour)

Pollutant Name: Reactive Org Gases   Temperature: ALL   Relative Humidity: ALL

Temp degF	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
70	0.004	0.008	0.005	0.000	0.000	0.044	0.007

Title   : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season   : Winter
Area   : Santa Cruz (NCC)
****

Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

Santa Cruz (NCC)   Santa Cruz (NCC)   Santa Cruz (NCC)

Table 6a: Partial Day Resting Loss Emissions (grams/hour)

Pollutant Name: Reactive Org Gases   Temperature: ALL   Relative Humidity: ALL

Temp degF	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
70	0.019	0.047	0.045	0.002	0.001	0.145	0.038

Title   : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season   : Winter
Area   : Santa Cruz (NCC)
****

Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

Santa Cruz (NCC)   Santa Cruz (NCC)   Santa Cruz (NCC)

Table 6b: Multi-Day Resting Loss Emissions (grams/hour)

Pollutant Name: Reactive Org Gases   Temperature: ALL   Relative Humidity: ALL

Temp degF	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
70	0.002	0.004	0.003	0.000	0.000	0.015	0.003

Title   : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season   : Winter
Area   : Santa Cruz (NCC)
****
*****
Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

Santa Cruz (NCC)   Santa Cruz (NCC)   Santa Cruz (NCC)

Table 7: Estimated Travel Fractions

Pollutant Name: Temperature: ALL   Relative Humidity: ALL

	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
%VMT	0.460	0.392	0.103	0.029	0.003	0.013	1.000
%TRIP	0.424	0.349	0.152	0.058	0.000	0.016	1.000
%VEH	0.451	0.380	0.092	0.026	0.001	0.051	1.000

Title   : Monterey Bay Unified APCD Subarea Winter CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/11/20 15:22:40
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season   : Winter
Area   : Santa Cruz (NCC)
****
*****
Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Winter
Emfac2007 Emission Factors: V2.3 Nov 1 2006

Santa Cruz (NCC)   Santa Cruz (NCC)   Santa Cruz (NCC)

Table 8: Evaporative Running Loss Emissions (grams/minute)

Pollutant Name: Reactive Org Gases   Temperature: 70F   Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
1	0.009	0.347	0.278	0.147	0.436	0.004	0.174
2	0.007	0.180	0.145	0.076	0.225	0.038	0.092
3	0.008	0.127	0.104	0.054	0.156	0.057	0.067
4	0.010	0.102	0.085	0.043	0.122	0.070	0.056
5	0.011	0.088	0.074	0.037	0.102	0.078	0.049
10	0.014	0.060	0.053	0.025	0.063	0.101	0.038
15	0.016	0.053	0.048	0.022	0.052	0.114	0.035
20	0.017	0.050	0.047	0.021	0.048	0.125	0.035
25	0.018	0.051	0.047	0.022	0.047	0.135	0.036
30	0.019	0.053	0.049	0.023	0.049	0.142	0.037
35	0.020	0.055	0.051	0.024	0.051	0.149	0.039
40	0.021	0.057	0.053	0.025	0.053	0.156	0.040
45	0.021	0.059	0.055	0.025	0.055	0.162	0.042
50	0.022	0.061	0.057	0.026	0.057	0.168	0.043
55	0.023	0.063	0.058	0.027	0.059	0.174	0.044
60	0.023	0.065	0.060	0.028	0.060	0.179	0.045

1 CALINE4 - (DATED CALINE4x)

3.0.0 PC (32 BIT) VERSION

Run Began on 11/20/2008 at 15:41:35

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Lake Ave and Holohan Rd
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U= 0.5 M/S Z0= 100. CM ALT= 0. (M)
BRG= WORST CASE VD= 0.0 CM/S
CLAS= 7 (G) VS= 0.0 CM/S
MIXH= 1000. M AMB= 1.7 PPM
SIGTH= 20. DEGREES TEMP= 15.0 DEGREE (C)

II. LINK VARIABLES

LINK DESCRIPTION	*	X1	Y1	X2	Y2	*	TYPE	VPH	EF (G/MI)	H (M)	W (M)
		LINK COORDINATES (M)									
1. Y SB1	*	684	1256	711	1201	*	AG	631	1.2	0.0	24.4
2. Y SB2	*	711	1201	745	1133	*	AG	613	2.4	0.0	24.4
3. Y SB3	*	745	1133	800	1025	*	AG	736	1.2	0.0	24.4
4. Y SB4	*	800	1025	858	906	*	AG	736	1.2	0.0	24.4
5. Y NB1	*	868	911	813	1024	*	AG	676	1.2	0.0	24.4
6. Y NB2	*	814	1024	761	1138	*	AG	359	2.4	0.0	24.4
7. Y NB3	*	761	1138	728	1205	*	AG	579	1.2	0.0	24.4
8. Y NB4	*	728	1205	700	1263	*	AG	579	1.2	0.0	24.4
9. Y LT1	*	720	1198	753	1134	*	AG	18	2.4	0.0	24.4
10. Y LT2	*	753	1134	802	1038	*	AG	317	2.4	0.0	24.4
11. X EB1	*	596	1103	682	1125	*	AG	803	1.2	0.0	18.3
12. X EB2	*	682	1125	750	1141	*	AG	583	2.4	0.0	18.3
13. X EB3	*	750	1141	826	1158	*	AG	601	1.2	0.0	18.3
14. X EB4	*	826	1158	923	1182	*	AG	601	1.2	0.0	18.3
15. X WB1	*	924	1170	832	1147	*	AG	327	1.2	0.0	18.3
16. X WB2	*	832	1147	757	1128	*	AG	204	2.4	0.0	18.3
17. X WB3	*	757	1128	687	1111	*	AG	521	1.2	0.0	18.3
18. X WB4	*	687	1111	599	1090	*	AG	521	1.2	0.0	18.3
19. X LT1	*	674	1115	753	1134	*	AG	220	2.4	0.0	18.3
20. X LT2	*	753	1134	841	1157	*	AG	123	2.4	0.0	18.3

III. RECEPTOR LOCATIONS

RECEPTOR	*	X	Y	Z
		COORDINATES (M)		
1. Recpt 1	*	805	1099	1.8
2. Recpt 2	*	691	1157	1.8
3. Recpt 3	*	729	1093	1.8
4. Recpt 4	*	778	1179	1.8

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	*	BRG (DEG)	*	PRED CONC (PPM)	*	1	2	3	4	5	6	7	8
						CONC/LINK (PPM)							
1. Recpt 1	*	292.	*	1.9	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2. Recpt 2	*	126.	*	1.9	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3. Recpt 3	*	6.	*	1.9	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Recpt 4	*	229.	*	1.9	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RECEPTOR	*	9	10	11	12	13	14	15	16
		CONC/LINK (PPM)							
1. Recpt 1	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2. Recpt 2	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3. Recpt 3	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Recpt 4	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RECEPTOR	*	17	18	19	20
		CONC/LINK (PPM)			
1. Recpt 1	*	0.0	0.0	0.0	0.0
2. Recpt 2	*	0.0	0.0	0.0	0.0
3. Recpt 3	*	0.0	0.0	0.0	0.0
4. Recpt 4	*	0.0	0.0	0.0	0.0

1

Run Ended on 11/20/2008 at 15:41:35

1 CALINE4 - (DATED CALINE4x)

3.0.0 PC (32 BIT) VERSION

Run Began on 11/20/2008 at 16:17:08

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Freedom and Green Valley
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U=	0.5 M/S	Z0=	100. CM	ALT=	0. (M)
BRG=	WORST CASE	VD=	0.0 CM/S		
CLAS=	7 (G)	VS=	0.0 CM/S		
MIXH=	1000. M	AMB=	1.7 PPM		
SIGTH=	20. DEGREES	TEMP=	15.0 DEGREE (C)		

II. LINK VARIABLES

LINK DESCRIPTION	LINK COORDINATES (M) X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
1. Y SB1	684	1256	711	1201	AG	1097	1.2	0.0	30.5
2. Y SB2	711	1201	745	1133	AG	928	2.4	0.0	30.5
3. Y SB3	745	1133	800	1025	AG	1325	1.2	0.0	30.5
4. Y SB4	800	1025	858	906	AG	1325	1.2	0.0	30.5
5. Y NB1	868	911	813	1024	AG	1417	1.2	0.0	30.5
6. Y NB2	814	1024	761	1138	AG	1019	2.4	0.0	30.5
7. Y NB3	761	1138	728	1205	AG	1257	1.2	0.0	30.5
8. Y NB4	728	1205	700	1263	AG	1257	1.2	0.0	30.5
9. Y LT1	720	1198	753	1134	AG	169	2.4	0.0	30.5
10. Y LT2	753	1134	802	1038	AG	398	2.4	0.0	30.5
11. X EB1	596	1103	682	1125	AG	1331	1.2	0.0	29.0
12. X EB2	682	1125	750	1141	AG	1093	2.4	0.0	29.0
13. X EB3	750	1141	826	1158	AG	1262	1.2	0.0	29.0
14. X EB4	826	1158	923	1182	AG	1262	1.2	0.0	29.0
15. X WB1	924	1170	832	1147	AG	981	1.2	0.0	29.0
16. X WB2	832	1147	757	1128	AG	584	2.4	0.0	29.0
17. X WB3	757	1128	687	1111	AG	982	1.2	0.0	29.0
18. X WB4	687	1111	599	1090	AG	982	1.2	0.0	29.0
19. X LT1	674	1115	753	1134	AG	238	2.4	0.0	29.0
20. X LT2	753	1134	841	1157	AG	397	2.4	0.0	29.0

III. RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. Recpt 1	805	1099	1.8
2. Recpt 2	691	1157	1.8
3. Recpt 3	729	1093	1.8
4. Recpt 4	778	1179	1.8

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) 1	2	3	4	5	6	7	8
1. Recpt 1	301.	2.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
2. Recpt 2	118.	2.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
3. Recpt 3	51.	2.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
4. Recpt 4	179.	2.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0

RECEPTOR	CONC/LINK (PPM) 9	10	11	12	13	14	15	16
1. Recpt 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2. Recpt 2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
3. Recpt 3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Recpt 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RECEPTOR	CONC/LINK (PPM) 17	18	19	20
1. Recpt 1	0.0	0.0	0.0	0.0
2. Recpt 2	0.0	0.0	0.0	0.0
3. Recpt 3	0.0	0.0	0.0	0.0
4. Recpt 4	0.0	0.0	0.0	0.0

1

Run Ended on 11/20/2008 at 16:17:08

1 CALINE4 - (DATED CALINE4x)

3.0.0 PC (32 BIT) VERSION

Run Began on 11/20/2008 at 16:08:47

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Green Valley and Holohan Rd
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U= 0.5 M/S	Z0= 100. CM	ALT= 0. (M)
BRG= WORST CASE	VD= 0.0 CM/S	
CLAS= 7 (G)	VS= 0.0 CM/S	
MIXH= 1000. M	AMB= 1.7 PPM	
SIGTH= 20. DEGREES	TEMP= 15.0 DEGREE (C)	

II. LINK VARIABLES

LINK DESCRIPTION	LINK COORDINATES (M) X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
1. Y SB1	684	1256	711	1201	AG	874	1.2	0.0	24.4
2. Y SB2	711	1201	745	1133	AG	701	2.4	0.0	24.4
3. Y SB3	745	1133	800	1025	AG	894	1.2	0.0	24.4
4. Y SB4	800	1025	858	906	AG	894	1.2	0.0	24.4
5. Y NB1	868	911	813	1024	AG	940	1.2	0.0	24.4
6. Y NB2	814	1024	761	1138	AG	831	2.4	0.0	24.4
7. Y NB3	761	1138	728	1205	AG	1150	1.2	0.0	24.4
8. Y NB4	728	1205	700	1263	AG	1150	1.2	0.0	24.4
9. Y LT1	720	1198	753	1134	AG	173	2.4	0.0	24.4
10. Y LT2	753	1134	802	1038	AG	109	2.4	0.0	24.4
11. X EB1	596	1103	682	1125	AG	715	1.2	0.0	21.3
12. X EB2	682	1125	750	1141	AG	396	2.4	0.0	21.3
13. X EB3	750	1141	826	1158	AG	569	1.2	0.0	21.3
14. X EB4	826	1158	923	1182	AG	569	1.2	0.0	21.3
15. X WB1	924	1170	832	1147	AG	2421	1.2	0.0	21.3
16. X WB2	832	1147	757	1128	AG	2228	2.4	0.0	21.3
17. X WB3	757	1128	687	1111	AG	2337	1.2	0.0	21.3
18. X WB4	687	1111	599	1090	AG	2337	1.2	0.0	21.3
19. X LT1	674	1115	753	1134	AG	319	2.4	0.0	21.3
20. X LT2	753	1134	841	1157	AG	193	2.4	0.0	21.3

III. RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. Recpt 1	805	1099	1.8
2. Recpt 2	691	1157	1.8
3. Recpt 3	729	1093	1.8
4. Recpt 4	778	1179	1.8

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) 1	2	3	4	5	6	7	8
1. Recpt 1	307.	2.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
2. Recpt 2	106.	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3. Recpt 3	52.	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Recpt 4	178.	2.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0

RECEPTOR	CONC/LINK (PPM) 9	10	11	12	13	14	15	16
1. Recpt 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
2. Recpt 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
3. Recpt 3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
4. Recpt 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1

RECEPTOR	CONC/LINK (PPM) 17	18	19	20
1. Recpt 1	0.0	0.0	0.0	0.0
2. Recpt 2	0.0	0.0	0.0	0.0
3. Recpt 3	0.0	0.0	0.0	0.0
4. Recpt 4	0.0	0.0	0.0	0.0

1

Run Ended on 11/20/2008 at 16:08:47

1 CALINE4 - (DATED CALINE4x)

3.0.0 PC (32 BIT) VERSION

Run Began on 11/20/2008 at 16:14:19

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Green Valley and Main
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U= 0.5 M/S Z0= 100. CM ALT= 0. (M)
BRG= WORST CASE VD= 0.0 CM/S
CLAS= 7 (G) VS= 0.0 CM/S
MIXH= 1000. M AMB= 1.7 PPM
SIGTH= 20. DEGREES TEMP= 15.0 DEGREE (C)

II. LINK VARIABLES

LINK DESCRIPTION	*	LINK COORDINATES (M) X1	Y1	X2	Y2	*	TYPE	VPH	EF (G/MI)	H (M)	W (M)
1. Y SB1	*	684	1256	711	1201	*	AG	899	1.2	0.0	35.0
2. Y SB2	*	711	1201	745	1133	*	AG	615	2.4	0.0	35.0
3. Y SB3	*	745	1133	800	1025	*	AG	1016	1.2	0.0	35.0
4. Y SB4	*	800	1025	858	906	*	AG	1016	1.2	0.0	35.0
5. Y NB1	*	868	911	813	1024	*	AG	1700	1.2	0.0	35.0
6. Y NB2	*	814	1024	761	1138	*	AG	912	2.4	0.0	35.0
7. Y NB3	*	761	1138	728	1205	*	AG	1444	1.2	0.0	35.0
8. Y NB4	*	728	1205	700	1263	*	AG	1444	1.2	0.0	35.0
9. Y LT1	*	720	1198	753	1134	*	AG	248	2.4	0.0	35.0
10. Y LT2	*	753	1134	802	1038	*	AG	788	2.4	0.0	35.0
11. X EB1	*	596	1103	682	1125	*	AG	2279	1.2	0.0	24.4
12. X EB2	*	682	1125	750	1141	*	AG	1747	2.4	0.0	24.4
13. X EB3	*	750	1141	826	1158	*	AG	2031	1.2	0.0	24.4
14. X EB4	*	826	1158	923	1182	*	AG	2031	1.2	0.0	24.4
15. X WB1	*	924	1170	832	1147	*	AG	2063	1.2	0.0	24.4
16. X WB2	*	832	1147	757	1128	*	AG	1662	2.4	0.0	24.4
17. X WB3	*	757	1128	687	1111	*	AG	2450	1.2	0.0	24.4
18. X WB4	*	687	1111	599	1090	*	AG	2450	1.2	0.0	24.4
19. X LT1	*	674	1115	753	1134	*	AG	532	2.4	0.0	24.4
20. X LT2	*	753	1134	841	1157	*	AG	401	2.4	0.0	24.4

III. RECEPTOR LOCATIONS

RECEPTOR	*	COORDINATES (M) X	Y	Z
1. Recpt 1	*	805	1099	1.8
2. Recpt 2	*	691	1157	1.8
3. Recpt 3	*	729	1093	1.8
4. Recpt 4	*	778	1179	1.8

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	* BRG (DEG)	* PRED CONC (PPM)	*	CONC/LINK (PPM) 1	2	3	4	5	6	7	8
1. Recpt 1	297.	2.1	*	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
2. Recpt 2	120.	2.1	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3. Recpt 3	49.	2.1	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Recpt 4	179.	2.1	*	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0

RECEPTOR	*	CONC/LINK (PPM) 9	10	11	12	13	14	15	16
1. Recpt 1	*	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
2. Recpt 2	*	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
3. Recpt 3	*	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
4. Recpt 4	*	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1

RECEPTOR	*	CONC/LINK (PPM) 17	18	19	20
1. Recpt 1	*	0.0	0.0	0.0	0.0
2. Recpt 2	*	0.1	0.0	0.0	0.0
3. Recpt 3	*	0.0	0.0	0.0	0.0
4. Recpt 4	*	0.0	0.0	0.0	0.0

1

Run Ended on 11/20/2008 at 16:14:20

APPENDIX C
CULTURAL RESOURCES

Archeological Resource Management. Cultural Resources Evaluation of Six Areas Proposed for Annexation to the City of Watsonville. February 2005.

CULTURAL RESOURCE EVALUATION OF SIX AREAS PROPOSED FOR ANNEXATION TO THE CITY OF WATSONVILLE

FOR

RBF CONSULTING
ATTN: MR. BILL WISEMAN
3180 IMJIN ROAD SUITE 104
MARINA, CA 93933
RY048/1328-04-155

Archeological Resource Management
Dr. Robert Cartier, Principal Investigator
496 North Fifth Street
San Jose, CA 95112
Phone: (408) 295-1373
FAX: (408) 286-2040
Email: armcartier@netscape.net

FEBRUARY 16, 2005

ABSTRACT

This cultural resource evaluation was carried out for six areas of land bordering the current city limits of Watsonville which are proposed for annexation by the city. The research included an archival search in the state records and a surface survey of each area. Two recorded historical resources are located within Area C: West of East Lake. These are P-44-400, a small motel or apartment building constructed circa the 1920's, and CA-SCR-335H, a portion of the historic Highway 152. One recorded archaeological site is located within Area D: East of East Lake; CA-SCR-121. This prehistoric site is described as a large shell midden and probable habitation site. A reported, but not formally recorded site is located in Area F: the Manabe/Burgstrom Area. This is the reported excavation of an unknown number of Native American burials during the construction of the Struve Slough in the northeast section of this area. Additional archival results for each area of the project are described in detail in the Archival Background section of this report. No traces of prehistoric cultural materials were noted during surface reconnaissance in any of the six areas. However, soils throughout each of these areas have been previously disturbed by agricultural and construction activities. In addition, surface soils were obscured in many areas. Minor traces of historic material, consisting of a sparse historic debris scatter, were noted in one area, the southwest portion of Buena Vista I. Recommendations for each area are made individually in the conclusion section of this report.

REQUEST FOR ARCHAEOLOGICAL EVALUATION

The cultural resource evaluation was carried out to determine the presence or absence of any significant cultural resources within the proposed annexation areas. Archaeological services were requested in July of 2004 in order to provide an evaluation that would investigate the possible presence of cultural resources. This study meets the requirements of CEQA (California Environmental Quality Act).

QUALIFICATIONS OF ARCHAEOLOGICAL RESOURCE MANAGEMENT

Archaeological Resource Management has been specifically engaged in cultural resource management projects in central California since 1977. The firm is owned and supervised by Dr. Robert Cartier, the Principal Investigator. Dr. Cartier has a Ph.D. in anthropology, and is certified by the Register of Professional Archaeologists (ROPA) for conducting cultural resource investigations as well as other specialized work in archaeology and history. He also fulfills the standards set forth by the Secretary of the Interior for inclusion as a historian and architectural historian and is certified as such on the State of California referral lists.

LOCATION AND DESCRIPTION OF THE SUBJECT AREAS

The six subject areas currently being considered for annexation into the City of Watsonville consist of: A: the Buena Vista Area, B: the Atkinson Lane Area, C: West of East Lake, D: East of East Lake, E: The Villages, and F: the Manabe-Burgstrom Area. Each of these areas is briefly described below.

Area A: Buena Vista I, II, and III

This area is subdivided into three sections, designated as I, II, and III. On the USGS 7.5 minute quadrangle of Watsonville West, the Universal Transverse Mercator Grid (UTMG) approximate coordinates for the Buena Vista Area as a whole are 6 06

645mE/40 90 175mN for the northernmost point, 6 08 470mE/40 89 020mN for the easternmost point, 6 06 855mE/40 87 465mN for the southernmost point, and 6 05 950mE/40 89 400mN for the westernmost point. Elevation within this area varies from 138 to 226 feet MSL. The nearest source of fresh water is the Hopkins Slough, which runs along the southern portion of the western boundary of the Buena Vista Area.

Area B: Atkinson Lane

On the USGS 7.5 minute quadrangle of Watsonville West, the Universal Transverse Mercator Grid (UTMG) approximate coordinates for the Atkinson Lane Area are 6 10 515mE/40 88 260mN for the northernmost point, 6 10 715mE/40 87 755mN for the easternmost point, 6 10 460mE/40 87 655mN for the southernmost point, and 6 09 995mE/40 87 930mN for the westernmost point. Elevation within this area varies from 80 to 120 feet MSL. The nearest source of fresh water is Corralitos Creek, which runs along a portion of the northern boundary of the Atkinson Lane Area.

Area C: West of East Lake

On the USGS 7.5 minute quadrangles of Watsonville West and Watsonville East, the Universal Transverse Mercator Grid (UTMG) approximate coordinates for the West of East Lake Area are 6 11 225mE/40 88 540mN for the northernmost point, 6 11 915mE/40 88 390mN for the easternmost point, 6 11 720mE/40 87 500mN for the southernmost point, and 6 10 550mE/40 88 270mN for the westernmost point. Elevation within this area varies from 63 to 92 feet MSL. The nearest source of fresh water is Corralitos Creek, which runs along the northern boundary of the West of East Lake Area.

Area D: East of East Lake

On the USGS 7.5 minute quadrangle of Watsonville East, the Universal Transverse Mercator Grid (UTMG) approximate coordinates for the East of East Lake Area are 6 11 940mE/40 88 380mN for the northernmost point, 6 12 945mE/40 86 860mN for the easternmost point, 6 12 890mE/40 86 790mN for the southernmost point, and 6 11 820mE/40 87 895mN for the westernmost point. Elevation within this area varies from 44 to 69 feet MSL. The nearest source of fresh water is Corralitos Creek, which runs along the northern and eastern boundaries of the East of East Lake Area.

Area E: The Villages

On the USGS 7.5 minute quadrangle of Watsonville East, the Universal Transverse Mercator Grid (UTMG) approximate coordinates for the Villages Area are 6 12 940mE/40 87 055mN for the northernmost point, 6 12 720mE/40 86 845mN for the easternmost and southernmost point, and 6 12 460mE/40 86 925mN for the westernmost point. Elevation within this area varies from 43 to 44 feet MSL. The nearest source of fresh water is Corralitos Creek, which runs approximately 800 feet east of the Villages Area.

Area F: Manabe-Burgstrom

On the USGS 7.5 minute quadrangle of Watsonville West, the Universal Transverse Mercator Grid (UTMG) approximate coordinates for the Manabe-Burgstrom Area are 6 08 670mE/40 85 530mN for the northernmost point, 6 09 700mE/40 85 165mN for the easternmost point, 6 08 915mE/40 84 495mN for the southernmost point, and 6 08 530mE/40 85 200mN for the westernmost point. Elevation within this area varies from

13 to 55 feet MSL. The nearest source of fresh water is the Watsonville Slough, which runs through the southern portion of the Manabe-Burgstrom Area.

The proposed project consists of the annexation of these areas into the City of Watsonville.

METHODOLOGY

This investigation consisted of an archival search, a surface reconnaissance, and a written report of the findings with appropriate recommendations. The archival research is conducted by transferring the study location to a state archaeological office which maintains all records of archaeological investigations. This is done in order to learn if any archaeological sites or surveys have been recorded within a half mile of the subject area. Each archival search with the state is given a file number for verification. The purpose of the surface reconnaissance is to determine whether there are traces of prehistoric or historic materials within the study area. The survey is conducted by an archaeologist, who examines exposed soils for early ceramics, Native American cooking debris, and artifacts made of stone, bone, and shell. Older structures, distinctive architecture, and subsurface historic trash deposits of potentially significant antiquity are also taken into consideration. A report is written containing the archival information, record search number, survey findings, and appropriate recommendations. A copy of this evaluation is sent to the state archaeological office in compliance with state procedure.

A cultural resource is considered "significant" if it qualifies as eligible for listing in the California Register of Historic Resources (CRHR). Properties that are eligible for listing in the CRHR must meet one or more of the following criteria:

1. Association with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States;
2. Association with the lives of persons important to local, California, or national history;
3. Embodying the distinctive characteristics of a type, period, region, or method of construction, or representing the work of a master, or possessing high artistic values; or
4. Has yielded, or has the potential to yield, information important to the prehistory or history of the local area, California, or the nation.

Most Native American prehistoric sites are eligible due to their age, scientific potential, and/or burial remains.

The CRHR interprets the integrity of a cultural resource as its physical authenticity. An historic cultural resource must retain its historic character or appearance and thus be recognizable as an historic resource. Integrity is evaluated by examining the subject's location, design, setting, materials, workmanship, feeling, and association. If the subject has retained these qualities, it may be said to have integrity. It is possible that a cultural resource may not retain sufficient integrity to be listed in the National Register of Historic Places yet still be eligible for listing in the CRHR. If a cultural resource retains the potential to convey significant historical/scientific data, it may be said to retain sufficient integrity for potential listing in the CRHR.

ETHNOGRAPHIC BACKGROUND

Early ethnographic accounts of local Native American cultures provide a cultural context for archaeological studies. The Ohlone, or Costanoan, Indians inhabited the San Francisco Bay regions from the Golden Gate south to Monterey. Derived from a Spanish word, Costanoan means "people of the coast," and is an older term. Descendants of these people prefer to refer to themselves as "Ohlone," and it is now the generally accepted form. The research area is located in the Calendaruc linguistic area, which shared many cultural traits with other linguistic groups in the Ohlone region. It is believed that the Ohlone Indians inhabited the area since A.D. 500, and that speakers of the Hokan language previously inhabited at least part of the region (Levy 1978). However, it is unclear when the Hokan or even earlier Paleo-Indians first came to the area. The earliest radiocarbon dates that are available for the area to which the Ohlone came to live are at SCR-177 (Cartier 1993).

The Ohlone were gatherers and hunters who utilized only the native flora and fauna with the exception of one domesticate, the dog. Yet, the abundance and high quality of natural resources allowed them to settle in semi-sedentary villages. The Ohlone were typically organized in basic political units called "tribelets" that consisted of 100 to 250 members (Kroeber 1954). The "tribelet" was an autonomous social unit consisting of one or more permanent villages with smaller villages in a relatively close proximity (Kroeber 1962). Parties went out from the major villages to locations within the tribal territory to obtain various resources.

The proximity of both mountainous and coastal regions in the Monterey Bay area made a diversity of resources available during different seasons to the native inhabitants. During the winter months, the low-lying flats near the Monterey Bay have abundant marine and waterfowl resources, while the nearby mountainous areas are best in the summer months for their nut, seed, and mammalian resources (King and Hickman 1973). A primary food source was acorns, abundant in autumn and easily stored for the remainder of the year. According to Gifford, the acorn industry of California was probably the most characteristic feature of its domestic economy (Gifford 1951). An elaborate process of grinding and leaching acorns is necessary to render them palatable. The acorn industry first became a major source of food in the Middle Period as is indicated by the appearance of mortars and pestles in the archaeological record (King and Hickman 1973). Other important resources include various plant foods, land animals, and the marine resources of the Monterey Bay. Fishing for salmon and steelhead in the creeks that emptied into Monterey Bay provided a seasonal resource. Shellfish processing sites were established above the rocky shores where abalone, mussels, clams, and various tide pool resources were gathered (City of Santa Cruz 1981). Both large and small land mammals were typically hunted, trapped or poisoned. Many items, including shell beads and ornaments, were extensively traded with other groups as far away as the Great Basin of Nevada (Davis 1974).

It is argued that contrary to usual conceptions of hunters and gatherers, native Californian groups, including the Ohlone, practiced a form of resource management that was close to agriculture. Bean and Lawton (1976) consider this pattern a "semi-agricultural" stage which included quasi-agricultural harvesting activity and proto-agricultural techniques. Some plants were pruned and reseeded seasonally for optimal production. Foods such as acorns were stored for many months at a time. Ethnographic accounts also report the repeated burning of woodlands grassbelt to increase animal and plant resources. It is likely to have made hunting conditions better by reducing scrubby growth and encouraging the growth of grasses and other plants that are appealing to grazers such as deer and elk. The plant growth succession after a burning is also rich in grains and legumes that were major food sources for Native Californians.

Bean and Lawton also claim that the abundance of plant and animal resources in California and the development of ingenious technological processes allowed Native Californians to develop social structures beyond the normal parameters of hunting and gathering. These include extensive political systems, controlled production and redistribution of goods, and alliances and trade with other groups.

Historical information on the six proposed annexation areas is contained in a separate report.

ARCHIVAL BACKGROUND

As part of the investigation, a study of the maps and records at the Northwest Information Center of the California Archaeological Site Inventory was conducted and given the file number of RY048/1328-04-155. This research into the records at the Information Center was done to determine if any known archaeological resources were reported in or around the subject areas. The findings for each area are described individually below:

Area A: Buena Vista Areas I, II, and III

The archival records reveal that there are no recorded sites within the boundaries of this area. Two previously recorded sites are located within one half mile of the Buena Vista area: CA-SCR-334H, and CA-SCR-209H. These sites are described below:

<u>CA-SCR-334H</u>
This site was recorded by L. Leach-Palm, J. Berg and S. Mikesell of Far Western in 1999. It is described as both the original and modern alignments of Highway 1 in Santa Cruz County. This site runs adjacent to the western boundary of the Manabe-Burgstrom area.

<u>CA-SCR-209H</u>
This site was originally recorded in 1979, then re-recorded in 1984 by Basin Research. It is described as the historic Jose Joaquin Adobe, a two story Mexican Rancho adobe built after 1830. This structure is located approximately 800 feet west of the Buena Vista area.

Three previous studies have been carried out which include portions of the Buena Vista project area within their scope. Two of these were carried out by the Santa Cruz Archaeological Society and plotted on base maps now kept at the Northwest Information Center, and are not described in detail. The third, S-9657, was recorded by A. Running and G. Breschini in 1988 and entitled "Preliminary Cultural Resources Overview of Two Proposed Power Line Routes, Watsonville, Santa Cruz County, California." This linear study was carried out within the central portion of Buena Vista Section I.

An additional six studies have been carried out within one half mile of the Buena Vista area: S-3779, S-10546, S-12569, S-12570, S-20575, and S-24518.

Area B: Atkinson Lane Area

The archival records reveal that there are no recorded sites within the boundaries of this area. In addition no previously recorded sites are located within one half mile of this area, and no previous studies have been recorded within it.

Area C: West of East Lake

The archival records reveal that two previously recorded sites are located within this area: P-44-400, and CA-SCR-335H. These sites are described below.

P-44-400

This site was recorded by L. Leach-Palm and S. Mikesell of Far Western in 1999. It is described as an historic Motel or apartment building, constructed circa the 1920's or 1930's. This site is located near the northeastern corner of Area C.

CA-SCR-335H

Recorded by L. Leach-Palm and S. Mikesell of Far Western in 1999, this site is described as the route of historic Highway 152. It is located along the eastern boundary of Area C.

Three additional prehistoric and historic sites have been previously recorded within one half mile of this area: CA-SCR-44H, P-44-395, and CA-SCR-104, described below:

CA-SCR-44H

This site was recorded by L. Leach Palm of Far Western in 1999. It is described as a large prehistoric habitation site. The main portion of this site is located approximately 1000 feet north of Area C, with a small outlying area located approximately 500 northeast of the project area.

P-44-395

This site, recorded in 1999 by L. Leach Palm and S. Mikesell of Far Western, consists of the historic town of Watsonville, and its boundaries were defined as the town of Watsonville boundaries as delineated on the USGS Watsonville East and West 7.5 Minute Quadrangle Maps.

CA-SCR-104

This site was recorded by M. Farley and R. Edwards in 1974. It is described as a habitation site containing dietary shell, faunal bone, fire cracked rock, chipped lithics, and possible human bone. This site is located approximately 1500 north of Area C.

One previous study has been carried out within Area C; S-4016 "An Assessment of the Cultural Resources of the Lower Pajaro River Basin, California, with Selected Preliminary Field Study". This study was carried out by R. Edwards and M. Farley in 1974. It is located in the northern central portion of Area C.

Area D: East of East Lake

Archival research has revealed that one previously recorded site is located within Area D: CA-SCR-121. This site is described below.

CA-SCR-121

This site was recorded in 1975 by J. Morris. It is described as an extensive midden deposit representing a probable habitation site, and included worked bone, lithic flakes, groundstone, and dietary shell. This site is located entirely within the southern portion of Area D.

One additional site, CA-SCR-44H is located within one half Mile of Area D. This site is described above under area C. Five previous studies have been carried out which include portions of Area D within their scope: S-3772, S-3838, S-3975, S-4025, and S-4102.

S-3772 was recorded by J Morris in 1976 and entitled "Preliminary Archaeological Reconnaissance of Pajaro Village Subdivision No. 2 and Additional Lands to be Annexed by the City of Watsonville." This study was carried out in the southern portion of Area D.

S-3838 was recorded by J. Morris in 1975 and entitled "Preliminary Archaeological Reconnaissance of Village Estates Subdivision No. 3 and Bay Villages Subdivision No. 5". This study was carried out within the southern portion of Area D.

S-3975 was recorded by J. Bard and C. Busby in 1979 and entitled "An Archaeological Assessment of CA-SCR-121, Santa Cruz County, California." This study covers the area of CA-SCR-121 as previously described above.

S-4025 was recorded by R. Cartier of ARM in 1978 and entitled "Archaeological Evaluation of the Pajaro Village Minor Land Division." This study is located within the southern portion of Area D.

S-4102 was recorded by T. Haversat and G. Breschini in 1980 and entitled "Preliminary Agreement on CA-SCR-121, a Prehistoric Indian Burial Site Owned by C & V Farms, Watsonville, Santa Cruz County, California." It is located within the southern portion of Area D.

Area E: Villages

Archival research reveals that no previously recorded sites are located within Area E. Two sites, CA-SCR-121, and CA-SCR-335H are located within one half mile of this area, however both these sites are described above. One previous study is located within this area: S-3772. This study is also described above.

Area F: Manabe-Burgstrom Area

The archival records reveal that one possible site has been recorded within the boundaries of this area. This is an area noted in the site record of CA-SCR-148, however it has not been formally recorded as a site. Located at the eastern end of the project area, it was noted to be the reported location of an undetermined number of Native burials which had been encountered during the construction of the south end of the Struve Slough. In addition, two previously recorded archaeological sites are located adjacent to this area: CA-SCR-107, and CA-SCR-334H. CA-SCR-107 is described below, CA-SCR-334H is described above under Area A.

<u>CA-SCR-107</u>
This site was recorded by Smith, Lonnberg, Farley, and Townsend in 1974. It is described as a large shell midden, including chipped lithics and faunal bone. This site is located adjacent to the western boundary of the Manabe-Burgstrom area.

Four additional prehistoric and historic sites have been previously recorded within one half mile of this area: CA-SCR-286, CA-SCR-332H, , CA-SCR-148, and CA-SCR-156.

<u>CA-SCR-286</u>
This site was recorded in 1999 by L. Leach-Palm of Far Western. It is described as a lithic and shell scatter. This site is located approximately 2000 feet south of the southernmost point of the Manabe-Burgstrom area.

CA-SCR-332H
Originally recorded by L. Leach-Palm and S. Mikesell of Far Western in 1999, this site is described as the historic route of Highway 129. It is located approximately 1800 feet south of the Manabe-Burgstorm area.

CA-SCR-148
This site was recorded by Archaeological Consulting and Research Services in 1976. This is an ethnobotanical site, and consists of the reported location of a "camp were plants were gathered for medicinal purposes by Native Californians." It is located approximately 800 feet north of the Manabe-Burgstrom area.

CA-SCR-156
Recorded by D. Chavez in 1977, this site is described as the reported location of the removal of Native American burials in the 1920's. Observation at the time of survey indicated the presence of possible midden soil with traces of shell constituents. This site is located approximately 1800 feet west of the Manabe-Burgstrom area

Two previous studies have been carried out which include portions of the project area within their scope. The first of these, S-3779 is a linear study which cuts through the central portion of the project area. It was recorded by W. Roop and K. Flynn in 1975 and entitled "Archaeological Impact Evaluation, Aptos County Sanitation District, Proposed Pipeline Evaluation, a Phase One Proposal for Right-of-way Routing Based on a Theoretical Model for Predicting the Archaeological Sensitivity within the Project Area." The second study, S-4036, encompasses the entire Manabe-Burgstrom area. It was recorded in 1976 by ACRS and entitled "Report of and Archaeological Reconnaissance of the Westside Annexation Properties."

An additional twenty-four studies have been carried out within one half mile of the Manabe-Burgstrom area: S-3768, S-3780, S-3846, S-3852, S-3899, S-4008, S-4037, S-4038, S-4053, S-6722, S-6808, S-8323, S-8674, S-8678, S-10227, S-10527, S-11019, S-11954, S-21986, S-22343, S-23086, S-23324, S-25267, and S-26671.

SURFACE RECONNAISSANCE

A "general surface reconnaissance" was conducted by a field archaeologist on all open land surfaces in the subject areas. A "controlled intuitive reconnaissance" was performed in places where burrowing animals, exposed banks and inclines, and other activities revealed subsurface stratigraphy and soil contents. The project area was divided into six broad "Areas", labeled A through F based upon boundaries defined in project maps. Area A was further divided into subsections I, II, and III. Each of these areas is evaluated separately below, and is shown in the attached project area map (Appendix B).

Area A: Buena Vista I

The boundaries of this area were established in the field by fence lines and paved streets. The northeast boundary is demarcated by fence lines along Briarwood Drive. The northwest boundary is also demarcated by fence lines. The east boundary is demarcated by residential fence lines that run along Manfre and Bradford Roads. The south boundary is demarcated by a property fence that runs from Zurich Avenue to Larkin Valley Road. Finally, the west boundary is demarcated by fence lines along Larkin Valley Road, Buena Vista Drive, and a residential area (N of Buena Vista Dr). Accessibility to the project area was fair; most areas were available for a walking survey. Soil visibility was poor; the majority of the surface area was obscured by existing structures and dense vegetation.

Vegetation consisted of tall grasses, shrubs, and trees, including large eucalyptus trees as well as apple orchards (north of Buena Vista Dr). Where native soils were exposed, a light brown loam was observed. Rock types noted included gravel and cobbles of chert and native sandstone. Historic cultural resources noted include a complete Murine bottle, as well as other glass and ceramic artifacts of historic age. This material was noted along the embankment of a dry creek on the southwest portion of the area. No traces of prehistoric cultural resources were noted during the surface reconnaissance. A barn which appears to date circa 1920's is present in the southern portion of this area. The structure is unused, and in poor condition.

Area A: Buena Vista II

The boundaries of this area were established in the field by property fence lines and paved streets. The north boundary is demarcated by Calabasas Road. The south boundary is demarcated by Buena Vista Drive. The southern half of the west boundary is demarcated by Old Adobe Road, and the northern half is demarcated by property fence lines. Finally, the east boundary is demarcated by residential fence lines. Accessibility to the project area was poor; much of the area was fenced off and unaccessible for a walking survey. Soil visibility was poor; the majority of the surface area was obscured by the existing structures and medium to dense vegetation. Vegetation consisted of native grasses, bushes, and trees, including domestic apple trees. Where native soils were exposed, a light brown loam was observed. Rock types noted include native sandstone and small granite cobbles. No traces of cultural resources, prehistoric or historic, were noted during the surface reconnaissance.

Area A: Buena Vista III

The boundaries of this area were established in the field by property fence lines and paved streets. The south boundary is demarcated by Calabasas Road. The east boundary is demarcated by residential fence lines that run down Barbara Way and extend to the north boundary at Freedom Boulevard. The west boundary is not clearly demarcated by fence lines, however boundaries were determined using project maps. Accessibility to the project area was fair; much of the area was available for a walking survey. Soil visibility was fair; the majority of the surface area was obscured by the existing structures, landscaping and agricultural areas. Vegetation throughout the area consisted mostly of apple trees, however native grasses in non-agricultural areas were also identified. Where native soils were exposed, a dark brown silty loam was observed. Rock types noted included Monterey-banded chert and native sandstone. No traces of cultural resources, prehistoric or historic, were noted during the surface reconnaissance.

Area B: Atkinson Lane

The boundaries of this area were established in the field by fence lines, paved streets, and dirt roads. The south boundary is demarcated by residential fence lines along Brookhaven Lane. The west boundary is demarcated by a wall along Brewington Avenue and residential fence lines along Paloma Way. The north boundary is demarcated by residential and other property fence lines that extend to the Corralitos Creek, which also comprises a portion of the boundary. The east boundary is demarcated by clear dirt roads separating adjacent agricultural areas. Accessibility to the project area was fair; the majority of the area was accessible for a walking survey. Soil visibility was fair; approximately fifty percent of the surface area was obscured by vegetation. Vegetation consisted of native marshland vegetation, including tall reeds and grasses, briar patches, and trees, as well as agricultural produce including apple trees and strawberry plants. A few cacti species were also identified in the area. Where native soils were exposed, a light brown loam was observed. Rock types noted included gravel of Monterey-banded chert, native sandstone, and some granite cobbles. No traces of cultural resources, prehistoric or historic, were noted during the surface reconnaissance.

Area C: West of East Lake

The boundaries of this area were established in the field by fence lines, paved streets and natural features. The north boundary is demarcated by the Corralitos Creek. The south boundary is demarcated by a fence line along Wagner Avenue. The east boundary is demarcated by a fence line along East Lake Avenue. The west boundary is demarcated by a dirt road separating adjacent agricultural areas. Accessibility to the project area was poor; much of the area was inaccessible due to fences. Soil visibility was fair; the majority of the surface area was obscured by agricultural vegetation. Vegetation throughout the area consisted primarily of agricultural plants, including apple trees and strawberry plants. Vegetation along the creek consisted mostly of large trees, grasses, and other native plants. Where native soils were exposed, a light brown silty loam was observed. Rock types noted include gravel and cobbles of granite and some native sandstone. No traces of prehistoric cultural resources were noted during the surface reconnaissance. One structure of historic age is present on the property. This building is a small motel or apartment building, built circa the 1920's. It was recorded on Department of Parks and Recreation 523 forms by L. Leach-Palm and S. Mikesell in 1999. The structure is located the far northeast corner of the area.

Area D: East of East Lake

The boundaries of this area were established in the field by fence lines, paved streets, and natural features. The north and east boundaries are demarcated by the Salsipuedes Creek. The south boundary is demarcated by a residential area that extends from Bronte Avenue to Almond Drive. The west boundary is demarcated by a series of property walls and East Lake Avenue. Accessibility to the project area was good; the majority of the area was available for a walking survey. Soil visibility was fair; approximately fifty percent of the surface area was obscured by existing structures (residences and greenhouses), agricultural vegetation, and vegetation along the creek. Vegetation consisted mostly of apple trees, but also includes other trees along the creek bed, tall grasses, reeds, and other marsh plants. Where native soils were exposed, a light brown silty loam was observed throughout most of the area, as well as hard, dark brown clay and yellow loamy clay in two areas where trenches were being excavated for a pipeline. Silty brown sand was also present in this disturbed area. Rock types noted included Monterey-banded chert, some native sandstone and several large granite stones placed along the levee running parallel to the creek. One previously recorded archaeological site is located within this area; CA-SCR-121. When originally recorded in 1975 the resource was described as a large shell midden and habitation site. This site is located on a small knoll in the southern portion of this area. No trace of this site was noted during the current survey. However, agricultural activities in this area may have significantly disturbed or obscured the upper layers of this site. Subsurface prehistoric cultural resources may still be present in this location.

Area E: Villages

The boundaries of this area were established in the field by paved streets and fences, on the west and south ends. The north and east boundaries are not clearly demarcated in the field, but boundaries were determined through use of project maps. Accessibility to the project area was good; the entire area was available for a walking survey. Soil visibility was good; the majority of the surface area was exposed. The vegetation present consisted of dry grass and agricultural lettuce. Where native soils were exposed, a light brown loam was observed. Rock types noted include gravel of Monterey-banded chert, some sandstone, and granite cobbles. No traces of cultural resources, prehistoric or historic, were noted during the surface reconnaissance.

Area F: Manabe/Burgstrom

The boundaries of this area were established in the field by existing roads, railroads, fence lines and constructed waterways. The south boundary is demarcated by railroad tracks. The west boundary is demarcated by Highway 1 and a canal that runs along the highway. The northwest boundary is demarcated by Struve Slough. The other west boundary parallel to the highway is demarcated by a perimeter wall around a new residential community. The north boundary is demarcated by the Harkins Slough. The east boundary is demarcated by fence lines, both residential and industrial. Accessibility to the project area was good; the entire area was available for a walking survey. Soil visibility was fair; the majority of the surface area was obscured by agricultural vegetation. Vegetation consisted primarily of strawberry plants, however marshland vegetation, including tall grasses, reeds, and trees were present along the embankment of the Harkin Slough. Where native soils were exposed, a brown soft loam and hard, dark brown clay were observed. Rock types noted include Monterey-banded chert and small amounts of sandstone and granite. During the construction of Struve Slough in the north east portion of this area, it was reported that an unknown number of Native American burials were excavated. No indication of prehistoric cultural resources were noted in this area, however much of the surface area was not visible due to vegetation. Subsurface cultural resource may be present in this area.

CONCLUSION AND RECOMMENDATIONS

The archival research revealed the presence of recorded cultural resources within the proposed annexation areas. In addition, agricultural activities, soil formation, and previous development may have obscured the presence of prehistoric or historic cultural resources in the areas scheduled for annexation. Due to the frequency of subsurface prehistoric deposits in the Watsonville region, it is recommended that any future proposed development in any of these areas be individually evaluated to determine its potential impact on cultural resources. Additional conclusions and recommendations are given individually below for each of the areas within the project.

Area A: Buena Vista I, II, and III

Archival research revealed no previously recorded archaeological sites within this area. During surface reconnaissance, traces of historic material were noted in the southwest portion of Buena Vista I, along the dry creek embankment. Therefore, in addition to the general recommendation made above, this portion of the Buena Vista Area should be considered particularly sensitive for historic archaeological resources.

Area B: Atkinson Lane

Archival research revealed no previously recorded archaeological sites within this area. In addition, no cultural resources, prehistoric or historic, were noted during surface reconnaissance. Therefore, no specific recommendations are being made for the Atkinson Lane Area beyond those stated above.

Area C: West of East Lake

Archival research revealed that two previously recorded historic sites are located within this area. These consist of CA-SCR-335H (the historic route of Highway 152) and P-44-400 (a motel or apartment complex dating from the 1920's). No additional prehistoric or historic resources were noted during surface reconnaissance. Therefore, in addition to the general recommendation made above, it is recommended that any future proposed projects which may include portions or either of these two sites be evaluated to determine their impact on these resources and appropriate mitigation measures be designed at that time.

Area D: East of East Lake

Archival research revealed the presence of one previously recorded prehistoric archaeological site within this area. This site, CA-SCR-121, is described as a probable habitation site including a large shell midden, and is located in the southern portion of this area. No traces of this site were noted during surface reconnaissance, however there remains a potential for subsurface cultural materials to be present. Therefore; in addition to the general recommendation made above, it is recommended that any future proposed projects in the southern portion of this area be evaluated to determine their impact on this resource, and appropriate mitigation measures be made at that time.

Area E: The Villages

The archival research revealed no previously recorded sites within this area, and no cultural resources, prehistoric or historic, were noted during surface reconnaissance. Therefore, no specific recommendations are being made for the Villages Area beyond those stated above.

Area F: Manabe-Burgstrom

Although archival research revealed no formally recorded sites within this area, it is reported that multiple Native-American burials were exposed during the construction of the southern portion of the Struve Slough. This reported site is located at the eastern end of the Manabe-Burgstrom Area. Another recorded prehistoric site is located adjacent to the western boundary of the area, CA-SCR-107. This is recorded as a large shell midden. Therefore in addition to the general recommendation made above, this area should be considered particularly sensitive for subsurface prehistoric archaeological resources.

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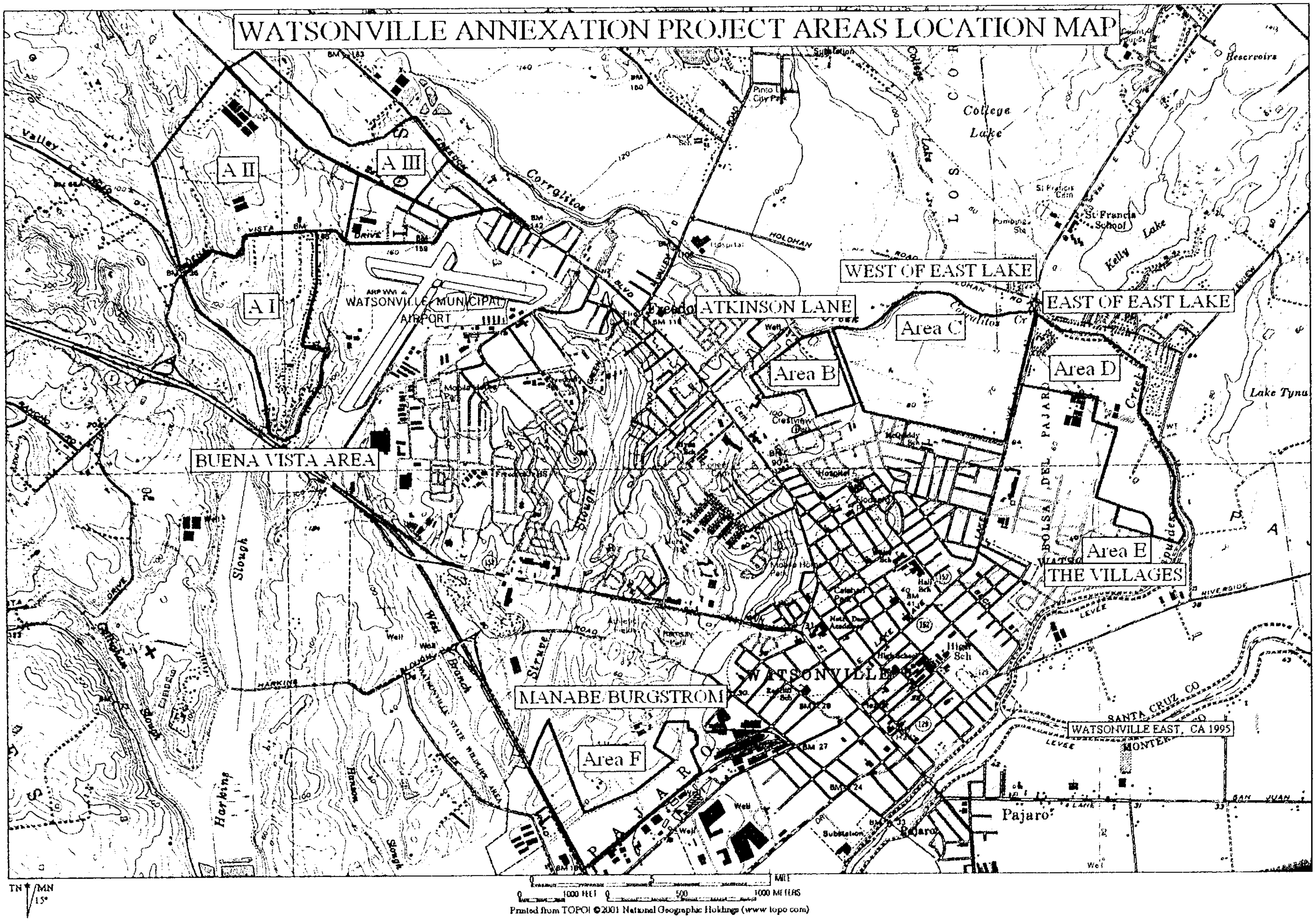
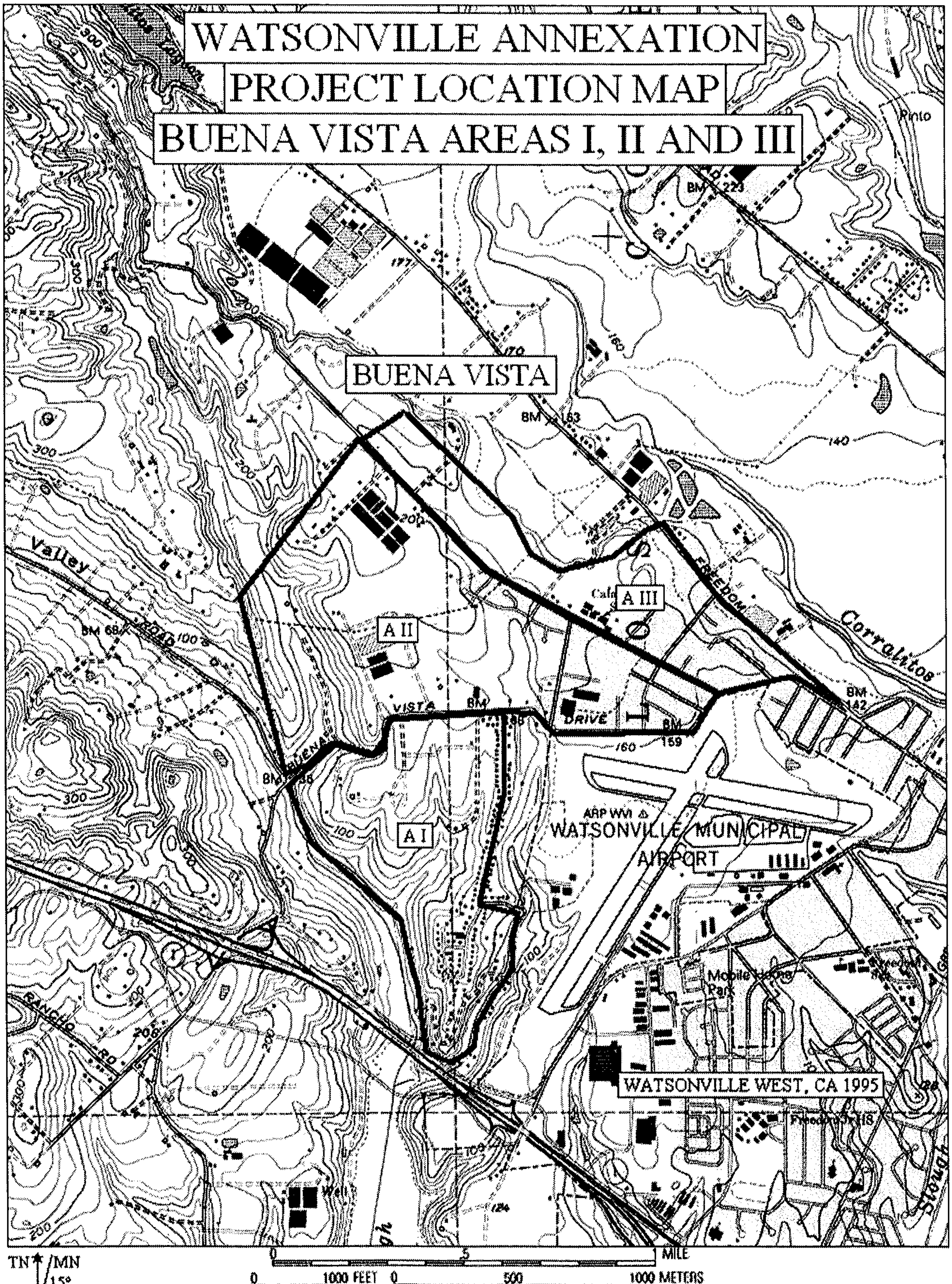
APPENDIX A:
PROJECT MAPS


WATSONVILLE ANNEXATION PROJECT AREAS LOCATION MAP
A II
A III
A I
WATSONVILLE MUNICIPAL AIRPORT
BUENA VISTA AREA
ATKINSON LANE
WEST OF EAST LAKE
EAST OF EAST LAKE
Area B
Area C
Area D
Area E
THE VILLAGES
MANABE BURGSTROM
Area F
WATSONVILLE
WATSONVILLE EAST, CA 1995
College Lake
Kelly Lake
Corralitos
Pajaro
1000 FEET
1000 METERS
Printed from TOPO! ©2001 National Geographic Holdings (www.topo.com)



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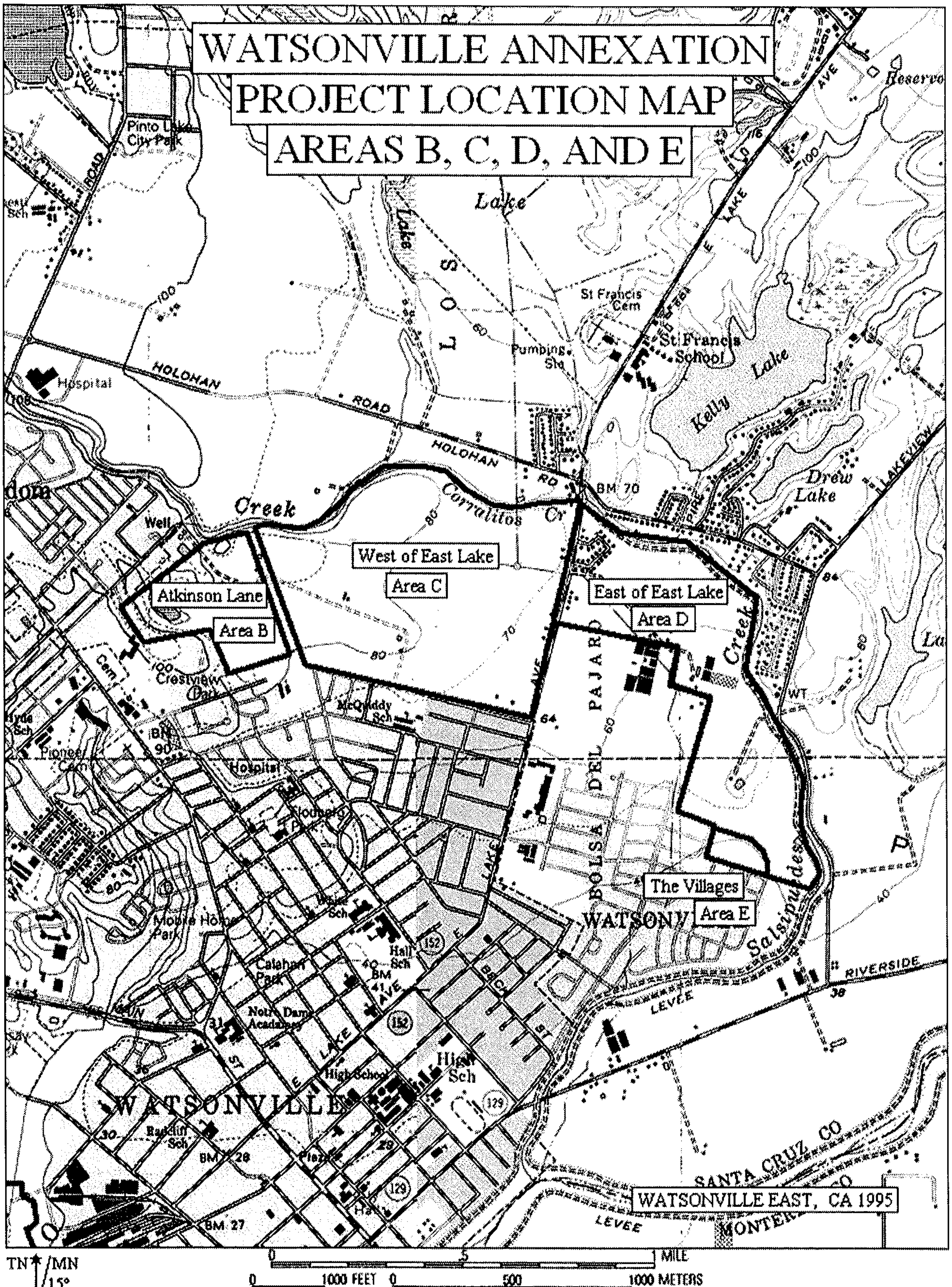

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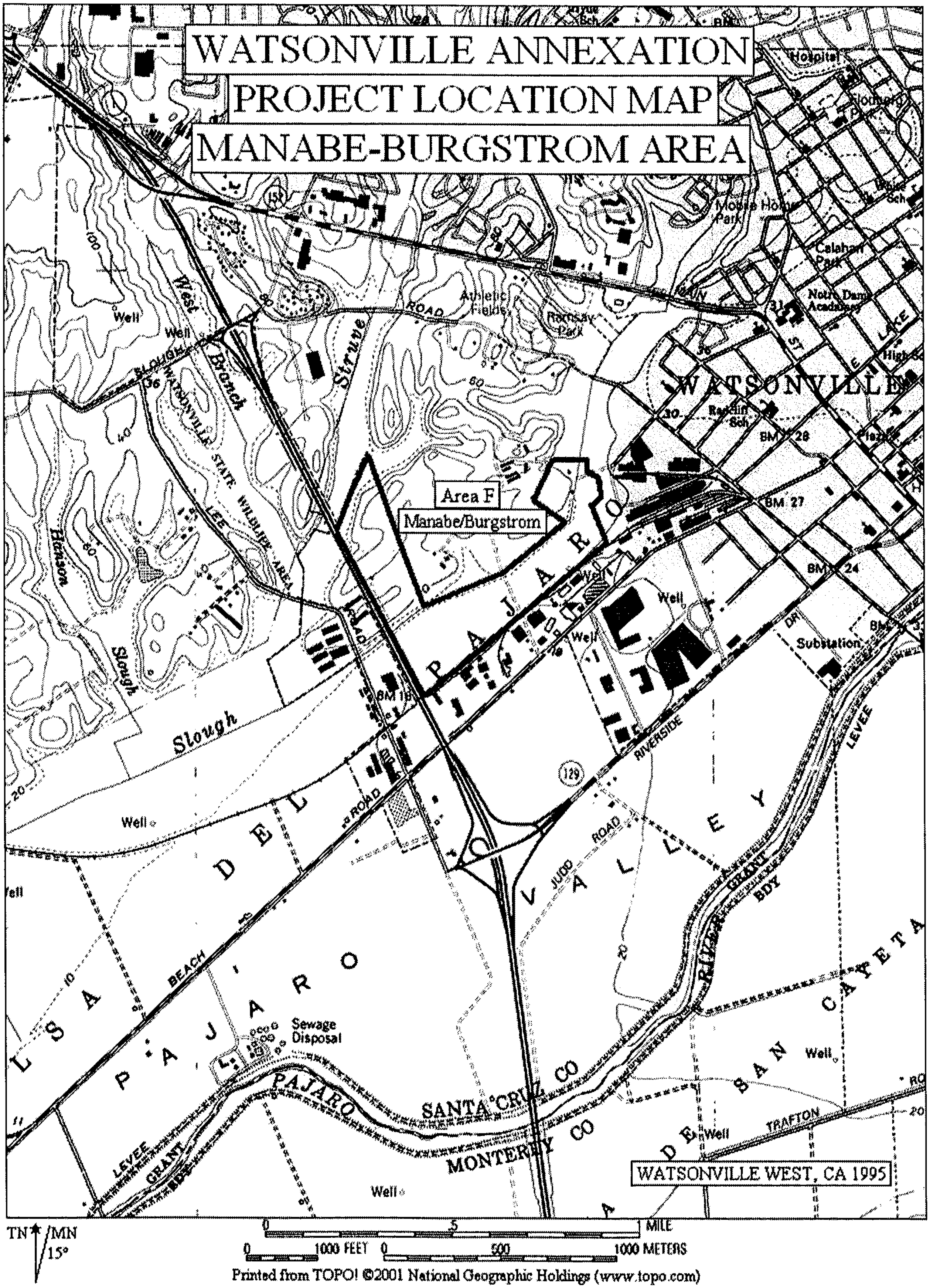

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APPENDIX B:
SITE RECORD FOR CA-SCR-121

Ca-SCr-1?
California State Site Designation ___

CABRILLO COLLEGE ARCHAEOLOGICAL SITE SURVEY RECORD
Watsonville East 7.5' 3865

1. C.A.S. Site S-1 2. Map USGS Quad 3. County Santa Cruz

4. TWN 12S Range 2E ; --- ¼ of --- ¼ of Sec. ---

5. Location Atop knoll on west side of Salsipuedes Creek ½ km. from the southern end of Lake Tynan.

U.T.M.G. Coordinate 127.870 6. Contour elevation 60'

7. Previous designations for site None known

8. Owner ___ 9. Address ___

10. Previous owners, dates ___

11. Present tenant ___

12. Attitude toward excavation ___

13. Description of site Extensive midden deposit. Probable year-round habitation site.

14. Area ca. 40,000 sq.m 15. Depth --- 16. Height ---

17. Vegetation Strawberry farm 18. Nearest water Salsipuedes Creek ~100 M N.E.

19. Soil of site Dark friable shell midden 20. Surrounding soil Reddish tan/sandy

21. Previous excavation None known

22. Cultivation Plowed but not planted. 23. Erosion Slight

24. Building, roads, etc. Farm house, outbuildings, farm roads, small reservoir.

25. Possibility of destruction Already significant.

26. House pits None observed

27. Other features ___

28. Burials None observed, likely present.

29. Artifacts Worked bone, utilized flakes, 2 stone bowl mortar fragments on the surface. Also much shellfish and lithic detritus.

30. Remarks Likely surrounded by marshes in prehistoric times. Slope less than 5%. Vertical distance to water ca. 5 meters.

31. Published references None known

32. Photos None taken 33. Sketch map See reverse

34. Date 11-20-75 35. Recorded by Joseph W. Morris

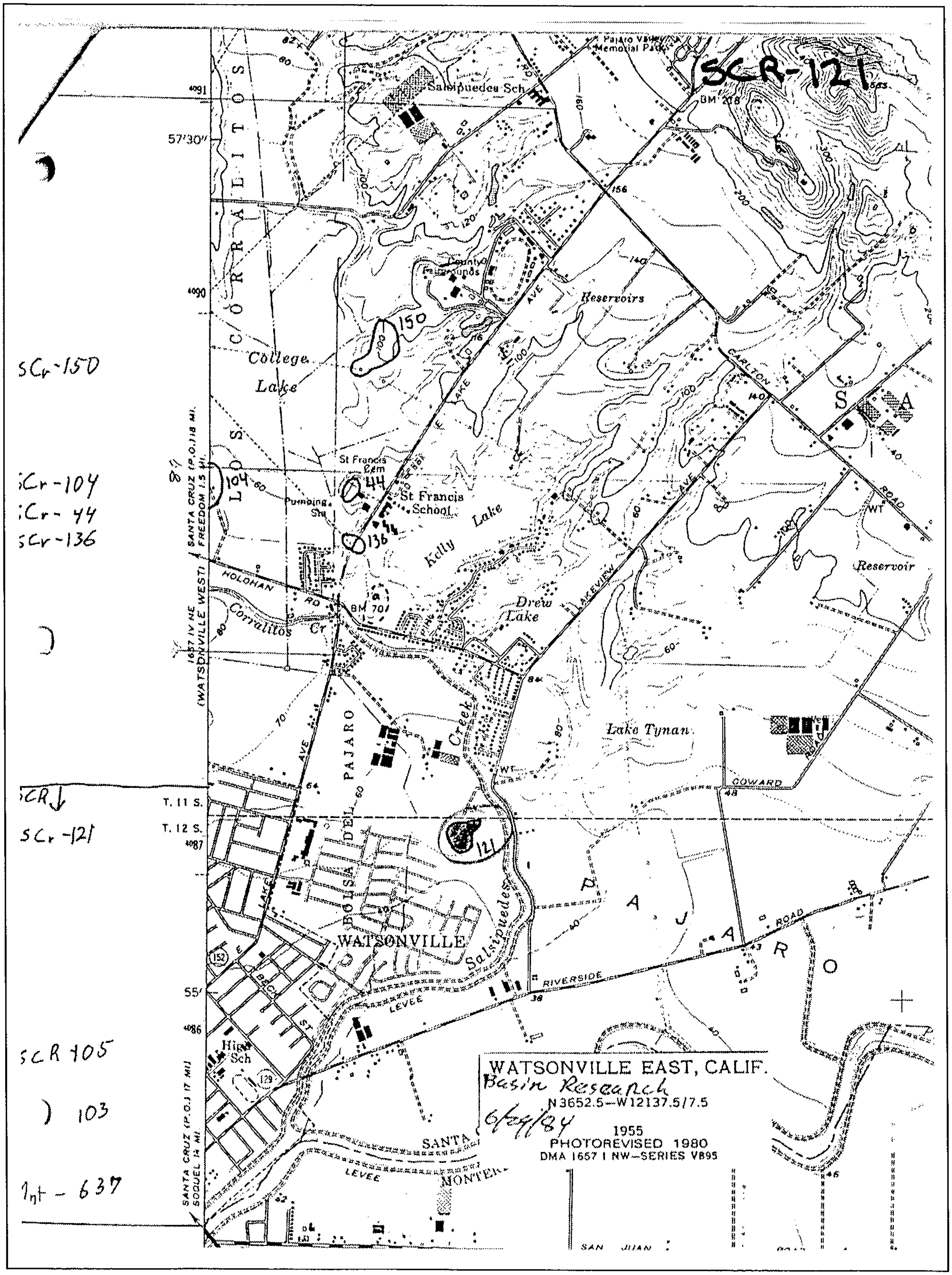
S-7781

See SIR / SCC-Cnur

See E-26 SCr

See S-92

E-229SCR


SCR-121
Salsipuedes Sch
Pajaro Valley Memorial Park
BM 208
57'30"
CORRALITOS
County Fairgrounds
Reservoirs
150
College Lake
SCr-150
LOS
St Francis Cem
St Francis School
Pumping Sta
104
44
136
SCr-104
SCr-44
SCr-136
Kelly Lake
CARLTON
ROAD
Reservoir
HOLOHAN RD
BM 70
Corralitos Cr
Drew Lake
LAKEVIEW
Lake Tynan
PAJARO DEL BOLSA
Creek
COWARD
SCR↓
T. 11 S.
T. 12 S.
SCr-121
121
P A J A R O
WATSONVILLE
Salsipuedes
RIVERSIDE
ROAD
LEVEE
SCR 105
) 103
High Sch
Int - 637
SANTA CRUZ (P.O.) 17 MI
SOQUEL 14 MI.
SANTA CRUZ (P.O.) 18 MI.
FREEDOM 1.5 MI.
1657 IV NE
(WATSONVILLE WEST)
SANTA
MONTEREY
SAN JUAN
WATSONVILLE EAST, CALIF.
Basin Research
N3652.5—W12137.5/7.5
6/29/84
1955
PHOTOREVISED 1980
DMA 1657 I NW—SERIES V895

APPENDIX D
BIOLOGICAL RESOURCES

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BIOTIC ASSESSMENT FOR THE PROPOSED CITY OF WATSONVILLE AND SANTA CRUZ COUNTY ATKINSON LANE SPECIFIC PLAN SANTA CRUZ COUNTY, CALIFORNIA

Prepared for

RBF Consulting
3180 Imjin Road, Suite 110
Marina, CA 93933

Prepared by

EcoSystems West Consulting Group
819½ Pacific Ave., Suite 4
Santa Cruz, CA 95060

January 2009

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INTRODUCTION

This report presents the methodologies and findings of a botanical and wildlife assessment conducted by EcoSystems West Consulting Group for the proposed City of Watsonville Atkinson Lane Specific Plan study area in Santa Cruz County, California. The objectives of the botanical and wildlife assessment were:

- To characterize the vegetation in the vicinity of proposed project site.
- To identify the wildlife resources (habitats and species) in the vicinity of the project site.
- To identify special-status plant and wildlife species and sensitive habitats occurring, or potentially occurring, in the project site.

SITE DESCRIPTION

The project site is located adjacent to city limits of Watsonville, south of Corralitos Creek, and east of Freedom Boulevard. The 68-acre site is bordered by residential development to the south and west and by private agriculture lands to the north and east. Residential neighborhoods and agricultural fields comprise the majority of the surrounding areas (Figure 1).

Existing features within the proposed project site include a seasonal wetland with an associated drainage/swale, an irrigated agricultural basin, a segment of Corralitos Creek, open ruderal/cultivated fields, orchards, unpaved farm roads and a few private residential and agricultural-related buildings (Figure 2).

PROJECT DESCRIPTION

In November 2002, the voters of the City of Watsonville passed Measure U, which directs the distribution of new growth within and around the City. Measure U was designed to protect commercial agriculture lands and environmentally sensitive areas while providing the means for the City to address housing and job needs for the next 20 to 25 years. Measure U established a 20 to 25-year urban limit line around the City, and directs growth into several unincorporated areas. The three primary areas of growth include the Buena Vista, Manabe-Ow (formerly Manabe-Burgstrom), and Atkinson Lane Specific Plan areas. In accordance with Measure U, the City of Watsonville General Plan, which was adopted by the City Council in June of 2006, identifies the project site as a new growth area to accommodate up to 600 new housing units, including affordable units, townhomes, and single-family homes.

The County of Santa Cruz General Plan and Housing Element require the rezoning of a 16-acre site within the project site to allow 200 housing units at a density of 20 units per acre by June 2009. The City is also required to provide housing capacity on the remainder of the project site (City expansion area) to address its projected needs for the next housing element cycle. To address these requirements, the City and County determined that it is in their mutual interest to jointly plan for the development of the entire project site. In 2007, the City and County entered into a Memorandum of Understanding (MOU) to jointly pursue a Specific Plan for the project site. The MOU sets specific project requirements that will fulfill the City and County obligations to provide adequate housing for the region and requires that the City and County create a development plan for the project site that addresses roadway layout, housing types and affordability restrictions, parks and schools, infrastructure financing, neighborhood concerns, protection of environmental resources, and specific development guidelines.

The County of Santa Cruz and the City of Watsonville are currently preparing a joint Specific Plan for the Atkinson Lane future growth area. The Atkinson Lane future growth area (project site) falls within the City of Watsonville Urban Growth Boundary. The total gross acreage of the project site is approximately 68 acres, which includes 16 acres of land to be developed by the County prior to annexation by the City to meet County affordable housing goals. The MOU estimates that up to 200 units may be developed within the 16-acre area. Development by the City would follow after 2010 wherein the City may propose to annex the 16-acre County site, as well as the City expansion area. Land uses and densities for the plan will be determined as part of the Specific Plan process.

Providing adequate access to the project site to serve the anticipated development without overwhelming the existing circulation system is a critical project objective. The City of Watsonville General Plan assumes that Wagner Avenue would be improved and connected to Crestview Drive to serve as the primary access arterial between Freedom Boulevard and East Lake Avenue. Secondary access routes will be analyzed including Atkinson Lane and Brewington Avenue. The proposed project will also analyze additional infrastructure necessary to serve the area including sewer lines, water lines, storm drains, gas and electric, cable, phone, etc.

This environmental review presents our preliminary assessment of existing wetlands and other sensitive biotic resources occurring or potentially occurring within the vicinity of the project area. A preliminary site plan (Watsonville, City of, 2007) and a Land Use Plan (RBF Consulting and Payatok Architects, Inc 2008) were available during our fall 2008 site evaluation. No other detailed plans or specific drawings were available.

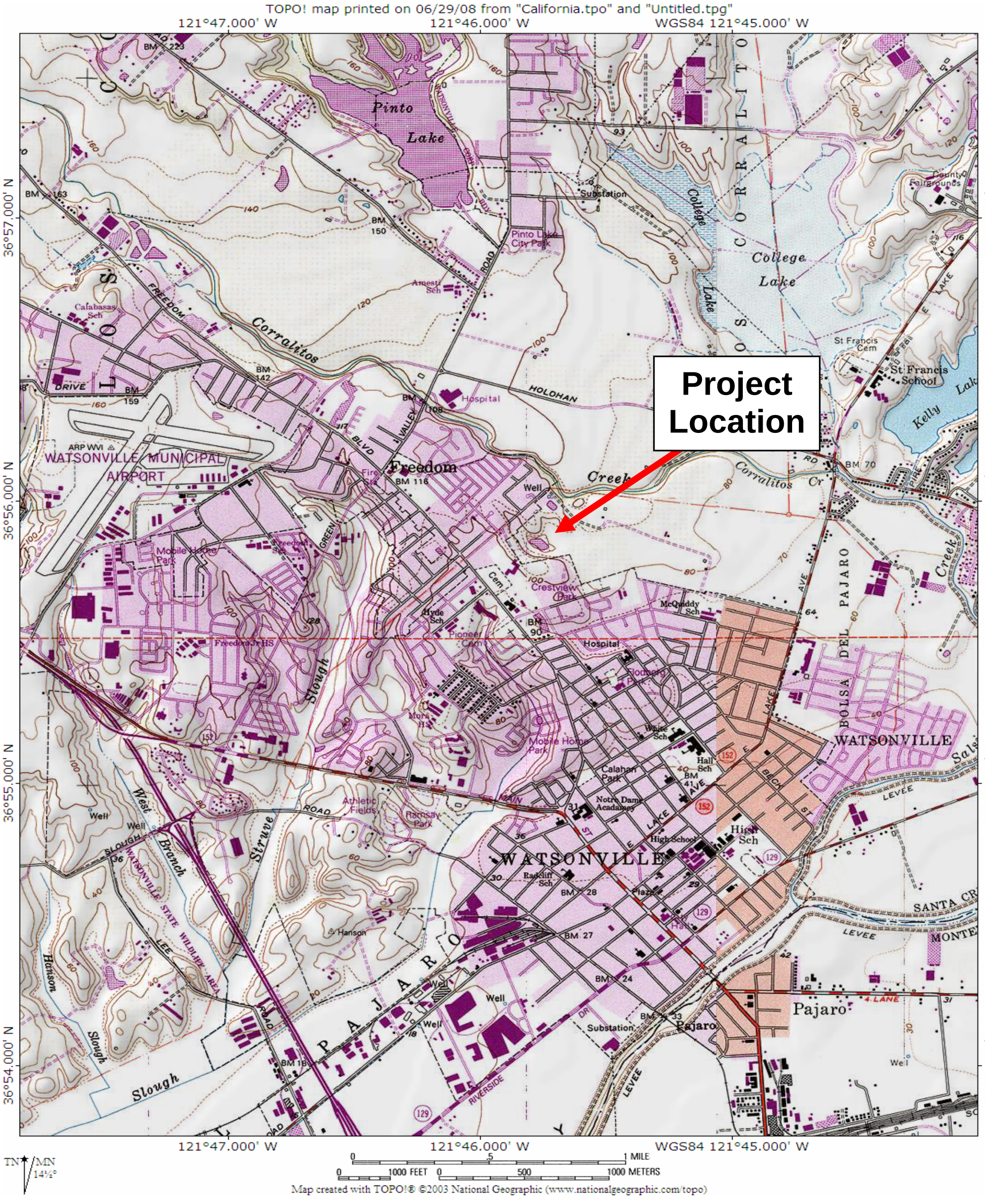

Figure 1. General location of the Proposed City of Watsonville Atkinson Lane Specific/Master Plan Area, Santa Cruz County, California.

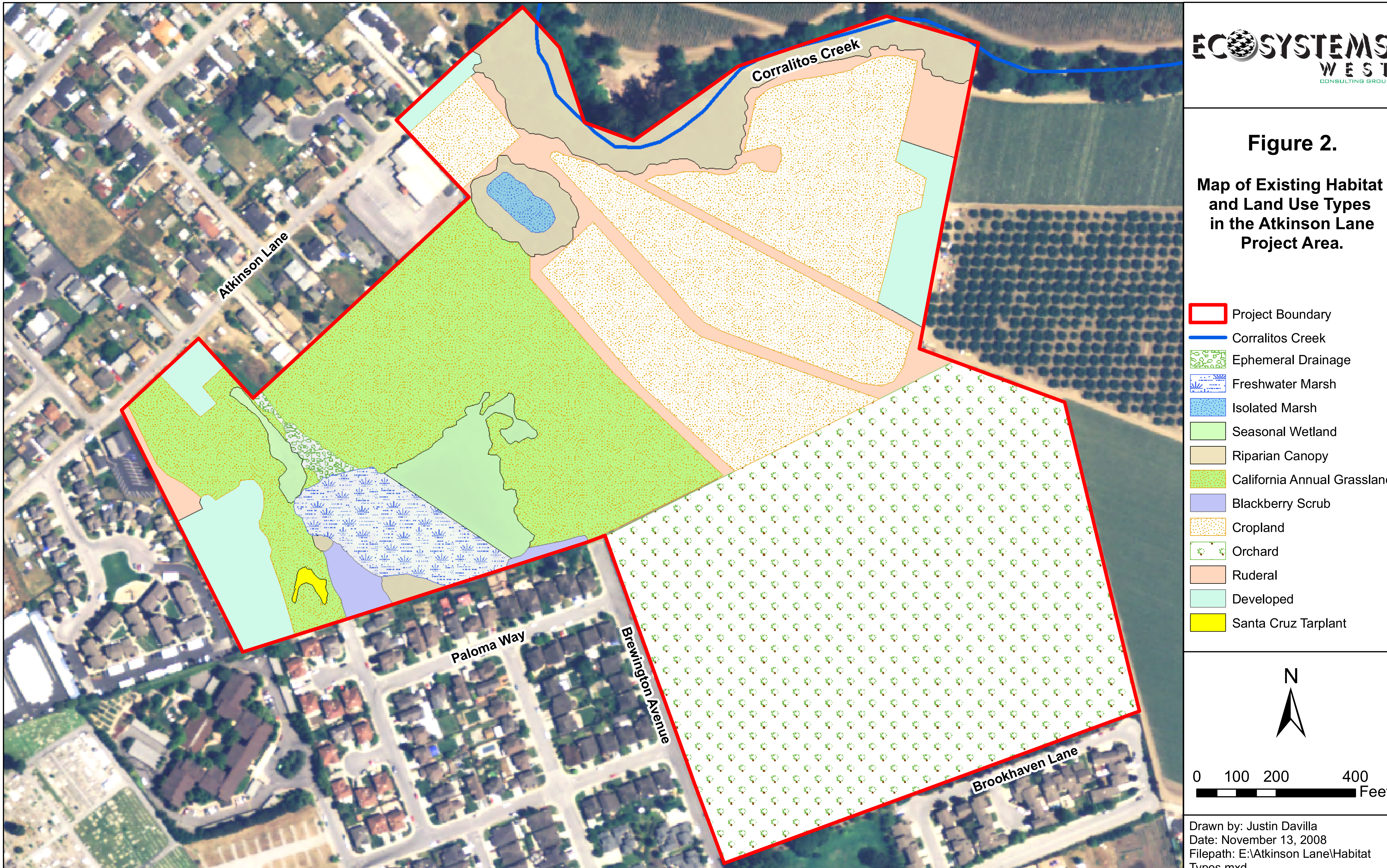

Figure 2.

Map of Existing Habitat and Land Use Types in the Atkinson Lane Project Area.

METHODS

Botany

Review of Literature and Data Sources

EcoSystems West botanists reviewed literature and special-status species databases to identify special-status plant species and sensitive habitat types with potential to occur in the project site. Sources reviewed include California Natural Diversity Data Base (CNDDB) occurrence records for the Soquel USGS 7.5 minute quadrangle; county occurrence records and USGS quadrangle occurrence records in the California Native Plant Society's (CNPS) *Online Inventory of Rare and Endangered Vascular Plants of California* (Tibor 2001; CNPS 2008) for the Watsonville West quadrangle and the seven surrounding quadrangles, and local and regional floras (Thomas 1960; Munz and Keck 1973; Hickman 1993).

Sources consulted for current agency status information include U.S. Fish and Wildlife Service (USFWS) (2008a, b, c) for federally listed species (including federal Proposed and Candidate species) and California Department of Fish and Game (CDFG) (2008a) for state listed species. Special-status species also include species listed on List 1A (Plants Presumed Extinct in California), List 1B (Plants Rare, Threatened, or Endangered in California and Elsewhere), or List 2 (Plants Rare, Threatened, or Endangered in California, But More Common Elsewhere) of the CNPS *Inventory* (Tibor 2001; CNPS 2008). These species fall under state regulatory authority under the provisions of the California Environmental Quality Act (CEQA) Guidelines.

Also considered special-status species are species included on List 3 (Plants About Which We Need More Information -- A Review List) or List 4 (Plants of Limited Distribution -- A Watch List) of the CNPS *Inventory*. These species are considered to be of lower sensitivity, and generally do not fall under specific state or federal regulatory authority. Specific mitigation considerations are not generally required for species in these categories.

Based on information from the above sources, we developed a target list of special-status plants with potential to occur in the vicinity of the project area (Appendix A).

Sensitive habitats include riparian corridors, wetlands, habitats for legally protected species and CDFG 'Species of Special Concern', areas of high biological diversity, areas providing important wildlife habitat, and unusual or regionally restricted habitat types. Habitat types considered sensitive include those listed on the CNDDB working list of 'high priority' habitats for inventory (i.e., those habitats that are rare or endangered within the borders of California) (Holland 1986; CDFG 2003) and areas considered to be 'sensitive habitats' under county General Plans. EcoSystems West botanists reviewed the CNDDB list of high priority habitats and the Santa Cruz County General Plan (1994) for sensitive habitat designations prior to conducting the site assessment visit.

Site Visit

An EcoSystems West biologist conducted a botanical assessment of the project area on 23 May 2008. The entire site was thoroughly evaluated on foot and all vascular plant species in identifiable condition when the site visit was conducted, regardless of regulatory status, were identified to species or infraspecific taxon using keys and descriptions in Thomas (1960); Munz and Keck (1973); and Hickman (1993).

We characterized and mapped all habitat types occurring on the site, and recorded data on physiognomy, dominant and characteristic species, topographic position, slope, aspect, substrate conditions, hydrologic regime, and evident disturbance for each habitat type. In classifying the habitat types on the site, we consulted the generalized plant community classification schemes of Holland (1986); Sawyer and Keeler-Wolf (1995); and the CDFG (2003). Our final classification and characterization of the habitat types of the project area was based on field observations.

EcoSystems West botanist Justin Davilla conducted a focused survey for special-status plants within the Atkinson Lane project area on 12 June 2008. The survey followed guidelines from the California Native Plant Society (2001) coincided with time periods for identifying those special-status plant species for which suitable habitat was present within the survey area (Appendix A).

The entire project area was traversed on foot with closer attention given to habitat types with an increased likelihood of supporting special-status plant species. Special-status plants encountered during the survey were mapped as polygons using differentially corrected GPS with a resource grade Trimble GeoExplorer-3 GPS receiver. Technical specifications for the GPS data included: 3D Mode, a PDOP filter of 8 or below, SNR filter of 6 or above, and an elevation mask of 15 degrees. We used a data dictionary to record attribute data for each feature. Attribute data recorded included: scientific name, data of observation, estimated number of individuals, phenology, aspect and slope, habitat type, overall site quality, and potential threats to the population. The GPS data was post-processing differentially corrected using data from the California Survey and Drafting Supply base station, Sacramento, California. Data was exported to ArcGIS shapefile(s) using Trimble Pathfinder Office software.

EcoSystems West evaluated the project area for sensitive habitats based on the following parameters:

COUNTY SIGNIFICANT TREE ORDINANCE

The County of Santa Cruz prohibits the removal of “significant trees” in sensitive habitats, including riparian corridors (County of Santa Cruz Panning Dept., 1994). Significant trees are those greater than 20 inches in diameter at breast height (DBH) for single stemmed trees; any sprout clump of five or more stems each of which is greater than 12 inches DBH; or any group consisting of five or more trees on one parcel, each of which is greater than 12 inches DBH. No stipulations are made for native versus non-native and/or ornamental trees. Exceptions are made for trees that are diseased or deemed hazardous to public safety; or pursuant to a Timber Harvest Plan or Fire Protection Plan submitted to and approved by the California Department of Forestry. Removal of significant trees in a riparian corridor would require a permit issued by the County of Santa Cruz Planning Department and would likely require mitigation including, but not limited to, planting of replacement trees at a ratio and species composition determined by the Planning Director. EcoSystems West evaluated the project area for the presence of significant trees.

RIPARIAN HABITAT

Riparian habitats are valued for wildlife habitat, stream bank stabilization, and flood control and are generally considered a sensitive resource by most city and county general plans.

The County of Santa Cruz riparian ordinance limits development activities in riparian areas and provides buffer/setback requirements based on slope and vegetation composition. Specifically, the ordinance states that a buffer "shall always extend fifty (50) feet beyond the edge of riparian woodland and twenty (20) feet beyond the edge of other woody vegetation as determined by the dripline" (County of Santa Cruz 1994). Exemptions are made for continuance of a preexisting use, pest control and eradication, drainage and erosion control, habitat restoration, and/or maintenance of existing levee structures. Applicants may file for a permit from the County of Santa Cruz enabling development activities in a riparian corridor. The permit application must include a property and project description, as well as proposed best management practices and potential mitigation measures.

POTENTIAL WETLANDS AND "OTHER WATERS" OF THE U.S.

Wetlands are defined as, "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (EPA, 40 CFR 230.3, and CE 33 CFR 328.3). The three criteria used to delineate wetlands are the presence of: (1) hydrophytic vegetation, (2) wetland hydrology, and (3) hydric soils. According to the US Army Corps of Engineers (Corps) Manual, evidence of at least one positive wetland indicator from each parameter must be found in order to make a positive determination. Under Section 404 of the Clean Water Act, the Corps is responsible for regulating the discharge of fill materials into wetlands and waters of the United States. A routine level delineation of wetlands and waters potentially subject to Corps jurisdiction was conducted by EcoSystems West on 1 May 2008.

Areas that are inundated for sufficient duration and depth to exclude growth of hydrophytic vegetation, such as lakes and ponds, or convey water, such as streams, are also subject to Section 404 jurisdiction. Along the Central California coast, these "other waters" can include intermittent and ephemeral streams, as well as lakes, and rivers. "Other waters' are identified by the presence of an ordinary high water (OHW) mark, a defined river or stream bed, a bank, or by the absence of emergent vegetation in ponds or lakes. An OHW mark is defined as the natural line on the shore established by fluctuations of water. The project area was concurrently evaluated for the presence of "other waters" at the time of the biotic assessment site visit.

WATERS OF THE STATE OF CALIFORNIA

Section 401 of the Clean Water Act (CWA) and the Porter-Cologne Water Quality Act (SWRCB 2002) assign overall responsibility for water rights and water quality protection to the State Water Resource Control Board (SWRCB) and directs the nine statewide Regional Water Quality Control Boards (RWQCBs) to develop and enforce water quality standards within their boundaries. Under California State law, "waters of the state" pertains to "any surface water or groundwater, including saline waters, within the boundaries of the state." As a result, water quality laws and permitting authority apply to both surface and groundwater.

Following the 2001 U.S. Supreme Court decision in *Solid Waste Agency of Northern Cook County v. Army Corps of Engineers* (*SWANCC*) the SWRCB released a legal memorandum confirming the State's jurisdiction over isolated wetlands. The memorandum stated that under the California Porter-Cologne Water Quality Control Act, discharges to wetlands and other "waters of the state" are subject to State regulation, including wetlands isolated from navigable waters or their tributaries. In the recent Supreme Court decision for *Rapanos v. United States* (547 U.S. 715 (2006)), the Court recommended further restrictions on federal jurisdiction and required that a "significant nexus" test be applied to those wetlands and "other waters" which are not navigable waters. A memorandum issued in June 2007 provides guidance to the Corps and EPA for implementing the Supreme Court's significant nexus test. Wetlands and others waters lacking a significant nexus to navigable waters of the U.S. may still be regulated by state Regional Water Quality Control Boards (RWQCB). In general, the RWQCB regulates discharge into isolated waters in much the same way as the Corps does for Federal-jurisdictional waters, using Porter-Cologne rather than Section 404 authority (SWRCB 2001).

Wildlife

Review of Literature and Data Sources

Prior to our site visit, EcoSystems West biologists reviewed CNDDB occurrence records of special-status wildlife species for the USGS 7.5 minute Watsonville West quadrangle. In addition, we reviewed documents for previous projects in the vicinity that contained sensitive wildlife species lists for Santa Cruz County. Sources consulted for up-to-date agency status information include the USFWS (1978, 2004, 2005a, 2006, and 2008b,c,d,e,f) for federally listed species and/or designations of critical habitats, and the CDFG for state species listed as 'Threatened' or 'Endangered' or as 'Species of Special Concern' (CDFG 2008b). Maps produced by the Biogeographic Information and Observation System (BIOS) (CDFG 2008c) and Santa Cruz County (2005) were also reviewed to obtain distribution information for special-status species.

The CDFG Mammal Species of Special Concern (Williams 1986) was reviewed, as was the list of species considered 'High Priority' by the Western Bat Working Group (WBWG) (1998). According to the CDFG Special Animals List, species designated as 'High Priority' by WBWG are defined as "imperiled or are at high risk of imperilment based on available information on distribution, status, ecology and known threats" (CDFG 2008b). These species fall under State regulatory authority under the provisions of the CEQA Guidelines.

From these sources we developed a target list of special status wildlife species and their habitat requirements to consider while assessing the project area (Table 1).

Table 1. Conservation status and habitat requirements of special-status wildlife species that may occur in the vicinity of the proposed Atkinson Lane Specific Plan project area, Santa Cruz County, California.

Common Name *Scientific Name*	Status			Habitat Requirements	Potential Occurrence
	Federal	State	Other		
Amphibians and Reptiles					
Santa Cruz long-toed salamander *Ambystoma macrodactylum croceum*	FE	SE	FP	Require shallow ponds with emergent and submerged vegetation for cover during the aquatic phase of their life. In terrestrial phase, require woodlands with a dense understory and abundant burrows.	**Not Expected** Nearest records from the project area are over 3 miles west, and northwest along Merk Road, Larkins Valley, and in Ellicott Pond. Occurrence is not expected due to the site being isolated from surrounding urban barriers, the distance to known populations, and the presence of non-native predators (e.g. bullfrog) (Mori 2008).
California tiger salamander *Ambystoma californiense*	FT	SC	-	Seasonal pools, stock ponds and irrigated agricultural basins, and ditches with nearby upland grasslands and/or open woodlands within Central California. May migrate over 1 mile to reach breeding ponds.	**Not Expected** Nearest records from the project area are over 3 miles west, in Buena Vista and Ellicott Ponds. Occurrence is not expected due to the site being isolated from surrounding urban barriers, the distance to known populations, regular discing practices of upland habitat, and the presence of non-native predators (e.g. bullfrog) (Mori 2008).
California red-legged frog *Rana draytonii*	FT	SC	-	Requires the presence of surface water until mid to late summer for reproduction; utilizes ephemeral and/or perennial systems with standing or slow moving flows; upland habitat includes leaf litter, burrows and crevices; adults may travel over 2 miles overland between aquatic sites.	**Possible** Nearest records from the project area are approximately 1.2 miles southwest in Watsonville Slough and 1.6 miles southwest in Struve Slough. The project site provides potential aquatic and dispersal habitat (Mori 2008; USFWS 2008f).
Western pond turtle *Actinemys marmorata*	-	SC	-	Found in ponds, marshes, rivers, streams, and ditches containing aquatic vegetation. Basks on logs, debris, banks and/or rocks. Moves up to 4 miles within a creek/drainage system, especially during'walk-abouts' before a female lays eggs. Forms nesting burrows in upland areas up to several hundred feet away from aquatic habitat in woodlands, grasslands, or open areas.	**Present** Observed within the large wetland feature in the project area during site visits in 2007 and 2008 (K. Glinka and B. Mori pers. obs.). Nearest known additional records are from 1.2 miles southwest in Struve Slough and 1.4 miles north in Pinto Lake. Project area provides aquatic, upland nesting, and dispersal habitat (Mori 2008).
Raptors and Birds (Nesting and/or Wintering)*					
Nesting birds of prey (Various species)	-	-	3503.5	Variety of woodland, riparian, and savanna habitats	**Possible** Tree stands in project area provide potential nesting habitat for birds of prey including owls and hawks.
Golden eagle *Aquila chrysaetos*	-	-	FP; BCC	Resident in open mountains, foothills, canyons, and open fields of Santa Cruz County. Nests in a mass of sticks on cliffs or in trees.	**Not Expected** Project area lacks suitable nesting habitat; May forage or occur as migrant.
Ferruginous hawk *Buteo regalis*	-	-	BCC	Winter visitor to open field and grasslands	**Possible (wintering)** Nearest record is from north Monterey Co.; May forage or occur as seasonal migrant.

Common Name *Scientific Name*	Status			Habitat Requirements	Potential Occurrence
	Federal	State	Other		
Northern harrier *Circus cyaneus*	-	SC	FP	Ground nester; grasslands, sloughs, wet meadows, savanna, and prairies.	**Not Expected** Project area lacks suitable nesting habitat from regular discing of grasslands and cultivation of agriculture fields. May forage over site or occur as migrant
White-tailed kite *Elanus leucurus*	-	-	FP	Nests in conifers on the margins of open areas including grasslands and sloughs containing a high abundance of small mammals and lizards.	**Possible** Project area provides potential nesting and wintering habitat in tree stands. May forage over site or occur as migrant.
Short eared owl *Asio flammeus*	-	SC	-	Ground nests and/or roosts in tall grass meadows, tules stands, or scrub habitats. Rare fall and winter visitor to the open fields and grasslands within Santa Cruz. County.	**Not Expected** Project area lacks suitable nesting habitat from regular discing of grasslands and cultivation of agriculture fields. Nearest known occurrence is approximately 8 miles south in Monterey County. May forage or occur as seasonal migrant.
Western burrowing owl *Athene cunicularia*	-	SC	BCC	Open areas with burrow features available to nest or winter in; Burrow features include small mammal burrows, rock piles/outcrops, sparsely vegetated berms/slopes along roadways, agriculture ponds, retention basins and culverts	**Not Expected** Project area lacks burrow features for nesting and/or wintering sites from regular discing of grasslands and cultivation of agriculture fields. Nearest record is approximately 8 miles south near Dolan Road in Monterey County.
Willow flycatcher *Empidonax traillii*	-	SE	-	Nests in riparian areas and large wet meadows with extensive willows. Usually found in riparian habitats during migration	**Not Expected** Project area lacks extensive dense willow riparian stand for nesting. May forage or occur as migrant.
Loggerhead shrike *Lanius ludovicianus*	-	SC	BCC	Grasslands, coastal sage scrub. Nests in low trees and shrubs; feeds on insects, lizards and small snakes.	**Not Expected** Project area lacks suitable breeding habitat from regular discing and cultivation of agricultural fields. Known to breed in the southern portion of Santa Cruz County, in the vicinity of Pajaro Valley. May forage or occur as migrant.
Yellow-breasted chat *Icteria virens*	-	SC	-	Nests in extensive dense riparian vegetation 1-8 ft. above the ground, with a well-developed understory.	**Not Expected** Project area lacks extensive dense riparian vegetation for nesting. May forage or occur as migrant.
Yellow warbler *Dendroica petechia brewsteri*	-	SC	-	Nests in deciduous riparian woodland with open canopy along streams or other watercourses; forages in dense understory of riparian woodland.	**Possible** Project area provides riparian vegetation for marginal potential nesting habitat. May forage or occur as migrant.
Tricolored blackbird *Agelaius tricolor*	-	SC	BCC	Colonial nesting species. Inhabits agricultural fields, pastures, ponds, sloughs, marshes, swamps, and estuaries. Nests in dense stands of tall emergent vegetation over water.	**Not Expected** Project area lacks suitable nesting and foraging habitat. Nearest records occur approximately 2.5 miles southwest in Struve Slough and 2.5 miles southwest in Hanson Slough. May forage over site or occur as migrant.

Common Name *Scientific Name*	**Status**			**Habitat Requirements**	**Potential Occurrence**
	Federal	**State**	**Other**		
Mammals					
Townsend's western big-eared bat *Corynorhinus townsendii*	-	SC	HP	Roost sites are highly associated w/ caves and mines; buildings must offer "cave-like" features; known to roost in tree hollows, under bridges, in residential attics and under decks. Highly sensitive.	**Not expected** Project area lacks 'cave-like' roosting features and is frequently exposed to human disturbance. May forage over site or occur as migrant.
Pallid bat *Antrozous pallidus*	-	SC	HP	Roost sites are primarily associated with oak, redwood, ponderosa pine, and giant sequoia forests. Will also roost under bridges and in buildings and rock outcrops.	**Possible** Project area provides potential roosting habitat features. May forage over site or occur as migrant.
Western red bat *Lasiurus blossevillii*	-	SC	HP;**	Roosts in foliage, primarily in riparian and wooded habitats.	**Possible** Project area provides potential roosting habitat in riparian and/wooded canopy. May forage over site or occur as migrant.
Fringed myotis *Myotis thysanodes*	-	-	HP: **	Roosts sites in California are primarily in buildings or mines; will also roost in large conifer snags and caves.	**Possible** Potential roosting habitat available in tree stands and structures in study area. May forage over site or occur as migrant.
Long-legged myotis *Myotis volans*	-	-	HP;**	Roosts primarily in large hollow tree snags or live trees with exfoliating bark; also uses rock crevices, mines, and buildings.	**Possible** Potential roost sites available in structures, snags, and trees with exfoliating bark, and broken tops in project area. May forage over site or occur as migrant.
San Francisco dusky-footed woodrat *Neotoma fuscipes annectens*	-	SC	-	Associated with riparian, oak woodland and redwood forest habitats. Builds stick nests under or in buildings, hollow trees, or in tree canopy.	**Possible** Potential habitat occurs in project area in willow riparian habitat, dense understory surrounding the irrigation pond and along Corralitos Creek. Minimal additional potential habitat occurs among scattered old structures on site.
American badger *Taxidea taxus*		SC	-	Friable soils and open, uncultivated grasslands and meadows. Forages on burrowing rodents, insects, and ground nesting birds. Badgers mate in the summer and early fall and experience delayed embryonic implantation. Young are born the following spring (March-April).	**Not Expected** Study area lacks suitable habitat for burrowing and foraging due to regular discing practices and cultivation of agriculture fields. Nearest historical records are approximately 3 miles west of project area.

Table 1 Notes:

*All nesting raptors (i.e., hawks and owls), native birds, and their occupied nests are federally protected under the Migratory Bird Treaty Act (MBTA) of 1918 (Title 16 United States Code, Section 703-712 as amended; 50 Code of Federal Regulations Section 21; and 50 Code of Federal Regulations Section 13) and by CDFG codes that support the act. The MBTA makes it unlawful to "take" (e.g., pursue, kill, harm, harass) any migratory bird or raptor listed in the 50 Code of Federal Regulations Section 10, including nests, eggs, or products.

Federal Status (USFWS 2008d; CDFG 2008b)

FE = Endangered: Any species, which is in danger of extinction throughout all, or a significant portion of its range
FT=Threatened: Any species, which is likely to become an endangered species within the foreseeable future throughout all, or a significant portion of its range.

State Status (Williams 1986; CDFG 2008b)

SE=Endangered: A native species or subspecies of animal which is in serious danger of becoming extinct throughout all, or a significant portion of its range, due to loss of habitat, change in habitat, over exploitation, predation, competition and/or disease.

SC=CDFG 'Species of Special Concern' are taxa given special consideration because they are biologically rare, very restricted in distribution, declining throughout their range, or at a critical stage in their life cycle when residing in California or taxa that are closely associated with a habitat that is declining in California (e.g., wetlands).

Other (WBWG 1998; CFGC 2006; CDFG 2008b)

3503.5 = Protected birds of prey (Order Falconiformes and Strigiformes) under California Fish and Game Code 3503.5.

FP= Fully Protected: This classification was the State's initial effort in the 1960's to identify and provide additional protection to those animals that were rare or faced possible extinction. Fully Protected species may not be taken or possessed at any time and no licenses or permits may be issued for their take except for collecting these species for necessary scientific research and relocation of the bird species for the protection of livestock.

BCC=Species of migratory nongame birds that USFWS considers to be of concern in the United States because of (1) documented or apparent population declines, (2) small or restricted populations, (3) dependence on restricted or vulnerable habitats.

HP =Considered "High Priority" on the Western Bat Working Group's (WBWG) Western Bat Species Regional Priority Matrix (1998).

******=Included on preliminary list of CDFG Mammal Species of Special Concern (Williams 1986).

Site Visit

EcoSystems West wildlife biologists reviewed distribution information and conducted site visits on 16 June, 21 August, and 6 November 2008. Our objective during these visits was to evaluate the site to determine if the target wildlife species listed in Table 1 are present or if potential habitat for these species occurs in the vicinity of the proposed project site. Focused-level wildlife surveys were not conducted as part of this assessment. Habitat evaluation methods for specific taxa are described below.

AMPHIBIANS AND REPTILES

EcoSystems West contracted B. Mori Biological Consulting Services to conduct a detailed assessment of the project site for special status amphibians and reptiles including the CTS, SCLTS, CRLF, and WPT (Appendix B). Detailed descriptions of habitat requirements for these species are provided in Appendix B.

Salamanders, frogs and turtles depend on both aquatic and non-aquatic habitats for substantial portions of the year. Information was gathered from aerial maps and from BIOS maps (CDFG 2008c) showing the locations of potential aquatic and upland habitat and of documented resources within approximately three miles of the project site. Museum and data base records were also reviewed. With this information, an evaluation was made to determine the likelihood that these species would occur within and/or migrate from nearby known locations through the project site. Formal protocol surveys for Santa Cruz long-toed salamander (SCLTS) (Brode 1993), California tiger salamander (CTS) (USFWS and CDFG 2003), and California red-legged frog (CRLF) (USFWS 2005b) were not conducted as part of this effort. B. Mori's assessment (Appendix B) was submitted to the USFWS for recommendations regarding the need for protocol-level surveys for the special-status amphibians. USFWS's response letter (October 30, 2008) is provided in Appendix C.

RAPTORS AND BIRDS

The bird species listed in Table 1 may occur as seasonal migrants, year-long residents, or nest in the vicinity of the project site. Nesting seasons for raptors takes place between January and August. The smaller passerine birds listed in Table 1, such as the yellow warbler, utilize nesting habitats in riparian/wetland areas, primarily with a well-developed understory (Suddjian 2000). Their nesting season generally occurs during the spring and summer.

EcoSystems West biologists conducted a visual assessment of the project site to evaluate the suitability of available habitat and to determine which of the birds listed in Table 1 could potentially nest, migrate through, or winter on the site. During this evaluation we identified and documented the location of any active nests or existing stick nest structures within the tree stands of the project site. Locations of active nest sites and potential nest structures were noted on field maps.

MAMMALS

During our site visits, our biologists assessed the availability and suitability of potential habitat for special-status mammals listed in Table 1. For bats, areas assessed included the tree stand canopy and fallen trees within the project area. During the day, we visually inspected trees on the property for potential bat roosting features such as broken tops, senescent limbs, hollows, crevices, holes, and furrowed bark. The exterior of some of the structures (e.g., sheds, awnings, and storage space) on the site were briefly examined to determine the potential for bat use (Brown et al. 1996).

The typical breeding season for bats occurs from mid April to September. Depending on the species, female bats congregate in small or large numbers to form maternity colonies to give birth and rear their young over the spring/summer season while males roost separately as individuals or in small bachelor groups. Juvenile bats begin flying by the fall season to forage and prepare for migration. Also depending on the species, males and females communally roost during the fall to breed before and during migration or before hibernating through the winter season (Brown et al. 1996). Our assessment was conducted when many of the target bat species (Table 1) would have had maternity colonies during the spring/summer season and/or formed temporary roosts during fall migration.

No interior inspections, evening bat acoustic monitoring, or emergence surveys, were conducted during our habitat assessment. We anticipate these advanced levels of survey effort will be conducted at a later date once project designs become finalized and evening access to the structures is arranged with property owners and tenants.

Biologists searched the project site for San Francisco dusky-footed woodrats and their stick nest structures. Woodrats are commonly found in areas with a moderate to dense canopy and thick understory near riparian areas. They build nests/houses from sticks, either on the ground or in trees; some up to heights of 3-5 feet tall on the ground and approximately up to 30 feet up in tree canopies (K. Glinka, personal observation). They also utilize slash piles of woody debris and abandoned buildings or structures in which to forage, seek refuge, or construct nest/house structures (Sakai and Noon 1993). Typically, several dens are built close together in a colony. In riparian areas, highest densities of woodrats and their houses are often encountered in willow thickets with an oak overstory. They are most numerous where shrub cover is dense and least abundant in open areas. San Francisco dusky-footed woodrats breed from December through September, with a peak in mid-spring. An examination was made of the ground, understory vegetation, tree stand canopies, slash piles, and structures (when accessible) within the project area.

In addition, the site was examined to determine whether suitable burrowing and/or foraging habitat were available for the American badger. Badgers are most abundant in uncultivated open stages of most shrub, forest, and herbaceous habitats with friable soils. They may dig burrows or reuse old burrows for cover and/or to have their young. Badgers primarily forage on fossorial rodents, especially California ground squirrels (*Spermophilus beecheyi*) and Botta's pocket gophers (*Thomomys bottae*). They may also forage for reptiles, insects, earthworms, eggs, birds and carrion. Their diet shifts seasonally and yearly in response to availability of prey (Zeiner et al 1988-1990). Locations of active woodrat nest structures and/or badger evidence (i.e. burrows, tracks, scat, and prey remains) were noted on field maps and photographed.

WILDLIFE MOVEMENT

Functional habitat connectivity between natural areas is essential to sustaining healthy wildlife populations and for the continued dispersal of native plant and animal species. Open space near aquatic environments and watersheds in developed or urban areas often offer dispersal routes for wildlife (Hayden, 2002). Maintaining sufficient wildlife dispersal routes that link aquatic/wetland environments to riparian corridors allows wildlife to access foraging areas and water resources as well as contributing to the maintenance of species richness and diversity (Hayden 2002; Hilty et al 2006).

EcoSystems West biologists assessed the project site for wildlife movement. Distributions of wildlife species known or with potential to occur were reviewed. Evidence of movement (e.g., observations of wildlife, trails, tracks, scat, and prey remains) were recorded. The scope of this assessment did not include determining the frequency of wildlife passing through the site, or determining the width of open space needed to link and maintain sufficient wildlife dispersal between existing habitat features. Wildlife movement falls under state regulatory authority under provisions of the CEQA Guidelines.

RESULTS

Botany

Floristic Inventory and Habitat Characterization

We recorded a total of 113 species of naturalized vascular plants in the Atkinson Lane project area. Of these, 47 species are native, and 66 species are non-native. A complete species list is presented in Appendix D. The majority of vegetation in the project area consists of an assortment of weedy annual grasses and forbs with Coast live oak, eucalyptus, sycamore, acacia and willows dominating riparian areas along Corralitos Creek. Freshwater marsh and seasonal wetlands within the property include an assortment of hydrophytic plants typical of the supporting hydrologic regimes of these features.

We recognize seven predominant habitat and land use types occurring in the project area: wetland/aquatic, riparian woodland, California annual grassland, Himalayan blackberry scrub, agricultural lands, ruderal, and developed/landscaped areas. Wetlands and riparian woodland are considered native habitats in the sense that they are not primarily associated with heavy, ongoing or repeated human disturbance. California annual grassland habitat is typically comprised of an array of naturalized grasses and forbs of Eurasian origin. The remaining habitat and land use types are entirely the result of human disturbance.

WETLAND/AQUATIC

Wetlands and aquatic features are valued as wildlife habitat and for the ability to filter and absorb contaminants present in stormwater runoff. Wetland and aquatic habitat within the project area are described in detail below.

<u>Freshwater marsh</u>- The freshwater marsh plant community is most closely related to Holland's (1986) coastal and valley freshwater marsh description and also corresponds to a phase of the bulrush-cattail series of Sawyer Keeler-Wolf (1995) and the CDFG (2003). The marsh areas within the project area are contained within deep, depressional basins. The larger marsh complex located in the western portion of the property is fed by seasonal precipitation and surface runoff conveyed by an ephemeral drainage entering the basin from the north. The feature is enclosed by a six foot levee to the east. The smaller marsh is located in the northern portion of the site near the terminus of Atkinson lane. This feature is situated in a man-made irrigated agricultural basin used for irrigating agricultural crops on the property.

Freshwater marsh habitat is dominated by emergent wetland vegetation including California bulrush (*Scirpus californicus*) and narrow-leaved cattail (*Typha angustifolia*). The larger marsh also contains a dense cover of water smartweed (*Polygonum amphibium* var. *emersum*) and scattered to locally dense patches of arroyo willow (*Salix lasiolepis*).

<u>Seasonal wetland</u>- Seasonal wetlands are primarily characterized by shallow depressional topography and are supported by a combination of direct precipitation, surface runoff from adjacent uplands, and seasonal fluctuations in the water table. Seasonal wetlands are defined as naturally occurring wetlands that periodically lack indicators of hydrophytic vegetation, hydric soil, or wetland hydrology due to normal seasonal or annual variability. Within the project area,

seasonal wetlands are infrequently saturated or inundated during the rainy season and are dominated by curly dock (*Rumex crispus*), soft chess (*Bromus hordeaceus*), prickly ox-tongue (*Picris echioides*), water smartweed, and Italian ryegrass. This habitat type is not specifically described by Holland, Sawyer Keeler-Wolf or the CDFG.

Ephemeral drainage- An ephemeral drainage is located immediately north of the large freshwater marsh wetland complex in the western portion of the project area. This feature conveys surface runoff from Atkinson Lane and surrounding uplands into the marsh during periods of heavy rainfall. This drainage is entirely dry for the majority of the year and is dominated by an assortment of annual grasses and forbs including Italian ryegrass, prickly ox-tongue and prickly lettuce (*Lactuca serriola*). The lower extent is dominated by Himalayan blackberry (*Rubus discolor*) and a stand of mature Pacific willow trees (*Salix lasiandr*a ssp. *lasiandra*). This habitat type is not specifically described by Holland, Sawyer Keeler-Wolf or the CDFG.

Corralitos Creek- Within the project area, Corralitos Creek is an intermittent waterway with steep streambanks and a sandy alluvial bottom. Flowing or standing water is absent for the majority of the year allowing for the persistence of herbaceous vegetation along cobbly portions of the streambed. Mugwort (*Artemesia douglasiana*), periwinkle (*Vinca major*) and flatsedge (*Cyperus eragrostis*) predominate below the ordinary high water mark of the creek.

RIPARIAN WOODLAND

The riparian woodland is associated with Corralitos Creek and the freshwater marsh habitats located within the project area. Riparian habitat along Corralitos Creek corresponds to elements of the sycamore alluvial woodland type of Holland (1986), the mixed willow and Coast live oak series of Sawyer Keeler-Wolf (1995) and the arroyo willow riparian forests and woodlands alliance of CDFG (2000). Riparian woodland occurs on the intermediate to steep embankments of Corralitos Creek. Although flowing water was not observed in Corralitos Creek at the time of the site visit, it appears that a seasonal/intermittent hydrologic regime supports this riparian woodland complex. Additional riparian woodland is situated on the embankments of freshwater marsh habitat in the western portion of the project and along the irrigated agricultural basin near the terminus of Atkinson Lane.

The riparian woodland associated with Corralitos Creek is dominated by several species of willow including arroyo willow (*Salix lasiolepis*), red willow (*Salix laevigata*), and Pacific willow (*Salix lasiandra* ssp. *lasiandra*). While Pacific willow and red willow generally have a typical tree growth form, with a single trunk well above the base, arroyo willow is typically an arborescent (tree-sized) shrub, with multiple trunks from the base. Coast live oak (*Quercus agrifolia*), black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), sycamore (*Platanus racemosa*), and big leaf maple (*Acer macrophyllum*) are other commonly associated tree species. The native woody vine Pacific blackberry (*Rubus ursinus*) and the non-native Himalayan blackberry (*Rubus discolor*), largely dominates the understory, forming dense, often impenetrable tangles. The native sub-shrub mulefat (*Baccharis salicifolia*), and invasive species such as veldt grass (*Ehrharta erecta*), German ivy (*Delairea odorata*), and periwinkle are also relatively common.

Coast live oak and arroyo willow dominate the riparian woodland habitat associated with freshwater marsh features, including the irrigated agricultural basin, on the property. The understory in these areas is comprised of patchy Himalayan blackberry and an assortment of non-native grasses and forbs.

CALIFORNIA ANNUAL GRASSLAND

This habitat type corresponds to the California annual grassland series of Sawyer Keeler-Wolf (1995) and to a phase of the non-native grassland type described by Holland (1986). California annual grassland occurs on the flat to moderately sloped areas throughout a significant percentage of undeveloped portions of the project site. Due to isolation from nearby coastal prairie habitat, as well as close proximity to urban development and annual spring tilling, grassland habitat within the site is highly disturbed and comprised primarily of weedy, non-native species.

Within the Atkinson Lane project area, California annual grassland is dominated by brome grasses (*Bromus diandrus*, *B. hordeaceus*), wild oats (*Avena* spp.), foxtail barley (*Hordeum murinum*), Italian ryegrass, filaree (*Erodium botrys*), wild radish (*Raphanus sativus*), black mustard (*Brassica nigra*), English plantain (*Plantago lanceolata*), and rough cat's ear (*Hypochaeris radicata*). The native annual herb, Santa Cruz tarplant (*Holocarpha macradenia*), a state Endangered and federally Threatened species, also occurs in the western half of the property. In general, a large percentage of plant species identified within this habitat type are listed as invasive weeds with "moderate to high ecological impacts" by the California Invasive Plant Council (Cal-IPC 2007).

BLACKBERRY SCRUB

Dense, impenetrable thickets of Himalayan blackberry are located along the levees and embankments surrounding the large freshwater marsh complex in the western portion of the project area. No other species are associated with this habitat type. This habitat type is not specifically described by Holland, Sawyer Keeler-Wolf or the CDFG.

AGRICULTURAL LANDS

Much of the land in the eastern half of the project area is presently used to grow strawberries and apples. The majority of these agricultural fields and orchards have been actively cultivated for many decades. Present management includes the seasonal application of herbicides and tilling with heavy machinery. As a result, these areas have marginal habitat value and do not support naturalized vegetation or sensitive plant communities.

RUDERAL

Ruderal areas are not described by Sawyer Keeler-Wolf, Holland or the CDFG. Ruderal habitat consists of highly disturbed, weedy areas immediately adjacent to existing urban and agricultural infrastructure or along dirt access roads throughout the property. Ruderal vegetation is comprised of aggressive, early-successional species such as bull mallow (*Malva nicaensis*), pineapple weed (*Chamomilla suaveolens*), wild radish, black mustard, and filaree.

DEVELOPED/LANDSCAPED

Developed and landscaped areas are comprised of urban and light-industrial infrastructure including residential housing, agricultural facilities and paved roads as well as actively landscaped areas associated with these features. Within the project area, several developed areas occur along the western and northeastern perimeters of the property boundary. Additionally, the eastern terminus of Atkinson Lane, a paved residential road, is also located within the project area boundary.

Sensitive Habitats

SIGNIFICANT TREES

Within the Atkinson Lane project area, an undetermined number of significant trees are scheduled for removal as a result of the proposed project. The majority of these trees include mature Coast live oaks surrounding the irrigated agricultural basin near the northwest corner of the project site. Currently, due to the perennial nature of the marsh, these trees function as riparian habitat and would be subject to protection under the County Significant Tree ordinance.

RIPARIAN HABITAT

The riparian woodland habitat within the Atkinson Lane project area is recognized as a "high priority" habitat type by CNDDB (CDFG 2003).

The riparian woodland along Corralitos Creek is supported by an intermittent flow regime. The present vegetation structure along the stream corridor is indicative of a historic hydrologic regime prior to heavy water usage associated with adjacent agriculture. The riparian corridor along Corralitos Creek will not be directly impacted by the proposed development. However, a permeable pedestrian walkway, wildlife viewing benches, and vegetated drainage swales are proposed for inclusion within the 50-foot buffer adjacent to the dripline of the riparian canopy.

Additional riparian vegetation occurs on the embankments of the irrigated agricultural basin in the northwest corner of the site near the terminus of Atkinson Lane. The overstory is comprised entirely of Coast live oak. The understory is lacking in riparian specific species although Himalayan blackberry and other ruderal weedy species are present in locally dense patches. This riparian feature is planned for removal by the proposed project.

POTENTIAL WETLANDS AND "OTHER WATERS" OF THE UNITED STATES

The freshwater marsh/seasonal wetland complex and ephemeral drainage, located in the western half of the planning area, and the irrigated agricultural basin, located in the northwestern corner of the planning area, are wetland features that meet ACOE parameters, based on the Wetland Delineation for Atkinson Lane (EcoSystems West 2009). Through analysis of drainage patterns, an RBF Consulting hydrologist proposed that these wetland features are likely isolated from navigable waters, and may therefore be exempt from 404 jurisdiction (RBF Consulting 2008). These features would be considered waters of the State of California, subject to the regulation by the State Water Resource Control Board (SWRCB) and the Wetlands Resources Policy of the California Department of Fish and Game (CDFG) and the Fish and Game Commission.

Corralitos Creek, an intermittent waterway with a clearly defined bed and ordinary high water mark, is classified as "other waters" of the U.S. and is mapped as a blue line stream on the USGS Watsonville West 7.5 minute quadrangle map. This feature would be subject to 404 jurisdiction.

WATERS OF THE STATE OF CALIFORNIA

An irrigated agricultural basin in the northwest corner of the property is likely exempt from Section 404 jurisdiction due to both the *SWANCC* and *Rapanos* Supreme Court decisions. While this feature has characteristics of freshwater marsh, it does not appear to have a hydrological connection to navigable "Waters of the U.S.", one of its tributaries, or an adjacent jurisdictional wetland. A hydrological connection was determined to be absent if (1) the wetland was located too far from another jurisdictional feature, and/or (2) the wetland did not have a discernable surface water connection that would allow surface water to be transported from the wetland directly into a jurisdictional feature. Moreover, this wetland feature is actively flooded via mechanical pumps and retained water is used for irrigating agricultural crops throughout the property. Although situated in a deep basin, it is unlikely that this feature would continue to maintain characteristics of freshwater marsh if irrigation was removed. This feature is scheduled for removal by the proposed project.

Located in the western half of the planning area, a large freshwater marsh located situated in a deep basin receives surface runoff from an ephemeral drainage and surrounding uplands. According to RBF 2008, the marsh is likely exempt from Section 404 jurisdiction as it does not appear to have a hydrological connection to navigable "Waters of the U.S." The marsh is separated from a seasonal wetland to the north by a levee approximately ten feet wide by 350 feet in length and is dominated by cattail, California bulrush, water smartweed, and arroyo willow.

Two seasonal wetlands are located within the planning area. The larger seasonal wetland is located immediately northeast of the levee abutting the potential freshwater marsh. The wetland is deepest in the southwest corner where it meets the levee. It contained several inches of standing water at the time of the delineation site visit and is dominated entirely by swamp smartweed. From here it gradates into shallower topography with plant species more typical of seasonal wetlands of the region. Dominant plants throughout this portion of the wetland include curly dock, Italian ryegrass, and prickly ox tongue. Several mature arroyo willows are also found along the northwest boundary of the wetland; however several of these willows have since been removed by annual discing activities. A smaller seasonal wetland is located immediately west of an ephemeral drainage and north of the freshwater marsh. This marginal wetland feature appears to be only periodically saturated during the rainy season and is comprised of a mix of hydrophytic and upland plants typical of seasonal wetlands including Italian ryegrass, curly dock, soft chess and spreading rush (*Juncus patens*). Through an analysis of drainage patterns by an RBF Consulting hydrologist (RBF 2008), these seasonal wetlands were proposed to be isolated from navigable waters of the U.S.

A linear ephemeral drainage is located in the northwestern corner of the planning area and appears to convey surface water from residential development to the north into the freshwater marsh following storm events. Because the swale is almost entirely vegetated and lacks a clearly defined bed, bank or OHW mark, it is best classified as a wetland rather than waters of the U.S. The uppermost portion of the feature is dominated by Himalayan blackberry, tall flatsedge, Italian ryegrass and curly dock while the lower half is comprised of an overstory of Pacific willow and a dense understory of blackberry and water smartweed. Soils were saturated during the assessment site visit but flowing or standing water was not observed in the drainage/swale at this time. This feature is directly connected to the large freshwater marsh. RBF Consulting (2008) suggests that these features lack a hydrologic connection with navigable waters of the U.S. and therefore may not be subject to Section 404 jurisdiction.

Special-Status Plant Species

One population of Santa Cruz tarplant (*Holocarpha macradenia*) was located in the PG&E easement in the westernmost portion of the Atkinson Lane project area. Santa Cruz tarplant is a small to medium-sized, annual herb in the sunflower family (Asteraceae). It is glandular, aromatic, and more or less sticky to the touch, and produces solitary or clustered flower heads with short but prominent yellow ray flowers. This species is federally listed as Threatened (USFWS 2000) and State-listed as Endangered (CDFG 2008a). It is also listed on List 1B of the CNPS *Inventory* (Tibor 2001; CNPS 2008).This population was initially observed by Brian Mori, a local biologist, approximately 15 years ago but was never reported to the CNDDB. This population, comprised of 59 individuals (per the 2008 survey), is located on flat terrace of California annual grassland. The majority of the plants observed are robust with several to many branching stems. The largest individuals were several decimeters in height and had more than 20 flowering buds.

Although the soils are mapped as Watsonville loam, the artificially flattened terrace contains coarse gravelly aggregate several inches below the ground surface. Furthermore, burnt vegetation observed in the area indicates that a short duration, low intensity fire occurred in the area within the past 18 months. Santa Cruz tarplant is often found in disturbed grassland and coastal prairie habitat with a high percent cover of non-native species (Bainbridge 2003). Disturbance such as grazing, mowing, scraping and burning has been shown to reduce the distribution and cover of species that compete with Santa Cruz tarplant for resources (Holl and Hayes 2006, Hayes 1998). However, annual deep tilling on the remainder of annual grassland habitat within the Atkinson Lane property is likely too disruptive to facilitate the germination and persistence of Santa Cruz tarplant. Despite tilling activities, is possible for a viable seedbank to have persisted in these areas, and a diminished disturbance regime could lead to the reemergence of a dormant Santa tarplant population (Bainbridge 2003)

The existing Santa Cruz tarplant population will not be impacted by the proposed development as it is located entirely within a PG&E easement. However, active management such as mowing and/or short duration grazing could help to maintain the long-term viability of the population and offset impacts to potential tarplant habitat elsewhere in the project area.

Wildlife

Amphibians and Reptiles

Of the amphibian and reptile species listed in Table 1, the CRLF is considered 'Possible' for occurrence on the project site, while the WPT was observed to be 'Present'. No other special-status amphibian species are expected to occur, as discussed below.

AMPHIBIANS

Upon review of B. Mori's habitat assessment for the SCLTS, CTS, and CRLF (Appendix B), because of the presence of suitable aquatic habitat within the project area and known CRLF localities within dispersal distance of the project area, the USFWS recommended that federal protocol-level surveys be conducted for the CRLF (Appendix C). The federal CRLF protocol specifies a set of eight field surveys be conducted between February and September in order to examine the site during the CRLF breeding, non-breeding, and dispersal seasons (USFWS 2005b). We anticipate these surveys will be conducted in 2009.

The USFWS concluded the SCLTS and CTS are not likely to occur within the project site and that protocol-level surveys for these species are not necessary (USFWS 2008e). These species are not expected to occur within the project site due to surrounding urban and agricultural barriers, distance from known populations of SCLTS and CTS, and regular discing practices on potential upland habitat (Mori 2008).

WESTERN POND TURTLE

EcoSystems West and B. Mori made direct observations of WPT basking on floating debris within the freshwater marsh/seasonal wetland in the planning area during recent site visits (K. Glinka, personal observation 2007; B. Mori 2008). Anecdotal evidence documents the occurrence of WPT in this wetland feature since 1993 (B. Mori, personal communication, 2008). In 1996, an individual sub-adult WPT was documented near the intersection of Crestview Drive and Brewington Avenue approximately 1500 feet southeast of the wetland (CNDDB 2008). A WPT was observed in the wetland again in 1997 (CNDDB 2008). The WPT is also known to occur approximately 1.2 miles southwest in Struve Slough, and 1.4 miles north in Pinto Lake (CNDDB 2008; Mori 2008). Western pond turtles are known to inhabit the Pajaro River system (CNDDB 2008), of which Corralitos Creek is a tributary. These locations are within dispersal distance of WPT in the planning area.

The WPT is highly associated with freshwater aquatic environments, but also requires upland habitat for portions of its life cycle as well as dispersal routes to other aquatic habitats. Female WPT have been documented laying their eggs in upland habitat from a minimum distance of 165 feet to a maximum of 1300 feet from their associated aquatic habitats (Holland 1994; Rathbun et al 1992). Male WPT have been documented nearly three miles from their associated aquatic habitat (B. Stafford, personal communication 2008). The freshwater marsh/seasonal wetland provides suitable aquatic habitat for WPT. As the wetland dries up, the nearby blackberry thickets and annual grasslands on the site provide potential upland nesting/aestivation[1] habitat;

[1] State of dormancy

however, discing practices in the cultivated areas may preclude successful reproduction (Mori 2008). In addition, the planning area provides potential dispersal habitat between the occupied wetland feature and Corralitos Creek and the Pajaro River system. The irrigated agricultural basin offers potential nesting/aestivation habitat, refuge/cover, and temporary foraging habitat between these larger aquatic features.

WPT are capable of moving long distances between aquatic environments and/or upland habitat to mate, nest or aestivate (Rathbun et al. 1992). B. Mori (2008) states that there is uncertainty regarding the status of the WPT population in the planning area and whether the site is utilized seasonally or year-round. The WPT population has persisted in the wetland feature within the planning area since 1993 (B. Mori, personal observation, 2008) and has been documented a distance of 1500 feet from this feature (CNDDB 2008). This implies that the WPT move from the occupied aquatic feature, disperse across/utilize other potential habitat on the site and in the vicinity of the site, and return to the wetland. According to the B. Mori's Site Assessment (Appendix B), it is reasonable to assume that Corralitos Creek/Salsipuedes Creek may serve as a dispersal/migration corridor for WPT since they are known to inhabit the Pajaro River system (CNDDB 2008) and are capable of moving over long distances (Rathbun et al 1992).

It is unknown which portions of the planning area WPT utilize for nesting, aestivating, and/or dispersing; however minimum habitat requirements for WPT include aquatic, nesting/aestivation, and dispersal habitat to prevent loss of viability or extirpation of the population.

Raptors and Birds

We observed a total of 10 potential stick-nest structures within the project area among the willow stand adjacent to the large seasonal wetland feature, within the stand of oaks surrounding the irrigated agricultural basin, and within the riparian woodland forest along Corralitos Creek. At the time of our site visits, we did not observe any special-status raptors or active nests within the project area (Table 1). Of the special status raptors and birds listed in Table 1, we determined the project site provides potential habitat for wintering Ferruginous hawks, and nesting white tailed kites and yellow warblers. The remaining raptor/bird species are not expected to nest on site due to regular discing activities and agricultural cultivation practices on open landscapes within the project site. These practices preclude successful reproduction of ground nesting raptors and birds and likely restrict ground squirrels from utilizing the site. Species such as the western burrowing owl are further limited from occupying the site because of the lack of ground squirrel burrows or other burrow features and limited prey base. While many of the bird species listed in Table 1 are not expected to nest within the project site, they may forage or occur as seasonal migrants. We heard an individual red-shouldered hawk calling within the vicinity of the project site during our spring site visit, observed a pair of red-tailed hawks in the late summer, and an individual during our fall season visits.

The tree stands adjacent to the seasonal wetland, the irrigated agricultural basin, and along Corralitos Creek provide potential habitat for more common species such as the red-shouldered hawk, red-tailed hawk, great horned owl, and many other passerine birds that are not considered special-status species. The federal Migratory Bird Treaty Act (MBTA) and California Fish and

Game Codes (CFGC) prohibit the destruction or possession of individual birds, birds of prey, eggs or active nests without federal and/or State authorization.

Mammals

Of the seven special status mammal species listed in Table 1, occurrences of four of the bat species and the San Francisco dusky-footed woodrat are considered 'Possible' within the project site. No other special-status mammal species are expected to occur, as discussed below.

BATS

We determined that the site provides potential roosting habitat for four of the five bat species listed in Table 1. The Townsend's big-eared bat is not expected to roost within the project site due to the lack of 'cave-like' features among the landscape and buildings, but may forage over or migrate through the site. Potential roosting habitat is available for the remaining four special status bat species in Table 1. The project site is also within the range of more common bat species found in California. These species include but are not limited to the big brown bat (*Eptesicus fuscus*), California myotis (*Myotis californicus*), and hoary bat (*Lasiurus cinerueus*). All of the bats in Table 1 and other more common bat species may forage in or migrate through the project area. Our limited access to many of the structures on site and lack of survey data prohibits us from making an accurate determination as to whether or not bats roost within the project site.

The California Fish and Game Codes (CFGC) protect non-listed bat species and their roosting habitat, including individual roosts and maternity colonies. These include CFGC Section 86; 2000; 2014; 3007; 4150, along with several sections under Title 14 of California Code of Regulations (CFGC 2006).

SAN FRANCISCO DUSKY-FOOTED WOODRAT AND AMERICAN BADGER

During our assessment of the project area, we did not observe any active San Francisco dusky woodrat nest/house structures. Marginal potential habitat is available among the willow riparian and tree stands near the large wetland feature, agricultural pond, and along Corralitos Creek. The project site is within the range of the species and potential habitat occurs within the project site.

The American badger is known to occur within 3 miles west of the project site (CNDDB 2008). We did not observe any individual badgers or their evidence (i.e. tracks, scat, prey remains) within the project site. Regular discing activities and cultivation of surrounding agricultural fields diminish habitat suitability for the badger. In addition, we made no observations of California ground squirrels, an important prey base for badgers. The American badger is not expected to occur within the project site due to the lack of suitable habitat.

Wildlife Movement

EcoSystems West observed individual wildlife, and/or their trails, tracks, and scat including raccoon (*Procyon lotor*), and brush rabbit (*Sylvilagus bachmani*), and striped skunk (*Mephitis mephitis*), within grassland and ruderal areas of the project site. Numerous migratory bird species were observed foraging, and/or migrating through the area, utilizing the scrub and tree canopies adjacent to the wetland feature, irrigated agricultural basin, ephemeral drainage, and along Corralitos Creek for cover, and flying back and forth in flocks between these habitat features. Minimal evidence of wildlife movement was observed on the developed and cultivated areas of the property.

The western pond turtle is known to occupy the wetland feature on the project site and requires upland habitat for a portion of its life cycle as well as dispersal routes to other aquatic habitats (Semlitsch and Bodie 2003). In addition to the wetland feature where WPT have been observed, the ephemeral drainage, agricultural pond, Corralitos Creek and associated willow riparian, blackberry scrub, riparian woodland, grassland, and ruderal habitats provide potential habitat for foraging, nesting, overwintering, and refuge/cover. According to Mori (2008), it is reasonable to assume that Corralitos Creek/Salsipuedes Creek serves as a dispersal/migration corridor for WPT since they are known to inhabit the Pajaro River system and are capable of moving over long distances. Though the WPT may spend much of its life within the wetland, retaining connectivity to Corralitos Creek/Salsipuedes Creek and the upland habitat between them is important to maintaining the viability of the population.

The scope of this assessment did not include determining the frequency of wildlife passing through the site, or determining the width of open space needed to link and maintain sufficient wildlife dispersal between existing habitat features; however, our direct observations of resident wildlife utilizing the space to access resources provides evidence that the property is part of a broad area linking wildlife to the upper and lower regions of Corralitos/Salsipuedes Creek and to the Pajaro River watershed.

Incidental Wildlife Species Observations

The majority of the proposed project site is comprised of cultivated and ruderal habitat types, and the site is surrounded by urban areas; however, the freshwater marsh, seasonal wetland, ephemeral drainage, Corralitos Creek, blackberry scrub, and riparian woodland habitat types provide habitat for a diverse assemblage of wildlife species. EcoSystems West biologists made the following incidental observations of wildlife species within the project area (Table 2).

Table 2. Incidental wildlife species observations.

Amphibians and Reptiles	
Pacific tree frog (*Hyla* [=*Psuedacris*] *regilla*)	Western fence lizard (*Sceloporus occidentalis*
Bullfrog (*Rana catesbeiana)*	
Birds	
Great blue heron *(Ardeo herodias)*	American crow (*Corvus brachyrhynchos)*
Canada Goose (*Branta Canadensis)*	Chestnut-backed chickadee (*Poecile rufescens)*
Mallard (*Anas platyrhynchos)*	Bushtit (*Psaltriparus minimus*)
Turkey vulture (*Cathartes aura*)	American robin (*Turdus migratorius*)
Red shouldered hawk (*Buteo lineatus)*	Townsend's warbler (*Dendroica townsendii*)

Red-tailed hawk (*Buteo jamaicensis)*	Wilson's warbler (*Wilsonia pusilla*)
Virginia rail (*Rallus limicola*)	California towhee (*Pipilo crissalis*)
Anna's hummingbird (*Calypte anna*)	Song sparrow (*Melospiza melodia*)
Downy woodpecker (*Picoides pubescens*)	Red-winged blackbird (*Agelaius phoeniceus*)
Black phoebe (*Sayornis nigricans*)	Meadow lark (*Sturnella neglecta*)
Say's phoebe (*Sayonrnis saya*)	House finch (*Carpodacus mexicanus*)
Western scrub jay (*Aphelocoma californica*)	House sparrow (*Passer domesticus*)
Mammals	
Botta's pocket gopher *(Thomomys bottae*)**.**	Striped skunk (*Mephitis mephitis*),
Brush rabbit (*Sylvilagus bachmani*)	Eastern fox squirrel (*Sciurus niger*).
Raccoon (*Procyon lotor*)	

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APPENDIX A. SPECIAL-STATUS PLANTS WITH POTENTIAL TO OCCUR

Appendix A. Status, distribution and habitat of special-status plants with potential to occur in the vicinity of the proposed Atkinson Lane Project Area in Aptos, Santa Cruz County, California.

Species **Common Name**[1]	USFWS Listing[2]	State Status[3]	CNPS Status[4]	Habitat Type[5]	Distribution by County[6]	Flowering Period[7]	Potential for Occurrence
Amsinckia lunaris bent-flowered fiddleneck	None	None	List 1B.2	Cismontane woodland, valley and foothill grassland, coastal bluff scrub	ALA, CCA, COL, LAK, MRN, NAP, SBT, SCL, SCR, SHA?, SIS?, SMT, SON, YOL	March-June	**LOW.** Poor quality grassland habitat within the project area. Nearest known occurrence in Scotts Valley.
Arabis blepharophylla bent-flowered fiddleneck	None	None	List 4.3	Broadleaved upland forest, lower montane coniferous forest, North Coast coniferous forest; damp rock and soil on outcrops, usually on roadcuts	CCA, MRN, SCR, SFO, SMT, SON	February-May	**NONE.** Suitable habitat not present within the project area.
Arctostaphylos andersonii Santa Cruz manzanita	None	None	List 1B.2	Chaparral; openings in and edges of broadleaved upland forest and north coast coniferous forest	SCL, SCR, SMT	November-April	**NONE.** Suitable habitat not present within the project area.
Arctostaphylos hookeri ssp. *hookeri* Hooker's manzanita	None	None	List 1B.2	Closed-cone coniferous forest, chaparral, cismontane woodland, coastal scrub	MNT, SCR	January-June	**NONE.** Suitable habitat not present within the project area.
Arctostaphylos pajaroensis Pajaro manzanita	None	None	List 1B.1	chaparral; sandy soil	MNT, SBT, SCR*	December-March	**NONE.** Suitable habitat not present within the project area.
Arctostaphylos regismontana Kings Mountain manzanita	None	None	List 1B.2	Broadleaved upland forest, chaparral, North Coast coniferous forest; granitic or sandstone	SCL, SCR?, SMT	January-April	**NONE.** Suitable habitat not present within the project area.
Arctostaphylos silvicola Bonny Doon manzanita	None	None	List 1B.2	Inland marine sands in chaparral, closed-cone coniferous forest, sand parkland, sandhill ponderosa pine forest	SCR	February-March	**NONE.** Suitable habitat not present within the project area.
Calandrinia breweri Brewer's calandrinia	None	None	List 4.2	Chaparral, coastal scrub; sandy or loamy, disturbed sites and burns	CCA, LAX, MEN, MNT, MPA, MRN, NAP, SBA, SBD, SCL, SCR, SCZ, SDG, SLO, SMT, SON, VEN, BA	March-June	**NONE.** Suitable habitat not present within the project area.

Appendix A. (continued)

Species **Common Name**[1]	USFWS Listing[2]	State Status[3]	CNPS Status[4]	Habitat Type[5]	Distribution by County[6]	Flowering Period[7]	Potential for Occurrence
Calochortus umbellata Oakland mariposa lily	None	None	List 4.2	Broadleaved upland forest, chaparral, cismontane woodland, lower montane coniferous forest, valley and foothill grassland; often serpentinite.	ALA, CCA, MRN, SCL, SCR*, SMT	March-May	**NONE.** Presumed extirpated from Santa Cruz County. Almost always associated with serpentinite.
Calyptridium parryi var. *hesseae* Santa Cruz Mtns. pussypaws	None	None	List 1B.1	Chaparral, cismontane woodland; sandy or gravelly openings	MNT, SBT, SCL, SCR*	May-July	**NONE.** Suitable habitat not present within the project area.
Carex comosa bristly sedge	None	None	List 2.1	Marshes and swamps, lake margins, coastal prairie, valley and foothill grassland	CCA, LAK, MEN, SAC, SBD*, SCR*, SFO*, SHA, SJQ, SON, Idaho, Oregon, Washington, other states	May-September	**LOW**. Suitable freshwater marsh habitat present within the project area However, presumed extirpated from Santa Cruz County.
Carex saliniformis deceiving sedge	None	None	List 1B.2	Coastal prairie, coastal scrub, meadows, coastal salt marshes	HUM, MEN, SCR*, SON	June-July	**NONE.** Perennial saline wetland habitat not present within the project area.
Castilleja latifolia Monterey paintbrush	None	None	List 4.3	Closed cone coniferous forest, cismontane woodland (openings), coastal dunes, coastal scrub; sandy soils	MNT, SCR	February-September	**NONE.** Suitable habitat not present within the project area.
Ceanothus cuneatus var. *rigidus* Monterey ceanothus	None	None	List 4.2	Closed cone coniferous forest, chaparral, coastal scrub; sandy soils	MNT, SLO, SCR*	April-June	**NONE.** Suitable habitat not present within the project area.
Ceanothus ferrisiae Coyote ceanothus	Endangered	None	List 1B.1	Chaparral, coastal scrub, valley and foothill grassland; serpentinite	SCL	January-March	**NONE.** Serpentinite soils not present within project area. Not known from Santa Cruz County.
Centromadia parryi ssp. *congdonii* Congdon's tarplant	None	None	List 1B.2	Valley and foothill grassland; alkaline soils	ALA, CCA, MNT, SCL(*?), SCR*, SLO, SOL*	May-November	**NONE.** Alkaline soils not present within the project area.
Chorizanthe pungens var. *hartwegiana* Ben Lomond spineflower	Endangered	None	List 1B.1	Inland marine sands in chaparral, closed-cone coniferous forest, sand parkland, sandhill ponderosa pine forest	SCR	April-July	**NONE.** Suitable habitat not present within the project area.

Appendix A. (continued)

Species **Common Name**[1]	USFWS Listing[2]	State Status[3]	CNPS Status[4]	Habitat Type[5]	Distribution by County[6]	Flowering Period[7]	Potential for Occurrence
Chorizanthe pungens var. *pungens* Monterey spineflower	Threatened	None	List 1B.2	Maritime chaparral, cismontane woodland coastal dunes, coastal scrub, valley and foothill grassland; sandy soils	MNT, SCR	April-June	**LOW.** Disturbed grassland with sandy loam soils unlikely to provide suitable habitat for this species.
Chorizanthe robusta var. *hartwegii* Scotts Valley spineflower	Endangered	None	List 1B.1	Meadows, grasslands in sandstone or mudstone	SCR	April-July	**NONE.** Suitable sandstone or mudstone habitat not present within the project area.
Chorizanthe robusta var. *robusta* robust spineflower	Endangered	None	List 1B.1	Coastal dunes, coastal scrub, openings in cismontane woodland, in sandy or gravelly soil	ALA*, MNT, MRN, SCL*, SCR, SFO, SMT*	April-September	**NONE.** Suitable habitat not present within the project area.
Clarkia concina ssp. *automixa* Santa Clara red ribbons	None	None	List 4.3	Cismontane woodland	ALA, SCL	April-July	**NONE.** Suitable habitat not present within the project area.
Cordylanthus rigidus ssp. *litoralis* seaside bird's beak	None	Endangered	List 1B.1	Closed cone coniferous forest, maritime chaparral, cismontane woodland, coastal dunes, coastal scrub; sandy often disturbed sites	MNT, SBA	May-September	**NONE.** Suitable habitat not present within the project area.
Cyperidium fasciculatum clustered lady's slippers	None	None	List 4.2	Lower montane coniferous forest, North Coast coniferous forest; usually serpentinite seeps and streambanks	BUT, DNT, HUM, NEV, PLU, SCL, SCR*, SHA, SIE, SIS, SMT, TEH, TRI, YUB, ID, OR, UT, WA+	March-July	**NONE.** Suitable coniferous forest and serpentine streambank habitat not present within the project area.
Cyperidium montanum mountain lady's slipper	None	None	List 4.2	Broadleaved upland forest, cismontane woodland, lower montane coniferous forest, North Coast coniferous forest	DNT, HUM, MAD, MEN, MOD, MPA, PLU, SIE, SIS, SMT, SON, TEH, TRI, TUO, OR, WA++	March-July	**NONE.** Suitable habitat not present within the project area.
Dudleya setchellii Santa Clara Valley dudleya	Endangered	None	List 1B.1	Cismontane woodland, valley and foothill grassland; serpentinite, rocky	SCL	April-October	**NONE.** Suitable serpentine outcrops not present within the project area. Not known from Santa Cruz County.
Elymus californicus California bottle-brush grass	None	None	List 4.3	Broadleaved upland forest, cismontane woodland, North Coast coniferous forest, riparian woodland	MNT, MRN, SCR, SMT, SON	July-September	**LOW.** Very limited potential for occurrence within low quality broadleaved upland forest habitat within the project area.

Appendix A. (continued)

Species **Common Name**[1]	USFWS Listing[2]	State Status[3]	CNPS Status[4]	Habitat Type[5]	Distribution by County[6]	Flowering Period[7]	Potential for Occurrence
Ericameria fasciculata Eastwood's goldenbush	None	None	List 1B.1	Closed-cone coniferous forest, chaparral, coastal dunes, coastal scrub; sandy openings	MNT	July-October	**NONE.** Suitable habitat not present within the project area.
Erysimum ammophilum sand-loving wallflower	None	None	List 1B.2	Chaparral, coastal dunes, coastal scrub; sandy openings	SCR	March-July	**NONE.** Suitable habitat not present within the project area.
Erysimum fransicanum San Francisco wallflower	None	None	List 4.2	Chaparral, coastal dunes, coastal scrub, valley and foothill grassland; often serpentinite or granitic substrates, roadcuts	MRN, SCL, SCR, SFO, SMT, SON	March-June	**NONE.** Granitic or serpentine soils not present within the project area. Nearest know occurrence north of the Santa Cruz city limits.
Erysimum teretifolium Santa Cruz wallflower	Endangered	Endangered	List 1B.1	Inland marine sands in chaparral, closed-cone coniferous forest, sand parkland, sandhill ponderosa pine forest	SCR	March-July	**NONE.** Suitable habitat not present within the project area.
Fritillaria agrestis stinkbells	None	None	List 4.2	Chaparral, cismontane woodland, pinyon and juniper woodland, valley and foothill grassland; clay or serpentinite.	ALA, CCA, FRE, KRN, MEN, MNT, MPA, PLA, SAC, SBT, SCR*, SMT*, STA, TUO, VEN, YUB	March-April	**NONE.** Poor quality grassland habitat within the project area does not contain clayey or serpentine soils.
Fritillaria liliaceae fragrant fritillary	None	None	List 1B.2	Cismontane woodland, coastal prairie, coastal scrub, valley and foothill grassland; often serpentinite	ALA, CCA, MNT, MRN, SBT, SCL, SFO, SMT, SOL, SON	February-April	**NONE.** Serpentine soils not present within the project area. Not known from Santa Cruz County.
Gilia tenuiflora ssp. *arenaria* sand gilia	Endangered	Threatened	List 1B.2	Chaparral, cismontane woodland, coastal dunes, coastal scrub, valley and foothill grassland; sandy openings	MNT	April-June	**NONE.** Not known from Santa Cruz County, sandy openings not present within the project area.
Grindelia hirsutula var. *maritima* San Francisco gumplant	None	None	List 1B.2	Coastal bluff scrub, coastal scrub, valley and foothill grassland; sandy or serpentinite soils	MNT, MRN, SCR, SFO, SLO, SMT	June-September	**NONE.** Not known from Santa Cruz County, true sand and serpentine soils not present within the project area.
Hoita strobilina Loma Prieta hoita	None	None	List 1B.1	Moist sites in chaparral, cismontane woodland, riparian woodland, often serpentinite	ALA*, CCA*, SCL, SCR	May-July (August-October)	**LOW.** Suitable riparian habitat present within the project area. However, *H. stroblina* is typically restricted to serpentine soils.

Appendix A. (continued)

Species **Common Name**[1]	USFWS Listing[2]	State Status[3]	CNPS Status[4]	Habitat Type[5]	Distribution by County[6]	Flowering Period[7]	Potential for Occurrence
Holocarpha macradenia Santa Cruz tarplant	Threatened	Endangered	List 1B.1	Coastal prairie, valley and foothill grassland, coastal scrub, often in clay or sandy soils	ALA*, CCA*, MNT, MRN*, SCR, SON*	June-October	**PRESENT.** Found in poor quality annual grassland habitat in westernmost portion of the property. Not observed in heavily tilled grassland throughout the remainder of the site.
Horkelia cuneata ssp. *sericea* Kellogg's horkelia	None	None	List 1B.1	Openings in closed-cone coniferous forest, maritime chaparral, coastal scrub, coastal prairie, in sandy or gravelly soil	ALA*, MRN*, MNT, SBA, SCR, SFO*, SLO, SMT	April-September	**NONE.** Suitable habitat not present within the project area.
Horkelia marinensis Point Reyes horkelia	None	None	List 1B.2	Coastal dunes, coastal prairie, coastal scrub, in sandy soil	MEN, MRN, SCR, SMT, SON	May-September	**NONE.** Suitable habitat not present within the project area.
Leptosiphon ambiguous serpentine leptosiphon	None	None	List 4.2	Cismontane woodland, coastal scrub, valley and foothill grassland; serpentinite	ALA, CCA, MER, SBT, SCL, SCR, SJQ, SMT, STA	March-June	**NONE.** Serpentine soils not present within the project area.
Leptosiphon grandiflorus large-flowered leptosiphon	None	None	List 4.2	Coastal bluff scrub, closed cone coniferous forest, cismontane woodland, coastal dunes, coastal prairie, coastal scrub, valley and foothill grassland; usually sandy	ALA, KRN, MAD, MER, MNT, MRN, SBA*, SCL, SCR*, SFO, SLO, SMT, SON	April-August	**LOW.** Poor quality grassland habitat exists within the project area; however, no recent extant occurrences known from Santa Cruz County.
Lessingia micradenia var. *glabrata* smooth lessingia	None	None	List 1B.2	Chaparral, cismontane woodland, valley and foothill grassland, roadsides, usually in serpentine soils	SCL	July-November	**NONE.** Not known from Santa Cruz County. Serpentine soils not present within the project area.
Lilium rubescens redwood lily	None	None	List 4.2	Broadleaved upland forest, lower montane coniferous forest, North Coast coniferous forest, upper montane coniferous forest; sometimes serpentinite and/or roadsides	DNT, HUM, LAK, MEN, NAP, SCR*, SHA, SIS	June-July	**NONE.** Suitable habitat not present within the project area.

Appendix A. (continued)

Species **Common Name**[1]	USFWS Listing[2]	State Status[3]	CNPS Status[4]	Habitat Type[5]	Distribution by County[6]	Flowering Period[7]	Potential for Occurrence
Lomatium parvifolium small-leaved lomatium	None	None	List 4.2	Closed cone coniferous forest, chaparral, coastal scrub, riparian woodland; serpentinite soils	MNT, SCR, SLO	February-June	**NONE.** Serpentine soils not present within the project area.
Lotus formosissimus harlequin lotus	None	None	List 4.2	Moist to wet places, broadleaved upland forest, coastal scrub, coastal bluff scrub, closed-cone coniferous forest, cismontane woodland, coastal prairie, meadows and seeps, marshes, north coast coniferous forest, valley and foothill grassland	DNT, HUM, MEN, MNT, MRN, SBT, SCR, SFO, SLO, SMT, SON, Oregon, Washington	March-July	**MODERATE.** May occur along margins of freshwater marsh and seasonal wetland habitat within the project area.
Malacothamnus arcuatus arcuate bush mallow	None	None	List 1B.2	Chaparral, cismontane woodland	SCL, SCR, SMT	April-September	**NONE.** Suitable habitat not present within the project area.
Malacothamus hallii Hall's bush mallow	None	None	List 1B.	Chaparral, coastal scrub	CCA, MEN, MER, SCL, SMT, STA	May-September	**NONE.** Suitable habitat not present within the project area.
Micropus amphibolus Mt. Diablo cottonweed	None	None	List 3.2	Rocky areas in broadleaved upland forest, chaparral, cismontane woodland, valley and foothill grassland, coastal scrub	ALA, CCA, COL, LAK, MNT, MRN, NAP, SBA, SCL, SCR, SJQ, SLO, SOL, SON	March-May	**LOW.** Low quality annual grassland habitat may provide suitable habitat within the project area. Several extant occurrences documented throughout Santa Cruz County.
Mimulus rattanii ssp. decurtatus Santa Cruz County monkeyflower	None	None	List 4.2	Chaparral, lower montane coniferous forest/margins; gravelly substrates	SCR	May-July	**NONE.** Suitable habitat not present within the project area.
Monardella undulata curly leaved monardella	None	None	List 4.2	Closed cone coniferous forest, chaparral, coastal dunes, coastal prairie, coastal scrub, lower montane coniferous forest (pine sandhills); sandy areas	MNT,MRN, SBA, SCR,SFO,SLO, SMT, SON	May-July	**NONE.** Suitable habitat not present within the project area.

Appendix A. (continued)

Species **Common Name**[1]	USFWS Listing[2]	State Status[3]	CNPS Status[4]	Habitat Type[5]	Distribution by County[6]	Flowering Period[7]	Potential for Occurrence
Monardella villosa var. *globosa* robust monardella	None	None	List 1B.2	Broadleaved upland forest, chaparral, cismontane woodland, coastal scrub, valley and foothill grassland	ALA, CCA, HUM, LAK, MRN, NAP, SMT, SON	June-August	**LOW.** Low quality broadleaved riparian forest and annual grassland habitat provide limited potential to support this species. Nearest known occurrence on eastern slope of Santa Cruz mountains.
Pedicularis dudleyi Dudley's lousewort	None	Rare	List 1B.2	Maritime chaparral, north coast coniferous forest, cismontane woodland, valley and foothill grassland	MNT, SCR*, SLO, SMT	April-June	**NONE.** Last known record for Santa Cruz County dates to 1884 collection. Extant occurrences in adjacent counties occur primarily in mixed evergreen forest habitat.
Penstemon rattanii var. *kleei* Santa Cruz Mtns. Beardtongue	None	None	List 1B.2	Chaparral, lower montane coniferous forest, North Coast coniferous forest, often in sandy soil	SCL, SCR	May-June	**NONE.** Suitable habitat not present within the project area.
Pentachaeta bellidiflora white-rayed pentachaeta	Endangered	Endangered	List 1B.1	Valley and foothill grassland, coastal scrub, coastal prairie	MNT, MRN*, SCR*, SMT	March-May	**NONE.** Nearest extant occurrence north of Santa Cruz near Eagle Rock. Presumed extirpated in Santa Cruz County.
Perideridia gairdneri ssp. *gairdneri* Gairdner's yampah	None	None	List 4.2	Moist sites in coastal prairie, broadleaved upland forest, chaparral, valley and foothill grassland, vernal pools	CCA, DNT, KRN, LAX*, MEN, MNT, MRN, NAP, ORA*, SBT, SCL, SCR, SDG*, SLO, SMT(*?), SOL, SON	June-October	**MODERATE.** Suitable annual grassland and seasonal wetland habitat located within the project area.
Pinus radiata Monterey pine	None	None	List 1B.1	Closed cone coniferous forest, cismontane woodland	MNT, SCR, SLO, SMT, BA, GU	N/A	**NONE.** The one Monterey pine located within the project area is outside of this species' native range and is considered an ornamental planting.
Piperia yadonii Yadon's rein orchid	Endangered	None	List 1B.1	Coastal bluff scrub, closed-cone coniferous forest, chaparral (maritime); sandy	MNT	(February) May-August	**NONE.** Suitable habitat not present within the project area.

Appendix A. (continued)

Species **Common Name**[1]	USFWS Listing[2]	State Status[3]	CNPS Status[4]	Habitat Type[5]	Distribution by County[6]	Flowering Period[7]	Potential for Occurrence
Plagiobothrys chorisianus var. chorisianus Choris' popcorn-flower	None	None	List 1B.2	Moist places in chaparral, coastal prairie, coastal scrub	ALA(*?), SCR, SFO, SMT	March-June	**NONE.** Suitable habitat not present within the project area.
Plagiobothrys chorisianus var. *hickmanii* Hickman's popcorn-flower	None	None	List 4.2	Moist places in closed-cone coniferous forest, chaparral, coastal scrub, marshes and swamps, vernal pools	MNT, SBT, SCL, SCR, SLO, SMT?	April-June	**MODERATE.** Suitable freshwater marsh and seasonal wetland habitat located within the project area.
Plagiobothrys diffusus San Francisco popcornflower	None	Endangered	List 1B.1	Coastal prairie, valley and foothill grassland	ALA, SCR, SFO*, SMT	March-June	**NONE.** The highly degraded nature of the seasonal annual grassland habitat within the project area is not likely to support this species.
Polygonum hickmanii Scotts Valley polygonum	Endangered	Endangered	List 1B.1	Valley and foothill grassland; sandstone	SCR	May-August	**NONE.** This sandstone specific species is known only from two small populations in Scotts Valley.
Ranunculus lobbii Lobb's aquatic buttercup	None	None	List 4.2	Cismontane woodland, North Coast coniferous forest, valley and foothill grassland, vernal pools; mesic areas	ALA, CCA, MEN, MRN, NAP, SCL, SOL, SON	March-April	**LOW.** Not known from Santa Cruz County. Seasonal wetlands within project area supports mix of ruderal weedy species.
Rosa pinetorum pine rose	None	None	List 1B.2	Closed cone coniferous forest	MNT, SCR	May-July	**NONE.** Suitable habitat not present within the project area.
Sanicula hoffmannii Hoffmann's sanicle	None	None	List 4.3	Broadleaved upland forest, mixed evergreen forest, chaparral, coastal scrub; serpentinite or clay	MNT, SBA, SCR, SCZ, SLO, SMT, SRO	March-May	**NONE.** Suitable habitat not present within the project area.
Sidalcea malachroides maple-leaved checkerbloom	None	None	List 4.2	Broadleaved upland forest, coastal prairie, coastal scrub, valley and foothill grassland; sandy areas	HUM, MEN, MNT, SCL, SCR, OR	May-August	**LOW.** Typically found in mesic forest habitats. Very limited potential for occurrence in sandy loam soils in annual grassland.
Streptanthus albidus ssp. *peramoenus* most beautiful jewelflower	None	None	List 1B.2	Chaparral, cismontane woodland, valley and foothill grassland; serpentinite	ALA, CCA, MNT, SCL, SLO	(March) April-September (October)	**NONE.** Serpentine soils not present within the project area. Not known from Santa Cruz County.

Appendix A. (continued)

Species **Common Name**[1]	USFWS Listing[2]	State Status[3]	CNPS Status[4]	Habitat Type[5]	Distribution by County[6]	Flowering Period[7]	Potential for Occurrence
Trifolium buckwestiorum Santa Cruz clover	None	None	List 1B.1	Coastal prairie; margins of broadleaved upland forest, cismontane woodland	MEN, MNT, SCL, SCR, SMT, SON	April-October	**NONE.** Suitable habitat not present within the project area.
Tifolium depauperatum var. *hydrophyllum* saline clover	None	None	List 1B.2	Marshes and swamps, mesic valley and foothill grassland, vernal pools; alkaline soils	ALA, COL(?), MNT, NAP, SBT, SCL, SCR, SLO, SMT, SOL, SON	April-June	**NONE.** Alkaline soils not present within the project area.
Zigadenus micranthus var. *fontanus* small-flowered death camus	None	None	List 4.2	Chaparral, cismontane woodland, lower montane coniferous forest, meadows and seeps, marshes and swamps	LAK, MEN. MNT, MRN, NAP, SBT, SCR, SLO, SMT, SON	April-July	**LOW** Typically found in serpentine soil is chaparral or wet meadows. Few documented occurrences in Santa Cruz County.

Appendix A. Notes:

[1]Nomenclature follows Hickman (1993); Tibor (2001); California Native Plant Society (2007).
[2]U.S. Fish and Wildlife Service (2007a, b, c).
[3]Section 1904, California Fish and Game Code (California Department of Fish and Game 2007a).
[4]Tibor (2001); California Native Plant Society (2007).
CNPS Lists: List 1A: Presumed extinct in California. List 1B: Rare, Threatened, or Endangered in California and elsewhere. List 2: Rare, Threatened, or Endangered in California, more common elsewhere. List 3: Plants about which more information is needed. List 4: Plants of limited distribution: a watch list. Threat Code extensions: .1: Seriously endangered in California. .2: Fairly endangered in California. .3 Not very endangered in California.
[5]Thomas (1960); Munz and Keck (1973); Hickman (1993); Tibor (2001); California Native Plant Society (2007); and unpublished information.
[6]Tibor (2001); California Native Plant Society (2007); and unpublished information; counties abbreviated by a three-letter code (below); occurrence in other states as indicated.
[7]Munz and Keck (1973); Tibor (2001); California Native Plant Society (2007)

ALA: Alameda
AMA: Amador
BUT: Butte
CCA: Contra Costa
COL: Colusa
DNT: Del Norte
FRE: Fresno
GLE: Glenn
HUM: Humboldt
KRN: Kern
LAK: Lake
LAX: Los Angeles
MAD: Madera
MEN: Mendocino
MER: Merced
MNT: Monterey
MOD: Modoc
MPA: Mariposa
MRN: Marin
NAP: Napa
NEV: Nevada
ORA: Orange
PLA: Placer
PLU: Plumas
RIV: Riverside
SAC: Sacramento
SBA: Santa Barbara
SBD: San Bernardino
SBT: San Benito
SCL: Santa Clara
SCR: Santa Cruz
SCZ: Santa Cruz Island (SBA Co.)
SDG: San Diego
SFO: San Francisco
SHA: Shasta
SIE: Sierra
SIS: Siskiyou
SJQ: San Joaquin
SLO: San Luis Obispo
SMT: San Mateo
SOL: Solano
SON: Sonoma
SRO: Santa Rosa Island (SBA Co.)
STA: Stanislaus
SUT: Sutter
TEH: Tehama
TRI: Trinity
TUL: Tulare
TUO: Tuolumne
VEN: Ventura
YOL: Yolo
YUB: Yuba

* Presumed extinct in these counties or states.

APPENDIX B. SPECIAL STATUS AMPHIBIAN AND REPTILE PRELIMINARY SITE ASSESSMENT

BRYAN M. MORI
BIOLOGICAL CONSULTING SERVICES
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July 30, 2008

Attn: Bill Davilla
Ecosystems West Consulting Group
819 ½ Pacific Avenue, Suite 4
Santa Cruz, CA 95060

Attn: Dave Pereksta
Ventura Fish and Wildlife Service Office
2493 Portola Road, Suite B
Ventura, CA 93003

Subject: Special-status Amphibian and Reptile Preliminary Site Assessment for the City of Watsonville Atkinson Lane Specific/Master Plan, Santa Cruz County, California.

Dear B. Davilla and D. Pereksta:

The purpose of this letter-report is to provide the County of Santa Cruz (the County) and the City of Watsonville (the City) information intended to guide the planning process for the proposed Atkinson Lane future growth area in Watsonville (Figure 1). It also provides resource agencies a preliminary assessment of special status amphibian and reptile species and their potential for occurrence within the vicinity of the proposed project area. The assessment focused on the following species - California tiger salamander (CTS) (*Ambystoma californiense*), Santa Cruz long-toed salamander (SCLTS) (*A. macrodactylum croceum*), California red-legged frog (CRF) (*Rana aurora draytonii*), and western pond turtle (WPT) (*Actinemys marmorata pallida*). Based on this assessment, it is anticipated that U.S. Fish and Wildlife Service (USFWS) will determine if protocol-level surveys for CTS, SCLTS, and/or CRF should be conducted prior to initiating project activities. The proposed project is currently focusing on developing a Specific Plan/Master Plan intending to provide land use alternatives by August 2008 and final adoption of the Specific Plan/Master Plan in March 2009. At the time of this assessment the land use alternatives had not been finalized or a construction schedule had not yet been established.

In summary, except for the western pond turtle, a definitive statement regarding the status of the focal species on the project site could not be made at this time, due to the absence of focused surveys. The western pond turtle has been identified on the site. The chances of CTS and SCLTS occurring on the site, appear to be very low to none, given the lack of known local breeding sites in the relevant project vicinity, the marginal quality of habitat on the project site, and the isolated nature of the site and it's setting within a landscape highly fragmented by urban and agricultural uses.

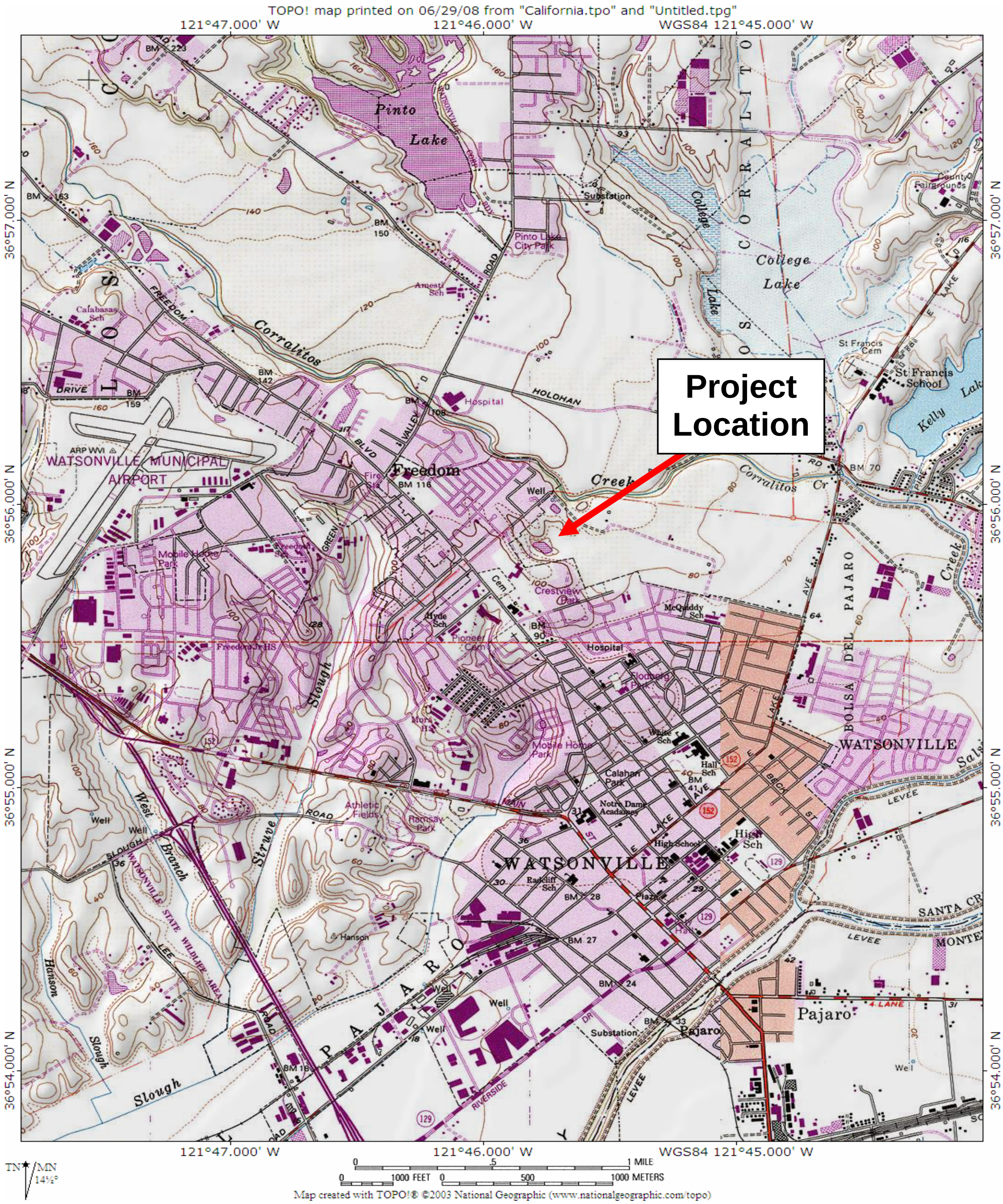

Figure 1. General location of the Proposed City of Watsonville Atkinson Lane Specific/Master Plan Area, Santa Cruz County, California.

The possibility of CRF presence at the project site is also considered low for the same reasons above; however, the chances of their occurrence on the site are slightly higher, due to the project location occurring between known occurrences of the frog from Struve Slough and Watsonville Sough to the south and the close proximity of potential non-breeding habitat in Corralitos Creek to the north (Figure 1). Surrounding urban development, however, creates barriers and likely restricts CRF movement between Corralitos Creek and Struve and Watsonville sloughs.

PROJECT DESCRIPTION

In November 2002, the voters of the City of Watsonville passed Measure U, which directs the distribution of new growth within and around the City. Measure U was designed to protect commercial agriculture lands and environmentally sensitive areas while providing the means for the City to address housing and job needs for the next 20 to 25 years. Measure U established a 20 to 25-year urban limit line around the City, and directs growth into several unincorporated areas. The three primary areas of growth include the Buena Vista, Manabe-Ow (formerly Manabe-Burgstrom), and Atkinson Lane Specific Plan areas. In accordance with Measure U, the City of Watsonville General Plan, which was adopted by the City Council in June of 2006, identifies the project site as a new growth area to accommodate up to 600 new housing units, including affordable units, townhomes, and single-family homes.

The County of Santa Cruz General Plan and Housing Element require the rezoning of a 16-acre site within the project site to allow 200 housing units at a density of 20 units per acre by June 2009. The City is also required to provide housing capacity on the remainder of the project site (City Expansion Area) to address it's projected needs for the next housing element cycle. To address these requirements, the City and County determined that it is in their mutual interest to jointly plan for the development of the entire project site. In 2007, the City and County entered into a Memorandum of Understanding (MOU) to jointly pursue a Specific Plan/Master Plan for the project site. The MOU sets specific project requirements that will fulfill the City and County obligations to provide adequate housing for the region and requires that the City and County create a development plan for the project site that addresses roadway layout, housing types and affordability restrictions, parks and schools, infrastructure financing, neighborhood concerns, protection of environmental resources, and specific development guidelines.

The County of Santa Cruz and the City of Watsonville are currently preparing a joint Specific Plan/Master Plan for the Atkinson Lane future growth area. The Atkinson Lane future growth area (project site) falls within the City of Watsonville Urban Growth Boundary. The total gross acreage of the project site is approximately 68 acres, which includes 16 acres of land to be developed by the County prior to annexation by the City to meet County affordable housing goals. The MOU estimates that up to 200 units may be developed within the 16-acre area. Development by the City would follow after 2010 wherein the City may propose to annex the 16-acre County site, as well as the City expansion area. Land uses and densities for the plan will be determined as part of the Master Plan/Specific Plan process.

Providing adequate access to the project site to serve the anticipated development without overwhelming the existing circulation system is a critical project objective. The City of Watsonville General Plan assumes that Wagner Avenue would be improved and connected to Crestview Drive to serve as the primary access arterial between Freedom Boulevard and East Lake Avenue. Secondary access routes will be analyzed including Atkinson Lane and Brewington Avenue. The proposed project will also analyze additional infrastructure necessary to serve the area including sewer lines, water lines, storm drains, gas and electric, cable, phone, etc. Existing wetlands, and other potential sensitive biotic resources occurring within the vicinity of the future growth area are currently being analyzed as part of the detailed environmental review. No other detailed plans or drawings were available at the time of this preliminary assessment.

METHODS

The assessment was performed using the following protocols as guides - Interim Guidance on Site Assessment for Determining the Presence or a Negative Finding of the California Tiger Salamander, October 2003 (USFWS and CDFG 2003) and Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog, August 2005 (USFWS 2005). These protocols also were used as guidelines for assessing SCLTS and WPT habitat, since formal habitat assessment protocols for these species are presently not available.

A reconnaissance-level survey was performed 5 and 17 June 2008 to evaluate habitat conditions at the project site. During the reconnaissance, the principal habitats were photographed (Appendix A – Photos) and conditions recorded in a field notebook. A pair of 10 x 40 powered binoculars was used to assist in wildlife identification.

The surrounding landscape within a one-mile radius of the site was qualitatively characterized, based on observations from public roads and using an aerial map and the Watsonville West USGS topographic quadrangle. For CRF and WPT, the CNDDB was accessed and other biologists were consulted for known localities within one mile of the project site (in some cases, beyond one mile), whereas for CTS and SCLTS, the search for records was expanded to at least 3.1 miles, as per protocol guidelines.

EXISTING CONDITIONS

Project Site

Aquatic Habitats: Aquatic habitats on the project site include an ephemeral drainage swale, a large detention basin, a seasonal wetland, an irrigation pond and a section of Corralitos Creek. Attachment B presents eight photos of on-site aquatic resources.

The drainage swale is located in the northwestern corner of the project site and conveys surface water (when present) to the large detention basin (Photos 1 and 2). The swale is approximately 340 feet long, with a narrow band of willows and dense understory of blackberry along the downstream-half of the corridor and annual ryegrass, smartweed, dock and blackberry within the upstream-half of the swale. The swale conveys surface run-off from urban development to the north and appears to be highly seasonal; the swale was dry during the June 5th and June 17th site visit.

The large detention basin is approximately 350 feet along its length and along the head, and roughly 270 feet across at the tail end (Photos 3 and 4). The basin is bermed along the eastern edge and along the head. The basin was nearly completely filled with cattails, with a narrow band of bulrush along the eastern margin. Dense willow and blackberry thickets grow along the basin's western edge and at its southeast corner, while dense smartweed grows along the eastern berm. Surface water was present in shallow pockets around the periphery of the basin. Shallow surface water also may have been present in the center of the basin, but was difficult to determine due to the dense growth of cattails. A western pond turtle, two bullfrogs (*Rana catesbeiana*) and unidentified frogs were observed during the site assessment.

A triangular-shaped, seasonal wetland occurs immediately adjacent to the detention basin, within a broad shallow depression (Photo 5). The length adjacent to the basin is roughly 270 feet, with the remaining two sides estimated at 180 feet each. The area is dominated by smartweed. Only a small pocket of shallow surface water was present during the assessment. During years of normal to heavy rainfall, a broad pool forms in the depression (pers. obs.). The margins of the wetland were disced sometime in the recent past.

An irrigation pond is present at the northeast corner of the project site (Photo 6). The pond is estimated to be 180 feet x 100 feet and is surrounded by a berm, which supports a narrow band of oak woodland vegetation and dense blackberry understory. The pond was nearly completely filled with bulrush. What appeared to be fairly deep pockets of surface water were present between the stands of bulrush; the water was tea-colored and dark, and the bottom was not visible from the small pier extending over the pond. One bullfrog and one unidentified frog, plus Pacific treefrog (*Pseudacris regilla*) larvae were observed on 5 June.

The section of Corralitos Creek within and adjacent to the project site boundary supports an overstory of mature cottonwood forest with coast live oak woodland, mature willows and a eucalyptus grove interspersed. The understory canopy included of young cottonwoods and willows, dogwood, acacia, coast redwood and big leaf maple. The shrub and herbaceous layer was dense and structurally complex; typical species included blackberry, stinging nettle, poison oak, German ivy and hemlock. During the 17 June reconnaissance, the channel adjacent to the site was completely dry (Photo 7). The substrate consists mostly of cobbles, with pockets of sand deposits. For the most part, the channel is v-shaped with moderate to steep-sided slopes, with occasional broad benches.

<u>Uplands:</u> Roughly two-thirds of the project site supports agricultural uses (i.e., strawberry fields and orchards). The majority of the remaining uplands consist of non-native annual grassland/ruderal vegetation and three single-family residential units, with varying degrees of landscape vegetation. Apparently, the majority of the grassland/ruderal vegetation is regularly disced and was largely barren on 6 June. Consequently, the presence of small mammal burrows was difficult to determine, but occasional occluded dens were observed. A narrow band of annual grassland/ruderal along the southwest edge of the swale and a vacant lot at the northwest corner do not appear to be maintained on a regular basis, as the vegetation was dense and the thatch layer thick, especially adjacent to the swale; as such, the presence of burrows was difficult to determine. Other minor components of the upland

include blackberry thickets, a small grove of live oaks and remnant orchard trees east and adjacent to the drainage, oak woodlands surrounding the irrigation pond, and scattered occurrences of coyote brush.

Off-Site

The following characterizations include upland and aquatic habitats within a one mile radius of the project site (Figures 2 and 3).

Uplands: The surrounding landscape is characterized by a sharp division between urban development and agricultural uses (Figure 2). A continuous block of urban development exists adjacent to the project site to the northwest, west, southwest, south and southeast. Urban land uses within this block include high-density residential, schools, commercial, industrial and a portion of the Watsonville Airport. Freedom Boulevard and Green Valley Road serve as main thoroughfares through this urbanized area. In contrast, continuous agricultural uses are present to the north, northeast, east and southeast, including row crop and orchards. Within this urban-agricultural matrix, native vegetation is limited to riparian habitat along Corralitos Creek; wetlands along the arm of Struve Slough and upper Watsonville Slough; and isolated patches of annual grasslands associated with College Lake, the Watsonville Airport and small ranches.

Aquatic Habitats: Only two ponds were identified within or just beyond the one mile radius of the project site (Figure 3), based on aerial photo and USGS topographic map interpretation and cursory observations from public roads.

Pond 1 is present to the northeast adjacent to the Lakeview Middle School track and field (Figure 3). The pond appears to serve as a catch basin for runoff from the playing fields, prior to entering Salsipuedes Creek. The basin is ringed by willows and supports scattered occurrences of cattails, bulrush and spikerush around the shoreline. No water was present on 6 June.

Pond 2 is to the southwest and is within an arm of Struve Slough (Figure 3). This pond appears to serve as a run-off detention basin for the surrounding subdivisions. The pond margins support mostly freshwater marsh vegetation, but a dense stand of willows is present at the tail end. No water was present in the pond on 6 June.

Other significant aquatic habitats within 1-mile of the site include Corralitos Creek and its tributaries, Struve Slough and upper Watsonville Slough. Corralitos Creek is intermittent and supports cottonwood-willow riparian forest, which is confined to the immediate banks due to urbanization and agriculture. Struve and Watsonville Sloughs support freshwater marsh vegetation and willow thickets and surface water is largely seasonal. Urban developments border both sloughs.

Source: City of Watsonville (2007)

RBF CONSULTING

0 500 1000 Feet
APPROXIMATE

4/24/08 JN 70-100118

ATKINSON LANE SPECIFIC PLAN/MASTER PLAN EIR

Project Site

Figure 2

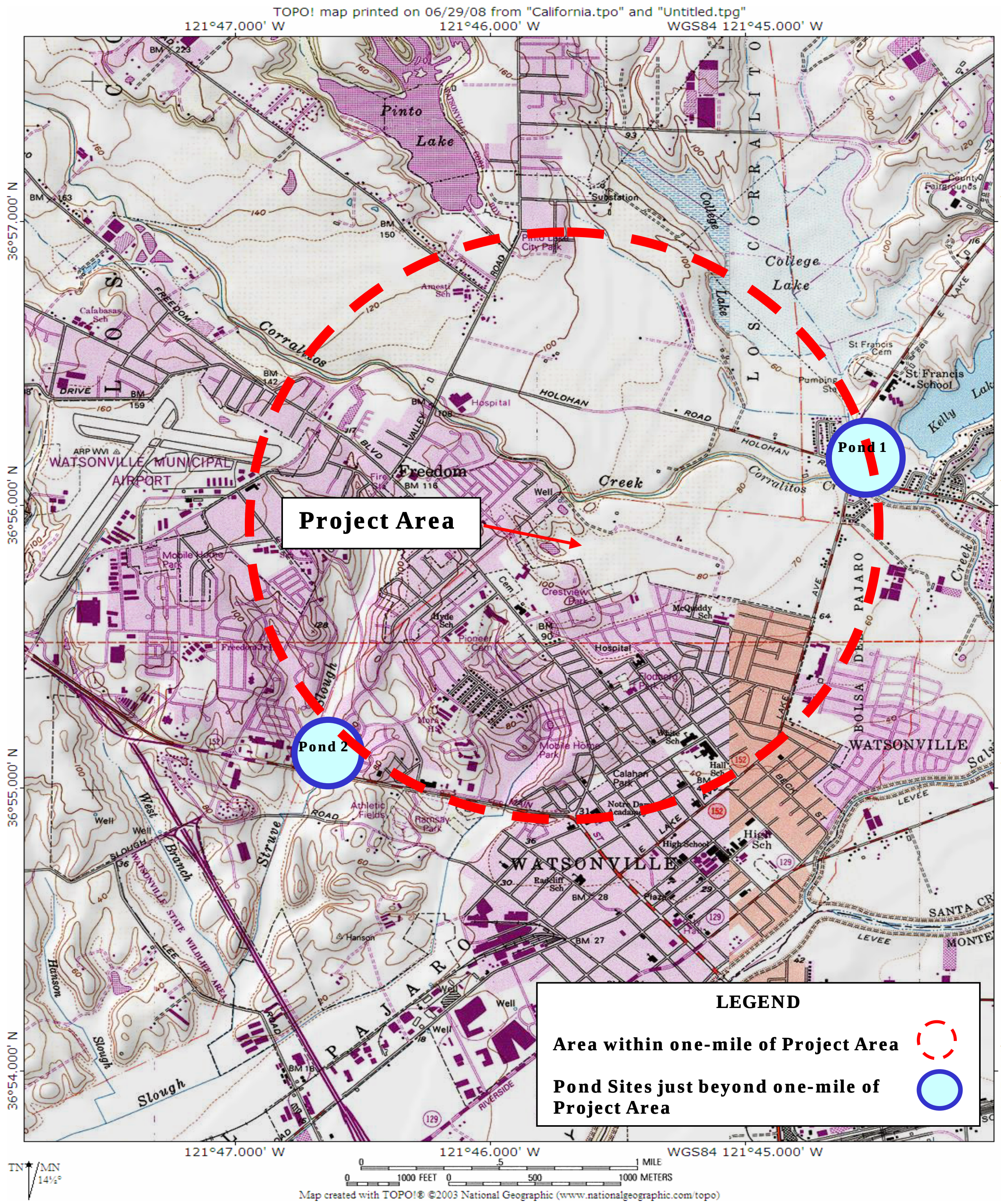

Figure 3. Locations of pond sites just beyond one mile of the proposed City of Watsonville Atkinson Lane Specific/Master Plan Area, Santa Cruz County,

SPECIES STATUS AND NATURAL HISTORY

California Tiger Salamander

The California tiger salamander is a Federal threatened species and State species of special concern (USFWS 2004a; CDFG 2008). The population consists of three Distinct Population Segments (DPS) – the Santa Rosa DPS, Santa Barbara DPS and Central California DPS, all of which are federally listed as threatened or endangered (USFWS 2004a; USFWS 2003). The California tiger salamander has disappeared from 55% of its historic range (Jennings and Hayes 1994). Presently, this species is distributed in the Central Valley from Yolo County south to Tulare County, and in the Coast Range valleys and lower foothills from Sonoma County south to Santa Barbara County (Shaffer 1991). California tiger salamanders primarily inhabit valley floor and foothill grasslands, open oak woodlands and scrub habitats encompassing vernal pools and seasonal ponds (Trenham 2001; USFWS 2000). Post-metamorphic individuals (i.e., adults and juveniles) live in rodent burrows in uplands for most of their lives (Trenham 2001; Trenham *et al* 2000; Loredo *et al* 1996). During the rainy season, typically November through March, adults migrate at night to aquatic breeding sites (Loredo and Van Vuren 1996), which include quiet waters of seasonal ponds, reservoirs, lakes and occasionally stream pools (Stebbins 1985). Tiger salamanders have osmoregulatory adaptations that allow for existence in highly alkaline aquatic environments (Kirschner et al. 1971; Romspert and McClanahan 1981). Based on a recent study, migration distances of adults between upland habitat and breeding pools generally are within 450 m (Trenham and Shaffer 2005), but distances up to 2 km (1.2 miles) have been recorded (USFWS 2000). In habitats encompassing several ponds, experienced adults may breed at more than one pond during their lifetime (Trenham *et al* 2001). The adults remain at the breeding pond from one day to several weeks, and then return to upland refugia (Loredo and Van Vuren 1996). Males migrate to breeding sites before females and tend to stay at breeding sites longer (e.g., 6 – 8 weeks for males and 1 – 2 weeks for females) (Trenham *et al* 2000; Loredo and Van Vuren 1996; Shaffer 1993). Eggs are laid singly, or in small groups of up to four, on stalks of submerged vegetation or other objects (e.g., rocks woody material, etc.), typically along the shoreline. The eggs hatch in 10 days to approximately three weeks (USFWS 2000; Jennings and Hayes 1994; Storer 1925). The number of eggs deposited per female per breeding season ranges from around 400 – 1,300 (USFWS 2000). The diet of larvae consists of aquatic insects and other invertebrates, and mostly tadpoles as the larvae grow larger (USFWS 2000; Petranka 1998; Anderson 1968). Larvae typically metamorphose in two to three months, from late spring to summer, when ponds begin to dry (USFWS 2000). Metamorphs emerge from ponds and seek shelter mostly in the immediate vicinity in burrows, cracks in the ground or under debris, but sometimes as far as 200 meters away, even in the absence of rain (Trenham 2001; Trenham and Shaffer 2005.; Loredo *et al* 1996). During the rainy-season, the juveniles continue to disperse farther to seek refuge in upland areas within 640 m of the breeding pond, but distances up to 1.6 km away from the breeding pond have been recorded (Jennings and Hayes 1994). Adults live up to at least 10 years, but take up to 4 – 5 years to reach sexual maturity (Trenham *et al* 2000). Females may not breed every year and only may breed once or twice during their lifetime (Trenham *et al* 2000). Sub-adults and adults appear to be "sit-and-wait" predators, preying on earthworms, insects and snails (CDFG 1990; Lindquist and Bachmann 1980). Threats and reasons for the decline of this species include loss of breeding and upland habitat and habitat fragmentation due to agricultural and urban development; the introduction of bullfrogs (*Rana catesbeiana*)and predatory non-native fishes; use of larval forms as fishing bait; and hybridization with introduced non-native tiger salamanders (USFWS 2000; Stebbins 2003).

Santa Cruz Long-toed Salamander

The Santa Cruz long-toed salamander was listed as endangered by the U.S. Fish and Wildlife Service in 1967 (USFWS 2004b), and subsequently in 1970 by the State of California under the California Species Preservation Act (Ruth 1989). The Santa Cruz long-toed salamander is the southernmost subspecies of *Ambystoma macrodactylum* and was first discovered in 1954 at Valencia Lagoon, near Aptos, in Santa Cruz County, California (Russell and Anderson 1956). Presently, the breeding population is restricted to southern Santa Cruz and northern Monterey Counties (USFWS 2004b). Adult and sub-adult Santa Cruz long-toed salamanders spend most of the year in upland refugia, including rodent burrows, leaf litter, underneath surface objects, and in rotting logs within dense oak woodlands, riparian vegetation and mesic coastal scrub (Ruth 1989). Adults migrate from upland habitats to seasonal/semi-perennial breeding ponds at night, during late fall and winter rains, generally from November through March. In contrast, juvenile dispersal is mostly confined to the first substantial fall rains, sometimes as early as August (M. Allaback, pers. comm.). Long-toed salamanders appear to travel in nearly straight lines, with marked individuals documented to migrate 0.6 mile from breeding ponds to upland habitat (USFWS 2004b; M. Allaback, pers. comm.). However, unmarked long-toed salamanders have been observed 1 mile from the nearest breeding pond (USFWS 2004b). Males usually precede females to the breeding site by one to two weeks, remain at the pond longer than females, and may mate with more than one female each season (Ruth and Tollestrup 1973; USFWS 2004b). Mating and egg-laying generally peak in January and February (USFWS 2004b). The female deposits 200 - 400 eggs singly on stems of emergent vegetation (Anderson 1967). After mating, the adults return to upland habitat within 6 - 12 weeks, typically by March or April (Ruth 1988; USFWS 2004b). Eggs hatch within 15 - 30 days and metamorphose into juveniles between May and September, depending on aquatic conditions. In drought years, larvae may perish prior to transformation due to insufficient water levels (Ruth 1988). Crustaceans (cladocerans and copepods) and tendipedids (midgefly larvae) are the primary food items of larvae (Anderson 1968). Recently metamorphosed salamanders (metamorphs) typically seek terrestrial refuge immediately adjacent to the breeding pond, and remain until dispersing during the first fall rains, however, early rains may induce metamorphs to move up to 200 feet from the breeding pond (Ruth 1989; USFWS 2004b). Important prey for juveniles and adults include isopods (pillbugs), beetles, centipedes, earthworms and spiders (Anderson 1968). Adults are estimated to live up to twenty years (Ruth 1988). A long life span and high reproductive output are believed to be adaptations, which allow for populations to persist at seasonal breeding sites during prolonged periods of drought (Reed 1979; Ruth 1988). Climatic changes over geologic time have restricted the distribution of the Santa Cruz long-toed salamander, making the species especially vulnerable to habitat loss resulting from agricultural and urban developments, predation from bullfrogs and non-native predatory fishes, as well as natural catastrophes related to climate and infestations (Ruth 1988; USFWS 2004b).

California Red-legged Frog

The California red-legged frog (*Rana draytonii*, hereafter CRF), is a federal threatened species and a State species of special concern (USFWS 2002; CDFG 2008). The historic range of this species extended southward from the Marin County coast, and inland from Shasta County south to Baja California (Jennings and Hayes 1994). The CRF has been extirpated from 70% of its former range (USFWS 1996). Presently, CRF is found primarily in central coastal California in natural and artificial ponds, quiet pools along streams and in coastal marshes (USFWS 1996). In the breeding season, CRF mostly inhabit pools greater than 2 feet deep, although shallow, perennial marsh habitat may also be productive if it is free of non-native aquatic predators (Hayes and Jennings 1988; B. Mori, pers. obs.). Optimal aquatic habitat is characterized by dense emergent or shoreline vegetation for cover. Seasonal ponds with little emergent/shoreline cover located in grasslands, however, may also be used for breeding, where water levels permit the metamorphosis of larvae and rodent burrows offer cover (USFWS 2002). Breeding typically occurs between December and April, depending on annual environmental conditions and locality. Egg masses containing 2,000 – 5,000 eggs are usually deposited near the water surface on emergent vegetation, but occasionally on the pond bottom where attachments are absent. Eggs require 6 to14 days to hatch and metamorphosis generally occurs within 3.5 to 7 months after hatching, although larvae have the ability to over-winter at some sites (Fellers, *et al.* 2001). Following metamorphosis, generally between July and September, juveniles are 25-35 mm in size and do not travel far from aquatic habitats, if appropriate cover is present. Dispersal of juveniles generally begins with the first rains of the weather-year, although all size classes will move in response to receding water. Radio-telemetry data indicate that adults engage in straight-line movements irrespective of riparian corridors or topography, and they may move up to 1.7 miles between non-breeding and breeding sites (Bulger, *et al.* 2003; Fellers and Kleeman 2007). They may take refuge in small mammal burrows, leaf litter or other moist areas during periods of inactivity or whenever it is necessary to avoid desiccation (Rathbun, *et al.* 1993; Jennings and Hayes 1994). At permanent ponds, most CRF remain at the pond but often move up to 300 feet into surrounding uplands, especially following rains, when individuals may spend days or weeks in upland habitats (Bulger, *et al.* 2003); whereas at seasonal breeding sites, frogs will move at least as far as the nearest suitable non-breeding habitat, e.g., riparian zone, marsh, etc. (Fellers and Kleeman 2007). Much of this species' habitat has undergone significant alteration by agricultural, urban development and water projects, leading to the extirpation of many populations (USFWS 1996). Other factors contributing to the decline of red-legged frogs include its historical exploitation as food; competition and predation by bullfrogs (*Rana catesbeiana*) and introduced predatory fishes (Jennings and Hayes 1985; Hayes and Jennings 1988; Lawler, *et al.*1999); and salinization of coastal breeding habitat (Jennings and Hayes 1990).

Western Pond Turtle

The western pond turtle (WPT) has been separated into two subspecies *Actinemys m. marmorata* is the northern subspecies and *Actinemys m. pallida* is the southern subspecies. Current research suggests, however, that the taxon may be represented by three distinct populations in California and may therefore require a taxonomic revision (Jennings and Hayes 1994). The southwestern pond turtle is a State species of special concern (CDFG 2008). In California, the pond turtle is distributed mostly along the Pacific slope drainages from Oregon to Mexico (Jennings and Hayes 1994). Pond turtles primarily occur in permanent freshwater ponds, lakes, marshes and quiet waters of streams (Bury and Holland 1993). Pond turtles favor sites with the largest and deepest pools and with an abundance of basking sites, such as partially submerged logs or rocks, matted emergent vegetation, or exposed shorelines (Bury and Holland 1993); pond turtles displace one another from basking sites, where such resources are limited (Bury and Wolfheim 1973). Pond turtles are highly sensitive and will seek cover when approached within 100 meters (Bury and Holland 1993). Undercut banks, root masses and boulder piles provide underwater escape cover (Bury and Holland 1993). Although highly aquatic, pond turtles leave the water to reproduce, aestivate and overwinter (Jennings and Hayes 1994). Females dig nests and deposit eggs, during May and June, along the shoreline or in a variety of open, sparsely vegetated upland habitats, usually within 200 meters from water, but as much as 500 meters, and mostly on south-facing slopes with well-drained clay soils (Rathbun *et al* 1992; Jennings and Hayes 1994). Nests must remain dry for proper incubation. The young hatch and may overwinter in the nest, before emerging in the spring (Jennings and Hayes 1994). Hatchlings require shallow water habitat with dense emergent vegetation and abundant zooplankton (Jennings and Hayes 1994). Pond turtles reach sexual maturity between seven and fourteen years of age (Bury and Holland 1993) and live to be over 42 years (Jennings and Hayes 1994). During dispersal, pond turtles can move up to two kilometers in search of suitable habitat and can tolerate a minimum of seven days without water (Jennings and Hayes 1994). Studies on central coast drainages show that turtles use upland habitat within 50 meters of the creek in times of drought or to avoid winter floods (Rathbun *et al* 2002) and up to 500 meters in other studies (Reese and Welsh 1997). Pond turtles are threatened by habitat alteration and loss due to water developments, agricultural practices and non-native predators (Jennings and Hayes 1994).

LOCAL SPECIAL-STATUS SPECIES RECORDS

Through consultation with other biologists, access of the CNDDB and gray-literature review, 10 records of CTS, SCLTS CRF and WPT were identified from the general project region. The nearest CRF records to the project site are from Watsonville Slough, approximately 1.2 miles to the southwest, and from Struve Slough, approximately 1.6 miles southwest of the site. The only known occurrences of CTS are south of State Route 1 at the Buena Vista site, 3.4 miles west of the project site, and from the Ellicott Slough National Wildlife Refuge (ESNWR), approximately 3.8 miles west of the site. The three nearest SCLTS records to the site are from Merk Pond, 3.7 miles to the northwest; ESNWR, 3.8 miles to the west; and from Larkin Valley, approximately 4.0 miles to the northwest. In addition to the observation of WPT at the project site, other localities include Struve Slough and Pinto Lake. These records are summarized on Table 1.

Table 1. Locations of CTS, SCLTS, CRF and WPT records from the Atkinson Lane project region in Santa Cruz County.

Taxon	Observation	Distance from Project Site	Source
California tiger salamander	South of Hwy 1, Buena Vista pond.	3.4 mi. W	CNDDB & BIOS 2008
	Ellicott Pond	3.8 mi W	CNDDB & BIOS 2008
Santa Cruz long-toed salamander	Merk Road	3.7 mi. NW	CNDDB & BIOS 2008
	Ellicott Pond	3.8 mi. W	CNDDB & BIOS 2008
	Larkins Valley	4 mi. NW	CNDDB & BIOS 2008
California red-legged frog	Watsonville Slough	1.2 mi. SW	CNDDB & BIOS 2008
	Struve Slough	1.6 mi. SW	CNDDB & BIOS 2008
Western pond turtle	On the project site.	–	K. Glinka pers. obs. onsite 2007; B. Mori pers. obs. 2008; CNDDB & BIOS 2008
	Struve Slough	1.2 mi. SW	CNDDB & BIOS 2008
	Pinto Lake	1.4 mi. N	CNDDB & BIOS 2008

DISCUSSION

California Tiger Salamander

The existence of a CTS population on the project site seems unlikely due to the combination of the following factors: 1) the aquatic habitats support bullfrogs, which are significant predators of native amphibians; 2) the uplands on the site are limited in area and marginal due to regular discing practices, which destroy potential refugia for adults and subadults; 3) the project site is isolated from other areas of potential CTS upland (e.g., extensive stands of annual grassland and oak woodlands) and aquatic habitat, due to extensive urbanization and agricultural uses surrounding the site; and 4) dispersal to the site from source populations is unlikely, since the closest known CTS populations are over three miles away and because of the isolated nature of the site from these localities. While these factors strongly suggest their absence from the site, no focused studies were conducted to support this conclusion.

Santa Cruz Long-toed Salamander

As with CTS, the presence of SCLTS on the project site is considered unlikely due to the combination of the following factors: 1) the aquatic habitats support bullfrogs, which are significant predators of native amphibians; 2) potential upland habitat on the site is confined to only a few isolated patches of dense blackberry and willow thickets; 3) the project site is isolated from other areas of primary upland habitat (e.g., extensive stands of moist oak woodlands, willow thickets and mesic coastal scrub) and aquatic habitat, due to extensive urbanization and agricultural uses surrounding the site; and 4) dispersal to the site from source populations is unlikely, since the closest known SCLTS populations are between three to four miles away and because of the isolated nature of the site from these localities. While these factors strongly suggest their absence from the site, no focused studies were conducted to support this conclusion.

California Red-legged Frog

The presence of CRF on the project site also is considered unlikely, due to the combination of the following factors: 1) the aquatic habitats on site support bullfrogs, which are significant predators of native amphibians; 2) potential non-breeding habitat on the site is confined to only a few isolated patches of dense blackberry, willow thickets and smartweed; 3) the project site is largely isolated from other areas of potential habitat, due to extensive urbanization and agricultural uses surrounding the site; and 4) dispersal to the site from source populations is unlikely, since the closest known CRF populations are over one mile away (Table 1), and because of the isolated nature of the site from these localities. Although CRF are known to use riparian corridors (such as Corralitos Creek) for migration and as non-breeding habitat, in this situation, no CRF observations are known from Corralitos Creek or nearby Salsipuedes Creek. The section of Corralitos Creek adjacent to the project site does not appear to provide a reliable source of standing water outside of the rainy season, and potential breeding ponds adjacent to the creek are lacking in the project vicinity. While these factors strongly suggest their absence from the site, no focused studies were conducted to support this conclusion.

Western Pond Turtle

Western pond turtles have been observed at the large detention basin sporadically since at least 1996 (pers. obs.). There is uncertainty regarding the status of the population and whether the site is used seasonally or year-round, since focused surveys have not been performed. The annual grasslands on the site appear to provide potential nesting habitat, however, discing practices may preclude successful reproduction. Given the level of urban and agricultural developments surrounding the site, it is reasonable to assume that Corralitos Creek/Salsipuedes Creek may serve as a dispersal/migration corridor for turtles, since they are known to inhabit the Pajaro River system and are capable of long distance movements.

CONCLUSIONS

Except for WPT, which is present on the project site, a conclusive determination regarding the presence/absence of CTS, SCLTS and CRF could not be made during this assessment, due to the lack of focused surveys. Several factors regarding the marginal/unsuitable habitat conditions present on the site and surrounding landscape, however, do suggest that their occurrence on the site is unlikely. As previously mentioned, based on the results of this assessment USFWS will determine whether or not protocol-level surveys should be conducted prior to initiating project activities and should reply to EcoSystems West Consulting Group with their comments.

Also, please call me at (831) 728-1043 if you have any comments or questions regarding this report.

Sincerely,

Bryan Mori
Consulting Wildlife Biologist

CC: Erika Spencer, Senior Planner, RBF Consulting
Todd Sexauer, Environmental Planner, County of Santa Cruz Planning Department
Suzi Aratin, Senior Planner, City of Watsonville Community Development Department

Attachments: Appendix A - Site Photographs

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APPENDIX A

Photographs of Features in the Vicinity of the Atkinson Lane Project Area

Photo 1. Downstream section of drainage swale.

Photo 2. Upstream section of drainage swale.

Photo 3. Overall view of detention basin.

Photo 4. Close-up view of detention basin.

Photo 5. Broad view of seasonal wetland.

Photo 6. Close up view of irrigation pond.

Photo 7. View of Corralitos Creek, June 2008

APPENDIX C. USFWS RESPONSE TO SPECIAL STATUS AMPHIBIAN AND REPTILE PRELIMINARY SITE ASSESSMENT

U.S. FISH & WILDLIFE SERVICE

United States Department of the Interior

TAKE PRIDE IN AMERICA

FISH AND WILDLIFE SERVICE
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

IN REPLY REFER TO:
81440-2008-TA-0607

October 30, 2008

Bill Davilla
Ecosystems West Consulting Group
819.5 Pacific Avenue, Suite 4
Santa Cruz, California 95060

Subject: Special Status Amphibian and Reptile Site Assessment for the Atkinson Lane Specific/Master Plan, Watsonville, Santa Cruz County, California

Dear Mr. Davilla:

We are responding to your letter, dated August 1, 2008, and the accompanying Special Status Amphibian and Reptile Site Assessment for the Atkinson Lane Specific/Master Plan (Site Assessment), Watsonville, Santa Cruz County, California. Your letter requested that we review the Site Assessment and provide guidance on the need for protocol level surveys for federally listed amphibians, including the endangered Santa Cruz long-toed salamander (*Ambystoma macrodactylum croceum*) and the threatened California red-legged frog (*Rana aurora draytonii*) and California tiger salamander (*Ambystoma californiense*). The current project consists of planning for residential development and associated infrastructure improvements on approximately 68 acres.

The U.S. Fish and Wildlife Service's (Service) responsibilities include administering the Endangered Species Act of 1973, as amended (Act), including sections 7, 9, and 10. Section 9 of the Act prohibits the taking of any endangered or threatened species. Section 3(18) of the Act defines take to mean to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Service regulations (50 CFR 17.3) define harm to include significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harassment is defined by the Service as an intentional or negligent action that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. The Act provides for civil and criminal penalties for the unlawful taking of listed species.

The project site includes an ephemeral drainage swale, a large detention basin, a seasonal wetland, an irrigation pond, and a section of Corralitos Creek. One or more of these aquatic habitats may provide breeding habitat for the above listed amphibians. However, upland habitats within the project area have been highly disturbed through disking and other agricultural activities, the project area is largely surrounded by agricultural and urban development, and the nearest known locality of either the Santa Cruz long-toed salamander or California tiger salamander is over 3 miles from the project area. Therefore, we conclude that neither of these species is likely to occur within the project area and protocol level surveys for them are not necessary.

California red-legged frogs may complete their entire life cycle within a single habitat type, such as a pond (U.S. Fish and Wildlife Service 2002) and are therefore less dependent on upland habitats than the Santa Cruz long-toed salamander or California tiger salamander. California red-legged frogs have been observed to move overland more than 2 miles (U.S. Fish and Wildlife Service 2002) and are known to occur within 1.2 miles of the project area. Because of the presence of suitable aquatic habitat within the project area and of known localities within dispersal distance of the project area, we recommend that surveys of the project area for the California red-legged frog be performed to protocol (U.S. Fish and Wildlife Service 2005).

Thank you for coordinating with us on this project to ensure that adequate information on the presence of listed species is gathered. If you have any questions regarding this letter, please contact Jacob Martin of my staff at (805) 644-1766, extension 285.

Sincerely,

David M. Pereksta
Assistant Field Supervisor

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APPENDIX D. LIST OF VASCULAR PLANT SPECIES OBSERVED

Appendix D. List of all Vascular Plant Species Observed During Atkinson Lane Habitat Assessment Site Visit.	
Scientific Name	**Common Name**
**Acacia dealbata*	silver wattle
Acer macrophyllum	big-leaved maple
**Agave americana*	century plant
Artemisia douglasiana	mugwort
**Anagallis arvensis*	scarlet pimpernel
**Avena barbata*	slender wild oat
**Avena fatua*	wild oat
Baccharis pilularis	coyote bush
**Beta vulgaris* var. *cicla*	chard
**Brassica nigra*	black mustard
Bromus carinatus	California brome
**Bromus diandrus*	ripgut grass
**Bromus hordeaceus*	soft chess
Calystegia purpurata	Pacific false bindweed
**Capsella bursa-pastoris*	sheppard's purse
**Carduus pycnocephalus*	Italian thistle
**Chamomilla suaveolens*	pineapple weed
**Chenopodium murale*	nettle leaved goosefoot
**Cirsium vulgare*	bull thistle
Clematis ligusticifolia	virgin's bower
**Conium maculatum*	poison hemlock
**Convolvuls arvensis*	bindweed
Cornus sericea	creek dogwood
**Cortaderia selloana*	pampas grass
Corylus cornuta	hazelnut
**Cotoneaster pannosa*	silverleaf cotoneaster
**Cynodon dactylon*	Bermuda grass
Cyperus eragrostis	flatsedge
**Delairea odorata*	cape ivy

Appendix D. List of all Vascular Plant Species Observed During Atkinson Lane Habitat Assessment Site Visit.

Scientific Name	Common Name
Distichlis spicata	saltgrass
**Ehrharta erecta*	veldt grass
Eleocharis macrostachya	spikerush
Epilobium ciliatum ssp. *ciliatum*	willow herb
Equisetum arvense	common horsetail
Equisetum laevigatum	smooth horsetail
**Erodium botrys*	common filaree
**Erodium cicutarium*	red-stemmed filaree
Eschscholzia californica	California poppy
**Eucalyptus globulus*	blue gum eucalyptus
**Filago gallica*	narrowleaved filago
**Foeniculum vulgare*	fennel
Galium aparine	sticky bedstraw
**Galium murale*	tiny bedstraw
**Geranium dissectum*	cutleaf geranium
**Gnaphalium luteo-album*	everlasting cudweed
**Hedera helix*	English ivy
**Hirschfeldia incana*	shortpod mustard
****Holocarpha macradenia*	Santa Cruz tarplant
**Hordeum marinum*	Mediterranean barley
**Hordeum murinum* ssp. *leporinum*	foxtail barley
**Hypochaeris radicata*	rough cat’s ear
Juglans californica var. *californica*	California black walnut
Juncus effusus	soft rush
Juncus patens	spreading rush
**Lactuca serriola*	prickly lettuce
**Lolium multiflorum*	annual ryegrass
Madia sativa	Coast tarweed
**Malus domestica*	common apple

Appendix D. List of all Vascular Plant Species Observed During Atkinson Lane Habitat Assessment Site Visit.

Scientific Name	**Common Name**
**Malva nicaeensis*	bull mallow
**Medicago polymorpha*	burclover
**Melilotus alba*	white sweetclover
**Opuntia ficus-indica*	Mission cactus
**Pennisetum clandestinum*	kikuyu grass
**Phalaris aquatica*	Harding grass
**Picris echioides*	prickly ox-tongue
**Plantago lanceolata*	English plantain
Platanus racemosa	sycamore
***Pinus radiata*	Monterey pine
**Piptatherum miliaceum*	smilo grass
**Poa annua*	annual bluegrass
Polygonum amphibium var. *emersum*	water smartweed
**Polygonum arenastrum*	common knotweed
**Polypogon monspeliensis*	rabbit-foot grass
Populus balsamifera ssp. *trichocarpa*	black cottonwood
Potamogeton natans	pondweed
Quercus agrifolia	Coast live oak
Rhamnus californica	California coffeeberry
**Raphanus sativus*	wild radish
Ribes divaricatum	gooseberry
Rorippa nasturtium-aquaticum	water cress
Rosa californica	California wild rose
**Rubus discolor*	Himalayan blackberry
Rubus ursinus	California blackberry
**Rumex acetosella*	sheep sorrel
**Rumex crispus*	curly dock
**Rumex pulcher*	fiddle dock
Sambucus mexicana	elderberry

Appendix D. List of all Vascular Plant Species Observed During Atkinson Lane Habitat Assessment Site Visit.	
Scientific Name	**Common Name**
Salix laevigata	red willow
Salix lasiandra ssp. *lasiandra*	Pacific willow
Salix lasiolepis	arroyo willow
Scirpus californicus	California bulrush
Scirpus microcarpus	small fruited bulrush
Scrophularia californica ssp. *floribunda*	California figwort
Sequoiadendron sempervirens	Coast redwood
**Senecio vulgaris*	common groundsel
Solanum americanum	common nightshade
**Sonchus asper*	prickly sow thistle
**Sonchus oleraceus*	common sow thistle
Stachys adjugoides	hedge nettle
Symphoricarpos albus var. *laevigatus*	common snowberry
Toxicodendron diversilobum	poison oak
**Tragopogon porrifolius*	purple salsify
**Trifolium dubium*	little hop clover
**Trifolium hirtum*	rose clover
**Trifolium incarnatum*	crimson clover
Typha angustifolia	narrow-leaved cattail
Urtica dioica	stinging nettle
**Vicia sativa*	common vetch
**Vinca major*	periwinkle
**Vulpia bromoides*	six-weeks fescue
Xanthium spinosum	spiny cocklebur
**Yucca* sp.	ornamental yucca
**Zantedeschia aethiopica*	calla lily

*** non-native plant species**
**** Considered special status species in native range, invasive non-native at the Atkinson Lane project area.**
***** Special status plant species**

DELINEATION OF
WETLANDS AND WATERS OF THE U.S.
SUBJECT TO SECTION 404 JURISDICTION
FOR THE
ATKINSON LANE SPECIFIC PLAN

Prepared for

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January 2009

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1.0 INTRODUCTION

1.1 Project Background

The Atkinson Lane Specific Plan project area covers approximately 68.4 acres and is located southeast of Atkinson Lane and north of Brookhaven Lane in the city of Watsonville, Santa Cruz County, California (Figure 1). The property is bounded to the south and west by residential development, agricultural fields and fruit orchards to the east, and Corralitos Creek to the north.

On 1 May 2008, staff biologist Justin Davilla of Ecosystems West Consulting Group conducted a routine wetland delineation of the project area to determine the extent of potential wetlands and waters subject to federal jurisdiction under Section 404 of the Clean Water Act. This report presents the results of this delineation.

1.2 Project Description

In November 2002, the City of Watsonville voted to approve Measure U, which established the urban limit line for the City for the next 25 years. The Atkinson Lane future growth area is part of the Measure U growth boundary, but is currently outside of the City limits. A portion of the site is within the City's existing sphere of influence. The future growth area consists of 65-acres, including 9 parcels. The County of Santa Cruz has identified two of these parcels (16-acres) for affordable housing density to meet the goals of their current Housing Element in the City's sphere of influence. Following discussions about the mutual benefits of joint development of site, the City and County have entered into a Memorandum of Understanding (MOU) to jointly pursue a Specific Plan for the 65-acre Atkinson Lane new development area, defined by Measure U and the City's General Plan.

Details of the Specific Plan were not available at the time of this delineation. The MOU estimates approximately 200 units (20 units per acre) to be developed within the 16-acre parcel to meet the County's goals. The City's General Plan identifies that up to 600 residential units may be generated in the planning area. Of this total, 400 units will be developed within the City-controlled lands.

The developed areas will eventually include necessary infrastructure including sewer lines, water lines, storm drains, and power, cable, and phone lines. Existing roads will be expanded and connected to create primary access to the development area. Secondary access routes will also be analyzed in the Specific Plan. The plan will also determine the necessity and location of additional parks, recreation areas, and possible education facilities for new community services. Existing wetlands and other potential sensitive biotic resources occurring within the vicinity of the future growth area are to be analyzed as part of the detailed environmental review. No other detailed plans or drawings were available at the time of this delineation.

Figure 1. Atkinson Lane Project Area Location Map

1.3 Regulatory Setting

Section 404 of the Clean Water Act

Section 404 of the Clean Water Act gives the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (Corps) regulatory and permitting authority regarding the discharge of dredged or fill material into "navigable waters of the United States". Section 502(7) of the Clean Water Act defines navigable waters as "waters of the United States, including territorial seas." Section 328 of Chapter 33 in the Code of Federal Regulations defines the term "waters of the United States" as it applies to the jurisdictional limits of the authority of the Corps under the Clean Water Act. A summary of this definition of "waters of the U.S." in 33 CFR 328.3 includes:

(1) waters used in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
(2) interstate waters and wetlands;
(3) "other waters" such as lakes, rivers, streams, mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters:
    i. used by interstate or foreign travelers for recreational or other purposes; or
    ii. from which fish or shellfish are taken and sold in interstate or foreign commerce; or
    iii. which are for industrial purpose by industries in interstate commerce;
(4) impoundments of waters otherwise defined as waters of the United States;
(5) tributaries of other waters;
(6) the territorial seas;
(7) wetlands adjacent to waters.

Therefore, for the purpose of determining Corps jurisdiction under the Clean Water Act, "navigable waters" as defined in the Clean Water Act are the same as "waters of the U.S." defined in the Code of Federal Regulations above.

The limits of Corps jurisdiction under Section 404 as given in 33 CFR Section 328.4 are as follows:

(a) *territorial seas:* three nautical miles in a seaward direction from the baseline;
(b) *tidal waters of the U.S.:*
    i. extending up to the high tide line or
    ii. up to the limit of adjacent non-tidal waters;
(c) *non-tidal waters of the U.S.:* ordinary high water mark or limit of adjacent wetlands;
(d) *wetlands:* to the limit of the wetland.

Section 328.3 of the Federal Code of Regulations defines wetlands as:

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

The delineation study determined the presence or absence of wetland indicators used by the Corps in making a jurisdictional determination. The three criteria used to delineate wetlands are the presence of: (1) hydrophytic (water-loving) vegetation, (2) wetland hydrology, and (3) hydric soils. According to the Corps Manual, evidence of at least one positive wetland indicator from each parameter must be found in order to make a positive determination.

2.0 METHODS

Prior to conducting field surveys, available reference materials were reviewed, including the 1980 Soil Survey of Santa Cruz (USDA, Soil Conservation Service (SCS)/Natural Resources Conservation Service (NRCS)), the Watsonville West USGS 7.5' quadrangle map, and available aerial photographs of the site. A focused evaluation of indicators of wetlands and waters was performed in the project area on May 1, 2008. The methods used in this study to delineate jurisdictional wetlands and waters are based on the *U.S. Army Corps of Engineers Wetlands Delineation Manual* (Corps Manual; Environmental Laboratory 1987). The routine method for wetland delineation described in the Corps Manual was used to identify areas potentially subject to Corps Section 404 jurisdiction within the project area. A general description of the project area, including plant communities present, topography and current and historical land use practices, was also generated during the delineation visit. The methods for evaluating the presence of wetlands and other waters of the United States employed during the site visit are described in detail below.

2.1 Potential Section 404 Wetlands

Data on vegetation, hydrology, and soils collected at sample points during the delineation site visit were recorded on standard Corps data forms. Once an area was determined to be a potential jurisdictional wetland, its boundaries were mapped using resource grade GPS equipment and overlaid on an aerial photo. The acreage of potential jurisdictional wetlands was measured digitally using ArcGIS software. Wetland indicators described in the Corps Manual that were used to make wetland determinations at each sample point in the project area are summarized below.

Vegetation

Plant species identified on the property were assigned a wetland indicator status according to the U.S. Fish and Wildlife Service list of plant species that occur in wetlands (Reed 1988). This wetland classification system is based on the expected frequency of occurrence in wetlands as shown in Table 1 below.

Table 1. Wetland Indicator Status Categories for Vascular Plants

INDICATOR STATUS	SYMBOL	FREQUENCY
OBLIGATE	OBL	greater than 99%
FACULTATIVE WETLAND	FACW	67-99%
FACULTATIVE	FAC	34-66%
FACULTATIVE UPLAND	FACU	1-33%
UPLAND (Not Listed)	UPL/NL	less than 1%
NO INDICATOR	NI	Undetermined

Plant species with an indicator status of OBL, FACW, and/or FAC are classified as hydrophytic vegetation according to methodology outlined in the Corps Manual. The hydrophytic vegetation criterion is met when greater than 50 percent of the dominant plant species have an indicator status of OBL, FACW, and/or FAC. Dominant plant species are those that contribute more to the character of the plant community than other species. For herbaceous plants, the 50/20 rule was applied where dominant plants are those that individually or collectively account for 50 percent of the total areal coverage of vegetation in the stratum, plus any other species that, by itself, accounts for at least 20 percent of the total.

Hydrology

The Corps jurisdictional wetland hydrology criterion is satisfied if an area is inundated or saturated for a period sufficient to create anoxic soil conditions during the growing season (minimum of 14 consecutive days in the Monterey Bay Area). Evidence of wetland hydrology can include direct evidence ("primary indicators"), such as visible inundation or saturation, drift lines, and surface sediment deposits (including algal mats), or indirect indicators ("secondary indicators"), such as oxidized root channels and the FAC-neutral test. If indirect or secondary indicators are used, at least two secondary indicators must be present to conclude that an area has adequate wetland hydrology. Primary and secondary hydrology indicators were used to determine if areas surrounding each sample point in the project area satisfied the Corps' hydrology criterion.

Soils

The Natural Resource Conservation Service (USDA NRCS) defines a hydric soil as:

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

Soils formed over long periods of time under wetland (anaerobic) conditions often possess characteristics that indicate they meet the definition of hydric soils. Hydric soils generally have a characteristic low matrix chroma, designated 0, 1, or 2, used to identify them as hydric. Chroma designations are determined by comparing a soil sample with a standard Munsell soil color chart (GretagMacbeth 2000). Soils with a chroma of 0 or 1 are considered hydric; however, some upland forest and grassland soils may also have dark (black), low chroma colors. Soils with a chroma of 2 must also have redoximorphic features (mottles) to be considered hydric. Soil profiles at each sample point in the project area were described to include horizon depths, color, redoximorphic features, and texture to determine if the soils satisfy the Corps' criteria for hydric soils. The NRCS manual *Field Indicators of Hydric Soils in the United States* (USDA, NRCS, 2002) was also used as a guide for determining hydric soils in the project area.

2.2 "Other Waters" of the U.S.

Areas that are inundated for sufficient duration and depth to exclude growth of hydrophytic vegetation, such as lakes and ponds, or convey water, such as streams, are also subject to Section 404 jurisdiction. In the Central California Coast, these "other waters" can include intermittent and ephemeral streams, as well as lakes, mudflats, playas, arroyos, and rivers. The project area was concurrently evaluated for the presence of "other waters" at the time of the delineation site visit.

Areas delineated as "other waters" are characterized by an ordinary high water (OHW) mark, defined as:

> *...that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impresses on the bank, shelving, changes in the characteristics of the soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.*
>
> (33 CFR Part 328.3)

"Other waters" are identified in the field by the presence of a defined river or stream bed, a bank, and evidence of the flow of water, or by the absence of emergent vegetation in ponds or lakes. Corps jurisdiction of waters in non-tidal areas extends to the ordinary high water (OHW) mark. "Other waters" within the project area were either mapped using sub-meter accuracy GPS units, or digitized using GIS software based on USGS topographic maps and aerial photograph interpretation.

2.3 Areas Exempt from Section 404 Jurisdiction

Some areas that meet the technical criteria for wetlands or waters may not be jurisdictional under Section 404 of the Clean Water Act. Included in this category are some man-induced wetlands which are areas that have developed at least some characteristics of naturally occurring wetlands due to either intentional or incidental human activities. Examples of man-induced wetlands include, but are not limited to, irrigated wetlands, stock ponds, drainage ditches excavated entirely in uplands, and dredged material disposal areas.

In addition, some isolated wetlands and waters may also be considered outside of Corps jurisdiction as a result of the Supreme Court's decision in *Solid Waste Agency of Northern Cook County (SWANCC) v. United States Army Corps of Engineers* (531 U.S. 159 (2001)). Isolated wetlands and waters are those areas that do not have a surface or groundwater connection to, and are not adjacent to a navigable “Waters of the U.S.”, and do not otherwise exhibit an interstate commerce connection. In the recent Supreme Court *Rapanos v. United States* (547 U.S. 715 (2006)) decision, the Court recommended further restrictions on federal jurisdiction over wetlands and required that a “significant nexus” test be applied to those wetlands and waters which are not “navigable”. A memorandum issued in June 2007 provides guidance to the Corps and EPA for implementing the Supreme Court’s significant nexus test. The *Rapanos* decision and the SWANCC decision may be applicable to this project area if any of the potential wetlands are considered to lack a direct connection or significant nexus with navigable waters.

3.0 PROJECT AREA DESCRIPTION

The project area is approximately 68.4 acres located southeast of Atkinson Lane, in the city of Watsonville, California (Figure 1). Elevations range from approximately 76 to 104 feet NGVD. The site is comprised of annual grassland, cultivated agricultural fields, fruit orchards, a detention basin, a large freshwater marsh, and a segment of Corralitos Creek. Escaped ornamental vegetation is found in some portions of the project area where it is bordered by residential development. The majority of annual grassland habitat is disced in late spring for fire prevention and weed control. The project area is crossed by a series of maintained dirt roads used for agriculture and site maintenance. Several former dirt roadways are evident throughout the open grassland and are at least partially overgrown by annual grasses and forbs. Riparian habitat associated with Corralitos Creek consists of an assortment of evergreen trees including Coast live oak, sycamore, and blue gum eucalyptus with a dense understory of perennial forbs including nettles, blackberry, and German ivy.

Vegetation

Four major natural vegetation types are present in the project area as described by Ecosystems West (2008): annual grassland, riparian woodland, freshwater wetland/marsh, and agricultural lands. The majority of the site is characterized by annual grassland, cultivated agricultural fields, and fruit orchards. Riparian woodland is located along the embankments of Corralitos Creek, a detention basin used for crop irrigation, and a large freshwater marsh in the south-central portion of the project area.

Annual grassland is dominated by primarily non-native annual grasses and forbs including wild oats (*Avena* spp.), ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), Italian rye-grass (*Lolium multiflorum*), filaree (*Erodium botrys*), cutleaf geranium (*Geranium dissectum*), and sheep sorrel (*Rumex acetosella*). Riparian woodland associated with Corralitos Creek in the northern portion of the site is characterized by open to nearly closed canopies of coast live oak (*Quercus agrifolia*) and blue gum eucalyptus (*Eucalyptus globulus*) with a dense herbaceous understory. Additional riparian habitat along the perimeter of freshwater marsh features is dominated by Coast live oak and arroyo willow (*Salix lasiolepis*). These areas often lack riparian species specific understories. Strawberries and fruit trees are the predominant food crops cultivated in agricultural areas within the project area. The freshwater marsh, detention basin, and other wetland and waters features are described in detail below.

Hydrology

The principal natural hydrological sources for the project area are precipitation, perched groundwater, and surface runoff from adjacent uplands. Corralitos Creek, an intermittent waterway in the northwest corner of the site, may provide an additional source of hydrology to the adjacent floodplain during extreme (100 year) rainfall events. A shallow west to east trending drainage conveys temporary runoff from uplands adjacent to Atkinson Lane into the freshwater marsh in the southern portion of the project area.

Soils

The Santa Cruz County Soil Survey (USDA 1980) identifies five soil map units within the project area (Figure 2). These soils types are describe in detail below.

- Baywood loamy sand, 0 to 2 percent slopes
- Elder sandy loam, 0 to 2 percent slopes
- Pinto loam, 0 to 2 percent slopes
- Watsonville loam, 2 to 15 percent slopes
- Water

The Soil Survey descriptions of these mapping units are presented below with indications of whether the soils are classified as hydric or not according to the Hydric Soils List for Santa Cruz County (USDA 1992).

Baywood loamy sand, 0 to 2 percent slopes-
This soil type is a very deep, somewhat excessively drained soil formed in aeolian deposits. Baywood soils are primarily found in rangelands or areas used for cultivating specialized crops including strawberries and brussel sprouts. Typical naturalized vegetation associated with this soil type includes annual grasses and forbs with widely scattered shrubs. Baywood loamy sand is particularly well suited to strawberry cultivation because drainage is optimal. The surface layer of this soil is brown loamy sand approximately 17 inches thick. The subsurface layer is typically dark grayish brown fine sand extending to a depth of 61 inches below the ground surface. This soil type is not classified as a hydric soil (USDA 1992). Baywood loamy sand is primarily found in lowland areas in the eastern half of the project area in fruit orchards.

Elder sandy loam, 0 to 2 percent slopes-
Elder sandy loam consists of very deep, well drained soils found on alluvial fans and plains and in narrow valleys. This highly productive soil type is intensively cultivated and supports crops such as brussel sprouts, apples, lettuce, and strawberries. Typically, the surface layer is grayish brown to dark grayish brown about 31 inches below the ground surface. The underlying material extends to a depth of approximately 60 inches and is brown to dark brown sandy loam. Elder sandy loam is not classified as a hydric soil; however, inclusions of loam are identified as hydric by the NRCS (USDA 1992). This soil type is located in the eastern portion of the site in areas used for strawberry cultivation and fallow rangeland.

Figure 2. Map of Soils Occurring within the Atkinson Lane Project

Pinto Loam, 0 to 2 percent slopes-
Pinto loam is typically found on marine terraces and old alluvial fans. This very deep, moderately well drained soil supports primarily shallow rooted crops because permeability is slow and available water capacity is 6.5 to 8 inches. The surface layer is a grayish brown loam approximately 14 inches thick. The subsurface layer is brownish yellow or light yellowish brown extending up to 30 inches below the surface. Included within this soil mapping unit are areas of Watsonville loam and Elkhorn sandy loam. Pinto loam is not considered hydric although areas with inclusions of Watsonville loam are classified as hydric by the NRCS (USDA 1992). Within the project area, Pinto loam occurs near the northwest entrance to the site immediately adjacent to Atkinson Lane in fallow rangeland and uncultivated agricultural fields.

Watsonville loam, 2 to 15 percent slopes-
This soil type is a deep, somewhat poorly drained soil generally formed in sedimentary alluvium. The Watsonville series is found on old coastal terraces and valleys of the central California coast. Common vegetation associated with this map unit includes annual grasses and forbs, oaks, California sage, coyote brush, and eucalyptus stands. The surface layer is typically a very dark grayish brown loam approximately 12 inches thick. The subsurface layer is often a light gray sandy loam with prominent yellowish brown redoximorphic mottles. The underlying material is a brown to grayish brown clay loam or clay extending up to 40 inches below the ground surface. This soil is classified as a hydric soil (USDA 1992) on marine terraces of the central California coast.

Water-
This includes areas that were classified as permanent bodies of standing water at the time the Santa Cruz County Soil Survey was completed. The two areas mapped as water within the Atkinson Lane project area remain inundated but currently function as freshwater marsh.

4.0 RESULTS

This report identified all areas that met the 1987 Corps Manual criteria as wetlands or possessed a discernable ordinary high water mark and could be classified as "other waters" of the United States. Potential jurisdictional areas are described in the following sections and shown on the enclosed map in Appendix A. Vegetation, soils, and hydrology data collected during the delineation site visit are reported on standard Corps data forms presented in Appendix B. Photographs of representative sample points and wetland features are provided in Appendix C. A detailed analysis of drainage patterns and hydrology of the site conducted by hydrologist Harvey Oslick of RBF Consulting is presented in Appendix D.

Corralitos Creek, an intermittent waterway with a clearly defined bed and ordinary high water mark, is classified as "other waters" of the U.S. This feature would likely be subject to 404 jurisdiction. EcoSystems West identified four additional areas within the project site as wetland features that meet Corp parmeters. These features were determined to lack a direct and discernable surface water hydrologic connection to navigable waters, their tributaries, or wetlands adjacent to navigable waters, through an analysis of drainage patterns and hydrology conducted by RBF Consulting (Appendix D). Under both the guidance published on the

SWANCC decision or the “significant nexus” test under the *Rapanos* decision, these features would not be considered jurisdictional under Section 404 of the Clean Water Act. This report provides the additional information necessary to make recommendations to the Corps on those areas that are potentially jurisdictional and those which are not.

Wetland boundaries were determined in the field by the predominance of hydrophytic vegetation, evidence of wetland hydrology including soil saturation, ponding, and the presence of oxidized rhizospheres, and shifts in topography. In a few areas, such as the outer boundaries of seasonal wetlands, indicators of hydric soils were observed both in wetland areas and adjacent upland grassland habitat; low chroma soil color with distinct mottles was commonly observed in the upper 12 inches of soil. Additionally, some areas had a soil chroma of 2, and faint redoximorphic features. In these areas, the dominance of hydrophytic vegetation, breaks in topography, and the presence of secondary indicators of wetland hydrology were relied upon to determine whether wetland criteria were met or not.

4.1 Potential Section 404 Jurisdictional Wetlands

None of the wetland features within the project area were identified as potential jurisdictional waters of the U.S. According to an analysis of drainage patterns and hydrology conducted by RBF Consulting (Appendix D) these areas appear to lack a significant nexus with navigable waters of the U.S. Isolated wetlands are not regulated by the Corps under Section 404 of the CWA. These wetlands are described in detail under *Section 4.3 Areas Potentially Exempt from Section 404 Jurisdiction.*

4.2 Potential “Other Waters” of the U.S.

A total of 1,427 linear feet (0.49 acres) of jurisdictional waters were mapped in the project area as potentially jurisdictional areas under Section 404 of the Clean Water Act. Corralitos Creek, located along the northern boundary of the project area, is the only waterway within the property identified as potentially jurisdictional. This feature has a defined bed and bank and evidence of an OHW mark throughout the entirety of its reach within the project area. In addition, this area supports a mature riparian corridor with tree and shrub species including Coast live oak, blue gum eucalyptus, arroyo willow, red willow (*Salix laevigata*), Pacific willow (*Salix lasiandra ssp. lasiandra*), sycamore (*Platanus racemosa*), silver wattle acacia (*Acacia dealbata*), hazelnut (*Corylus cornuta* var. *californica*), elderberry (*Sambucus mexicana*), and Himalayan blackberry (Appendix B). In addition, this feature is mapped as a blue line stream on the USGS Watsonville West quadrangle map.

4.3 Areas Potentially Exempt from Section 404 Jurisdiction

Freshwater Marsh

A 2.07 acre freshwater marsh located in the western portion of the project area was designated as an isolated wetland because it lacks a hydrological connection to navigable “Waters of the U.S.”, one of its tributaries, or an adjacent jurisdictional wetland, according to a detailed hydrologic analysis of drainage patterns on the site conducted by RBF Consulting (Appendix D). A hydrological connection was determined to be absent if (1) the wetland was located too far from another jurisdictional feature, and/or (2) the wetland did not have a discernable surface water connection that would allow surface water to be transported from the wetland directly into a jurisdictional feature. The hydrologic analysis (Appendix D) indicates that overland or subsurface flow does not enter culverts or other tributaries with connectivity to navigable waters including Corralitos Creek, Harkin Slough or the Pacific Ocean. Overland flow was considered where such flow may occur during average (2-year) storm events based on the presence of surface water flow indicators such as sediment deposits, ditches, and/or culverts that collect surface flow and direct it to downstream navigable waters. The perennial freshwater marsh is separated from a seasonal wetland to the north by a levee approximately ten feet wide by 350 feet in length. Water contained within the marsh has direct groundwater connectivity with the adjacent seasonal wetland; however, under normal conditions, standing water in the seasonal wetland either evaporates or sheets into a large apple orchard to the southeast.

The freshwater marsh contained several feet of standing water at the time of the late spring site visit and was dominated entirely by hydrophytic plants including California bulrush (*Scirpus californicus*, OBL), narrowleaf cattail (*Typha angustifolia*, OBL), swamp smartweed (*Polygonum amphibium* var. *emersum*, OBL) , and arroyo willow (OBL). The hydric soil indicators observed along the edge of the sampled marsh included low-chroma coloration with prominent redoximorphic mottles. Mottling was typically observed as oxidation along root channels and iron masses in the soil matrix.

It was initially presumed that the levee separating the freshwater marsh from the seasonal wetland to the north was an upland feature. However, upon closer inspection, a representative sample point taken along the top of the levee met the three wetland criteria and is considered to be located within a wetland. Although this feature does not have topography typical of jurisdictional wetlands, the levee is completely dominated by swamp smartweed. Additionally, the soil pit associated with this sample point revealed soil saturation throughout the upper 12 inches of the profile and evidence of hydric soil formation. The levee has been mapped as an extension of the freshwater marsh (Appendix B).

EcoSystems West determined that an irrigated agricultural basin (0.31 acres) in the northwest corner of the property was likely exempt from Section 404 jurisdiction due to both the *SWANCC* and *Rapanos* Supreme Court decisions. While this feature had characteristics of freshwater marsh habitat, it does not appear to have a hydrological connection to navigable "Waters of the U.S". Moreover, this man-made wetland is actively flooded via mechanical pumps and retained water is used for irrigating agricultural crops throughout the property. Although situated in a deep basin, it is unlikely that this man-induced wetland would continue to maintain characteristics of freshwater marsh if irrigation was removed.

Seasonal Wetlands

Seasonal wetlands are primarily characterized by shallow depressional topography and are supported by a combination of direct precipitation, surface runoff from adjacent uplands, and seasonal fluctuations in the water table. Two seasonal wetlands totaling 1.87 acres were located within the Atkinson Lane project area. The larger seasonal wetland (1.58 acres) is located immediately north of the levee abutting the potential freshwater marsh. The wetland is deepest in the southwest corner where it meets the levee. It contained several inches of standing water at the time of the delineation site visit and is dominated entirely by swamp smartweed. From here it gradates into shallower topography with plant species more typical of seasonal wetlands of the region. Dominant plants throughout this portion of the wetland include curly dock (*Rumex crispus,* FACW-), Italian ryegrass (*Lolium multiflorum*, FAC), and prickly ox tongue (*Picris echioides*, FAC). Several mature arroyo willows (*Salix lasiolepis*, OBL) are also found along the northwest boundary of the wetland. As mentioned above, this feature is likely isolated from other Waters of the U.S. and standing water either evaporates or sheets overland and dissipates into an adjacent apple orchard to the southwest (Appendix D).

A smaller seasonal wetland (0.29 acres) is located immediately north of the larger freshwater marsh and west of an ephemeral drainage. This marginal wetland feature appears to be only periodically saturated during the rainy season and is comprised of a mix of hydrophytic and upland plants typical of seasonal wetlands including Italian ryegrass, curly dock, soft chess and spreading rush (*Juncus patens,* FAC). Although this feature has a direct hydrological connection to the marsh and ephemeral drainage, according to the hydrologic analysis (Appendix D), it is not connected to navigable waters of the U.S. and therefore would not be subject to Section 404 jurisdiction.

Wetland hydrology indicators observed in the sampled seasonal wetlands generally consisted of a combination of primary and secondary indicators. Primary indicators of wetland hydrology included standing water and/or saturated soils in the upper 12 inches of the soil profile. Secondary indicators observed included oxidized root channels, satisfaction of the FAC-neutral test, and "other" indicators such as depressional topography. Hydric soil indicators in the sampled seasonal wetland consisted of low chroma colors and redoximorphic characteristics such as mottling and oxidized root channels.

Ephemeral Drainage/Swale

A linear drainage swale (0.28 acres) is located in the northwestern corner and appears to convey surface water into the larger freshwater marsh following storm events. Because the swale is almost entirely vegetated and lacks a clearly defined bed, bank or OHW mark, it is best classified as a wetland rather than "other waters" of the U.S. The uppermost portion of the feature is dominated by Himalayan blackberry (*Rubus discolor*, FACW), tall flatsedge (*Cyperus eragrostis*, FACW), Italian ryegrass and curly dock while the lower half is comprised of an overstory of Pacific willow (OBL) and a dense understory of Himalayan blackberry and smartweed. Soils were saturated at the time of the delineation site visit but flowing or standing water was not observed at this time. This feature is directly connected to the isolated freshwater marsh; however, according to the hydrologic analysis (Appendix D) there is no evidence that it satisfies the significant nexus criteria and therefore is considered as an isolated wetland.

4.4 Problem Areas/Atypical Situations

Several wetlands within the project area are classified as seasonal wetlands which meet all three wetlands parameters during wetter portions of the year but often lack wetland indicators of hydrology and/or vegetation during the drier portion of the growing season. The primary sources of hydrology for the seasonal wetlands appear to be from precipitation and runoff from surrounding uplands. Because the wetland delineation was completed in spring, it is not expected that wetland indicators would have been lacking at the time of the site visit. However, plant species composition within the seasonal wetlands is likely to differ somewhat during later site visits and evidence of wetland hydrology may be more difficult to discern outside of the rainy season. Atypical situations include wetlands that are the result of unauthorized activities, natural events, or man-induced wetlands purposely or incidentally created by human activities. These include irrigated wetlands and impoundments (such as levees) that alter the natural hydrology of an area. Both freshwater marsh features identified within the project area are man-induced wetlands. Atypical wetlands are evaluated by the Corps on a case-by-case basis to determine whether “normal circumstances” are present.

5.0 CONCLUSION

The Atkinson Lane project area has four distinct areas with wetland indicators (Appendix B). These areas have hydric soils characterized by low-chroma colors and/or redoximorphic characteristics, a predominance of hydrophytic vegetation with FAC, FACW, and OBL classified plants, and wetland hydrology characterized by drainage patterns, sediment deposits, oxidized root channels, and/or satisfaction of the FAC-neutral test. However, despite meeting the three wetland indicators, these features are characterized as isolated wetlands lacking direct connectivity to navigable Waters of the U.S., according the hydrologic analysis conducted by RBF Consulting. Moreover, the irrigated agricultural basin in the northwest corner of the project area is actively flooded with mechanical pumps and is unlikely to function as a freshwater marsh if irrigation was discontinued. Therefore, these features are not likely subject to federal jurisdiction although they may still be regulated under Section 401 of the CWA and by other local laws /ordinances pertaining the project area.

In addition to potential jurisdictional wetlands, the project area contains approximately 1,427 linear feet (0.49 acres) of Corralitos Creek, a potentially jurisdictional river. A summary of potentially jurisdictional and isolated wetlands and other waters is presented in Table 2.

Table 2. Summary of Potential Section 404 Jurisdictional Wetlands and Waters of the U.S.

Feature Type	**Potential Jurisdictional Area (Acres)**	**Potential Non-Jurisdictional Area (Acres)**
Freshwater Marsh	0.0	2.38
Seasonal Wetland	0.0	1.87
Ephemeral Drainage/Swale	0.0	0.28
Corralitos Creek	0.49 (1,427 linear feet)	0.0
Total	**0.49 Acres**	**4.53Acres**

The conclusion of this delineation is based on conditions observed at the time of the field survey conducted on May 1, 2008.

6.0 REFERENCES

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Appendix A. Map of Potential Jurisdictional Wetlands and Waters of the U.S

ECOSYSTEMS WEST CONSULTING GROUP

Appendix A.

Map of Potential Jurisdictional Wetlands and Waters of the U.S.

- Project Boundary (68.4 acres)
- Corralitos Creek (0.49 acres/1,427 l. ft)
- Freshwater Marsh (2.07 acres)
- Seasonal Wetland (1.85 acres)
- Isolated Marsh (0.31 acres)
- Ephemeral Drainage (0.29 acres)
- Non-wetland Riparian (4.52 acres)
- Sample Points

N

0 125 250 500 Feet

Drawn by: Justin Davilla
Date: July 2008
Filepath: E:\Atkinson Lane\Wetland Delineation.mxd

Appendix B. Army Corps Wetland Delineation Data Forms

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Atkinson Lane Applicant/Owner: Santa Cruz County Investigator: Justin Davilla EcoSystems West	Date: 5/1/08 County: Santa Cruz State: CA
Do Normal Circumstances Exist on the site? (Yes) No Is the site significantly disturbed (Atypical Situation)? Yes (No) Is the area a potential Problem Area? (Yes) No (If needed, explain on reverse.) possible seasonal wetland	Community ID: Upland Transect ID: Plot ID: SP1

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Hordeum marinum	H	FAC	9. Rumex crispus	H	FACW-
2. Avena barbata	H	NL	10. Bromus hordeaceus	H	FACU-
3. Vicia villosa	H	NL	11.		
4. Vulpia bromoides	H	FACW	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 50%

Remarks: Only 50% of dominant + sub-dominant plants are FAC - OBL. Does not pass FAC-neutral test; therefore not dominated by wetland vegetation.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

X No Recorded Data Available

Field Observations:

- Depth of Surface Water: 0 (in.)
- Depth to Free Water in Pit: >12 (in.)
- Depth to Saturated Soil: >12 (in.)

Wetland hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- X Oxidized Root Channels in Upper 12"
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: Oxidized root channels in upper 6" of soil profile but no other evidence of wetland hydrology

SOILS

SP 1

Map Unit Name
(Series and Phase): Pinto loam

Drainage Class: Moderately well

Field Observations
Confirm Mapped Type? (Yes circled) No

Taxonomy (Subgroup): thermic Typic Argixerolls

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-12		10 YR 3/2	7.5 YR 5/6	1% distinct	loam

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- _X_ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: A chroma of 2 with distinct mottles is generally considered evidence of hydric soil development.

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	Yes	(No circled)	(Circle)
Wetland Hydrology Present?	Yes	(No circled)	
Hydric Soils Present?	(Yes circled)	No	

(Circle)
Is this Sampling Point Within a Wetland? Yes (No circled)

Remarks: Sample point 1 is located in a shallow swale / roadcut but lacks indicators for wetland vegetation or hydrology. The sample point is not located within a wetland.

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Atkinson Lane Applicant/Owner: Santa Cruz County Investigator: Justin Davilla EcoSystems West	Date: 5/1/08 County: Santa Cruz State: CA
Do Normal Circumstances Exist on the site? **(Yes)** No Is the site significantly disturbed (Atypical Situation)? Yes **(No)** Is the area a potential Problem Area? Yes **(No)** (If needed, explain on reverse.)	Community ID: ____ Transect ID: ____ Plot ID: SP2

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Polygonum amphibium	H	OBL	9.		
2. var. emersum			10.		
3. Scirpus californicus	H	OBL	11.		
4. Typha latifolia	H	OBL	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100%

Remarks: Sample point located along southern edge of marsh dominated by obligate plants

HYDROLOGY

X Recorded Data (Describe in Remarks):
____ Stream, Lake, or Tide Gauge
____ Aerial Photographs
X Other - marked on soil survey
____ No Recorded Data Available

Field Observations:

Depth of Surface Water: 0 (in.)

Depth to Free Water in Pit: 10 (in.)

Depth to Saturated Soil: 6 (in.)

Wetland hydrology Indicators:
Primary Indicators:
____ Inundated
X Saturated in Upper 12 Inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12"
____ Water-Stained Leaves
____ Local Soil Survey Data
____ FAC-Neutral Test
____ Other (Explain in Remarks)

Remarks: Taken at wetland edge, soils not inundated but saturated in upper 12" of soil profile.

SOILS

SP2

Map Unit Name
(Series and Phase): "Water"

Drainage Class: N/A

Field Observations
Confirm Mapped Type? Yes (No) [circled: No]

Taxonomy (Subgroup): N/A

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-16		10 YR 2/1	None	None	Clay loam /muck

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Very dark, low chroma soils with high organic content

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

Is this Sampling Point Within a Wetland? (Yes) No (Circle)

Remarks: Sample point located at edge of Freshwater marsh/ dentention basin.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Atkinson Lane Applicant/Owner: Santa Cruz County Investigator: Justin Davilla Ecosystems West	Date: 5/1/08 County: Santa Cruz State: CA
Do Normal Circumstances Exist on the site? **(Yes)** No Is the site significantly disturbed (Atypical Situation)? Yes **(No)** Is the area a potential Problem Area? **(Yes)** No (If needed, explain on reverse.) Levee berm	Community ID : ____ Transect ID: ____ Plot ID: SP3

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Polygonum amphibium	H	OBL	9.		
2. var. emersum			10.		
3.			11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100%

Remarks: Dominated entirely by smartweed

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

X No Recorded Data Available

Field Observations:

Depth of Surface Water: 0 (in.)

Depth to Free Water in Pit: >16 (in.)

Depth to Saturated Soil: 8" (in.)

Wetland hydrology Indicators:

Primary Indicators:
- ___ Inundated
- X Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- X Oxidized Root Channels in Upper 12"
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- X FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: Despite sample point location on levee berm, soil pit was saturated in upper 12 inches of the profile

SOILS

SP3

Map Unit Name (Series and Phase): Elder sandy loam

Drainage Class: well drained

Taxonomy (Subgroup): thermic Cumulic Haploxerolls

Field Observations
Confirm Mapped Type? Yes (No) — "No" circled

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-2	O				Organic detritus
2-16	A	10YR 2/1	10YR 5/6	10% Prominent	clay

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Clay soil with prominent oxidized rhizospheres and low chroma

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes)	No	(Circle)
Wetland Hydrology Present?	(Yes)	No	
Hydric Soils Present?	(Yes)	No	

Is this Sampling Point Within a Wetland? (Circle) (Yes) No

Remarks: Sampling point is located on a levee berm approximately 8-10' above adjacent standing water in marsh but meets all three wetland criteria.

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Atkinson lane Applicant/Owner: Santa Cruz County Investigator: Justin Davilla Ecosystems West	Date: 5/1/08 County: Santa Cruz State: CA
Do Normal Circumstances Exist on the site? (Yes) No Is the site significantly disturbed (Atypical Situation)? Yes (No) Is the area a potential Problem Area? (Yes) No (If needed, explain on reverse.) seasonal drainage w/ vegetation + poorly defined bed + bank.	Community ID: Wetland Transect ID: Plot ID: SP4

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Lolium multiflorum	H	FAC	9. Rumex crispus	H	FACW-
2.			10. Bromus hordeaceus	H	FACU -
3.			11. Lactuca serriola	H	FAC
4.			12. Picris echioides	H	FAC*
5.			13. Geranium dissectum	H	NL
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100%

Remarks: Point taken in driest portion of drainage w/out Himalayan blackberry or willows. Dominated by Italian ryegrass.

HYDROLOGY

___ Recorded Data (Describe in Remarks): ___ Stream, Lake, or Tide Gauge ___ Aerial Photographs ___ Other X No Recorded Data Available	Wetland hydrology Indicators: Primary Indicators: ___ Inundated X Saturated in Upper 12 Inches ___ Water Marks ___ Drift Lines ___ Sediment Deposits ___ Drainage Patterns in Wetlands
Field Observations: Depth of Surface Water: 0 (in.) Depth to Free Water in Pit: >12 (in.) Depth to Saturated Soil: 6 (in.)	Secondary Indicators (2 or more required): X Oxidized Root Channels in Upper 12" ___ Water-Stained Leaves ___ Local Soil Survey Data ___ FAC-Neutral Test X Other (Explain in Remarks)

Remarks: Soil profile was saturated in upper portion of cross section. Deep tire ruts from ATV in channel also indicate extent of saturation.

SOILS

SP4

Map Unit Name
(Series and Phase): Watsonville loam

Drainage Class: somewhat poorly drained
Field Observations
Confirm Mapped Type? (Yes) No

Taxonomy (Subgroup): thermic Xeric Agrialbolls

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-12		10 YR 3/1	10 YR 5/6	1% Distinct	clay loam

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- X Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- X Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Low chroma soils with oxidized root channels/mottles meets hydric soil criterion

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes)	No	(Circle)
Wetland Hydrology Present?	(Yes)	No	
Hydric Soils Present?	(Yes)	No	

Is this Sampling Point Within a Wetland? (Yes) No (Circle)

Remarks: The ephemeral drainage appears to convey water following rainfall events but does not have a clearly defined ordinary high water mark and a marginal bed and bank. The feature is vegetated and best characterized as a wetland.

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Atkinson Lane	Date: 5/1/08
Applicant/Owner: Santa Cruz County	County: Santa Cruz
Investigator: Justin Davilla EcoSystems West	State: CA
Do Normal Circumstances Exist on the site? (Yes) No	Community ID:
Is the site significantly disturbed (Atypical Situation)? Yes (No)	Transect ID:
Is the area a potential Problem Area? (Yes) No (If needed, explain on reverse.) Seasonal wetland	Plot ID: SP5

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Polygonum amphibium	H	OBL	9.		
2. var. emersum	H		10.		
3. Rumex crispus	H	FACW-	11.		
4. Bromus hordeaceus	H	FACU	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 66%

Remarks: Despite dominance by wetland vegetation in the vicinity of the sample point, this wetland feature has a diverse mix of upland vegetation.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

- Depth of Surface Water: 0 (in.)
- Depth to Free Water in Pit: >12 (in.)
- Depth to Saturated Soil: >12 (in.)

Wetland hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- X Oxidized Root Channels in Upper 12"
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- X FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: No soil saturation or inundation but meets secondary indicators of wetland hydrology.

SOILS

SP5

Map Unit Name
(Series and Phase): Watsonville loam

Drainage Class: somewhat poorly drained

Field Observations
Confirm Mapped Type? (Yes) No

Taxonomy (Subgroup): thermic Xeric Agrialbolls

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-12		10YR 2/1	10YR 5/6	5% / Prominent	loamy clay

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- X Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Soils have low chroma and oxidized root channels

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes)	No	(Circle)
Wetland Hydrology Present?	(Yes)	No	
Hydric Soils Present?	(Yes)	No	

(Circle)

Is this Sampling Point Within a Wetland? (Yes) No

Remarks: The sampling point meets all three wetland criteria; however the seasonal wetland has marginal coverage by hydrophytic plants throughout its entirety

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Atkinson Lane Applicant/Owner: Santa Cruz County Investigator: Justin Davilla EcoSystems West	Date: 5/1/08 County: Santa Cruz State: CA
Do Normal Circumstances Exist on the site? (Yes) No Is the site significantly disturbed (Atypical Situation)? Yes (No) Is the area a potential Problem Area? Yes (No) (If needed, explain on reverse.)	Community ID: Upland Transect ID: Plot ID: SP6

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Lolium multiflorum	H	FAC	9.		
2. Bromus hordeaceus	H	FACU-	10.		
3. Raphanus sativa	H	NL	11.		
4. Vicia sativa	H	FACU	12.		
5. Geranium dissectum	H	NL	13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 20%

Remarks: Not dominated by wetland vegetation.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

X No Recorded Data Available

Field Observations:

Depth of Surface Water: 0 (in.)

Depth to Free Water in Pit: >12 (in.)

Depth to Saturated Soil: >12 (in.)

Wetland hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12"
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: Very compacted soil with no evidence of wetland hydrology.

SOILS

SP6

Map Unit Name
(Series and Phase): Watsonville loam

Drainage Class: somewhat poorly drained
Field Observations
Confirm Mapped Type? (Yes) No

Taxonomy (Subgroup): thermic Xeric Argialbolls

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-12		10YR 3/3	—	—	loam

Hydric Soil Indicators:

___ Histosol
___ Histic Epipedon
___ Sulfidic Odor
___ Aquic Moisture Regime
___ Reducing Conditions
___ Gleyed or Low-Chroma Colors
___ Concretions
___ High Organic Content in Surface Layer Sandy Soils
___ Organic Streaking in Sandy Soils
___ Listed on Local Hydric Soils List
___ Listed on National Hydric Soils List
___ Other (Explain in Remarks)

Remarks: Very hard compacted soil with a chroma of 3 and no oxidized rhizospheres ∴ no evidence of hydric soil formation.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes (No) (Circle)
Wetland Hydrology Present? Yes (No)
Hydric Soils Present? Yes (No)

(Circle)
Is this Sampling Point Within a Wetland? Yes (No)

Remarks: Does not meet wetland criteria; therefore, the sample point is not located within a wetland.

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Atkinson Lane Applicant/Owner: Santa Cruz County Investigator: Justin Davilla EcoSystems West	Date: 5/1/08 County: Santa Cruz State: SP7
Do Normal Circumstances Exist on the site? (Yes) No Is the site significantly disturbed (Atypical Situation)? Yes (No) Is the area a potential Problem Area? (Yes) No (If needed, explain on reverse.) Seasonal Wetland.	Community ID: Wetland Transect ID: Plot ID: SP7

VEGETATION

Dominant Plant Species	Stratum	Indicator	Sub-Dominant Plant Species	Stratum	Indicator
1. Lolium multiflorum	H	FAC	9. Vicia sativa	H	FACU
2. Hordeum marinum	H	FAC	10. Geranium dissectum	H	NL
3. Rumex Crispus	H	FACW-	11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100%

Remarks: Dominated by hydrophytic vegetation, but sub-dominant plants are not wetland indicator species.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water: 0 (in.)

Depth to Free Water in Pit: >12 (in.)

Depth to Saturated Soil: >12 (in.)

Wetland hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- X Oxidized Root Channels in Upper 12"
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- X FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: Meets 2ndary indicators but only marginally.

SOILS

SP7

Map Unit Name
(Series and Phase): Watsonville loam

Drainage Class: somewhat poorly drained
Field Observations
Confirm Mapped Type? (Yes) No

Taxonomy (Subgroup): thermic Xeric Argialbolls

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-12		10YR 3/1	10YR 5/6	2% Faint	loam

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Soils have a chroma of 1 and oxidized root channels/mottles

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes)	No	(Circle)
Wetland Hydrology Present?	(Yes)	No	
Hydric Soils Present?	(Yes)	No	

Is this Sampling Point Within a Wetland? (Circle) (Yes) No

Remarks: Despite marginal vegetation and hydrology indicators, this sample point meets the three criteria and is located within a wetland.

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Atkinson Lane Applicant/Owner: Santa Cruz County Investigator: Justin Davilla EcoSystems West	Date: 5/1/08 County: Santa Cruz State: CA
Do Normal Circumstances Exist on the site? (Yes) No Is the site significantly disturbed (Atypical Situation)? (Yes) No Is the area a potential Problem Area? (Yes) No (If needed, explain on reverse.) Recently burned, shallow non-native aggregate landfill.	Community ID: Upland Transect ID: Plot ID: SP8

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Hordeum marinum	H	FAC	9. Plantago lanceolata	H	FAC-
2. Bromus hordeaceus	H	FACU-	10. Bromus diandrus	H	NL
3. Trifolium hirtum	H	NL	11. Vulpia bromoides	H	FACW
4. Lolium multiflorum	H	FAC	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 50%

Remarks: Mix of ruderal plants; including sub-dominant plants, this area is not dominated by hydrophytic plants

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

x No Recorded Data Available

Field Observations:

Depth of Surface Water: 0 (in.)

Depth to Free Water in Pit: >4 (in.)

Depth to Saturated Soil: >4 (in.)

Wetland hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12"
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: No evidence of wetland hydrology.

SOILS

SP8

Map Unit Name (Series and Phase): Watsonville loam

Drainage Class: somewhat poorly drained

Field Observations Confirm Mapped Type? Yes (No) [No circled]

Taxonomy (Subgroup): thermic Xeric Agrialbolls

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-4		10 YR 3/3			loam
4+		N/A			Coarse aggregate

Hydric Soil Indicators:

___ Histosol
___ Histic Epipedon
___ Sulfidic Odor
___ Aquic Moisture Regime
___ Reducing Conditions
___ Gleyed or Low-Chroma Colors
___ Concretions
___ High Organic Content in Surface Layer Sandy Soils
___ Organic Streaking in Sandy Soils
___ Listed on Local Hydric Soils List
___ Listed on National Hydric Soils List
___ Other (Explain in Remarks)

Remarks: Area is level from apparent fill used to construct power substation on adjacent parcel. No evidence of hydric soil formation.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes (No) (Circle) [No circled]
Wetland Hydrology Present? Yes (No) [No circled]
Hydric Soils Present? Yes (No) [No circled]

Is this Sampling Point Within a Wetland? (Circle) Yes (No) [No circled]

Remarks: None of the three wetland criteria met. Therefore, sampling point is not located within a wetland.

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Atkinson Lane Applicant/Owner: Santa Cruz County Investigator: Justin Davilla EcoSystems West	Date: 5/1/08 County: Santa Cruz State:
Do Normal Circumstances Exist on the site? (Yes) No Is the site significantly disturbed (Atypical Situation)? Yes (No) Is the area a potential Problem Area? Yes (No) (If needed, explain on reverse.)	Community ID: Upland Transect ID: Plot ID: SP9

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Avena barbata	H	NL	9. Picris echioides	H	FAC
2. Raphanus sativa	H	NL	10. Bromus diandrus	H	NL
3. Vicia sativa	H	FACU	11.		
4. Geranium dissectum	H	NL	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-): 0%

Remarks: This area is not dominated by wetland vegetation.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

X No Recorded Data Available

Field Observations:

Depth of Surface Water: 0 (in.)

Depth to Free Water in Pit: >12 (in.)

Depth to Saturated Soil: >12 (in.)

Wetland hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12"
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: Very hard soil, no evidence of wetland hydrology aside from faint mottles in upper portion of soil profile

SOILS

SP9

Map Unit Name (Series and Phase): Watsonville loam

Drainage Class: somewhat poorly drained

Field Observations
Confirm Mapped Type? (Yes) No

Taxonomy (Subgroup): thermic Xeric Agrialbolls

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-12		10YR 3/2	10YR 5/6	1% Faint	clay loam

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Mottling was very faint, otherwise soils were not low chroma

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes (No) (Circle)
Wetland Hydrology Present? Yes (No)
Hydric Soils Present? Yes (No)

(Circle)
Is this Sampling Point Within a Wetland? Yes (No)

Remarks: Despite some faint mottling, there was no evidence of wetland vegetation, hydrology, or soils. This sampling point is not located within a wetland.

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Atkinson Lane Applicant/Owner: Santa Cruz County Investigator: Justin Davilla EcoSystems West	Date: 5/1/08 County: Santa Cruz State: CA
Do Normal Circumstances Exist on the site? (Yes) No Is the site significantly disturbed (Atypical Situation)? Yes (No) Is the area a potential Problem Area? (Yes) No (If needed, explain on reverse.) Seasonal Wetland	Community ID: wetland Transect ID: Plot ID: SP10

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Polygonum amphibium	H	OBL	9.		
2. var. emersum			10.		
3. Picris echioides	H	FAC	11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100%

Remarks: Sample point completely dominated by wetland vegetation.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

X No Recorded Data Available

Field Observations:

Depth of Surface Water: 0 (in.)

Depth to Free Water in Pit: >12 (in.)

Depth to Saturated Soil: >12 (in.)

Wetland hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- X Oxidized Root Channels in Upper 12"
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- X FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: Sample point located in area that is clearly seasonally inundated. Very pronounced, bright mottles in soil profile.

SOILS

SP10

Map Unit Name
(Series and Phase): Watsonville loam

Drainage Class: somewhat poorly drained
Field Observations
Confirm Mapped Type? (Yes) No

Taxonomy (Subgroup): thermic Xeric Agrialbolls

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-14		10 YR 3/1	7.5 YR 5/8	10% Prominent	clay loam

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer Sandy Soils
- ___ Organic Streaking in Sandy Soils
- X Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Very low chroma with bright prominent mottles

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

(Circle)
Is this Sampling Point Within a Wetland? (Yes) No

Remarks: This area meets all three wetland criteria.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Atkinson Lane Applicant/Owner: Santa Cruz County Investigator: Justin Davilla EcoSystems West	Date: 5/1/08 County: Santa Cruz State: California
Do Normal Circumstances Exist on the site? (Yes) No Is the site significantly disturbed (Atypical Situation)? Yes (No) Is the area a potential Problem Area? (Yes) No (If needed, explain on reverse.) Seasonal Wetland	Community ID: wetland Transect ID: Plot ID: SP11

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Salix lasiolepis	S	OBL	9.		
2. Rumex crispus	H	FACW-	10.		
3. Lolium multiflorum	H	FAC	11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100%

Remarks: Completely dominated by wetland vegetation

HYDROLOGY

___ Recorded Data (Describe in Remarks): ___ Stream, Lake, or Tide Gauge ___ Aerial Photographs ___ Other X No Recorded Data Available	Wetland hydrology Indicators: Primary Indicators: ___ Inundated ___ Saturated in Upper 12 Inches ___ Water Marks ___ Drift Lines ___ Sediment Deposits ___ Drainage Patterns in Wetlands Secondary Indicators (2 or more required): X Oxidized Root Channels in Upper 12" ___ Water-Stained Leaves ___ Local Soil Survey Data X FAC-Neutral Test ___ Other (Explain in Remarks)
Field Observations: Depth of Surface Water: 0 (in.) Depth to Free Water in Pit: >16 (in.) Depth to Saturated Soil: >16 (in.)	

Remarks: Area meets secondary indicators of wetland hydrology

SOILS

SP11

Map Unit Name
(Series and Phase): Watsonville loam

Drainage Class: somewhat poorly drained

Field Observations
Confirm Mapped Type? (Yes) No

Taxonomy (Subgroup): thermic Xeric Agrialbolls

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-16		10 YR 3/2	7.5 YR 5/6	5% Distinct	loam

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- _x_ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer Sandy Soils
- ___ Organic Streaking in Sandy Soils
- _x_ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Not as dark as other sample points in this seasonal wetland but a chroma of 2 with distinct mottles provides evidence of hydric soil formation.

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes)	No	(Circle)
Wetland Hydrology Present?	(Yes)	No	
Hydric Soils Present?	(Yes)	No	

(Circle)

Is this Sampling Point Within a Wetland? (Yes) No

Remarks: This sample point is located at the northern boundary of large seasonal wetland.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Atkinson Lane
Applicant/Owner: Santa Cruz County
Investigator: Justin Davilla EcoSystems West

Date: 5/1/08
County: Santa Cruz
State: CA

Do Normal Circumstances Exist on the site? **(Yes)** No
Is the site significantly disturbed (Atypical Situation)? Yes **(No)**
Is the area a potential Problem Area? Yes **(No)**
(If needed, explain on reverse.)

Community ID: Upland
Transect ID:
Plot ID: SP12

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Rumex crispus	H	FACW-	9.		
2. Vicia sativa	H	FACU	10.		
3. Avena barbata	H	NL	11.		
4. Bromus diandrus	H	NL	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 25%

Remarks: This sample point is not dominated by wetland vegetation

HYDROLOGY

___ Recorded Data (Describe in Remarks):
___ Stream, Lake, or Tide Gauge
___ Aerial Photographs
___ Other
X No Recorded Data Available

Field Observations:

Depth of Surface Water: 0 (in.)
Depth to Free Water in Pit: >16 (in.)
Depth to Saturated Soil: >16 (in.)

Wetland hydrology Indicators:
Primary Indicators:
___ Inundated
___ Saturated in Upper 12 Inches
___ Water Marks
___ Drift Lines
___ Sediment Deposits
___ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
X Oxidized Root Channels in Upper 12"
___ Water-Stained Leaves
___ Local Soil Survey Data
___ FAC-Neutral Test
___ Other (Explain in Remarks)

Remarks: Despite presence of oxidized root channels, no other primary or secondary indicators of wetland hydrology were observed.

SOILS

SP12

Map Unit Name (Series and Phase): Elder sandy loam

Drainage Class: well drained

Taxonomy (Subgroup): thermic Cumulic Haploxerolls

Field Observations Confirm Mapped Type? Yes (No) [No circled]

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-16		10YR 3/1	7.5YR 5/8	7% Prominent	loam

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Area has low chroma soils and bright prominent mottles; therefore there is evidence of hydric soil formation.

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	Yes	(No) [circled]	(Circle)
Wetland Hydrology Present?	Yes	(No) [circled]	
Hydric Soils Present?	(Yes) [circled]	No	

(Circle)

Is this Sampling Point Within a Wetland? Yes (No) [No circled]

Remarks: Despite evidence of hydric soils, the area does not meet hydrophytic vegetation of wetland hydrology criteria.

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Atkinson Lane
Applicant/Owner: Santa Cruz County
Investigator: Justin Davilla EcoSystems West

Date: 5/1/08
County: Santa Cruz
State: CA

Do Normal Circumstances Exist on the site? (Yes) No
Is the site significantly disturbed (Atypical Situation)? Yes (No)
Is the area a potential Problem Area? (Yes) No
(If needed, explain on reverse.) Man-made isolated detention/irrigation basin

Community ID: Wetland
Transect ID:
Plot ID: SP13

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Scirpus californicus	H	OBL	9.		
2.			10.		
3.			11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100%

Remarks: Sample point is dominated by bulrush and standing water.

HYDROLOGY

X Recorded Data (Describe in Remarks):
____ Stream, Lake, or Tide Gauge
____ Aerial Photographs
____ Other
____ No Recorded Data Available

Field Observations:

Depth of Surface Water: 3 (in.)

Depth to Free Water in Pit: N/A (in.)

Depth to Saturated Soil: N/A (in.)

Wetland hydrology Indicators:
Primary Indicators:
X Inundated
____ Saturated in Upper 12 Inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12"
____ Water-Stained Leaves
____ Local Soil Survey Data
____ FAC-Neutral Test
____ Other (Explain in Remarks)

Remarks: Area recorded as "water" in SCS soil survey and was inundated at the time of the delineation site visit.

SOILS

SP13

Map Unit Name
(Series and Phase): "Water"

Drainage Class: N/A

Field Observations
Confirm Mapped Type? (Yes) No

Taxonomy (Subgroup): N/A

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-12		3/10Y (Gley 1)	7.5 YR 5/8	50% Prominent	clayey muck

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- X Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Inundated detention basin with gleyed soils

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes)	No	(Circle)
Wetland Hydrology Present?	(Yes)	No	
Hydric Soils Present?	(Yes)	No	

(Circle)

Is this Sampling Point Within a Wetland? (Yes) No

Remarks: Sample point is located in a marsh / irrigation detention basin.

Approved by HQUSACE 3/92

Appendix C. Representative Photographs of the Atkinson Lane Property

Top. Potentially jurisdictional freshwater marsh in north-central portion of the Project Area.
Bottom. Sample point of levee berm separating freshwater marsh from seasonal wetland.

ECOSYSTEMS WEST CONSULTING GROUP

Left. Sample point 13 in potentially isolated detention basin in northwest of property.

Right. Sample point 4 dominated by Italian ryegrass in ephemeral drainage/swale.

ECOSYSTEMS WEST CONSULTING GROUP

Top. Sample point 10 in seasonal wetland north of levee dominated by smartweed.

Bottom. Overview of seasonal wetland adjacent to freshwater marsh and ephemeral drainage/swale.

Appendix D. Atkinson Lane Specific Plan Stormwater Constraints and Opportunities Memorandum Prepared by RBF Consulting Hydrologist

MEMORANDUM

To: City of Watsonville **JN** 7010118
From: RBF Consulting
Date: March 13, 2008
Subject: Atkinson Lane Specific Plan Stormwater Constraints and Opportunities

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This memorandum addresses the current storm water drainage on the Atkinson Lane project area as well as possible opportunities and constraints associated with the storm water on the project site as it relates to future development.

The project site is currently used for agricultural purposes with open space that has two wetlands/runoff-storage areas as shown in Exhibit 1.

Soil Conditions

According to the National Cooperative Soil Survey by the National Resources Conservation Service, Hydrologic soil groups A, B, C, and D are all present on the project site as shown in Exhibit 2A. The eastern and southern portions of the project area have Type A and B soils which have moderate to high infiltration rates. The western and northern portions of the project area have Type C and D soils which have slow to very slow infiltration rates with high runoff potential (see Exhibits 2A through 2D).

Existing Conditions

Drainage Areas

The project area was divided into five drainage areas as shown in Exhibit 1 for the purpose of evaluating existing conditions. The areas of the drainage areas are presented in Table 1.

Table 1. Project drainage areas.

Identification	Area (acres)
DA 1	1.7
DA 2	17.8
DA 3	34.9
DA 4	5.8
DA 5	4.2

The area directly adjacent to Corralitos Creek on the north portion of the project site drains into the Creek and does not contribute to the three drainage areas. Additionally, area on the eastern portion of the project area drains to the east and south from the drainage area.

Drainage Area 1 contains a runoff storage area that is nearly half of its total drainage area. The runoff will pond in this storage area. Because no runoff is conveyed to the drainage area from an offsite location, there is little potential for overtopping the storage area. Instead, the storage area will retain the water until it infiltrates or evaporates.

Drainage Area 2 also has a runoff storage area where ponding occurs. The offsite residential development to the north of Drainage Area 2 is tributary to Drainage Area 2. When the water surface elevation in the storage area is at 74 feet, the surface area is approximately 1.7 acres. At a water surface elevation of 78 feet, the storage area covers approximately 4.8 acres, at which level additional runoff would likely spill east and south towards Crestview Park, along the existing overland release path illustrated in Exhibit 1.

The majority of the site is in Drainage Area 3, which drains to the south towards Crestview Park. Crestview Park contains a detention basin connected to the City's stormwater conveyance system.

Drainage Area 4 drains north to Corralitos Creek and east of the project area to the adjacent agriculture fields. Drainage Area 5 drains south and east of the project area to the adjacent agriculture fields.

Existing Storm Drain System

Based on information obtained from City provided GIS data, runoff from approximately 23 acres of residential development just north of the project site collects in a storm drain system and discharges through a 12" pipe directly to Drainage Area 2.

A 36" storm drain pipe exists under Brewington Avenue just east of the second storage area. This storm drain pipe collects runoff from approximately 22 acres south and west of the project area. This storm drain pipe conveys the runoff south to the Crestview Park which acts as an off-channel detention basin. At the northwest side of Crestview Park, flow exits a 42" storm drain pipe into a short section of concrete lined channel and then flows into a 18" storm drain pipe. During low-flow conditions, all of the runoff is contained in the channel and bypasses Crestview Park. During high-flow storm events, runoff spills over the channel and into the park. A 12" outlet is located on the southwest corner of the Park.

A 3-acre residential development east of Crestview Park and south of the project area also drains into the storm drain conveyance system upstream of the detention basin.

The existing storm drain system around the project area, according to GIS data from the City, is shown in Exhibit 3

Hydrology

Design precipitation is based off the County of Santa Cruz Design Criteria. The rainfall intensity for the 100-year, 60 minute duration event is approximately 1.3 inches per hour, based on page 48 of the County's Design Criteria. These can be converted to other duration and return periods based on the intensity duration curves on page 49. The resulting 24 hour depths are shown in Table 2.

Table 2. Precipitation depths based on the County of Santa Cruz Design Criteria

Return Period (years)	24-Hour Depth (in)
RP 2	3.23
RP 5	4.28
RP 10	5.04
RP 15	5.49
RP 25	6.05
RP 50	6.80
RP 100	7.56

The curve numbers that estimate the amount of runoff based on soil type and land use were taken from Urban Hydrology for Small Watersheds (TR-55) by the US Department of Agriculture, pages 2-5 through 2-8. The curve numbers of the drainage areas are presented in Table 3.

Table 3. Curve numbers for the drainage areas.

Drainage Area	CN	Percent Impervious	Description
1	79	0	Open Space, Fair Condition, Soil Type C
2	71	0	Meadow-continuous grass, Soil Type C
3	72	0	Row Crops, Straight Row, Soil Type A

Flooding Potential

The area directly adjacent to Corralitos Creek is currently designated by FEMA as a Zone AE flood zone with a 100-year water surface elevation varying from approximately 90 feet at the western edge to 85 feet near the eastern edge of the project as shown in Exhibit 4.

While the runoff storage area in Drainage Area 2 is not currently designated as a flood zone, there is still flooding risk as surface water ponds in the area. This risk can be understood in the context of expected precipitation depths. According to the Watsonville Storm Drainage Master Plan, the average yearly precipitation for the City of Watsonville is 20.7 inches, and the average annual evaporation for the region is 67.5 inches, however the most evaporation would occur during the summer months. In an average year, it is estimated that Drainage Area 2 would receive approximately 33 acre-feet of runoff, assuming 50% is lost to initial abstraction and infiltration. The pond volume between 74 feet and 78 feet elevation is about 10 acre-feet. Considering expected runoff into the storage area in Drainage Area 2, overflows would be a relatively common occurrence, though overflows may not occur during dry years.

Based on precipitation data compiled by Mr. Jim Goodrich, former California State Climatologist, the most extreme year for precipitation between 1874 and 2001 was 1998 when approximate 46.26 inches of precipitation fell on the City of Watsonville. For this amount of precipitation Drainage Area 2 would receive approximately 74 acre-feet of runoff, much of which would be expected to spill over and flow towards Crestview Park.

Hydrology and Hydraulics Model

To estimate the peak flows and volumes of runoff for the design events, a model was created in the computer program xpsmm. The SCS method was used to generate hydrographs for the existing conditions. The SCS Type I rainfall distribution (see TR-55, page B-2) was scaled for each of the precipitation depths in Table 2.

The model incorporated runoff from offsite developments north of the project area that discharges to Drainage Area 2 and south and west of the project area that discharges to the storm water conveyance system at Crestview Park. These areas are shown as Offsite Areas 1, 2, and 3 in Exhibit 1.

The results of the model show that all of the runoff generated in Drainage Area 1 is retained in the storage area located in Drainage Area 1. The storage area in Drainage Area 2 spills over during the 15, 25, 50, and 100-year events. Overflow rates were calculated based on a starting water surface elevation of 74 feet and an elevation versus capacity relationship developed from the available topographic data. For the 15-year and 25-year events, the peak flow between Drainage Area 2 and Drainage Area 3 is 0.8 cfs and 2.8 cfs, while the peak flow for the 50 and 100-year events is 2.9 and 3.7 cfs respectively.

Potential Impacts of Site Grading

Development of the project area will most likely change the site grading. This may impact both the drainage boundaries and the effective onsite storage.

Altering Drainage Boundaries

Development of the site will potentially alter the existing drainage area boundaries. This may increase or decrease the number of drainage areas within the project area and establish new points of concentration for the storm water runoff.

It is anticipated that the runoff from existing conditions Drainage Areas 4 and 5 would be collected and drained toward the City's storm drainage system to avoid creating new outfall locations.

Altering Effective Onsite Storage

Grading of the developed sight may potentially eliminate the storage area in Drainage Area 1 and decrease the footprint of the storage area in Drainage Area 2. The elimination of this first storage area would redirect runoff into another drainage area.

If the surface area of the storage area in Drainage Area 2 is decreased, it has the potential to increase the frequency and severity of spillage due to a decrease in storage volume, assuming the same amount of runoff is directed to the storage area. However, potential developments in the project area may alter or divert the volume of runoff directed to the storage area. The potential impacts of any diversion would need to be considered.

Potential impacts of increased impervious area

The possible land use plan contains a variety of uses including high-density residential, single family residential, estate homes, mixed-use, and park/open space as shown in Exhibit 5. The development of these areas would increase the impervious area of the project site and would have the potential to increase the peak discharge rates from the project site as well as the volume of runoff. A summary of the resulting SCS curve numbers due to development is shown in Table 4 (see TR-55, pages 2-5 through 2-8).

Table 4. Land use and SCS curve numbers for the possible land uses.

Land Use	Area	Hydrologic Soil Group	Pervious Area CN	Percent Impervious*
Single Family Residential	17.0	B	61	38
Medium Family Residential	1.2	B	61	38
Medium Family Residential	1.1	D	84	65
High Density Residential	12.9	D	84	65
Park	12.1	B	61	0
Pond	2.9	D	84	0
Estate Homes	7.9	A	49	20
Mixed Use/PG&E	1.7	D	84	72

* CN of 98 used for impervious areas

Using the precipitation information presented previously, runoff generated by the potential land use plan was compared to the runoff generated by the existing condition in the xpswmm computer model.

Actual existing condition site runoff is impacted by volumetric storage routing through storage area 2 and Crestview Park. Future condition runoff will be impacted by changes to site grading that alters storage routing and the overall increase in runoff associated with new impervious area.

Storage routing through Crestview Park assumed that the tennis courts on the southwest corner of Crestview Park are estimated to be at an elevation of 71’ due to a lack of more precise survey data. The volume of the detention basin when the water surface elevation is at 71’ is approximately 4 acre-feet. When the water surface elevation of the detention basin exceeds 71’, the excess runoff will spill onto the tennis courts and onto Crestview Drive and south on Brewington Avenue. For the pre-development conditions, this occurs somewhere between the 15-year and 25-year storm events. Assuming the same size detention basin for the post-development conditions, the spilling could occur for precipitation between the 2-year and the 5-year events.

In order to mitigate for increased runoff due to development, an additional 4 acre-feet would be necessary to reduce spilling to between the 15-year and 25-year event as presently occurs in the existing detention basin. In order to mitigate for development and provide enough storage for the 100-year event, 2 acre-feet more, for a total of 6 additional acre-feet of storage would be necessary.

Potential Flooding Concerns

As previously mentioned, the area directly adjacent to Corralitos Creek is currently designated by FEMA as a Zone AE flood zone. No changes to the flood zone are proposed.

As described previously, the wetlands area in Drainage Area 2 has the potential for flooding both the area below the maximum water surface elevation and the area adjacent to it that receives the overflow when the maximum water surface elevation is exceeded. Addition of impervious area that drains directly to the storage area may increase the flooding potential. However, redirecting the offsite drainage away from the storage area may decrease the flooding potential, but would need to be mitigated. Also, as development occurs between the storage area and Crestview Park, the existing overland release path may be altered or removed which may increase the flood risk.

As land use plans are evaluated, the flooding risk of the storage area in Drainage Area 2 will also need to be evaluated carefully in order to account for the risk of spillage or flooding.

Potential Water Quality Impacts

Development of the project site has the potential to contribute to the pollutants that enter the storm water conveyance system. "All developments are required to incorporate a Structural or Treatment Control BMP or combination of BMPs best suited to reducing the pollutant loadings in storm water runoff to the Maximum Extent Practicable (see Watsonville Storm Water Land Development Standards, Section 2)."

Potential Mitigation Measures

The City's Storm Water Land Development Standards require that "No development of 1 acre or larger shall cause higher rates of storm water runoff than those that existed prior to the project (Section 1)." Because development has the potential to increase storm water runoff rates, steps must be taken to mitigate the increased rates as well as address the risk of flooding.

Mitigation for Impacts to Surface Water Flooding

Because the storage area in Drainage Area 2 has the potential for spilling and flooding, the impacts of surface water flooding would need to be mitigated. A passive regulation system could be developed that allows the wetlands area to drain to a detention area downstream when there is volume available in the downstream detention area. This could be accomplished with gates and/or valves and sensors to maintain a more constant water surface elevation in the storage area. This would increase the usefulness of the storage area as a detention area, but also decrease the risk of spillage.

In case of failure of the system or extreme events, an overland release path would need to be developed to mitigate the impacts of flooding from overflows of the wetlands area. This could be accomplished by grading the streets to allow excess flow to be detained or routed to other areas, or creating a channel to collect and convey flows.

Mitigation for Impacts to Downstream Discharges

To mitigate the impacts of development of the project site, Crestview Park could be expanded north, onto the project site, to increase the volume of runoff that it could capture.

Also, the presence of Hydrologic Soil Groups A and B in the project area may have the potential to allow infiltration vaults or trenches to be used to decrease the discharge of runoff downstream. The areas of Type A and B soil would need to be studied by a geotechnical engineer to confirm infiltration rates and the suitability of such areas for storm water infiltration vaults or trenches.

Mitigation for Impacts to Water Quality

The City's Storm Water Land Development Standards list several required items that are to be implemented during the design and entitlement process that mitigate for impacts on both water quality and increase in downstream discharge rates:

- Concentrate or cluster development on portions of a site while leaving the remaining land in a natural undisturbed condition.
- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.
- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native plants.
- Promote natural vegetation by using parking lot islands and other landscaped areas.
- Preserve riparian areas and wetlands when present on site (a 50-foot setback from the edge of wetland and riparian areas is required).
- Convey runoff safely from the tops of slopes and stabilize disturbed slopes (see City Erosion Control Standards for more information)
- Utilize natural drainage systems to the Maximum Extent Practicable
- Stabilize permanent channel crossings
- Vegetate slopes with native species appropriate for the surrounding habitat.

- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion, with the approval of all agencies with jurisdiction, e.g., the U.S. Army Corps of Engineers and the California Department of Fish and Game (Sections 3 and 4)

Additionally, Crestview Park can be used to help meet the City's BMP requirements. The current function of the Park as an off-channel detention basin can be altered slightly to allow the upstream runoff to pass through a biofilter such as a vegetated swale or strip in the detention basin before being channeled back into the City's stormwater conveyance system. Most of the park area could be retained as a recreation area, while the portion dedicated to the biofilter would be affected during frequent precipitation events.

According to the City's Storm Water Land Development Standards, volumetric-based storm water quality BMPs, such as biofilters, are based on the Directly Connected Impervious Area (DCIA) in the developed area. Based on the possible land uses, the percentage of DCIA would be less than 50%. The required storage volume for 50% DCIA would be about 2 acre-feet. For less than 50% DCIA, the required storage volume would decrease by about 0.25 acre-feet for every 10% reduction in DCIA.

Exhibit 1: Existing Drainage Areas
Exhibit 2: Soil Survey
Exhibit 3: Existing Storm Drain System
Exhibit 4: FEMA FIRMette
Exhibit 5: Post-Development Possible Land Use

BRYAN M. MORI
BIOLOGICAL CONSULTING SERVICES
1016 Brewington Avenue, Watsonville, CA 95076. Tel: 831-728-1043

July 30, 2008

Attn: Bill Davilla
Ecosystems West Consulting Group
819 ½ Pacific Avenue, Suite 4
Santa Cruz, CA 95060

Attn: Dave Pereksta
Ventura Fish and Wildlife Service Office
2493 Portola Road, Suite B
Ventura, CA 93003

Subject: Special-status Amphibian and Reptile Preliminary Site Assessment for the City of Watsonville Atkinson Lane Specific/Master Plan, Santa Cruz County, California.

Dear B. Davilla and D. Pereksta:

The purpose of this letter-report is to provide the County of Santa Cruz (the County) and the City of Watsonville (the City) information intended to guide the planning process for the proposed Atkinson Lane future growth area in Watsonville (Figure 1). It also provides resource agencies a preliminary assessment of special status amphibian and reptile species and their potential for occurrence within the vicinity of the proposed project area. The assessment focused on the following species - California tiger salamander (CTS) (*Ambystoma californiense*), Santa Cruz long-toed salamander (SCLTS) (*A. macrodactylum croceum*), California red-legged frog (CRF) (*Rana aurora draytonii*), and western pond turtle (WPT) (*Actinemys marmorata pallida*). Based on this assessment, it is anticipated that U.S. Fish and Wildlife Service (USFWS) will determine if protocol-level surveys for CTS, SCLTS, and/or CRF should be conducted prior to initiating project activities. The proposed project is currently focusing on developing a Specific Plan/Master Plan intending to provide land use alternatives by August 2008 and final adoption of the Specific Plan/Master Plan in March 2009. At the time of this assessment the land use alternatives had not been finalized or a construction schedule had not yet been established.

In summary, except for the western pond turtle, a definitive statement regarding the status of the focal species on the project site could not be made at this time, due to the absence of focused surveys. The western pond turtle has been identified on the site. The chances of CTS and SCLTS occurring on the site, appear to be very low to none, given the lack of known local breeding sites in the relevant project vicinity, the marginal quality of habitat on the project site, and the isolated nature of the site and it's setting within a landscape highly fragmented by urban and agricultural uses.

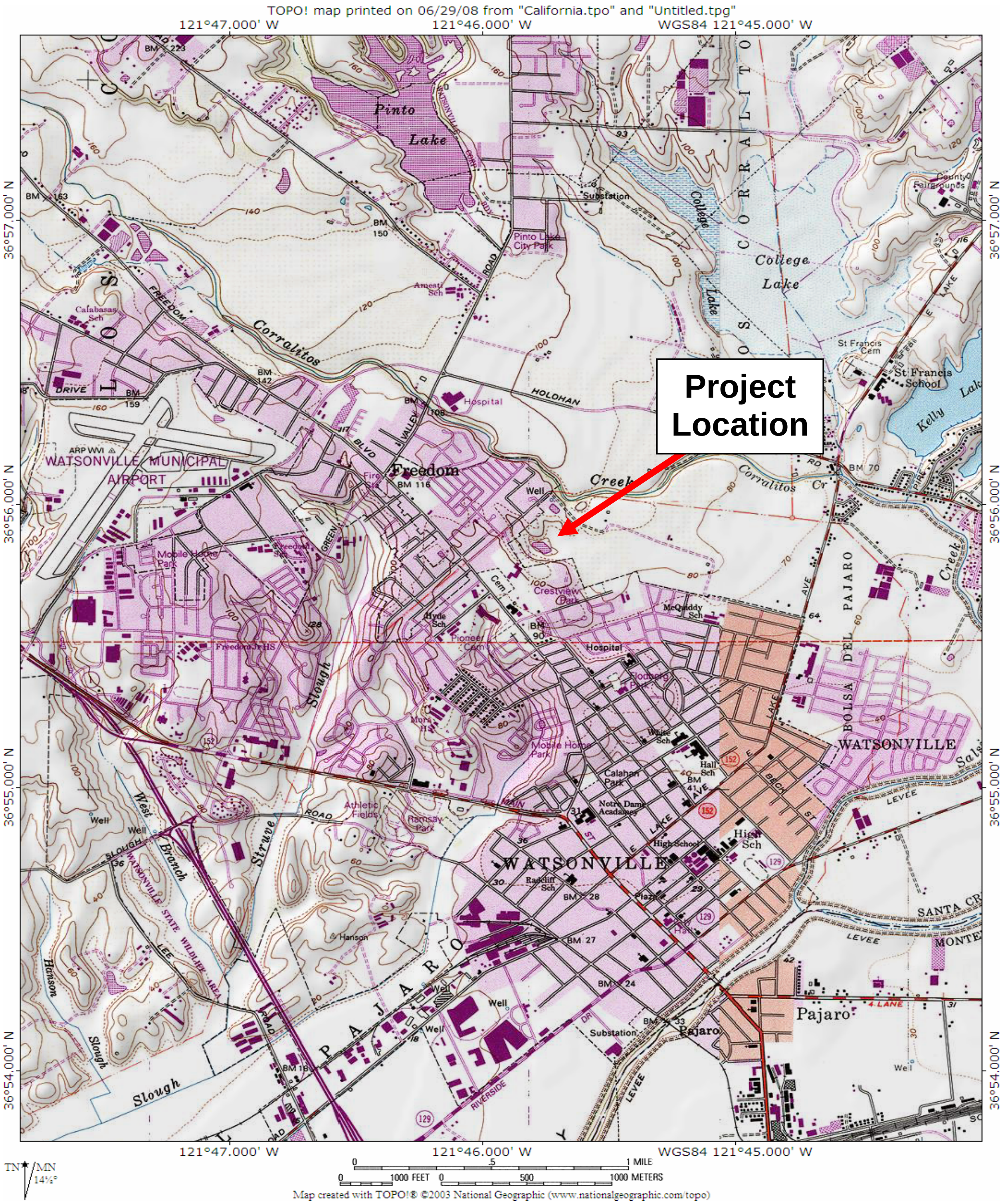

Figure 1. General location of the Proposed City of Watsonville Atkinson Lane Specific/Master Plan Area, Santa Cruz County, California.

The possibility of CRF presence at the project site is also considered low for the same reasons above; however, the chances of their occurrence on the site are slightly higher, due to the project location occurring between known occurrences of the frog from Struve Slough and Watsonville Sough to the south and the close proximity of potential non-breeding habitat in Corralitos Creek to the north (Figure 1). Surrounding urban development, however, creates barriers and likely restricts CRF movement between Corralitos Creek and Struve and Watsonville sloughs.

PROJECT DESCRIPTION

In November 2002, the voters of the City of Watsonville passed Measure U, which directs the distribution of new growth within and around the City. Measure U was designed to protect commercial agriculture lands and environmentally sensitive areas while providing the means for the City to address housing and job needs for the next 20 to 25 years. Measure U established a 20 to 25-year urban limit line around the City, and directs growth into several unincorporated areas. The three primary areas of growth include the Buena Vista, Manabe-Ow (formerly Manabe-Burgstrom), and Atkinson Lane Specific Plan areas. In accordance with Measure U, the City of Watsonville General Plan, which was adopted by the City Council in June of 2006, identifies the project site as a new growth area to accommodate up to 600 new housing units, including affordable units, townhomes, and single-family homes.

The County of Santa Cruz General Plan and Housing Element require the rezoning of a 16-acre site within the project site to allow 200 housing units at a density of 20 units per acre by June 2009. The City is also required to provide housing capacity on the remainder of the project site (City Expansion Area) to address it's projected needs for the next housing element cycle. To address these requirements, the City and County determined that it is in their mutual interest to jointly plan for the development of the entire project site. In 2007, the City and County entered into a Memorandum of Understanding (MOU) to jointly pursue a Specific Plan/Master Plan for the project site. The MOU sets specific project requirements that will fulfill the City and County obligations to provide adequate housing for the region and requires that the City and County create a development plan for the project site that addresses roadway layout, housing types and affordability restrictions, parks and schools, infrastructure financing, neighborhood concerns, protection of environmental resources, and specific development guidelines.

The County of Santa Cruz and the City of Watsonville are currently preparing a joint Specific Plan/Master Plan for the Atkinson Lane future growth area. The Atkinson Lane future growth area (project site) falls within the City of Watsonville Urban Growth Boundary. The total gross acreage of the project site is approximately 68 acres, which includes 16 acres of land to be developed by the County prior to annexation by the City to meet County affordable housing goals. The MOU estimates that up to 200 units may be developed within the 16-acre area. Development by the City would follow after 2010 wherein the City may propose to annex the 16-acre County site, as well as the City expansion area. Land uses and densities for the plan will be determined as part of the Master Plan/Specific Plan process.

Providing adequate access to the project site to serve the anticipated development without overwhelming the existing circulation system is a critical project objective. The City of Watsonville General Plan assumes that Wagner Avenue would be improved and connected to Crestview Drive to serve as the primary access arterial between Freedom Boulevard and East Lake Avenue. Secondary access routes will be analyzed including Atkinson Lane and Brewington Avenue. The proposed project will also analyze additional infrastructure necessary to serve the area including sewer lines, water lines, storm drains, gas and electric, cable, phone, etc. Existing wetlands, and other potential sensitive biotic resources occurring within the vicinity of the future growth area are currently being analyzed as part of the detailed environmental review. No other detailed plans or drawings were available at the time of this preliminary assessment.

METHODS

The assessment was performed using the following protocols as guides - Interim Guidance on Site Assessment for Determining the Presence or a Negative Finding of the California Tiger Salamander, October 2003 (USFWS and CDFG 2003) and Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog, August 2005 (USFWS 2005). These protocols also were used as guidelines for assessing SCLTS and WPT habitat, since formal habitat assessment protocols for these species are presently not available.

A reconnaissance-level survey was performed 5 and 17 June 2008 to evaluate habitat conditions at the project site. During the reconnaissance, the principal habitats were photographed (Appendix A – Photos) and conditions recorded in a field notebook. A pair of 10 x 40 powered binoculars was used to assist in wildlife identification.

The surrounding landscape within a one-mile radius of the site was qualitatively characterized, based on observations from public roads and using an aerial map and the Watsonville West USGS topographic quadrangle. For CRF and WPT, the CNDDB was accessed and other biologists were consulted for known localities within one mile of the project site (in some cases, beyond one mile), whereas for CTS and SCLTS, the search for records was expanded to at least 3.1 miles, as per protocol guidelines.

EXISTING CONDITIONS

Project Site

Aquatic Habitats: Aquatic habitats on the project site include an ephemeral drainage swale, a large detention basin, a seasonal wetland, an irrigation pond and a section of Corralitos Creek. Attachment B presents eight photos of on-site aquatic resources.

The drainage swale is located in the northwestern corner of the project site and conveys surface water (when present) to the large detention basin (Photos 1 and 2). The swale is approximately 340 feet long, with a narrow band of willows and dense understory of blackberry along the downstream-half of the corridor and annual ryegrass, smartweed, dock and blackberry within the upstream-half of the swale. The swale conveys surface run-off from urban development to the north and appears to be highly seasonal; the swale was dry during the June 5th and June 17th site visit.

The large detention basin is approximately 350 feet along its length and along the head, and roughly 270 feet across at the tail end (Photos 3 and 4). The basin is bermed along the eastern edge and along the head. The basin was nearly completely filled with cattails, with a narrow band of bulrush along the eastern margin. Dense willow and blackberry thickets grow along the basin's western edge and at its southeast corner, while dense smartweed grows along the eastern berm. Surface water was present in shallow pockets around the periphery of the basin. Shallow surface water also may have been present in the center of the basin, but was difficult to determine due to the dense growth of cattails. A western pond turtle, two bullfrogs (*Rana catesbeiana*) and unidentified frogs were observed during the site assessment.

A triangular-shaped, seasonal wetland occurs immediately adjacent to the detention basin, within a broad shallow depression (Photo 5). The length adjacent to the basin is roughly 270 feet, with the remaining two sides estimated at 180 feet each. The area is dominated by smartweed. Only a small pocket of shallow surface water was present during the assessment. During years of normal to heavy rainfall, a broad pool forms in the depression (pers. obs.). The margins of the wetland were disced sometime in the recent past.

An irrigation pond is present at the northeast corner of the project site (Photo 6). The pond is estimated to be 180 feet x 100 feet and is surrounded by a berm, which supports a narrow band of oak woodland vegetation and dense blackberry understory. The pond was nearly completely filled with bulrush. What appeared to be fairly deep pockets of surface water were present between the stands of bulrush; the water was tea-colored and dark, and the bottom was not visible from the small pier extending over the pond. One bullfrog and one unidentified frog, plus Pacific treefrog (*Pseudacris regilla*) larvae were observed on 5 June.

The section of Corralitos Creek within and adjacent to the project site boundary supports an overstory of mature cottonwood forest with coast live oak woodland, mature willows and a eucalyptus grove interspersed. The understory canopy included of young cottonwoods and willows, dogwood, acacia, coast redwood and big leaf maple. The shrub and herbaceous layer was dense and structurally complex; typical species included blackberry, stinging nettle, poison oak, German ivy and hemlock. During the 17 June reconnaissance, the channel adjacent to the site was completely dry (Photo 7). The substrate consists mostly of cobbles, with pockets of sand deposits. For the most part, the channel is v-shaped with moderate to steep-sided slopes, with occasional broad benches.

<u>Uplands:</u> Roughly two-thirds of the project site supports agricultural uses (i.e., strawberry fields and orchards). The majority of the remaining uplands consist of non-native annual grassland/ruderal vegetation and three single-family residential units, with varying degrees of landscape vegetation. Apparently, the majority of the grassland/ruderal vegetation is regularly disced and was largely barren on 6 June. Consequently, the presence of small mammal burrows was difficult to determine, but occasional occluded dens were observed. A narrow band of annual grassland/ruderal along the southwest edge of the swale and a vacant lot at the northwest corner do not appear to be maintained on a regular basis, as the vegetation was dense and the thatch layer thick, especially adjacent to the swale; as such, the presence of burrows was difficult to determine. Other minor components of the upland

include blackberry thickets, a small grove of live oaks and remnant orchard trees east and adjacent to the drainage, oak woodlands surrounding the irrigation pond, and scattered occurrences of coyote brush.

Off-Site

The following characterizations include upland and aquatic habitats within a one mile radius of the project site (Figures 2 and 3).

Uplands: The surrounding landscape is characterized by a sharp division between urban development and agricultural uses (Figure 2). A continuous block of urban development exists adjacent to the project site to the northwest, west, southwest, south and southeast. Urban land uses within this block include high-density residential, schools, commercial, industrial and a portion of the Watsonville Airport. Freedom Boulevard and Green Valley Road serve as main thoroughfares through this urbanized area. In contrast, continuous agricultural uses are present to the north, northeast, east and southeast, including row crop and orchards. Within this urban-agricultural matrix, native vegetation is limited to riparian habitat along Corralitos Creek; wetlands along the arm of Struve Slough and upper Watsonville Slough; and isolated patches of annual grasslands associated with College Lake, the Watsonville Airport and small ranches.

Aquatic Habitats: Only two ponds were identified within or just beyond the one mile radius of the project site (Figure 3), based on aerial photo and USGS topographic map interpretation and cursory observations from public roads.

Pond 1 is present to the northeast adjacent to the Lakeview Middle School track and field (Figure 3). The pond appears to serve as a catch basin for runoff from the playing fields, prior to entering Salsipuedes Creek. The basin is ringed by willows and supports scattered occurrences of cattails, bulrush and spikerush around the shoreline. No water was present on 6 June.

Pond 2 is to the southwest and is within an arm of Struve Slough (Figure 3). This pond appears to serve as a run-off detention basin for the surrounding subdivisions. The pond margins support mostly freshwater marsh vegetation, but a dense stand of willows is present at the tail end. No water was present in the pond on 6 June.

Other significant aquatic habitats within 1-mile of the site include Corralitos Creek and its tributaries, Struve Slough and upper Watsonville Slough. Corralitos Creek is intermittent and supports cottonwood-willow riparian forest, which is confined to the immediate banks due to urbanization and agriculture. Struve and Watsonville Sloughs support freshwater marsh vegetation and willow thickets and surface water is largely seasonal. Urban developments border both sloughs.

Source: City of Watsonville (2007)

RBF CONSULTING

0 500 1000 Feet
APPROXIMATE

4/24/08 JN 70-100118

ATKINSON LANE SPECIFIC PLAN/MASTER PLAN EIR

Project Site

Figure 2

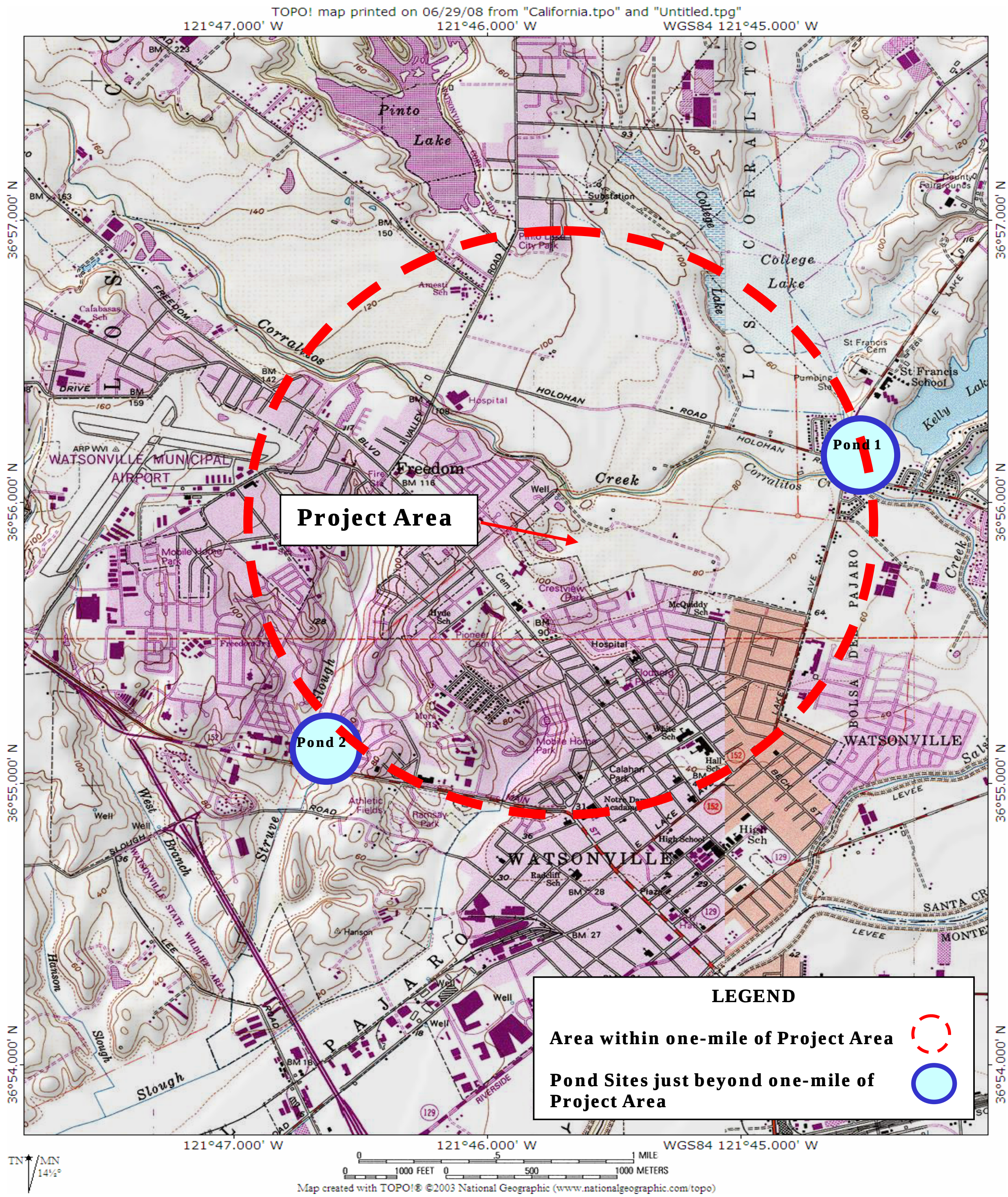

Figure 3. Locations of pond sites just beyond one mile of the proposed City of Watsonville Atkinson Lane Specific/Master Plan Area, Santa Cruz County,

SPECIES STATUS AND NATURAL HISTORY

California Tiger Salamander

The California tiger salamander is a Federal threatened species and State species of special concern (USFWS 2004a; CDFG 2008). The population consists of three Distinct Population Segments (DPS) – the Santa Rosa DPS, Santa Barbara DPS and Central California DPS, all of which are federally listed as threatened or endangered (USFWS 2004a; USFWS 2003). The California tiger salamander has disappeared from 55% of its historic range (Jennings and Hayes 1994). Presently, this species is distributed in the Central Valley from Yolo County south to Tulare County, and in the Coast Range valleys and lower foothills from Sonoma County south to Santa Barbara County (Shaffer 1991). California tiger salamanders primarily inhabit valley floor and foothill grasslands, open oak woodlands and scrub habitats encompassing vernal pools and seasonal ponds (Trenham 2001; USFWS 2000). Post-metamorphic individuals (i.e., adults and juveniles) live in rodent burrows in uplands for most of their lives (Trenham 2001; Trenham *et al* 2000; Loredo *et al* 1996). During the rainy season, typically November through March, adults migrate at night to aquatic breeding sites (Loredo and Van Vuren 1996), which include quiet waters of seasonal ponds, reservoirs, lakes and occasionally stream pools (Stebbins 1985). Tiger salamanders have osmoregulatory adaptations that allow for existence in highly alkaline aquatic environments (Kirschner et al. 1971; Romspert and McClanahan 1981). Based on a recent study, migration distances of adults between upland habitat and breeding pools generally are within 450 m (Trenham and Shaffer 2005), but distances up to 2 km (1.2 miles) have been recorded (USFWS 2000). In habitats encompassing several ponds, experienced adults may breed at more than one pond during their lifetime (Trenham *et al* 2001). The adults remain at the breeding pond from one day to several weeks, and then return to upland refugia (Loredo and Van Vuren 1996). Males migrate to breeding sites before females and tend to stay at breeding sites longer (e.g., 6 – 8 weeks for males and 1 – 2 weeks for females) (Trenham *et al* 2000; Loredo and Van Vuren 1996; Shaffer 1993). Eggs are laid singly, or in small groups of up to four, on stalks of submerged vegetation or other objects (e.g., rocks woody material, etc.), typically along the shoreline. The eggs hatch in 10 days to approximately three weeks (USFWS 2000; Jennings and Hayes 1994; Storer 1925). The number of eggs deposited per female per breeding season ranges from around 400 – 1,300 (USFWS 2000). The diet of larvae consists of aquatic insects and other invertebrates, and mostly tadpoles as the larvae grow larger (USFWS 2000; Petranka 1998; Anderson 1968). Larvae typically metamorphose in two to three months, from late spring to summer, when ponds begin to dry (USFWS 2000). Metamorphs emerge from ponds and seek shelter mostly in the immediate vicinity in burrows, cracks in the ground or under debris, but sometimes as far as 200 meters away, even in the absence of rain (Trenham 2001; Trenham and Shaffer 2005.; Loredo *et al* 1996). During the rainy-season, the juveniles continue to disperse farther to seek refuge in upland areas within 640 m of the breeding pond, but distances up to 1.6 km away from the breeding pond have been recorded (Jennings and Hayes 1994). Adults live up to at least 10 years, but take up to 4 – 5 years to reach sexual maturity (Trenham *et al* 2000). Females may not breed every year and only may breed once or twice during their lifetime (Trenham *et al* 2000). Sub-adults and adults appear to be “sit-and-wait” predators, preying on earthworms, insects and snails (CDFG 1990; Lindquist and Bachmann 1980). Threats and reasons for the decline of this species include loss of breeding and upland habitat and habitat fragmentation due to agricultural and urban development; the introduction of bullfrogs (*Rana catesbeiana*)and predatory non-native fishes; use of larval forms as fishing bait; and hybridization with introduced non-native tiger salamanders (USFWS 2000; Stebbins 2003).

Santa Cruz Long-toed Salamander

The Santa Cruz long-toed salamander was listed as endangered by the U.S. Fish and Wildlife Service in 1967 (USFWS 2004b), and subsequently in 1970 by the State of California under the California Species Preservation Act (Ruth 1989). The Santa Cruz long-toed salamander is the southernmost subspecies of *Ambystoma macrodactylum* and was first discovered in 1954 at Valencia Lagoon, near Aptos, in Santa Cruz County, California (Russell and Anderson 1956). Presently, the breeding population is restricted to southern Santa Cruz and northern Monterey Counties (USFWS 2004b). Adult and sub-adult Santa Cruz long-toed salamanders spend most of the year in upland refugia, including rodent burrows, leaf litter, underneath surface objects, and in rotting logs within dense oak woodlands, riparian vegetation and mesic coastal scrub (Ruth 1989). Adults migrate from upland habitats to seasonal/semi-perennial breeding ponds at night, during late fall and winter rains, generally from November through March. In contrast, juvenile dispersal is mostly confined to the first substantial fall rains, sometimes as early as August (M. Allaback, pers. comm.). Long-toed salamanders appear to travel in nearly straight lines, with marked individuals documented to migrate 0.6 mile from breeding ponds to upland habitat (USFWS 2004b; M. Allaback, pers. comm.). However, unmarked long-toed salamanders have been observed 1 mile from the nearest breeding pond (USFWS 2004b). Males usually precede females to the breeding site by one to two weeks, remain at the pond longer than females, and may mate with more than one female each season (Ruth and Tollestrup 1973; USFWS 2004b). Mating and egg-laying generally peak in January and February (USFWS 2004b). The female deposits 200 - 400 eggs singly on stems of emergent vegetation (Anderson 1967). After mating, the adults return to upland habitat within 6 - 12 weeks, typically by March or April (Ruth 1988; USFWS 2004b). Eggs hatch within 15 - 30 days and metamorphose into juveniles between May and September, depending on aquatic conditions. In drought years, larvae may perish prior to transformation due to insufficient water levels (Ruth 1988). Crustaceans (cladocerans and copepods) and tendipedids (midgefly larvae) are the primary food items of larvae (Anderson 1968). Recently metamorphosed salamanders (metamorphs) typically seek terrestrial refuge immediately adjacent to the breeding pond, and remain until dispersing during the first fall rains, however, early rains may induce metamorphs to move up to 200 feet from the breeding pond (Ruth 1989; USFWS 2004b). Important prey for juveniles and adults include isopods (pillbugs), beetles, centipedes, earthworms and spiders (Anderson 1968). Adults are estimated to live up to twenty years (Ruth 1988). A long life span and high reproductive output are believed to be adaptations, which allow for populations to persist at seasonal breeding sites during prolonged periods of drought (Reed 1979; Ruth 1988). Climatic changes over geologic time have restricted the distribution of the Santa Cruz long-toed salamander, making the species especially vulnerable to habitat loss resulting from agricultural and urban developments, predation from bullfrogs and non-native predatory fishes, as well as natural catastrophes related to climate and infestations (Ruth 1988; USFWS 2004b).

California Red-legged Frog

The California red-legged frog (*Rana draytonii*, hereafter CRF), is a federal threatened species and a State species of special concern (USFWS 2002; CDFG 2008). The historic range of this species extended southward from the Marin County coast, and inland from Shasta County south to Baja California (Jennings and Hayes 1994). The CRF has been extirpated from 70% of its former range (USFWS 1996). Presently, CRF is found primarily in central coastal California in natural and artificial ponds, quiet pools along streams and in coastal marshes (USFWS 1996). In the breeding season, CRF mostly inhabit pools greater than 2 feet deep, although shallow, perennial marsh habitat may also be productive if it is free of non-native aquatic predators (Hayes and Jennings 1988; B. Mori, pers. obs.). Optimal aquatic habitat is characterized by dense emergent or shoreline vegetation for cover. Seasonal ponds with little emergent/shoreline cover located in grasslands, however, may also be used for breeding, where water levels permit the metamorphosis of larvae and rodent burrows offer cover (USFWS 2002). Breeding typically occurs between December and April, depending on annual environmental conditions and locality. Egg masses containing 2,000 – 5,000 eggs are usually deposited near the water surface on emergent vegetation, but occasionally on the pond bottom where attachments are absent. Eggs require 6 to14 days to hatch and metamorphosis generally occurs within 3.5 to 7 months after hatching, although larvae have the ability to over-winter at some sites (Fellers, *et al.* 2001). Following metamorphosis, generally between July and September, juveniles are 25-35 mm in size and do not travel far from aquatic habitats, if appropriate cover is present. Dispersal of juveniles generally begins with the first rains of the weather-year, although all size classes will move in response to receding water. Radio-telemetry data indicate that adults engage in straight-line movements irrespective of riparian corridors or topography, and they may move up to 1.7 miles between non-breeding and breeding sites (Bulger, *et al.* 2003; Fellers and Kleeman 2007). They may take refuge in small mammal burrows, leaf litter or other moist areas during periods of inactivity or whenever it is necessary to avoid desiccation (Rathbun, *et al.* 1993; Jennings and Hayes 1994). At permanent ponds, most CRF remain at the pond but often move up to 300 feet into surrounding uplands, especially following rains, when individuals may spend days or weeks in upland habitats (Bulger, *et al.* 2003); whereas at seasonal breeding sites, frogs will move at least as far as the nearest suitable non-breeding habitat, e.g., riparian zone, marsh, etc. (Fellers and Kleeman 2007). Much of this species' habitat has undergone significant alteration by agricultural, urban development and water projects, leading to the extirpation of many populations (USFWS 1996). Other factors contributing to the decline of red-legged frogs include its historical exploitation as food; competition and predation by bullfrogs (*Rana catesbeiana*) and introduced predatory fishes (Jennings and Hayes 1985; Hayes and Jennings 1988; Lawler, *et al.*1999); and salinization of coastal breeding habitat (Jennings and Hayes 1990).

Western Pond Turtle

The western pond turtle (WPT) has been separated into two subspecies *Actinemys m. marmorata* is the northern subspecies and *Actinemys m. pallida* is the southern subspecies. Current research suggests, however, that the taxon may be represented by three distinct populations in California and may therefore require a taxonomic revision (Jennings and Hayes 1994). The southwestern pond turtle is a State species of special concern (CDFG 2008). In California, the pond turtle is distributed mostly along the Pacific slope drainages from Oregon to Mexico (Jennings and Hayes 1994). Pond turtles primarily occur in permanent freshwater ponds, lakes, marshes and quiet waters of streams (Bury and Holland 1993). Pond turtles favor sites with the largest and deepest pools and with an abundance of basking sites, such as partially submerged logs or rocks, matted emergent vegetation, or exposed shorelines (Bury and Holland 1993); pond turtles displace one another from basking sites, where such resources are limited (Bury and Wolfheim 1973). Pond turtles are highly sensitive and will seek cover when approached within 100 meters (Bury and Holland 1993). Undercut banks, root masses and boulder piles provide underwater escape cover (Bury and Holland 1993). Although highly aquatic, pond turtles leave the water to reproduce, aestivate and overwinter (Jennings and Hayes 1994). Females dig nests and deposit eggs, during May and June, along the shoreline or in a variety of open, sparsely vegetated upland habitats, usually within 200 meters from water, but as much as 500 meters, and mostly on south-facing slopes with well-drained clay soils (Rathbun *et al* 1992; Jennings and Hayes 1994). Nests must remain dry for proper incubation. The young hatch and may overwinter in the nest, before emerging in the spring (Jennings and Hayes 1994). Hatchlings require shallow water habitat with dense emergent vegetation and abundant zooplankton (Jennings and Hayes 1994). Pond turtles reach sexual maturity between seven and fourteen years of age (Bury and Holland 1993) and live to be over 42 years (Jennings and Hayes 1994). During dispersal, pond turtles can move up to two kilometers in search of suitable habitat and can tolerate a minimum of seven days without water (Jennings and Hayes 1994). Studies on central coast drainages show that turtles use upland habitat within 50 meters of the creek in times of drought or to avoid winter floods (Rathbun *et al* 2002) and up to 500 meters in other studies (Reese and Welsh 1997). Pond turtles are threatened by habitat alteration and loss due to water developments, agricultural practices and non-native predators (Jennings and Hayes 1994).

LOCAL SPECIAL-STATUS SPECIES RECORDS

Through consultation with other biologists, access of the CNDDB and gray-literature review, 10 records of CTS, SCLTS CRF and WPT were identified from the general project region. The nearest CRF records to the project site are from Watsonville Slough, approximately 1.2 miles to the southwest, and from Struve Slough, approximately 1.6 miles southwest of the site. The only known occurrences of CTS are south of State Route 1 at the Buena Vista site, 3.4 miles west of the project site, and from the Ellicott Slough National Wildlife Refuge (ESNWR), approximately 3.8 miles west of the site. The three nearest SCLTS records to the site are from Merk Pond, 3.7 miles to the northwest; ESNWR, 3.8 miles to the west; and from Larkin Valley, approximately 4.0 miles to the northwest. In addition to the observation of WPT at the project site, other localities include Struve Slough and Pinto Lake. These records are summarized on Table 1.

Table 1. Locations of CTS, SCLTS, CRF and WPT records from the Atkinson Lane project region in Santa Cruz County.

Taxon	Observation	Distance from Project Site	Source
California tiger salamander	South of Hwy 1, Buena Vista pond.	3.4 mi. W	CNDDB & BIOS 2008
	Ellicott Pond	3.8 mi W	CNDDB & BIOS 2008
Santa Cruz long-toed salamander	Merk Road	3.7 mi. NW	CNDDB & BIOS 2008
	Ellicott Pond	3.8 mi. W	CNDDB & BIOS 2008
	Larkins Valley	4 mi. NW	CNDDB & BIOS 2008
California red-legged frog	Watsonville Slough	1.2 mi. SW	CNDDB & BIOS 2008
	Struve Slough	1.6 mi. SW	CNDDB & BIOS 2008
Western pond turtle	On the project site.	–	K. Glinka pers. obs. onsite 2007; B. Mori pers. obs. 2008; CNDDB & BIOS 2008
	Struve Slough	1.2 mi. SW	CNDDB & BIOS 2008
	Pinto Lake	1.4 mi. N	CNDDB & BIOS 2008

DISCUSSION

California Tiger Salamander

The existence of a CTS population on the project site seems unlikely due to the combination of the following factors: 1) the aquatic habitats support bullfrogs, which are significant predators of native amphibians; 2) the uplands on the site are limited in area and marginal due to regular discing practices, which destroy potential refugia for adults and subadults; 3) the project site is isolated from other areas of potential CTS upland (e.g., extensive stands of annual grassland and oak woodlands) and aquatic habitat, due to extensive urbanization and agricultural uses surrounding the site; and 4) dispersal to the site from source populations is unlikely, since the closest known CTS populations are over three miles away and because of the isolated nature of the site from these localities. While these factors strongly suggest their absence from the site, no focused studies were conducted to support this conclusion.

Santa Cruz Long-toed Salamander

As with CTS, the presence of SCLTS on the project site is considered unlikely due to the combination of the following factors: 1) the aquatic habitats support bullfrogs, which are significant predators of native amphibians; 2) potential upland habitat on the site is confined to only a few isolated patches of dense blackberry and willow thickets; 3) the project site is isolated from other areas of primary upland habitat (e.g., extensive stands of moist oak woodlands, willow thickets and mesic coastal scrub) and aquatic habitat, due to extensive urbanization and agricultural uses surrounding the site; and 4) dispersal to the site from source populations is unlikely, since the closest known SCLTS populations are between three to four miles away and because of the isolated nature of the site from these localities. While these factors strongly suggest their absence from the site, no focused studies were conducted to support this conclusion.

California Red-legged Frog

The presence of CRF on the project site also is considered unlikely, due to the combination of the following factors: 1) the aquatic habitats on site support bullfrogs, which are significant predators of native amphibians; 2) potential non-breeding habitat on the site is confined to only a few isolated patches of dense blackberry, willow thickets and smartweed; 3) the project site is largely isolated from other areas of potential habitat, due to extensive urbanization and agricultural uses surrounding the site; and 4) dispersal to the site from source populations is unlikely, since the closest known CRF populations are over one mile away (Table 1), and because of the isolated nature of the site from these localities. Although CRF are known to use riparian corridors (such as Corralitos Creek) for migration and as non-breeding habitat, in this situation, no CRF observations are known from Corralitos Creek or nearby Salsipuedes Creek. The section of Corralitos Creek adjacent to the project site does not appear to provide a reliable source of standing water outside of the rainy season, and potential breeding ponds adjacent to the creek are lacking in the project vicinity. While these factors strongly suggest their absence from the site, no focused studies were conducted to support this conclusion.

Western Pond Turtle

Western pond turtles have been observed at the large detention basin sporadically since at least 1996 (pers. obs.). There is uncertainty regarding the status of the population and whether the site is used seasonally or year-round, since focused surveys have not been performed. The annual grasslands on the site appear to provide potential nesting habitat, however, discing practices may preclude successful reproduction. Given the level of urban and agricultural developments surrounding the site, it is reasonable to assume that Corralitos Creek/Salsipuedes Creek may serve as a dispersal/migration corridor for turtles, since they are known to inhabit the Pajaro River system and are capable of long distance movements.

CONCLUSIONS

Except for WPT, which is present on the project site, a conclusive determination regarding the presence/absence of CTS, SCLTS and CRF could not be made during this assessment, due to the lack of focused surveys. Several factors regarding the marginal/unsuitable habitat conditions present on the site and surrounding landscape, however, do suggest that their occurrence on the site is unlikely. As previously mentioned, based on the results of this assessment USFWS will determine whether or not protocol-level surveys should be conducted prior to initiating project activities and should reply to EcoSystems West Consulting Group with their comments.

Also, please call me at (831) 728-1043 if you have any comments or questions regarding this report.

Sincerely,

Bryan Mori
Consulting Wildlife Biologist

CC: Erika Spencer, Senior Planner, RBF Consulting
Todd Sexauer, Environmental Planner, County of Santa Cruz Planning Department
Suzi Aratin, Senior Planner, City of Watsonville Community Development Department

Attachments: Appendix A - Site Photographs

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APPENDIX A

Photographs of Features in the Vicinity of the Atkinson Lane Project Area

Photo 1. Downstream section of drainage swale.

Photo 2. Upstream section of drainage swale.

Photo 3. Overall view of detention basin.

Photo 4. Close-up view of detention basin.

Photo 5. Broad view of seasonal wetland.

Photo 6. Close up view of irrigation pond.

Photo 7. View of Corralitos Creek, June 2008

APPENDIX E
GEOLOGY AND SOILS

Pacific Crest Engineering. Feasibility Level Geotechnical Investigation & Engineering Geology Report for Atkinson Lane Development, Watsonville, California. March 2009.

FEASIBILITY LEVEL
GEOTECHNICAL INVESTIGATION
&
ENGINEERING GEOLOGY REPORT
FOR
ATKINSON LANE DEVELOPMENT
WATSONVILLE, CALIFORNIA

FOR
RBF CONSULTING
MARINA, CALIFORNIA

BY
PACIFIC CREST ENGINEERING INC.
CONSULTING GEOTECHNICAL ENGINEERS
0829-SZ77-H62
MARCH 2009
www.4pacific-crest.com

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Feasibility Level Engineering Geology Report

Pacific Crest Engineering Inc. www.4pacific-crest.com

444 Airport Blvd, Suite 106
Watsonville, CA 95076
Phone: 831-722-9446
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March 2, 2009

Project No. 0829-SZ77-H62

RBF Consulting
3180 Imjin Road, Suite 110
Marina, California 93933

Attention: Ms. Elizabeth Caraker, Senior Associate

Subject: Feasibility Level Geotechnical Investigation and Engineering Geology Report
Atkinson Lane Future Growth Area
Watsonville, California

Dear Ms. Caraker,

In accordance with your authorization, we have performed a feasibility level geotechnical investigation and engineering geology report for the Atkinson Lane future growth area located in Watsonville, California. The feasibility level engineering geology report was prepared by Zinn Geology, and is included within Appendix D of this report.

The accompanying report presents our conclusions and recommendations as well as the results of the geotechnical investigation on which they are based. If you have any questions concerning the data, conclusions or recommendations presented in this report, please call our office.

Very truly yours,

PACIFIC CREST ENGINEERING INC.

REGISTERED PROFESSIONAL ENGINEER
MICHAEL D. KLEAMES
No. GE 2204
Exp. 3-31-10
GEOTECHNICAL
STATE OF CALIFORNIA

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Copies: 4 to Client

FEASIBILITY LEVEL GEOTECHNICAL INVESTIGATION

PURPOSE AND SCOPE

This report describes the feasibility level geotechnical investigation and presents results, including recommendations, for the future residential growth project located at the terminus of Atkinson Lane in Watsonville, California. Our scope of services for this project has consisted of:

1. Discussions with project team members.

2. Review of the pertinent published material concerning the site including County planning maps, preliminary site plans, geologic and topographic maps, and other available literature.

3. The drilling and logging of 26 test borings and 16 Cone Penetrometer Test (CPT) soundings.

4. Laboratory analysis of retrieved soil samples.

5. Engineering analysis of the field and laboratory results. This included a quantitative liquefaction analysis of the subsurface soils.

6. Preparation of this feasibility level report documenting our investigation and presenting preliminary recommendations for design of the project.

LOCATION AND DESCRIPTION

The County of Santa Cruz and the City of Watsonville are in the process of preparing a joint Specific Plan/Master Plan for the Atkinson Lane future growth area. Please refer to Figure No. 1, Regional Site Map, for the approximate location. The central portion of the site is located at the following coordinates:

Latitude = 36.931214 degrees
Longitude = -121.759820 degrees

The project area is planned for affordable market rate housing and neighborhood services along with parks and recreation space to serve the residents of Pajaro Valley. The total gross area of the site is approximately 68 acres. The proposed Specific Plan/Master Plan includes approximately 34 acres designated for residential uses, including 11 acres for "Residential-High Density" and 23 acres for "Residential-Medium Density." An additional 3.9 acres is planned for expansion of the adjacent Crestview Park. The proposed project also includes 4.0 acres of a designated riparian area and a 1.9 acre riparian buffer adjacent to Corralitos Creek, the preservation of a 3.9 acre existing wetland and incorporation of a 2.7 acre wetland buffer. Additionally, 1.3 acres are designated for storm water swales, 2.2 acres are reserved for a PG&E substation, and 14.9 acres are allocated for a 200 foot agricultural buffer located on the eastern boundary of the project site adjacent to the existing agricultural fields. The entire 68 acres of the project site falls within the County of Santa Cruz.

At the time of our site visits, the 68 acre project site was comprised of 11 parcels. Three of the parcels consisted of strawberry fields and apple orchards (approximately 45.1 acres). The strawberry fields and apple orchards were well maintained and groomed while the remainder of the subject site was either overgrown or plowed and tilled and unused. Five of the parcels (4.6 acres) were used for residential purposes; these parcels, located along Atkinson Lane, include one that was vacant and four that were comprised of single family residences. Two parcels consisted of open fields; one parcel (2.5 acres) included a flat, plowed dirt area that was possibly used for farming purposes. The other parcel was comprised of weeds and native plants that sloped to the south to a slough (14.4 acres). This site was eventually plowed and tilled. The last parcel consisted of a Pacific Gas and Electric sub-station (2.2 acres). It was not maintained and sloped easterly towards the slough. The site is bound by Corralitos Creek and Atkinson Lane to the north, apple orchards to the east, and residential subdivisions to the south and west.

A pond was noted on the southwestern portion of the site in the vicinity of Borings 16, 17, 18, 19 and 26. The pond was roughly 4 acres and covered with vegetation although standing water was visible as well. The pond is south of Boring No. 18, west of Boring No. 19 and east of Boring No. 16 , 17 and 26. Please refer to Figure No. 2, Site Map Showing Test Boring Locations for the approximate location of the pond.

Based upon our review of the preliminary site plan it is our understanding that the County has identified 34 acres designated as affordable housing. A total of 200 units are initially planned while the remaining parcels may have an additional 400 units. The plan includes an expansion of Wagner Street to connect with Crestview Drive to serve as the primary arterial between Freedom Boulevard and East Lake Avenue. Secondary access routes will be analyzed and include Atkinson Lane and Brewington Avenue. This plan will also analyze additional infrastructure necessary to serve the area. This includes: sewer lines, water lines, storm drains, electrical, cable, as well as other public utilities.

We assume the structures will be one and/or two-stories in height, of wood frame and masonry construction, combined with some concrete slab- on-grade. Structural loading conditions are not known at this time, but are expected to be typical of residential-type construction. We also presume the project will require exterior flatwork, landscaping and attendant utility improvements.

FIELD INVESTIGATION

Soil Borings

Eleven 8-inch diameter test borings were drilled on the site on April 21st and 22nd, 2008 and February 6th and 9th, 2009 using hollow-stem drill augers. Fifteen 6-inch diameter test borings were drilled on the site on May 5th, 6th, and 7th, 2008 using solid-stem drill augers. The location of the test borings are shown on Figure No. 2, Site Map Showing Test Borings. The drilling method used was hydraulically operated continuous flight augers. A geologist from Pacific Crest Engineering Inc., was present during the drilling operations to log the soil encountered and to choose soil sampling type and locations.

Relatively undisturbed soil samples were obtained at various depths by driving a split spoon sampler 18 inches into the ground. This was achieved by dropping a 140 pound down hole safety hammer through a vertical height of 30 inches. The number of blows needed to drive the sampler for each 6 inch portion is recorded and the total number of blows needed to drive the last 12 inches is reported as the Standard Penetration Test (SPT) value. The outside diameter of the samplers used in this investigation was either 3 inches or 2 inches, and is noted respectively as "L" or "T" on the boring logs. All standard penetration test data has been normalized to a 2 inch O.D. sampler so as to be the SPT "N" value.

The soils encountered in the borings were continuously logged in the field and visually described in accordance with the Unified Soil Classification System (ASTM D2488 (Modified), Figure No. 3). The soil classification was verified and or modified upon completion of laboratory testing.

Appendix A contains the site plan showing the locations of the test borings and the Log of Test Borings presenting the soil profile explored in each boring, the sample locations, and the SPT "N" values for each sample. Stratification lines on the boring logs are approximate as the actual transition between soil types may be gradual.

Cone Penetrometer Soundings

Four cone Penetrometer (CPT) soundings with pore pressure measurements were advanced on May 1, 2008. Another twelve CPT soundings were performed on February 12th and 13th, 2009. The CPT soundings were located next to hollow stem test borings that were advanced to a depth of 51 ½ feet. The CPT soundings were also extended to a depth of 50 feet, to match the depth of the hollow-stem test borings. A geologist and/or engineer from Pacific Crest Engineering Inc., was present to supervise the field operations. The locations of the Cone Penetrometer Soundings are shown on Figure No. 2, Site Map Showing Test Borings and CPT Soundings.

The Cone Penetrometer soundings with Pore Pressure Measurements were advanced using a hydraulically operated Hogentogler H0322 electronic cone with an apex angle of 60 degrees, a diameter of 35.7 mm, and a friction sleeve with a surface area of 150 square cm. A saturated piezo element was placed between the cone and the friction sleeve to obtain dynamic pore pressure parameters. Continuous measurements were made of the tip resistance, the friction sleeve resistance, and the dynamic pore pressure. Correlations between these measurements and many soil properties were made using charts developed by Robertson (1990).

Appendix A contains the site plan showing the locations of the CPT soundings and Appendix B contains the logs presenting the CPT resistance to penetration as a function of depth, the sleeve friction as a function of depth, and interpretations of the soil behavior types interpreted from the CPT sounding data. Please note that the classification of soil *"behavior type"* shown on the sounding logs is exactly that and should not be misidentified as a specific soil type based upon any classification system. This is because no soil samples were extracted from the soundings advanced by the CPT rig; the interpretations are soil "*behavior types*" derived from calculations and interpolations that are performed by the CPT vendor's software.

LABORATORY INVESTIGATION

The laboratory testing program was developed to help in evaluating the engineering properties of the materials encountered on the site. Laboratory tests performed include:

a. Moisture Density relationships in accordance with ASTM test D2937.

b. Direct Shear tests in accordance with ASTM test D3080.

c. Unconfined Compression tests in accordance with ASTM test D2166.

d. Atterberg Limits tests in accordance with ASTM test D4318.

e. Consolidation tests in accordance with ASTM test D2435.

f. "R" Value tests in accordance with California test 301.

g. Gradation tests in accordance with ASTM test D1140 and D422.

h. Expansion Potential tests in accordance with ASTM test D4829 and the UBC 29-2.

i. Corrosivity testing including pH, resistivity, chloride concentration, and sulfate concentration.

The results of the laboratory tests are presented on the boring logs opposite the sample tested. Selected test results are also presented graphically in Appendix A.

SOIL CONDITIONS

Regional Geologic Maps

The surficial geology in the area of the project site is mapped as Fluvial Facies, Younger Flood Plain Deposits, and Older Flood Plain Deposits (Brabb, 1997; Dupre and Tinsley, 1991). The Fluvial Facies are described as partially consolidated, moderately to well graded silt, sand, silty clay and gravel. The Younger Flood Plain Deposits are described as unconsolidated deposits of fine-grained sand and silt with thin discontinuous layers of clay. The Older Flood Plain Deposits are described as unconsolidated sand, silt, and clay that are fine-grained. The native soils encountered in the test borings and interpreted from the CPT soundings are consistent with these descriptions. Please refer to Appendix D, Feasibility Level Engineering Geology Report, for a more detailed discussion of the regional geologic setting of the site.

Soil Borings

The twenty-six test borings on the project site encountered a range of soils including sandy clay, silty sand, sandy silt, clayey sand, sand, silt, silty clay/silt, clay, and fat clay. Most of the borings exhibited inter-layered sands, silty sands, clays, and fat clays. Nineteen of the twenty-six explored borings contained lenses of fat clay. Please refer to the graphical depiction of the underlying stratigraphy portrayed on the cross sections shown of Plate 2 of the Zinn Geology report appended to this report. The cross sections were developed on the basis of boring and CPT data.

Boring No.'s 4, 6, 8, 10, 11, and 16 were evaluated quantitatively for liquefaction, and most encountered potentially loose and liquefiable sandy soils. Boring No. 2 and Boring No. 5 were not specifically analyzed for liquefaction for this preliminary study due to the shallow nature of the test borings; however it should be noted that these borings did encounter potentially loose and liquefiable soils. The CPT soundings were also evaluated for liquefaction as well as lateral spreading potential.

Turning to the cross section provided to us by Zinn Geology for the site (Plate 2 – appended to this report), we note that the site is predominantly underlain by three stratigraphic subunits, a sand package, underlain by a clay package, with silt package appearing to underlie everything across the site to the depths explored for this project. As may be noted on the geological cross sections, the lateral and vertical variations are extremely complex within the generalized subunits, as is typically found in dynamic fluvial environments. Additionally, it should be noted that the complexity of the stratigraphy drawn by Zinn Geology appears to be directly correlative to the spacing and array between the borings and the soundings. In our opinion, a plausible assumption is that the site stratigraphy is very complex, with very few, if any specific stratigraphic beds being continuous across the site.

Groundwater

Groundwater was encountered in 17 test borings. The depth to water varied within each test boring; Boring No. 2 encountered groundwater at 26 ½ feet; Boring No. 4 encountered groundwater at 36 ½ feet; Boring No. 5 encountered groundwater at 20 feet; Boring No. 8 encountered groundwater at 27 feet; Boring No. 10 encountered groundwater at 28 feet; Boring No. 11 encountered groundwater at 20 ½ feet; Boring No. 12 encountered groundwater at 24 feet, 3 inches; Boring No. 13 encountered groundwater at 23 feet; Boring No. 14 encountered groundwater at 25 feet; Boring No. 15 encountered groundwater at 24 feet; Boring No. 16 encountered groundwater at 13 feet; Boring No. 18 encountered groundwater at 6 feet; Boring No. 19 encountered groundwater at 27 feet; and Boring No. 20 encountered groundwater at 12 ½ feet. Boring No. 23 encountered groundwater at 35 feet, Boring No. 24 encountered groundwater at 35 feet and Boring No. 25 encountered groundwater at 20 feet. It should be noted that the groundwater level was not allowed to stabilize for more than a few hours, therefore, the actual groundwater level may be higher or lower than initially encountered.

Groundwater levels used in our analysis were estimated on the basis of available groundwater data from adjacent borings. Where a groundwater table was encountered, we assumed a rise of 10 feet for seismic conditions. Where no groundwater was encountered to a depth of 50 feet, a minimum groundwater elevation of 25 feet below the existing ground surface was assumed.

Based upon our observation of short-term groundwater levels in our test borings, and due to the abundance of clay lenses throughout all of our test borings, it is our opinion that groundwater elevations do not radiate laterally from Corralitos Creek but tend to seasonally collect within discontinuous, more permeable soil layers.

Cone Penetrometer Soundings

The soils encountered in our CPT soundings, as interpreted based on charts developed by Robertson (1990), consisted of a variety of soil types very similar to those encountered in the adjacent test borings. Please note that the interpretations for the CPT soundings are merely interpretations. As discussed above, the classification of soil *"behavior type"* shown on the sounding logs should not be misidentified as a specific soil type based upon any classification system. This is because no soil samples were extracted from the soundings advanced by the CPT rig; the interpretations are soil *"behavior types"* derived from calculations and interpolations that are performed by the CPT vendor's software. Please refer to Appendix B for the results of CPT testing and the resulting interpretations of soil behavior type (SBT). Ten of the CPT soundings were accompanied by drilled borings to provide visual interpretation and identify soil classifications for selected samples.

The continuity of the soundings lends further credence to the hypothesis that the overall site stratigraphy is fairly complex, with many interfingering and intercalated beds of different soils and soil behavior types, as would be expected in a dynamic fluvial depositional environment. Considering the fact that the complexity of the geometry of the stratigraphy portrayed upon the cross sections issued by Zinn Geology, it is our opinion that the stratigraphy across the entire site is probably at least as complex as that shown on the Zinn Geology cross sections. The importance and implication of this hypothesis will be noted in later sections of this report, where the hazards of liquefaction and lateral spreading are analyzed, since the potential of those hazards relies upon the overall site stratigraphy.

REGIONAL SEISMIC SETTING

The seismic setting of the site is one in which it is reasonable to assume that the site will experience significant seismic shaking during the lifetime of the project.

Based upon our review of the fault maps for the Santa Cruz area (Greene et al. 1973, Hall et al. 1974), and the Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada (CDMG, 1998), active or potentially active faults which may significantly affect the site include those listed in the Table No. 1, below.

TABLE No. 1, Faults in the Santa Cruz County Area

Fault Name	Distance (miles)	Distance (km.)	Direction	Slip Rate* (mm/yr)	M_w Max.*
San Andreas – 1906 Segment	3.9	6.3	Northeast	24	7.9
Zayante – Vergeles	0.9	1.5	Northeast	0.1	7.0
Monterey Bay – Tularcitos	15.6	25.3	Southwest	0.5	7.3

*Source: CDMG, February, 1998

Please refer to Appendix D, Feasibility Level Engineering Geology Report, for a more thorough discussion of the regional geologic setting.

SEISMIC HAZARDS

This section provides a general summary of the seismic hazards associated with the project site. For a more complete review of this issue, please refer to the Feasibility Level Geology Report prepared by Zinn Geology within Appendix D.

In general, seismic hazards which may affect project sites in the Monterey Bay area include ground shaking, ground surface fault rupture, liquefaction and lateral spreading, and seismically induced slope instabilities. Geotechnical aspects of these issues are discussed below:

Ground Shaking

Intense ground shaking generated by earthquakes from nearby local faults will likely occur on the site within the design life of any structure proposed for this project. Structures founded on thick soft soil deposits, such as those encountered on the subject site, are more likely to experience more destructive shaking, with higher amplitude and lower frequency, than structures founded on bedrock. The intensity of ground shaking is generally commensurate with distance to the earthquake epicenters. However, it should be noted that significantly higher ground accelerations may occur in thick soft soil deposits large distances from earthquake epicenters than bedrock at a comparative distance. Structures built in accordance with the latest edition of the California Building Code may have an increased potential for experiencing relatively minor damage which could be repairable. The seismic design of the project should be based on the 2007 California Building Code (CBC) as it has incorporated the most recent seismic design parameters. The following values for the seismic design of the project site were derived or taken from the 2007 CBC:

TABLE No. 2, The 2007 CBC Seismic Design Parameters

Design Parameter	Specific to Site	Reference (See Note 1)
Site Class	E, Soft Soil	Table 1613.5.2
Mapped Spectral Acceleration for Short Periods	Ss = 1.941 g	Fig. 22-3, ASCE 7-05
Mapped Spectral Acceleration for 1-second Period	S_1 = 0.856 g	Fig. 22-4, ASCE 7-05
Short Period Site Coefficient	Fa = 0.9	Table 1613.5.3(1)
1-Second Period Site Coefficient	Fv = 2.4	Table 1613.5.3(2)
MCE Spectral Response Acceleration for Short Period	S_{MS} = 1.747 g	Section 1613.5.3
MCE Spectral Response Acceleration for 1-Second Period	S_{M1} = 2.053 g	Section 1613.5.3
5% Damped Spectral Response Acceleration for Short Period	S_{DS} = 1.165 g	Section 1613.5.4
5% Damped Spectral Response Acceleration for 1-Second Period	S_{D1} = 1.369 g	Section 1613.5.4
Seismic Design Category **(See Notes 2 and 3)**	E	Section 1613.5.6

Note 1: Design values may also have been obtained by using the Ground Motion Parameter Calculator available on the USGS website at http://earthquake.usgs.gov/research/hazmaps/design/index.php. Refer to the "Liquefaction" section for further information on how the Site Class may have been derived.

Note 2: Seismic Design Category assumes Class II occupancy per 2007 CBC Table 1604.5. Pacific Crest Engineering Inc. should be contacted for revised Table 2 seismic design parameters if the building has a different occupancy rating from the one assumed.

Note 3: Based on Section 1613.5.6 of the 2007 CBC, the S_1 value exceeds 0.75g. Therefore, the appropriate Seismic Design Category is E rather than D assuming this development will consist primarily of Category II structures.

Please note that the above minimum prescriptive building code values are appropriate for structures of specific stories, material types and occupancy ratings outlined by the CBC. The above values do not preclude the use of more conservative site-specific values that could conceivably be generated by an engineer or geologist, nor should they be inappropriately applied to structures excluded from those by the CBC.

Seismic Accelerations

It should be noted that the seismic design values in Table No.2 above are based on values derived from the 2007 California Building Code. For the purpose of evaluating peak ground accelerations, Zinn Geology performed a site-specific deterministic seismic hazard analysis.

Deterministic analysis for the site using a deep soil site attenuation relationship yields a mean peak ground acceleration of 0.63g and mean peak ground acceleration plus one dispersion of 0.94g (based on the closest seismic shaking source, the Zayante-Vergeles Fault). The Zinn Geology report also provides the "maximum considered earthquake ground motion" as defined by FEMA (1998). Refer to Table No. 2 within the Zinn Geology Report for more information (Appendix D).

It should be noted that if the deterministically derived values listed in the Zinn Geology report are used for project design, that we recommend utilizing the attenuation relationships developed by Sidigh, et al. Please refer to Appendix D for further details of the analysis.

Ground Surface Fault Rupture

Ground surface fault rupture occurs along the surficial trace(s) of active faults during significant seismic events. Pacific Crest Engineering Inc. has not performed a specific investigation for the presence of active faults on the project site. Since the nearest known active or potentially active fault is mapped approximately 1.5 km from the site (Hall et al, 1974), the potential for ground surface fault rupture to occur within the stipulated design life of any structure at this site is considered low.

Liquefaction

Liquefaction tends to occur in loose, saturated fine grained sands, coarse silts or clays with a low plasticity. In order for liquefaction to occur there must be the proper soil type, soil saturation, and cyclic accelerations of sufficient magnitude to progressively increase the water pressures within the soil mass. Non-cohesive soil shear strength is developed by the point to point contact of the soil grains. As the water pressures increase in the void spaces surrounding the soil grains the soil particles become supported more by the water than the point to point contact. When the water pressures increase sufficiently, the soil grains begin to lose contact with each other resulting in the loss of shear strength and continuous deformation of the soil where the soil appears to liquefy.

Based upon our review of the regional liquefaction maps (Dupre', 1975; Dupre' and Tinsley, 1980) the site is located in an area classified as having a moderately high potential for liquefaction.

The potential for liquefaction was evaluated quantitatively for this project, based upon the data obtained from our exploratory borings. For the borings, our analysis utilized the software program LiquefyPro Version 5, which is based upon the most recent recommendations of the NCEER Workshop and SP117 Implementation. The program calculates a factor of safety against liquefaction and also estimates seismically-induced settlement due to both liquefaction and dynamic compaction of loose, dry sands above the design water table. The data from the CPT soundings was evaluated for liquefaction and lateral spreading potential using the software program by CLiq by GeoLogismiki. Please refer to Appendix C for the model parameters and results we obtained.

The analysis included a peak ground acceleration value of 0.63g. This value is the deterministically derived value for estimated peak ground acceleration as noted in Table 2 of the Zinn Geology Report (refer to Appendix D).

It should be noted that the peak ground acceleration value of 0.63g is somewhat higher than the procedure outlined within the 2007 California Building Code (CBC). Section 1802.2.7 of the 2007 CBC allows for determination of the peak ground acceleration value by first determining the S_{DS} value as outlined in Section 1613 of the 2007 CBC (the S_{DS} value is the 5% damped spectral response acceleration for short periods). The S_{DS} value is then divided by 2.5 to determine the peak ground acceleration, as defined in Section 1802.2.7 of the 2007 CBC. Using this method, the peak ground acceleration value would be 0.47g.

Our liquefaction analysis included seven test borings, all drilled to a depth of at least 50 feet. This included Boring No.'s 4, 6, 8, 10, 11, 12, and 16. Boring No.'s 8, 10, 11 and 12 were located adjacent to southern embankment of Corralitos Creek. Boring No. 16 was located near the pond in the western section of the proposed development. Boring No.'s 4 and 6 were located in the southern and central portions of the proposed development, respectively. Our analysis conservatively assumed the ground water level during above-average rainfall years could rise an additional 10 feet from the level first encountered in the test borings for our study. We believe this is a conservative assumption at present.

The results of our liquefaction analysis indicate that the area near Boring No.'s 6, 8, and 10 were most susceptible to liquefaction and to a lesser extent the area near Boring No.'s 12 and 16. Boring No.'s 8, 10 and 12 are located along the southern embankment of Corralitos Creek, in an area where liquefaction would be considered likely. Boring No.6 was located in the central area of the property, and Boring No.16 was located near the pond in the western area of the property. Boring No.'s 4 and 11 did not exhibit any significant potential for liquefaction, based on our analysis. The areas of Boring No. 2 and Boring No. 5 may also be susceptible to liquefaction, although neither boring was specifically analyzed for this preliminary study due to the shallow nature of the test borings.

Estimated settlements due to liquefaction-induced settlement and dynamic compaction of loose, dry sands were also calculated using LiquefyPro, based upon the work by Ishihara and Yoshimine and Seed. On the basis of our analysis, we estimate the magnitude of possible seismically-induced ground surface settlement could range from 0.5 to 10 inches. The recommendations of this report are intended to reduce the potential for structural damage to an acceptable risk level, however strong seismic shaking could result in architectural damage and the need for post-earthquake repairs. It should be assumed that exterior improvements around the building such as pavements, slabs, sidewalks or patios will need to be repaired or replaced following strong seismic shaking. An increased depth of subgrade compaction below exterior improvements will assist in minimizing the damage to these elements.

Estimated settlements due to liquefaction (dry settlement excluded) for CPT's 1 through 4 and CPT 6 (which were advanced adjacent to B11, B10 B8, B12 and B6, respectively), were also evaluated using the CLiq software. The following table provides a comparison of results between the two methods:

TABLE No. 3, Comparison of *Liquefaction Induced* Settlement
(Dry Settlement Excluded)

CPT Sounding	CLiq Vertical Settlement (Inches)	Liquefy Pro at Adjacent Boring (Inches)
CPT-1	1.35	0.02 (B-11)
CPT-2	2.74	3.08 (B10)
CPT-3	3.26	7.89 (B8)
CPT-4	1.24	1.18 (B12)
CPT-6	0	1.94 (B6)

Please refer to Appendix C for a summary of results from our quantitative liquefaction analyses of boring and CPT data.

The determination that the site has liquefiable soils would generally trigger a special Site Class F designation, per Table 1613.5.2 of the 2007 CBC. However, Site Coefficients F_a and F_v are determined by Tables 1613.5.3(1) and 1613.5.3(2) of the 2007 CBC. Note b for Site Class F refers to Section 11.4.7 of ASCE 7-05. This section states "*The site-specific ground motion procedures set forth in Chapter 21 are permitted to be used to determine ground motions for any structure. A site response analysis shall be performed in accordance with Section 21.1 for structures on Site Class F sites, unless the exception to Section 20.3.1 is applicable.*" Section 20.3.1.1 of ASCE 7-05 states the following under "Exception": "*For structures having fundamental periods of vibration equal to or less than 0.5 s, site-response analysis is not required to determine spectral accelerations for liquefiable soils. Rather, a site class is permitted to be determined in accordance with Section 20.3 and the corresponding values of Fa and Fv determined from tables 11.4-1 and 11.4-2.*" These are the same tables as Tables 1613.5.3(1) and 1613.5.3(2) from the 2007 CBC.

Based on the above discussion, it is our opinion that a Site Class F designation is <u>not</u> appropriate for the project site. This is based on the assumption that the proposed development will likely consist of one to three-story buildings that should have a fundamental period less than 0.5 seconds. **The Project Structural Engineer should confirm that building heights of one to three stories in vertical height have a fundamental period less than 0.5 seconds. If this assumption is not correct, a detailed site response analysis may be required for the project site.** Based on the SPT blow count procedure outlined in Section 1613.5.5 of the 2007 CBC, we have determined the appropriate Site Class is E with a Seismic Design Category of E.

Please note: The Site Class designation does not eliminate the potential for settlement and structural damage due to liquefaction of the subsurface soils. This must be considered in the project design, and is described in more detail within the "Discussions, Conclusions and Recommendations" section of this report. Furthermore, if the fundamental period of any proposed structures will exceed 0.5 seconds, than the Site Class F procedure must be utilized to derive seismic design values.

Liquefaction Induced Lateral Spreading
Liquefaction induced lateral spreading occurs when a liquefied soil mass fails toward an open slope face, or fails on an inclined topographic slope. Our analysis of the project site indicates that the potential for liquefaction to occur is high, and consequently the potential for lateral spreading is also high.

We performed a quantitative lateral spreading analysis for the 16 CPT locations shown in Figure 2. This analysis was performed using CLiq v.1.3 software which was developed under the close guidance of Dr. Peter Robertson, having in mind specific features of the CPT that can be used to provide a more advanced analysis. Such features include the transition layer detection algorithm and evaluation of cyclic softening in clays. The liquefaction assessment method used in CLiq is the one recommended by NCEER 1998 (also known as the Youd et al. 2000 method) which provides concise results regarding the estimation of vertical settlements and lateral displacements.

Lateral displacements were not calculated below a depth of 2H below the toe of the creek bank or the bottom of the pond. A summary of calculated lateral displacements are presented in Appendix C. Total lateral displacements ranged from 0 to 65 inches.

As shown in Appendix C, predicted lateral displacement is significant within the soundings closest to the creek bank. Predicted lateral displacements dropped rapidly with increasing distance from the creek. The analysis for CPT-7, located about 475 feet from the creek, predicted displacements on the order of 2 inches; however this movement is occurring at a depth of 26 to 28 feet which is nearly twice the depth of the present creek channel.

For the pond area to the southwest of the project site, please refer to our liquefaction analysis from Boring No.16 within Appendix C (which was extended to a depth of 50 feet). We also performed liquefaction and lateral spread calculations with CLiq software at CPT-14 (B18) located on the northeast side of the pond, and CPT-16 (B26) located on the west side of the pond. The results of our analysis indicate a significant lateral spreading hazard within the confines of the pond boundary, with calculated displacements of more than 16 inches at CPT-14 and 5 inches at CPT-16.

It is apparent that lateral spreading potential is high in the near vicinity of Corralitos Creek and the pond, with calculated displacements on the order of 5 to 65 inches. Based on a recent paper titled *"Zero-Displacement Lateral Spreads, 1999 Kocaeli, Turkey Earthquake"* (Journal of Geotechnical and Geoenvironmental Engineering, January 2009), some fine-grained sediments, although liquefiable by current criteria, may not be susceptible to significant shear deformation or lateral spreading due to their dilative nature or an inherent undrained shear strength of liquefied plastic silts. The research noted that while discontinuous layers of saturated sands liquefied during an earthquake, lateral spreading did not occur. This may be due to sufficient shear resistance within the discontinuities to prevent these sediments from laterally spreading. Lateral spreading within dilative, fine grained sand-like sediments or plastic clay-like sediments also did not occur. It is believed that these deposits may be too dense or dilative to allow shallow lateral spreads to develop at shallow depths, at least for earthquakes less than $M_w = 8$. *Laboratory results from samples obtained from our study indicate clay soils with predominant intermediate to highly plasticity. The JGGE paper suggests that, although some of these materials may be liquefiable, they may not be subjected to lateral spreading (although our calculations may suggest otherwise).*

In consideration of the CPT data and test borings we have analyzed to date, as well as the conclusions of the JGGE paper, it is our opinion that a minimum setback distance 150 feet from the top of the creek channel bank is required to mitigate the risk due to the lateral spreading hazard to an ordinary level for the proposed residential development.

For similar reasons in the pond area we recommend a prescribed minimum setback of 50 feet from the existing riparian/wetlands area, or 50 feet from the high water mark, whichever is greater, to achieve the objective of mitigating the risk due to lateral spreading to an ordinary level.

Please refer to Appendix C for a graphical summary presenting the results of our lateral spreading analysis results.

It should be noted that we believe the basis of our liquefaction and lateral spreading analysis is extremely conservative, assuming both extremely high groundwater elevations combined with a major 7.9 magnitude earthquake. However, it must be cautioned that liquefaction and lateral spreading analysis is an inexact science and the mathematical models of the liquefaction and liquefiable soils contain many simplifying assumptions, not the least of which are isotropy and homogeneity. An analysis of ground water hydrology for this site was outside the scope of our study, therefore actual ground water conditions which differ from those assumed in our analysis could result in a lower factor of safety and higher displacements. Liquefaction/lateral spreading analyses and the generated factors of safety should be used as indicating trend lines. A soil deposit with a safety factor less than one will not necessarily fail, but the probability of slope movement will be greater than a soil deposit with a higher safety factor. Conversely, a soil deposit with a safety factor greater than one may fail, but the probability of stability is higher than a soil deposit with a lower safety factor.

Landsliding
Seismically-induced landsliding is a hazard with low potential for affecting most of the site since the majority of the area studied is gently sloping. However, it should be noted that slope failures are possible along the steep embankments of Corralitos Creek during strong seismic shaking, which could present a risk to development located atop the creek embankment. This risk can be adequately mitigated to an ordinary level, in our opinion, if the lateral spread hazard and risk set-back distances from the embankment for future development on the site recommended herein are closely followed.

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

GENERAL

The results of our feasibility level investigation indicate that from a geotechnical engineering standpoint the property may be developed for residential purposes. This study is considered a feasibility level study and therefore should not be used for final project design. *We recommend a final geotechnical report be prepared for the development after the site layout plans are more complete, with residential and street areas and utilities identified in greater detail. The final geotechnical report should include additional test borings and analysis to confirm the results of these preliminary findings and provide final, detailed recommendations for all aspects of the project design.*

Our laboratory testing indicates that the near surface soils consist primarily of silty sands in many areas, with low expansive properties. However, clay soils were identified in the upper five feet in 9 of the 20 test borings (Boring No.'s 1, 6, 11, 12, 13, 16, 17, 18, and 19). The areas where clay soil was present in the upper five feet were found to possess low to high expansive properties. This analysis was based on Atterberg Limits tests per ASTM D4318 and Expansion Index tests per ASTM D4829 and UBC 29-2. Of the six Expansion Index tests performed on the upper clay soils, four had low expansion potential, while two had high expansion potential. The high expansion potential samples were taken near Boring No.1 and No. 17 (refer to Appendix A for the laboratory test results). Mitigation measures for dealing with areas of expansive soil are discussed further within this report.

Liquefaction and lateral spreading of the subsurface soils is a hazard along Corralitos Creek and at other locations across the proposed development. Given the high potential and the attendant risks to proposed developments from liquefaction and lateral spreading along Corralitos Creek, we are recommending a prescriptive minimum development set-back of 150 feet from the southern "top of bank" for Corralitos Creek. We also recommend a minimum set-back of 50 feet from the pond located in the western property area (the 50 foot set-back should apply to the high water mark for the pond, or the existing riparian/wetlands boundary, whichever is greater). If this setback is adhered to for the layout of the residential developments, the attendant risk due to the aforementioned hazards will be ordinary.

The upper 20 feet of soils in general are considered loose to very loose across the project site. In addition, the upper 1 to 2 feet of the on-site soils are ripped and disked on a frequent basis for farming purposes. The loose nature of the upper soils make the proposed residential buildings susceptible to settlement and associated foundation and building distress.

The project site is located within a seismically active area and strong seismic shaking is expected to occur within the design lifetime of the project. Improvements should be designed and constructed in accordance with the most current CBC and the recommendations of this report to minimize reaction to seismic shaking. Structures built in accordance with the latest edition of the California Building Code have an increased potential for experiencing relatively minor damage, which should be repairable, however strong seismic shaking could result in architectural damage and the need for post-earthquake repairs.

SUMMARY OF GEOTECHNICAL ISSUES

The on-site soils were found to have the following geotechnical issues with respect to the proposed residential development:

1. Liquefaction and lateral spreading hazard: This issue appears to be worst along the southern embankment of Corralitos Creek and within the pond area at the western portion of the site. An area of potentially liquefiable soil was also identified in the area of Boring No.'s 6 in the central area of the proposed development. The loss of soil support due to liquefaction can cause damage to building foundations and structures placed over these areas. We would also recommend deeper test borings and additional liquefaction analysis in the area surrounding Boring No. 2 and Boring No. 5, which may also be susceptible to liquefaction hazard. We recommend that these potential liquefaction areas be addressed in the future as part of the final design-level Geotechnical Investigation to be completed for the project site.

2. Expansive soils were identified in the area of Boring No.'s 1 and 17. Boring No.1 is located on the eastern side of the development, and Boring No.17 is located on the western side of the development. Expansive soils can be damaging to building foundations as they tend to "expand" or swell during the winter months, and "shrink" or settle during summer months. This shrink\swell cycle can cause damage to building foundations and structures placed over these areas. Expansive soil conditions for new roadway pavements can be mitigated to an acceptable risk if the pavement sections are properly designed according to the appropriate R-value for the subgrade soils and the soil properly moisture conditioned and compacted per the "Site Grading Issues" and "Pavement Design" sections of this report.

3. The soils across the project site are relatively loose for the upper 20 to 30 feet. These soils are prone to settlement due to surcharge loads from new fills and buildings. This settlement can also cause damage to building foundations and structures placed over these areas.

PRELIMINARY MITIGATION MEASURES

Based upon our review of the geotechnical issues, we believe the most appropriate method to address all of the geotechnical issues outlined in Items 1 to 3 above would be to construct the residential developments upon a structural mat foundation system. The structural mat would likely consist of a 12-inch thick concrete slab (approximate), with one or two layers of reinforcing steel placed within the mat. The mat would be designed to "float" the residence above soft or liquefiable soil areas, and also resist the effect of expansive soils which may tend to lift the structural mat. These mats are also sometimes designed as post-tensioned slabs, which are quite common in many residential developments.

Other options to mitigate the geotechnical issues outlined in Items 1 to 3 above could include: 1) vibro-replacement (stone columns), 2) dynamic deep compaction, or 3) Rammed Aggregate Piers®. These options could be further explored in the final design-level geotechnical report to be prepared in the future for the proposed development.

Given the potential for liquefaction and lateral spreading to occur along Corralitos Creek, we are recommending a minimum development set-back of 150 feet from the southern "top of bank" for Corralitos Creek. We also recommend a minimum set-back of 50 feet from the pond located in the western property area, in the vicinity of Borings No. 16, 17, 18, and 19 (the 50 foot set-back should apply to the high water mark for the pond, or the existing riparian/wetlands boundary, whichever is greater).

Please note: The final geotechnical report may identify significant areas of the property which are clearly not susceptible to liquefaction, expansive soils, or loose upper soils. In this case, it is possible that these areas of the development will not require a structural mat foundation system (or other special geotechnical mitigation measures), based on future studies to be performed at the project site. If this occurs, standard shallow footings may be found acceptable for the project site.

SITE GRADING ISSUES

Site grading should include adequate removal of trees, row crops, surface vegetation, tree roots and organically contaminated topsoil.

It is possible that there are areas of man-made fill on the project site that our field investigation did not detect. Areas of man-made fill, if encountered on the project site will need to be completely excavated to undisturbed native material. The excavation process should be observed and the extent designated by the Geotechnical Engineer. Any voids created by fill removal must be backfilled with properly compacted approved native soils that are free of organic and other deleterious materials, or with approved imported fill.
Given the loose nature of the upper soils, we recommend road and pavement areas include a zone of recompacted soil which extends at least 18 inches below proposed pavement sections (the 18 inch zone should extend below asphaltic concrete, aggregate base and subbase sections).

Note: On-site grading work performed during or soon after the rainy season may encounter on-site soils which are too wet to use as engineered fill. These materials may require a diligent and active drying and/or mixing operation to reduce the moisture content to the levels required to obtain adequate compaction as an engineered fill. If the on-site soils or other materials are too dry, water may need to be added. In some cases the time and effort to dry the on-site soil may be considered excessive, and the import of aggregate base may be required.

The soil on the project site should be compacted as follows:

a. In pavement areas the upper 8 inches of subgrade, and all aggregate subbase and aggregate base, should be compacted to a minimum of 95% of its maximum dry density,
b. In pavement areas all utility trench backfill should be compacted to 95% of its maximum dry density,
c. All remaining soil on the project site should be compacted to a minimum of 90% of its maximum dry density.

Native or imported soil used as engineered fill on this project should meet the following requirements:

a. free of organics, debris, and other deleterious materials,
b. free of "recycled" materials such as asphaltic concrete, concrete, brick, etc.,
c. granular in nature, well graded, and contain sufficient binder to allow utility trenches to stand open,
d. free of rocks in excess of 2 inches in size.

In addition to the above requirements, import fill should have a Plasticity Index between 4 and 12, and a minimum Resistance "R" Value of 30, and be non-expansive.

CUT AND FILL SLOPES

All fill slopes should be constructed with engineered fill meeting the minimum density requirements of this report and have a gradient no steeper than 3:1 (horizontal to vertical). Fill slopes should not exceed 15 feet in vertical height unless specifically reviewed by Pacific Crest Engineering Inc. Where the vertical height exceeds 15 feet, intermediate benches must be provided. These benches should be at least 6 feet wide and sloped to control surface drainage. A lined ditch should be used on the bench.

Fill slopes should be keyed into the native slopes by providing a 10 foot wide base keyway sloped negatively at least 2% into the bank. The depth of the keyways will vary, depending on the materials encountered. It is anticipated that the depth of the keyways may be 3 to 6 feet, but at all locations shall be at least 2 feet into firm material.

Subsequent keys may be required as the fill section progress upslope. Keys will be designated in the field by the Geotechnical Engineer. See Figure No. 96 for general details.

Cut slopes should not exceed a 3:1 (horizontal to vertical) gradient and a 15 foot vertical height unless specifically reviewed by the Geotechnical Engineer. Where the vertical height exceeds 15 feet, intermediate benches must be provided. These benches should be at least 6 feet wide and sloped to control surface drainage. A lined ditch should be used on the bench.

The above slope gradients are based on the strength characteristics of the materials under conditions of normal moisture content that would result from rainfall falling directly on the slope, and do not take into account the additional activating forces applied by seepage from spring areas. Therefore, in order to maintain stable slopes at the recommended gradients, it is important that any seepage forces and accompanying hydrostatic pressure encountered be relieved by adequate drainage. Drainage facilities may include subdrains, gravel blankets, rock fill surface trenches or horizontally drilled drains. Configurations and type of drainage will be determined by the Geotechnical Engineer during the grading operations.

If a fill slope is to be placed above a cut slope, the toe of the fill slope should be set back at least 8 feet horizontally from the top of the cut slope. A lateral surface drain should be placed in the area between the cut and fill slopes.

EROSION CONTROL

The surface soils are classified as having a low to high potential for erosion (low potential in areas where clay is predominant at the surface, and high potential where sandy or silty sands are predominant at the surface). Therefore, the finished ground surface should be planted with ground cover and continually maintained to minimize surface erosion. For specific and detailed recommendations regarding erosion control on and surrounding the project site, you should consult with the project civil engineer or an erosion control specialist.

The surfaces of all cut and fill slopes should be prepared and maintained to reduce erosion. This work, at a minimum, should include track rolling of the slope and effective planting. The protection of the slopes should be installed as soon as practicable so that a sufficient growth will be established prior to inclement weather conditions. It is vital that no slope be left standing through a winter season without the erosion control measures having been provided

UTILITY TRENCHES

Utility trenches that are parallel to the sides of the building should be placed so that they do not extend below a line sloping down and away at a 2:1 (horizontal to vertical) slope from the bottom outside edge of the building slab or footing.

Utility pipes should be designed and constructed so that the top of pipe is a minimum of 36 inches below the finish subgrade elevation of any road or pavement areas. Any pipes within the top 24 inches of finish subgrade should be concrete encased, per design by the Project Civil Engineer.

All utility trenches which enter beneath perimeter areas of the buildings should be backfilled with controlled density fill (such as 2-sack sand\cement slurry) to help minimize potential moisture intrusion below interior floors. The width of the plug should be at least <u>three times</u> the width of the footing or grade beam at the building perimeter, but not less than 36 inches. The Geotechnical Engineer of Record for the development should be contacted to observe the placement of slurry plugs. In addition, all utility pipes which penetrate through the footings, stemwalls or grade beams (below the exterior soil grade) should also be sealed water-tight, as determined by the Project Engineer or Architect.

SURFACE DRAINAGE

Following completion of the project we recommend that storm drainage provisions and performance of permanent erosion control measures be closely observed through the first season of significant rainfall, to determine if these systems are performing adequately and, if necessary, resolve any unforeseen issues.

Surface water must not be allowed to pond or be trapped adjacent to the building foundations nor on the building pad nor in the parking areas.

All roof eaves should be guttered, with the outlets from the downspouts provided with adequate capacity to carry the storm water from the structures to reduce the possibility of soil saturation and erosion. The connection should be in a closed conduit which discharges at an approved location away from the structures and the graded area. The discharge location should not be located at the top of, or on the face of any topographic slopes. We would recommend a discharge point which is at least 10 feet down slope of any foundation or fill areas.

Final grades should be provided with a positive gradient away from all foundations in order to provide for rapid removal of the surface water from the foundations to an adequate discharge point. Soil grades should slope away from foundation areas at least 5 percent for the first 10 feet. Impervious surface areas should slope away from foundations at least 2 percent for the first 10 feet. The Project Civil Engineer or Architect should refer to 2007 CBC Section 1803.3 for further information. Concentrations of surface water runoff should be handled by providing necessary structures, such as paved ditches, catch basins, etc.

Cut and fill slopes should be constructed so that surface water will not be allowed to drain over the top of the slope face. This may require berms along the top of fill slopes and surface drainage ditches above cut slopes. All cut, fill and disturbed native slope areas should be hydro-seeded or other means of erosion control provided, as determined by the Project Civil Engineer.

Irrigation activities at the site should not be done in an uncontrolled or unreasonable manner.

The building and surface drainage facilities must not be altered nor any filling or excavation work performed in the area without first consulting the Geotechnical Engineer of Record for the development. Surface drainage improvements developed by the project civil engineer must be maintained by the property owner at all times, as improper drainage provisions can produce undesirable affects.

PAVEMENT DESIGN

The upper soils vary considerably across the development for pavement design purposes. The "R" Values of the subgrade soils varied from a low of 5 to a high of 74. Although subgrade soil R-values ranged as high as 74, these values exceed the maximum R-value of 50 as recommended by Caltrans in Section 614.3 of the 2006 Highway Design Manual. Therefore, our preliminary pavement design is limited to a maximum assumed R-value of 50 for the subgrade soils.

For preliminary planning purposes, we assumed three main R-values for pavement design. This included an R-value less than 5, an R-value of 25, and an R-value of 50. The final geotechnical report should include follow-up R-value sampling to confirm soil R-values along proposed street areas of the project development.

Pacific Crest Engineering Inc. has not performed a site specific traffic study to determine the actual traffic indices associated with this project. These values are for general design purposes only and the values may need modification. Traffic volume and equivalent axle loads that exceed the assumed TI could be destructive to the pavement, resulting in an accelerated rate of deterioration and the need for increased maintenance.

The following three tables provide a preliminary flexible pavement design which is based on the Caltrans Highway Design Manual – Chapter 600 (last updated September 1, 2006).

The following pavement sections are suggested:

TABLE No. 4
Recommended Pavement Sections for assumed **R-Value less than 5**

Material	Traffic Index			
	5	6	7	8
Asphalt Concrete	3.0 inches	3.5 inches	4.0 inches	4.5 inches
Class 2 Aggregate Base, R=78 min.	4.0 inches	6.0 inches	7.0 inches	8.0 inches
Class 2 Aggregate Sub-base, R=50 min.	7.0 inches	8.0 inches	10.0 inches	12.0 inches

TABLE No. 5
Recommended Pavement Sections for assumed **R-Value of 25**

Material	Traffic Index			
	5	6	7	8
Asphalt Concrete	3.0 inches	3.5 inches	4.0 inches	4.5 inches
Class 2 Aggregate Base, R=78 min.	7.0 inches	9.0 inches	11.0 inches	8.0 inches
Class 2 Aggregate Sub-base, R=50 min.	-- inches	-- inches	-- inches	6.0 inches

TABLE No. 6
Recommended Pavement Sections for assumed **R-Value of 50**

Material	Traffic Index			
	5	6	7	8
Asphalt Concrete	3.0 inches	3.5 inches	4.0 inches	4.5 inches
Class 2 Aggregate Base, R=78 min.	4.0 inches	6.0 inches	7.0 inches	8.0 inches
Class 2 Aggregate Sub-base, R=50 min.	-- inches	-- inches	-- inches	-- inches

To have the selected pavement sections perform to their greatest efficiency, it is very important that the following items be considered:

a. Properly scarify and moisture condition the upper 8 inches of the subgrade soil and compact it to a minimum of 95% of its maximum dry density, at a moisture content 1 to 3% over the optimum moisture content for the soil.

b. Provide sufficient gradient to prevent ponding of water.

c. Use only quality materials of the type and thickness (minimum) specified. All aggregate base and subbase must meet Caltrans Standard Specifications for Class 2 materials, and be angular in shape. All Class 2 aggregate base should be ¾ inch maximum in aggregate size.

d. Compact the base and subbase uniformly to a minimum of 95% of its maximum dry density.

e. Use ½ inch maximum, Type "A" medium graded asphaltic concrete. Place the asphaltic concrete only during periods of fair weather when the free air temperature is within prescribed limits by Cal Trans Specifications.

f. Place ¼ gallon per square yard of SG-70 prime coat over the aggregate base section, prior to placement of the asphaltic concrete.

g. Porous pavement systems which consist of porous paving blocks, asphaltic concrete or concrete are generally not recommended due to the potential for saturation of the subgrade soils and resulting increased potential for a shorter pavement life. At a minimum, porous pavement systems should include a layer of Mirafi HP370 geotextile fabric placed on the subgrade soil beneath the porous paving section. These pavement systems should only be used with the understanding by the Owner of the increased potential for pavement cracking, rutting, potholes, etc.

h. Maintenance should be undertaken on a routine basis.

SOIL CORROSIVITY

Corrosivity tests were run on two representative surface soil samples collected on the project site. These results are summarized as follows:

TABLE No. 7, Corrosivity Test Summary

Sample	Soil Resistivity	Chloride	Sulfate (water soluble)	pH
	Ohm-cm	mg/kg	mg/kg	
1-1-1	1254	3	431	6.5
2-1-1	4736	4	<5	6.3
6-1-1	1198	18	13	6.2
13-1-1	1637	14	<5	6.6
15-1-1	6306	6	<5	6.7

Cal Trans considers a site to be corrosive to foundation elements if one or more of the following conditions exist at the site:

a. Minimum soil resistivity is less than 1,000 ohm-cm
b. Chloride concentration is greater than or equal to 500 mg/Kg (ppm)
c. Sulfate concentration is greater than or equal to 2000 mg/Kg (ppm)
d. The soil pH is 5.5 or less

Refer to Cal Trans Corrosion Guidelines, version 1.0 (September, 2003) for additional information.

Based on the results of the soil resistivity, chloride, sulfate and pH, it appears that the conditions in the shallow existing soil may be assumed to be non-corrosive based on Cal Trans guidelines. The corrosion potential for any imported select fill should also be checked for corrosivity. The Project Civil Engineer should be made aware of the corrosive soil issues so that appropriate subsurface piping can be designed for the project site.

Please refer to Appendix A for the specific results of the corrosivity testing by the analytical laboratory.

SUMMARY

This report provides a feasibility level study of our findings, conclusions and recommendations concerning the geotechnical issues associated with developing the project site. The geotechnical issues outlined herein present serious challenges, but are regularly addressed and mitigated on many residential, commercial and industrial projects throughout the Watsonville area.

The main geotechnical issues include liquefaction of subsurface soils, lateral spreading potential near Corralitos Creek, loose soils within the upper 20 to 30 feet, and expansive soils. It is believed all of these issues can be mitigated by the use of a structural mat foundation system combined with appropriate set-backs from Corralitos Creek and the pond area.

This report is not intended for project level design. A final geotechnical report should be prepared for the development once the initial grading plans and layout of residential and street areas is determined.

Please note that this report includes four appendices. Appendix A provides a summary of our laboratory test results, Appendix B provides a summary of the CPT testing and data analysis, Appendix C provides a summary of our liquefaction analysis, and Appendix D includes the Feasibility Level Engineering Geology Report prepared by Zinn Geology.

Please refer to the Zinn Geology report within Appendix D for a more complete discussion of the geologic hazards and seismic shaking issues associated with the project site.

LIMTATIONS AND UNIFORMITY OF CONDITIONS

1. This Feasibility Level Geotechnical Investigation was prepared specifically for you and for the specific project and location described in the body of this report. This report and the recommendations included herein should be utilized for this specific project and location exclusively. This Geotechnical Investigation should not be applied to nor utilized on any other project or project site. Please refer to the ASFE "Important Information about Your Geotechnical Engineering Report" attached with this report.

2. The recommendations of this report are based upon the assumption that the soil conditions do not deviate from those disclosed in the borings. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that planned at the time, our firm should be notified so that supplemental recommendations can be provided.

3. This report is issued with the understanding that it is the responsibility of the owner, or his representative, to ensure that the information and recommendations contained herein are called to the attention of the Architects and Engineers for the project and incorporated into the plans, and that the necessary steps are taken to ensure that the Contractors and Subcontractors carry out such recommendations in the field.

4. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural process or the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated, wholly or partially, by changes outside of our control. This report should therefore be reviewed in light of future planned construction and then current applicable codes. This report should not be considered valid after a period of two (2) years without our review.

5. This report was prepared upon your request for our services in accordance with currently accepted standards of professional geotechnical engineering practice. No warranty as to the contents of this report is intended, and none shall be inferred from the statements or opinions expressed.

6. The scope of our services mutually agreed upon for this project did not include any environmental assessment or study for the presence of hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below or around this site.

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

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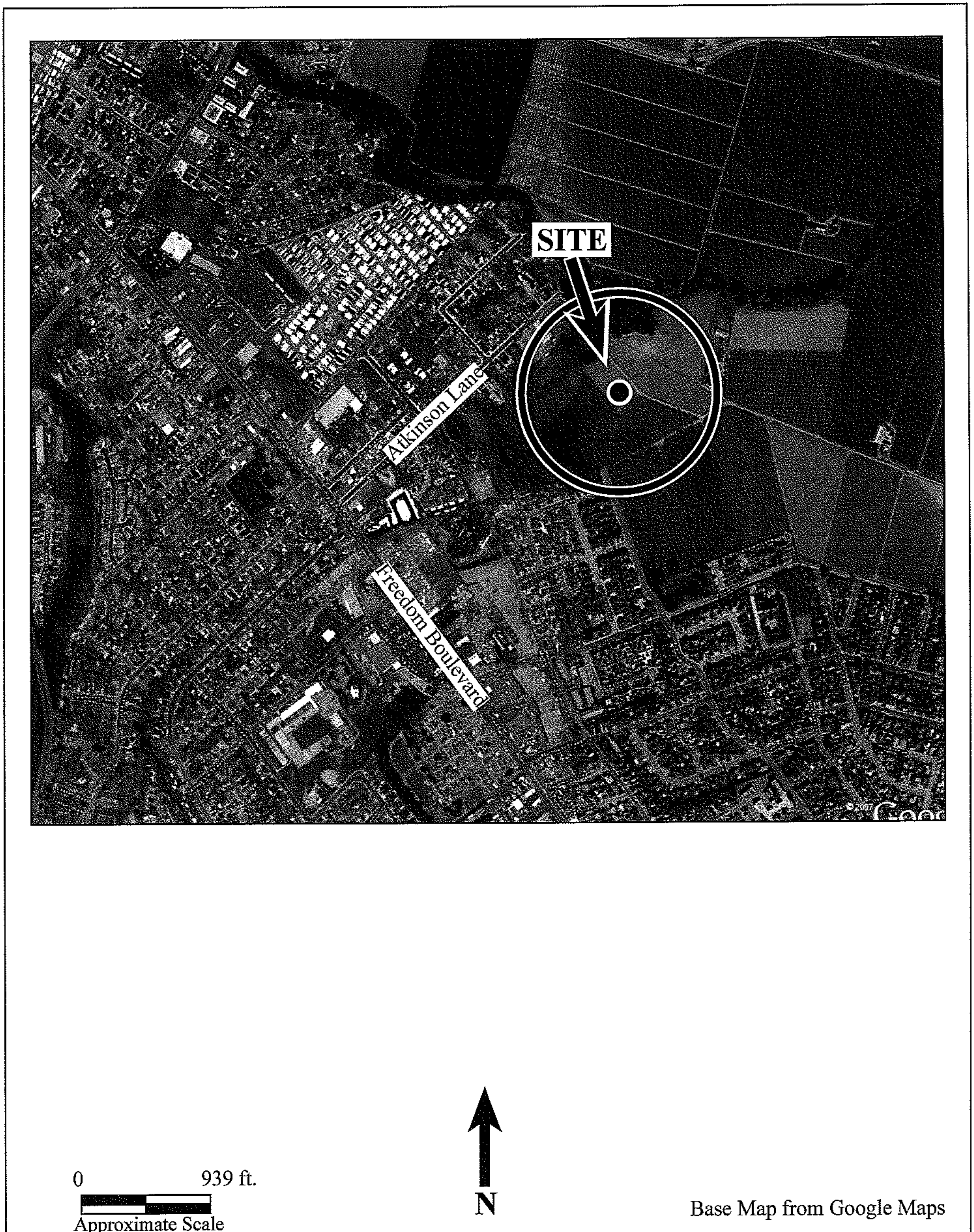
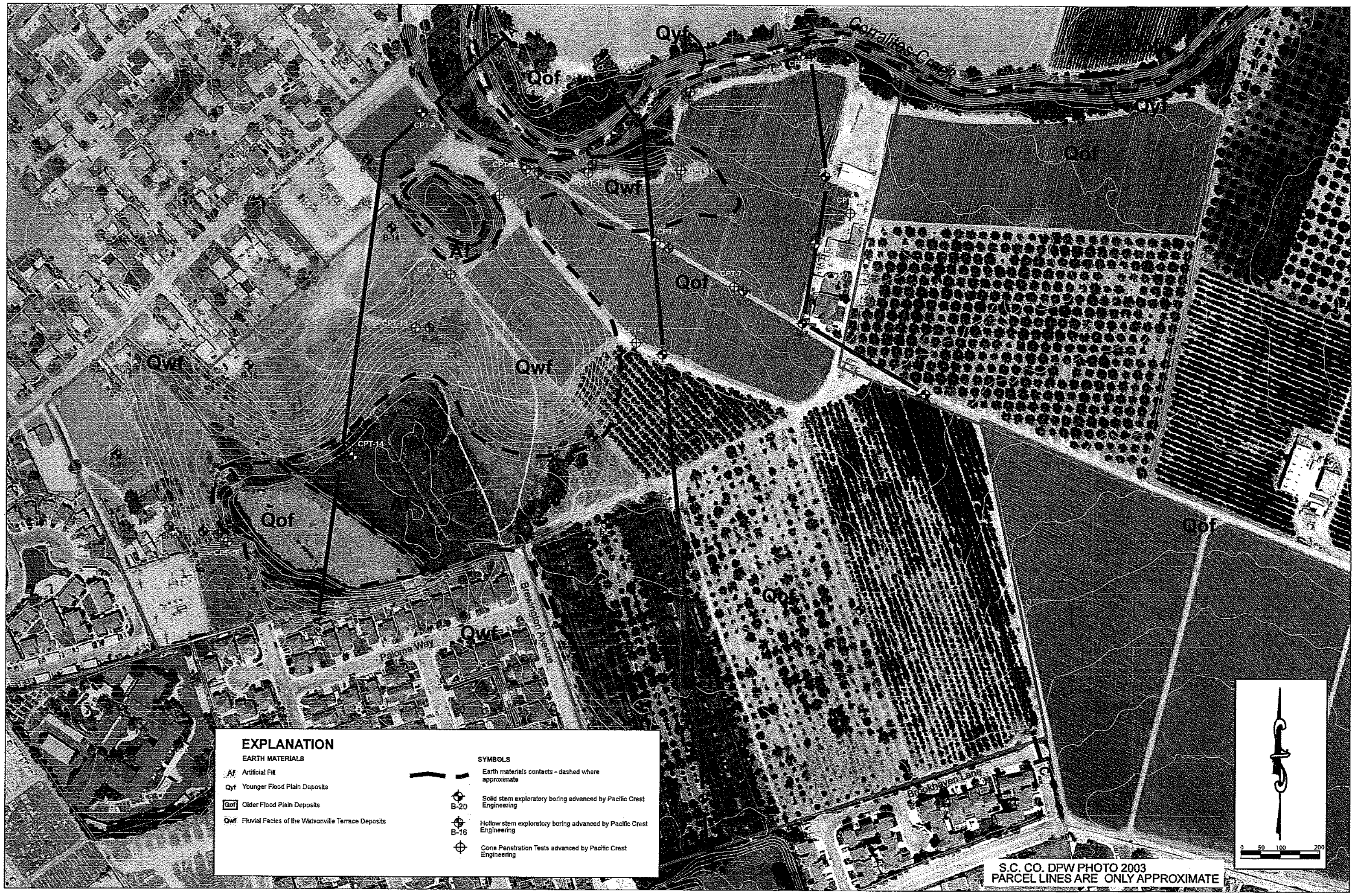
APPENDIX A

Regional Site Map
Site Map Showing Test Borings
Boring Log Explanation
Log of Test Borings
Atterberg Limits
Direct Shear Test Results
R Value Results
Expansion Potential Test Results
Cal Trans Corrosivity Report
Keyway Detail



Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Regional Site Map** Atkinson Lane Development Watsonville, California	Figure No. 1 Project No. 0829 Date: 3/2/09



Base Map Provided By Zinn Geology March, 2009

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Site Plan Showing Test Boring Locations** Atkinson Lane Development Watsonville, California	Figure No. 2 Project No. 0829 03/02/09

UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D2488 (Modified)

PRIMARY DIVISIONS			GROUP SYMBOL	SECONDARY DIVISIONS
COARSE GRAINED SOILS MORE THAN HALF OF MATERIAL IS LARGER THAN #200 SIEVE SIZE	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN #4 SIEVE	CLEAN GRAVELS (LESS THAN 5% FINES)	GW	Well graded gravels, gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels or gravels-sand mixtures, little or no fines
		GRAVELS (MORE THAN 12% FINES)	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines
			GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines
	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN #4 SIEVE	CLEAN SANDS (LESS THAN 5% FINES)	SW	Well graded sands, gravelly sands, little or no fines
			SP	Poorly graded sands or gravelly sands, little or no fines
		SANDS (MORE THAN 12% FINES)	SM	Silty sands, sand-silt mixtures, non-plastic fines
			SC	Clayey sands, sand-clay mixtures, plastic fines
FINE GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN #200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT IS LESS THAN 35%		ML	Inorganic silts and very fine clayey sand silty sands, with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly, sand, silty or lean clays
			OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS LIQUID LIMIT IS BETWEEN 35% AND 50%		MI	Inorganic silts, clayey silts and silty fine sands of intermediate plasticity
			CI	Inorganic clays, gravelly/sandy clays and silty clays of intermediate plasticity
			OI	Organic clays and silty clays of intermediate plasticity
	SILTS AND CLAYS LIQUID LIMIT IS GREATER THAN 50%		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			CH	Organic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils

BORING LOG EXPLANATION

LOGGED BY______ DATE DRILLED______________ BORING DIAMETER_______ BORING NO.____

Depth, ft.	Sample No. and Type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density, p.c.f.	Moisture % of Dry Wt.	MISC. LAB RESULTS
1			← Ground water elevation	NOTE: All blows/foot are normalized to 2" outside diameter sampler size					
2	1-1 L		← Soil Sample Number ← Soil Sampler Size/Type L = 3" Outside Diameter M = 2.5" Outside Diameter T = 2" Outside Diameter ST = Shelby Tube BAG = Bag Sample						
3									
4									
5									

RELATIVE DENSITY

SANDS AND GRAVELS	BLOWS/FOOT
VERY LOOSE	0-4
LOOSE	4-10
MEDIUM DENSE	10-30
DENSE	30-50
VERY DENSE	OVER 50

CONSISTENCY

SILTS AND CLAYS	BLOWS/FOOT
VERY SOFT	0-2
SOFT	2-4
FIRM	4-8
STIFF	8-16
VERY STIFF	16-32
HARD	OVER 32

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Boring Log Explanation** Atkinson Lane Development Watsonville, California	Figure No. 3 Project No. 0829 Date: 3/2/09

LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 1

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0-4	1-1 L		Brown Sandy CLAY, very fine to fine grained, coarse rounded pebbles scattered throughout the sample, small mica flakes scattered throughout the sample, medium plasticity, damp, stiff	CL	9				
4.5-9.5	1-2 L		Brown Sandy SILT, very fine to fine grained, sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, medium plasticity, damp, stiff	ML	7		97.2	18.5	Gravel = 0.0% Sand = 34.1% Fines = 65.9%
9.5-14.8	1-3 L		Brown SAND, fine to coarse grained, sub-angular to sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, coarsens with depth, coarse rounded pebbles near 11 1/2 feet, black staining near 11 feet, damp, loose	SP	8		93.7	27.5	
15-16.5	1-4 L		Brown Clayey SAND, very fine to medium grained, sub-rounded shaped, sticky texture, very small mica flakes scattered throughout the sample, damp, loose	SC	8		106.6	18.3	
16.5-24			Brown SAND, poorly graded, very fine to medium grained, sub-rounded shaped, small mica flakes scattered throughout the sample, damp, loose	SP					
20	1-5 T		Color change to reddish brown, slight increase in fines content, damp, loose		8			12.3	

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Log of Test Borings** Atkinson Lane Development Watsonville, California	Figure No. 4 Project No.0829 Date: 3/2/09

LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 1

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25	1-6 T		Brown SAND, fine to medium grained, sub-angular to sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, trace rounded coarse pebbles, damp, medium dense	SP					
26			Mottled brown and gray Silty CLAY/ SILT, smooth texture, very fine grained, low to medium plasticity, damp, stiff	CL-ML	14			9.2	
28			Boring Terminated at 26 and 1/2 feet. No Groundwater was encountered.						

Depth scale: 25–48

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Log of Test Borings** Atkinson Lane Development Watsonville, California	Figure No. 5 Project No.0829 Date: 3/2/09

LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 2

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1	2-1 L		Brown SAND, fine to medium grained, sub-angular to sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, trace coarse rounded pebbles/gravels scattered throughout the sample, damp, loose	SP					
2					7				
5	2-2 L		Decrease in coarseness of sand, very fine to fine grained, fining downward, trace medium rounded pebbles near 6 1/2 feet, damp, loose						
6					6		99.5	9.7	
10	2-3 L		Increase in coarseness of sand, very fine to medium grained with trace of coarse grains, medium to coarse rounded pebbles scattered throughout the sample, damp, loose						
11			Brown SILT, very fine grained, smooth texture, very small mica flakes scattered throughout the sample, damp, stiff	ML	8		97.4	26.4	
15	2-4 L		Mottled brown and reddish brown Silty CLAY/SILT, very fine grained, smooth texture, small mica flakes scattered throughout the sample, low to medium plasticity, damp, stiff	CL-ML					
16					11		91.7	32.0	
20	2-5 T		Brown SAND, fine to medium grained, sub-angular to sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, damp, loose	SP					
21			Brown Silty CLAY/SILT, very fine grained, smooth texture, mica flakes scattered throughout the sample, low to medium plasticity, damp, stiff	CL-ML	12			10.7	

Depth scale: 1–24

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Log of Test Borings** Atkinson Lane Development Watsonville, California	Figure No. 6 Project No.0829 Date: 3/2/09

LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 2

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	2-6 T		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, small mica flakes scattered throughout the sample, trace medium to coarse rounded pebbles, moist to slightly wet, loose	SM	8			20.2	35.8% Passing #200 Sieve
30–31	2-7 T		Brown Silty CLAY/SILT, smooth texture, very fine grained, small mica flakes scattered throughout the sample, low to medium plasticity, damp, firm	CL-ML	6	19		32.9	
			Boring Terminated at 31 and 1/2 feet. Ground water encountered at 26 and 1/2 feet.						

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Log of Test Borings** Atkinson Lane Development Watsonville, California	Figure No. 7 Project No.0829 Date: 3/2/09

LOGGED BY CLR DATE DRILLED 5/6/08 BORING DIAMETER 6" BORING NO. 3

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1–2	3-1 L		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, very small mica flakes scattered throughout the sample, poorly graded, damp, loose	SM	5		108.5	10.3	Gravel = 0.5% Sand = 71.9% Fines = 27.6%
5–6	3-2 L		Brown SAND, quartz rich, fine to medium grained, sub-angular to sub-rounded shaped, mica flakes scattered throughout the sample, poorly graded, damp, loose	SP	8		104.4	6.7	
10–11	3-3 L		Decrease in coarseness of sand, fining downward, damp, loose		7		101.7	10.7	
			Brown Silty SAND, very fine to fine grained, trace angular to sub-angular medium to coarse grains, mica flakes scattered throughout the sample, poorly graded, damp, loose	SM					
15–16	3-4 L		Mottled dark brown, brown, and reddish brown CLAY, smooth texture, medium plasticity, mica flakes scattered throughout the sample, damp, stiff	CL	11		102.8	23.4	Qu = 665 psf
20–21	3-5 T		Brown SAND, fine to coarse grained, sub-angular to sub-rounded shaped, poorly graded, trace very coarse rounded pebbles, mica flakes scattered throughout the sample, damp, medium dense	SP	18			7.0	
			Boring Terminated at 21 and 1/2 feet. No groundwater encountered.						

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Log of Test Borings** Atkinson Lane Development Watsonville, California	Figure No. 8 Project No.0829 Date: 3/2/09

LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 4

Depth (feet)	Sample No. and Type	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1–2	4-1 L	Brown Gravelly SAND with Silt, fine to medium grained, sub-angular to sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, rounded very coarse river pebbles scattered throughout the sample, damp, medium dense	SG	12				Direct Shear: C = 525 psf Φ = 44º Gravel = 31.0% Sand = 62.6% Fines = 6.4%
5	4-2 L	Lack of pebbles, damp, loose						
6		Dark gray CLAY, smooth texture, very fine grained, intermediate plasticity, damp, stiff	CL-CI	10	19	95.8	27.7	Qu = 994 psf
10–11	4-3 L	Mottled tan and brown CLAY with Sand, clay is very fine grained, smooth texture, and exhibits medium plastic characteristics, sand is medium to coarse grained, sub-angular to sub-rounded shaped, and poorly graded, very coarse rounded pebbles scattered throughout the sample, silt pocket near 11 1/2 feet, damp, firm	CL	8	20	108.7	13.9	
15–16	4-4 L	Mottled light brown, gray, and reddish brown Fat CLAY, very fine grained, smooth texture, high plasticity, damp, very stiff	CH	26				
20–21	4-5 L	Damp, very stiff		17	41	82.7	35.9	

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Log of Test Borings
Atkinson Lane Development
Watsonville, California

Figure No. 9
Project No.0829
Date: 3/2/09

LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 4

Depth (feet)	Sample No. and Type	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	4-6 L	Mottled grayish brown, gray, and reddish brown Fat CLAY, very fine grained, smooth texture, thin oxidized lines and veins scattered throughout the sample, high plasticity, damp, very stiff	CH	28	55	86.5	35.1	
30–31	4-7 L	Color change to brownish gray, increase in amount of oxidized veins scattered throughout the sample, damp, very stiff		28				
35–36	4-8 L	Damp, very stiff (groundwater symbol)		28		89.2	33.8	100% Passing #200 Sieve
40–41	4-9 L	Mottled yellowish brown and reddish brown patches near 41 1/2 feet, high plastic characteristics, damp near 41 1/2 feet, wet near 41 feet, very stiff		20	37	84.5	38.5	
45–46	4-10 L	Color change to gray, oxidized patches and veins scattered throughout the sample, damp near 46 1/2 feet wet near 46 feet, damp, hard		36	31	90.0	32.0	

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Log of Test Borings
Atkinson Lane Development
Watsonville, California

Figure No. 10
Project No.0829
Date: 3/2/09

LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 4

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49–51	4-11 L		Gray Silty CLAY/SILT, very fine grained, smooth texture, oxidation patches and oxidized veins scattered throughout the sample, intermediate plasticity, damp, hard	CI					
51–53			Grayish brown SILT, very fine to fine grained, smooth texture, very small mica flakes and oxidation patches scattered throughout the sample, intermediate plasticity, damp, near 51 1/2 feet wet near 51 feet, hard	ML	39	18	95.4	29.4	
53			Boring Terminated at 51and 1/2 feet. Ground water encountered at 44 feet and stabilized at 36 and 1/2 feet.						

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Log of Test Borings** Atkinson Lane Development Watsonville, California	Figure No. 11 Project No.0829 Date: 3/2/09

LOGGED BY CLR DATE DRILLED 5/6/08 BORING DIAMETER 6" BORING NO. 5

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–2	5-1 L		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, damp, loose	SM	5		112.8	12.5	27.7% Passing #200 Sieve
5–6	5-2 L		Increase in fine grained sand, decrease in fines content, slight coarsening downward, color change to tannish brown, sub-angular medium to coarse grains near 6 1/2 feet, damp, loose		6		98.3	13.1	
9.5–11	5-3 L		Brown SAND very fine to fine grained, sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, damp, loose	SP	8		96.9	14.7	
14.5–16	5-4 L		Mottled reddish brown, brown and gray Clayey SAND, very fine to fine grained, slight sticky texture, small mica flakes scattered throughout the sample, poorly graded, damp, loose	SC	9		113.3	12.3	21.2% Passing #200 Sieve Qu = 487 psf
19.5–24	5-5 T	▼	Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, moist to slightly wet, loose	SM	10			22.2	Gravel = 0.0% Sand = 63.1% Fines = 36.9%

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LOGGED BY CLR DATE DRILLED 5/6/08 BORING DIAMETER 6" BORING NO. 5

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	5-6 T		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, trace sub-angular medium grains, wet, medium dense	SP	11			24.9	13.8% Passing #200 Sieve
30–31	5-7 T		Increase in fines content, slight fining downward, wet, loose		8			33.0	26.6% Passing #200 Sieve
32–48			Boring Terminated at 31 and 1/2 feet. Groundwater was encountered at 21 and 1/2 feet, then rose to 20 feet prior to backfilling.						

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LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 6

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1–4	6-1 L		Mottled light brown and dark brown Sandy CLAY, very fine to fine grained, small mica flakes scattered throughout the sample, medium to high plasticity, damp, stiff	CL	12				Direct Shear: C = 700 psf Φ = 28°
5–7	6-2 L		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, small mica flakes scattered throughout the sample, very coarse rounded pebbles scattered throughout the sample, damp, loose	SM	7		107.7	13.0	
10–14	6-3 L		Brown Silty SAND, poorly graded, very fine to medium grained, sub-rounded shaped, mica flakes scattered throughout the sample, coarse rounded pebbles scattered throughout the sample, trace sub-angular coarse grains, damp, medium dense		14		104.3	4.4	Gravel = 0.0% Sand = 93.9% Fines = 6.1%
15–16	6-4 L		Brown Sandy SILT, very fine to fine grained, sub-rounded shaped, small mica flakes scattered throughout the sample, damp, stiff	ML	10		111.6	18.4	32.3% Passing #200 Sieve
17–19			Brown Clayey SAND, very fine to medium grained, sub-angular to sub-rounded shaped, sticky texture, low plasticity, trace sub-angular coarse grains and mica flakes scattered throughout the sample, damp, loose	SC					
20–24	6-5 L		Brown CLAY with Sand, very fine to fine grained smooth texture, low plasticity, sub-rounded shaped, oxidation patches scattered throughout the sample, damp, very stiff	CL	16	15			

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LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 6

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–29	6-6 L		Mottled light gray and reddish tan Fat CLAY, very fine grained, smooth texture, high plasticity, very small mica flakes scattered throughout the sample, dark brown/black veins scattered throughout the sample, damp, very stiff	CH	23	50	92.1	31.6	
30–34	6-7 L		Mottled brown, gray, and reddish brown SILT, smooth texture, very fine grained, very small mica flakes scattered throughout the sample, damp, very stiff	ML	20				
35–39	6-8 L		Mottled bluish gray and reddish brown Fat CLAY, very fine grained, smooth texture, very small mica flakes scattered throughout the sample, high plasticity,oxidized veins scattered throughout the sample, damp, very stiff	CH	25	46	81.6	39.7	Qu = 3417 psf
40–44	6-9 L		Dark oxidized patches and patches of black clay near 41 feet, damp, very stiff		25		85.5	38.1	
45–48	6-10 L		Dark oxidized patches and patchesof charcoal near 45 1/2 feet, damp, very stiff		25	56	86.5	35.8	

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LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 6

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49–51	6-11 L		Mottled bluish gray, reddish brown, and gray Fat CLAY, very fine grained, smooth texture, high plasticity, very small mica flakes scattered throughout the sample, damp, very stiff	CH	27	40	93.2	32.1	
52–72			Boring Terminated at 51 and 1/2 feet. No ground water encountered.						

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LOGGED BY CLR DATE DRILLED 5/6/08 BORING DIAMETER 6" BORING NO. 7

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–3	7-1 L		Brown SAND with Silt, very fine to fine grained, poorly graided, sub-rounded shaped, very small mica flakes scattered throughout the sample, trace sub-angular grains near 3 1/2 feet, rounded pebbles near 3 feet, damp, loose	SM	7		108.3	10.6	
5–6	7-2 L		Increase in fines content, very coarse rounded shaped, pebbles scattered throughout the sample, damp, loose		7		105.0	11.2	
6.5			Brown SAND, fine grained, sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, trace sub-angular to sub-rounded medium grains, damp, loose	SP					
10–11	7-3 L		Slight increase in fines content, very fine grains, damp, loose		10		101.4	20.6	
11.5			Brown Silty SAND, very fine to medium grained, sub-angular to sub-rounded shaped, trace sub-angular coarse grains, small mica flakes scattered throughout the sample, poorly graded, damp, loose	SM					
15–16	7-4 L		Lack of medium and coarse grains, increase in fines content, fining downward, damp, loose						
16			Brown SAND with Clay, slight sticky texture, very fine to coarse grained, sub-angular to sub-rounded shaped, small mica flakes scattered throughout the sample, trace coarse rounded pebbles near 16 1/2 feet, damp, loose	SC	5		109.5	18.6	
19.5–21	7-5 T		Light brown Silty SAND, very fine to fine grained, sub-rounded shaped, small mica flakes scattered throughout the sample, trace medium and coarse sub-angular grains scattered throughout the sample, damp, medium dense	SM	17			15.3	

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LOGGED BY CLR DATE DRILLED 5/6/08 BORING DIAMETER 6" BORING NO. 7

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	7-6 T		Brown SAND with Silt, very fine to medium grained, sub-rounded shaped, trace rounded coarse grains scattered throughout the sample, small mica flakes scattered throughout the sample, damp, medium dense	SM	14			10.5	
29.5–31	7-7 T		Variegated Gravelly SAND, fine to coarse grained, sub-angular to sub-rounded shaped, poorly graded, mica flakes scattered throughout the sample, angular to rounded very coarse pebbles scattered throughout the sample, pockets of silty sand scattered throughout the sample, damp, medium dense	SG	25			7.4	
35–36	7-8 T		Increase in coarseness of sand, predominately medium to coarse grains with few fines, coarsening downward, fractured and broken river rocks scattered throughout the sample, damp, dense		37			6.7	
36.5			Boring Terminated at 36 and 1/2 feet. No groundwater was encountered.						

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LOGGED BY CLR DATE DRILLED 4/21/08 BORING DIAMETER 8" HS BORING NO. 8

Depth (feet)	Sample No. and Type	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–4.5	8-1 L; 8-2 L	Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, damp, loose	SM	6		91.0	15.8	42.9% Passing #200 Sieve
4.5–5.3	8-3 T	Brown SAND, fine grained, poorly graded, sub-rounded shaped, small mica flakes scattered throughout the sample, damp, loose	SP	5			9.3	
5.3–8		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, damp, loose	SM	7			14.8	31.6% Passing #200 Sieve
8–13	8-4 T	Brown Silty SAND, fine to medium grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, damp, medium dense		13			7.3	6.4% Passing #200 Sieve
13–18	8-5 T	Brown SILT, very fine grained, smooth texture, intermediate plasticity, small mica flakes scattered throughout the sample, moist to wet, soft	MI & OI	4	11		40.0	98.8% Passing #200 Sieve
18–23	8-6 T	Brown Silty SAND, very fine to fine grained, sub-rounded shaped, very small mica flakes scattered throughout the sample, low plasticity, wet, loose	SM	7			21.7	Gravel = 2.1% Sand = 65.8% Fines = 32.1%
23–24	8-7 T	Brown Silty SAND, very fine to medium grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, wet, loose	SP					

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LOGGED BY CLR DATE DRILLED 4/21/08 BORING DIAMETER 8" HS BORING NO. 8

Depth (feet)	Sample No. and Type	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
24–25	8-7 T	Brown Silty SAND, very fine to medium grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, wet, loose	SM	9			16.1	10.5% Passing #200 Sieve
25–28	8-8 T	Brown CLAY, very fine grained, smooth texture, very small mica flakes scattered throughout the sample, intermediate plasticity, moist, stiff (groundwater symbol)	CI	9	26		30.2	
28–33	8-9 T	Brown Silty SAND, very fine to fine grained, sub-rounded shaped, very small mica flakes scattered thoughout the sample, wet, very loose	SM	4			24.6	47.6% Passing #200 Sieve
33–38	8-10 T	Brown Clay, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, low to medium plasticity, moist, firm	CL	8	14		25.4	
38–43	8-11 T	Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, trace medium grains, wet, loose	SM	10			23.7	36.7% Passing #200 Sieve
43–48	8-12 T	Moist, medium dense		14			19.2	36.0% Passing #200 Sieve

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LOGGED BY CLR DATE DRILLED 4/21/08 BORING DIAMETER 8" HS BORING NO. 8

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49–50	8-13 T		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small micas flakes scatered throughout the sample, wet, medium dense	SM	15			23.8	34.5% Passing #200 Sieve
50–72			Boring Terminated at 50 feet. Groundwater initially encountered at 15 feet, stabilized at 27 feet.						

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Figure No. 21
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LOGGED BY CLR DATE DRILLED 5/6/08 BORING DIAMETER 6" BORING NO. 9

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–4.5	9-1 L		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, rounded pebbles scattered throughout the sample, damp, loose	SM	5		99.8	10.0	25.5% Passing #200 Sieve
4.5–10	9-2 L		Brown SAND, quartz rich, fine to coarse grained, sub-angular to sub-angular shaped, mica flakes scattered throughout the sample, broken and whole rounded pebbles scattered throughout the sample, poorly graded, damp, medium dense	SP	17				Direct Shear: C = 195 psf $\phi = 24^{o}$
10–15.5	9-3 B		Clayey SAND, very fine to medium grained, low plasticity, sub-rounded shaped, mica flakes scattered throughout the sample, damp, loose No sample was recovered. Spoils are described above. Fining to Sandy CLAY	SC	6			18.8	
15.5–16.5	9-4 L		Brown CLAY, very fine grained, smooth texture, mica flakes scattered throughout the sample, low to medium plasticity, damp, firm	CL	7			29.4	
16.5–24			Boring Terminated at 16 and 1/2 feet. No groundwater was encountered.						

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Figure No. 22
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LOGGED BY CLR DATE DRILLED 4/21/08 BORING DIAMETER 8" HS BORING NO. 10

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1–2	10-1 L		Brown Silty SAND, very fine to fine grained, trace medium sub-rounded gravels, poorly graded, very small mica flakes scattered throughout the sample, damp, very loose	SM	4		99.8	18.2	49.4% Passing #200 Sieve
4	10-2 L		Bits of charcoal near 4 feet, sub-angular to sub-rounded medium to very coarse gravels near 4 1/2 feet, large rounded river rock near 4 1/2 feet, damp, very loose		2			12.6	
5–6	10-3 T		Lack of pebbles and rocks, increase in coarseness of sand, coarsening downward, very fine to medium grained, damp, very loose		2			10.1	14.4% Passing #200 Sieve
8–9	10-4 T		Brown SAND, fine to medium grained, sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, damp, loose	SM	9			9.5	44.3% Passing #200 Sieve
10			Brown Silty SAND, moderately cemented, very fine grained, mica flakes scattered throughout the sample, damp, loose	SM					
14	10-5 T		Brown Silty SAND, very fine to fine grained, there is a significant amount of slough in the sample; the native is the fine grained soil the slough is the sand, several sub-angular to sub-rounded river rocks, damp, loose		7			9.5	16.0% Passing #200 Sieve
19	10-6 T		Color change to mottled brown, gray and reddish brown, trace rounded river pebbles and medium gravels scattered throughout the sample, mica flakes scattered throughout the sample, damp to moist, medium dense		12			13.9	27.7% Passing #200 Sieve
23–24	10-7 T		Color change to brown, trace medium grains, damp, medium dense		16				Gravel = 0.0% Sand = 80.5% Fines = 19.5%

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LOGGED BY CLR DATE DRILLED 5/5/08 BORING DIAMETER 6" BORING NO. 10

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
24–25	10-7 T		Brown Silty SAND, very fine to fine grained, trace medium grains, poorly graded, mica flakes scattered throughout the sample, damp, medium dense	SM	16			10.6	
28–29	10-8 T		Brown Sandy CLAY, very fine to medium grained, sub-angular to sub-rounded shaped, low to medium plasticity, very small mica flakes scattered throughout the sample, moist, stiff	CL	14	13		22.7	
33–34	10-9 T		Mottled brown, grayish brown and reddish brown Fat CLAY, smooth texture, very fine grained, very small mica flakes scattered throughout the sample, high plasticity, damp, stiff	CH	14	43		31.6	
39	10-10 T		Color change to mottled gray and reddish brown, damp, stiff		10	47		35.1	
44	10-11 T		Color change to mottled bluish gray and yellowish brown very smooth texture, damp, stiff		14	42		35.7	

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LOGGED BY CLR DATE DRILLED 4/21/08 BORING DIAMETER 8" HS BORING NO. 10

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49	10-12 T		Bluish gray Fat CLAY, very fine grained, very smooth texture, oxidized patches and veins of decomposed organics scattered throughout the sample, trace charcoal, medium plasticity, damp, stiff	CH	14	45		34.9	
50			Boring Terminated at 50 feet. Groundwater was initially encountered at 29 and 1/2 feet, and stabilized at 28 feet.						

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Figure No. 25
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LOGGED BY CLR DATE DRILLED 4/21/08 BORING DIAMETER 8" BORING NO. 11

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1–2	11-1 L		Yellowish brown Sandy CLAY, very fine to fine grained, very small mica flakes scattered throughout the sample, low plasticity , damp, very stiff	CL	22	17	114.7	15.3	
4–5	11-2 L		Yellowish brown Sandy SILT very fine to fine grained, very small mica flakes scattered throughout the sample, patches of gray near 5 feet, damp, very stiff	ML	25			20.3	56.8% Passing #200 Sieve
9–10	11-3 T		Yellowish brown Silty SAND, very fine to fine grained, trace medium grains, sub-angular to sub-rounded shaped, very small mica flakes scattered throughout the sample, poorly graded, slightly damp, dense	SM	36			7.4	17.9% Passing #200 Sieve
14–15	11-4 T		Mottled grayish brown and brownish red Fat CLAY, smooth texture, very fine grained, low plastic characteristics, very small mica flakes scattered throughout the sample, slightly damp, very stiff	CH	27	47		27.5	
19–20	11-5 T		Damp, very stiff		17	60		31.9	
24	11-6 T		Color change to mottled gray and brownish red, smooth texture, low to medium plasticity, damp to wet, stiff						

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Figure No. 26
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LOGGED BY CLR DATE DRILLED 4/21/08 BORING DIAMETER 8" BORING NO. 11

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25	11-6 T		Mottled gray and brownish red Fat CLAY, high plasticity, very fine grained, smooth texture, very small mica flakes scattered throughout the sample, damp to wet, stiff	CH	12	43		37.4	
29	11-7 T		Damp, stiff		11	35		36.5	
34	11-8 T		Color change to mottled bluish gray and reddish brown, damp, very stiff		18	46		36.2	
39	11-9 T		Color change to bluish gray, trace oxidized patches scattered throughout the sample, damp, stiff		12	36		34.1	
44	11-10 T		Color change to mottled bluish gray and light yellowish brown, damp, very stiff		17	39		36.8	
48									

LOGGED BY CLR DATE DRILLED 4/21/08 BORING DIAMETER 8" BORING NO. 11

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49	11-11 T		Mottled bluish gray and yellowish brown Fat CLAY, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, high plasticity, damp, very stiff	CH	18	34		36.5	
50			Boring Terminated at 50 feet. Groundwater encountered at 24 and 1/2 feet and stabilized at 20 and 1/2 feet.						
72									

LOGGED BY CLR DATE DRILLED 4/22/08 BORING DIAMETER 8" HS BORING NO. 12

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1–3	12-1 L		Mottled brown, grayish tan and reddish orange Sandy CLAY, very fine to fine grained, intermediate plasticity, very small mica flakes scattered throughout the sample, damp,very stiff	CL-CI	16	19	113.4	18.5	
4–8	12-2 L		Mottled dark brown and reddish brown Clayey SAND, very fine to fine grained, sub-rounded shaped , very small mica flakes scattered throughout the sample, poorly graded, damp, dense	SC	36		120.5	14.5	47.6% Passing #200 Sieve
9–12	12-3 T		Brown CLAY with Sand, very fine to fine grained, low to medium plasticity, very small mica flakes scattered throughout the sample, damp, stiff	CL	13	11		18.1	
13–17	12-4 T		Mottled reddish brown and grayish brown Clayey SAND, very fine to medium grained, sub-rounded shaped, slight sticky texture, poorly graded, very small mica flakes scattered throughout the sample, large fractured river rock in the sample, damp, medium dense	SC	17			16.8	33.2% Passing #200 Sieve
18–23	12-5 T		Mottled gray and reddish brown SILT with Sand, smooth texture, very fine to fine grained, very small mica flakes scattered throughout the sample, intermediate plasticity, damp, stiff Water in the hole, collected sample and waited 17 minutes	MI-OI	9	12		25.4	
24	12-6 T		Mottled gray and reddish brown Fat CLAY, smooth texture, very fine grained, high plasticity, very small mica flakes scattered throughout the sample, damp, stiff	CH	11	56		42.5	

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Figure No. 29
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LOGGED BY CLR DATE DRILLED 4/22/08 BORING DIAMETER 8" HS BORING NO. 12

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–28			Mottled gray and reddish brown Fat CLAY, smooth texture, very fine grained, high plasticity, very small mica flakes scattered throughout the sample, damp, stiff	CH					
29–33	12-7 T		Color change to brownish gray, damp, stiff		13	57		35.0	
34–37	12-8 T		Color change to mottled gray and reddish orange, damp, very stiff		16	39		35.0	
38–42	12-9 T		Damp, stiff		10	27		35.0	
43–48	12-10 T		Color change to mottled gray and reddish brown, damp, very stiff		16	32		34.2	

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Figure No. 30
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LOGGED BY CLR DATE DRILLED 4/22/08 BORING DIAMETER 8" HS BORING NO. 12

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49	12-11 T		Bluish gray Fat CLAY, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, medium plasticity, damp, stiff	CH		27		35.5	
50			Boring Terminated at 50 feet. Groundwater was encountered at 24 feet and 3 inches.						

Depth scale: 49–72 feet

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LOGGED BY CLR DATE DRILLED 5/7/08 BORING DIAMETER 6" BORING NO. 13

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1	13-1 L		Mottled light brown and brownish red Sandy CLAY, very fine to fine grained, low plasticity, very small mica flakes scattered throughout the sample, damp, very stiff	CL	13				
3			Mottled brown, tan and reddish brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, damp, medium dense	SM					
5	13-2 L		Mottled brown and reddish brown Clayey SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, medium to very coarse sub-angular to rounded gravels and pebbles scattered throughout the sample, damp, dense	SC	39				Direct Shear: C = 650 psf $\Phi = 36°$
10	13-3 L		Increase in coarseness and content of sand, very fine to medium grained, coarsening downward, lack of sub-angular gravels, rounded pebbles scattered throughout the sample, damp, medium dense		20		109.3	17.9	Gravel = 7.1% Sand = 67.8% Fines = 25.1%
15	13-4 L		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, damp, dense	SM	31		97.5	16.7	27.0% Passing #200 Sieve
17			Brown SAND, fine to medium grained, sub-rounded shaped, poorly graded, mica flakes scattered throughout the sample, damp, dense	SP					
20	13-5 T		Mottled brownish gray and reddish brown CLAY, very fine grained, smooth texture, very small mica flakes scattered throughout the sample, intermediate plasticity to non-plastic, damp, stiff	ML	14	19		39.3	

Depth scale: 1–24 feet

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LOGGED BY CLR DATE DRILLED 5/7/08 BORING DIAMETER 6" BORING NO. 13

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	13-6 T		Mottled brown and blackish brown Fat CLAY, very fine grained, smooth texture, high plasticity, very small mica flakes and oxidation patches scattered throughout the sample, damp, very stiff	CH	21	64		36.7	
27–48			Boring terminated at 26 and 1/2 feet. Groundwater initially encountered at 25 feet and came up to 23 feet.						

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LOGGED BY CLR DATE DRILLED 5/7/08 BORING DIAMETER 6" BORING NO. 14

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–5	14-1 L		Mottled grayish brown, yellowish tan, brown and reddish brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, oxidation patches scattered throughout the sample, thin roots near 1 1/2 feet, coarse to very coarse sub-angular gravels scattered throughout the sample, slightly damp to dry, very dense	SM	50/6				Direct Shear: C = 175 psf $\phi = 28^{\circ}$
5–9.5	14-2 L		Yellowish tan Clayey SAND, very fine to fine grained, sub-rounded shaped, oxidation patches scattered throughout the sample, coarse rounded pebbles scattered throughout the sample, veins of black clay scattered throughout the sample, poorly graded, damp, dense	SC	37		113.2	18.6	
9.5–14.5	14-3 L		Yellowish brown Sandy CLAY, very fine to fine grained, low plasticity, fairly high sand content, very small mica flakes scattered throughout the sample, damp, very stiff	CL	22				
14.5–19.5	14-4 L		Mottled brownish red and grayish brown SILT, very fine to fine grained, smooth texture, very small mica flakes scattered throughout the sample, damp, very stiff	ML	18		95.2	29.4	
19.5–24	14-5 T		Brownish gray Fat CLAY, very fine grained, smooth texture, high plasticity, oxidation patches scattered throughout the sample, damp, stiff	CH	14	44		35.7	

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LOGGED BY CLR DATE DRILLED 5/7/08 BORING DIAMETER 6" BORING NO. 14

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	14-6 T		Mottled brownish gray and brownish orange Fat CLAY, very fine grained, smooth texture, high plasticity, patchesof brick orange claynear 26 1/2 feet, damp, stiff	CH	15	55		31.7	
30–31	14-7 T		Lack of brick orangeclay, increase in amount of oxidation patches scattered thoughout the sample, damp, very stiff		18			35.6	
34–36	14-8 T		Mottled gray and reddish brown Silty CLAY, very fine grained, very sticky texture, imtermediate plasticity, damp, very stiff	CI	18	26		33.5	99.9% Passing #200 Sieve
37			Boring terminated at 36 and 1/2 feet. Groundwater was initially encountered at 26 and 1/2 feet, but stabilized at 25 feet.						

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LOGGED BY CLR DATE DRILLED 5/7/07 BORING DIAMETER 6" BORING NO. 15

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1–2	15-1 L		Mottled light brown, brown and dark brown Sandy SILT, very fine to fine grained, thin roots near 2 feet, yellowish orange oxidation patches scattered throughout the sample, very small mica flakes scattered throughout the sample, black patches near 2 1/2 feet, damp, stiff	ML	14				
5–6	15-2 L		Yellowish brown Silty SAND, very fine to medium grained, sub-rounded shaped, very small mica flakes scattered throughout the sample, very coarse rounded pebbles scattered throughout the sample, poorly graded, damp, dense	SM	34		124.2	12.7	
10–11	15-3 L		Increase in coarseness and content of sand, more medium grains, coarsening downward, increase in content of rounded pebbles, sub-angular coarse gravels scattered throughout the sample, damp, dense		32		113.6	16.7	
15–16	15-4 B		No sample recovered. Spoils from hole were described as yellowish brown Fat CLAY, very fine grained, smooth texture, high plasticity, mica flakes scattered throughout the sample, damp, very stiff	CH	23			27.3	
20–21	15-5 T		Color change to mottled gray and orange, patches of black clay scattered throughout the sample, high plasticity, damp, stiff		14	56		39.0	

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LOGGED BY CLR DATE DRILLED 5/7/08 BORING DIAMETER 6" BORING NO. 15

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	15-6 T		Mottled gray brownish red Fat CLAY, very fine grained, smooth texture, high plasticity, very small mica flakes scattered throughout the sample, damp, very stiff	CH	30			33.6	
27–48			Boring Terminated at 26 and 1/2 feet. Groundwater was encountered at 24 feet.						

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Figure No. 37
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LOGGED BY CLR DATE DRILLED 4/22/08 BORING DIAMETER 8" HS BORING NO. 16

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–2	16-1 L		Mottled blackish brown and brown CLAY, thin roots near 2 feet, intermediate plasticity, very fine grained, very small mica flakes and oxidation patches scattered throughout the sample, damp, very stiff	CI	15	22	110.2	18.1	59.6% Passing #200 Sieve
2–4			Mottled brownish tan and grayish tan Sandy CLAY, very fine to medium grained, sub-rounded shaped, slight sticky texture, very small mica flakes scattered thoughout the sample, poorly graded, damp, stiff	CL					
4–5	16-2 L		Mottled grayish tan and reddish orange CLAY, very fine grained, smooth texture, intermediate plasticity, very small mica flakes scattered throughout the sample, damp, very stiff	CI	23	25	102.0	15.9	
5–7			Brown SAND with Clay, very fine to medium grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, coarse to very coarse rounded gravels near 5 feet, damp, medium dense	SC					
7–10	16-3 T		Mottled gray and reddish brown CLAY, intermediate plasticity, very fine grained, smooth texture, very small mica flakes scattered throughout the sample, damp, stiff	CI	9	21		34.7	89.4% Passing #200 Sieve
10–13			Mottled gray and reddish brown SILT, very fine grained, small mica flakes scattered throughout the sample, damp, stiff	ML					
13–15	16-4 T		Mottled grayish brown and reddish brown Fat CLAY, very fine grained, very smooth texture, high plasticity, very small mica flakes scattered throughout the sample, damp, stiff	CH	12	62		35.5	
19–20	16-5 T		Color change to mottled gray and reddish brown, damp, very stiff		19	38		29.3	
22–23			Encountered groundwater waited 35 minutes for stabilization						
24	16-6 T		Possible maganese oxide staining or organic staining scattered throughout the sample, damp, very stiff		17	45		37.4	

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Figure No. 38
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LOGGED BY CLR DATE DRILLED 4/22/08 BORING DIAMETER 8" HS BORING NO. 16

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
24–25	16-6 T		Mottled gray and reddish brown Fat CLAY, smooth texture,very fine grained, high plasticity, very small mica flakes scattered throughout the sample, damp, very stiff	CH	17	45		37.4	
28–30	16-7 T		Color change to mottled gray and reddish brown, damp, very stiff		18	32		36.5	
33–35	16-8 T		Color change to mottled bluish gray and reddish brown, damp, very stiff		18	51		34.6	
38–40	16-9 T		Slight silty texture, damp, stiff		15	36		35.4	
43–45	16-10 T		Damp, very stiff		20	39		20.6	
46–48									

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LOGGED BY CLR DATE DRILLED 4/22/08 BORING DIAMETER 8" HS BORING NO. 16

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
48–50	16-11 T		Mottled bluish gray and light reddish brown Fat CLAY, very fine grained, smooth texture, very small mica flakes scattered throughout the sample, high plasticity, slight staining from organics, damp, very stiff	CH	17	53		37.0	
50–72			Boring Terminated at 50 feet. Groundwater was encountered at 25 feet and stabilized at 13 feet after 35 minutes						

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LOGGED BY CLR DATE DRILLED 5/7/08 BORING DIAMETER 6" BORING NO. 17

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1 2 3 4	17-1 L		Black Clayey SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, thin root scattered throughout the sample, medium to coarse sub-angular to rounded pebbles scattered throughout the sample, damp, medium dense	SC	23				Direct Shear: C = 300 psf Φ = 40°
5 6 7 8 9	17-2 L		Brown Clay, very fine grained, smooth texture, low to medium plasticity, oxidation patches scattered throughout the sample, black patches near 6 1/2 feet, very small mica flakes scattered throughout the sample, damp, stiff	CL	11		82.7	38.2	
10 11 12 13 14	17-3 L		Mottled brownish gray and reddish brown Clayey SILT, very fine grained, smooth texture, very small mica flakes scattered throughout the sample, low plasticity to non-plastic, damp, very stiff	ML	20		93.3	30.5	
15 16	17-4 L		Mottled gray and reddish brown Silty CLAY, very fine grained, smooth texture, low to medium plasticity, very small mica flakes scattered throughout the sample, damp, very stiff	CL	16				
17 18 19 20 21 22 23 24			Boring Terminated at 16 and 1/2 feet. No groundwater was encountered, but a slight seep zone was encountered near 16 and 1/2 feet.						

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LOGGED BY CLR DATE DRILLED 5/7/08 BORING DIAMETER 6" BORING NO. 18

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1 2 3 4	18-1 L		Dark brown CLAY with Sand, very fine grained, smooth texture, low to medium plasticity, thin roots near 2 feet, rounded pebbles near 2 1/2 feet, trace medium sub-rounded grains scattered throughout the sample, damp, firm	CL	8		113.9	15.2	
5 6 7 8 9	18-2 L		Mottled dark brown and light brown Fat CLAY, very fine grained, smooth texture, high plasticity, small mica flakes scattered throughout the sample, black clay veins near 6 feet, damp, stiff	CH	13	38	102.5	23.2	
10 11 12 13 14	18-3 L		Mottled gray and reddish brown Clayey SILT, very fine grained, smooth texture, low plasticity to non-plastic, very small mica flakes scattered throughout the sample, damp, very stiff	ML	17		83.3	40.3	99.9% Passing #200 Sieve
15 16 17 18 19	18-4 L		Mottled gray and reddish brown Silty CLAY, very fine grained, smooth texture, intermediate plasticity, very small mica flakes scattered throughout the sample, black clayey veins and patches scattered throughout the sample, damp, very stiff	CI	25		86.5	36.7	
20 21 22 23 24	18-5 T		Trace black patches scattered throughout the sample, damp, stiff		14	20		36.0	99.6% Passing #200 Sieve

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LOGGED BY CLR DATE DRILLED 5/7/08 BORING DIAMETER 6" BORING NO. 18

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25	18-6 T		Mottled bluish gray and reddish brown Fat CLAY, very fine grained, smooth texture, high plasticity, very small mica flakes scattered throughout the sample, damp, stiff	CH	14	44		36.0	
30	18-7 T		Damp, very stiff		16			38.8	
31 1/2			Boring Terminated at 31 and 1/2 feet. Groundwater was encountered at 15 feet and stabilized at 6 feet.						

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LOGGED BY CLR DATE DRILLED 5/6/08 BORING DIAMETER 6" BORING NO. 19

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
2	19-1 L		Brown Silty SAND, very fine to medium grained, sub-angular to sub-rounded shaped, poorly graded, medium to coarse sub-angular to sub-rounded grains and pebbles near 3 1/2 feet, damp, loose	SM	5		109.6	12.6	
5	19-2 L		Mottled dark brown and light reddish brown CLAY, very fine grained, smooth texture, low to medium plasticity, small oxidized nodes near 6 feet, damp, stiff	CL	14		94.8	31.0	Qu = 3073 psf
10	19-3 L		Color change to mottled gray, brownish red and brown, very small mica flakes scattered throughout the sample, damp, very stiff		21		89.7	36.2	
15	19-4 L		Mottled gray and tannish red Fat CLAY, very fine grained, smooth texture, high plasticity, damp, very stiff	CH	20		88.0	36.2	
20	19-5 L		Very small mica flakes scattered throughout the sample, damp, very stiff		16	52	89.3	34.7	

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LOGGED BY CLR DATE DRILLED 5/6/08 BORING DIAMETER 6" BORING NO. 19

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	19-6 T		Grayish brown CLAY, very fine grained, smooth texture, intermediate plasticity, small mica flakes and oxidation patches scattered throughout the sample, damp, very stiff	CI	20	17		35.5	95.6% Passing #200 Sieve
30–31	19-7 T		Mottled grayish brown and reddish brown Silty CLAY, very fine grained, smooth texture, very small mica flakes scattered throughout the sample, low to medium plasticity, damp, very stiff	CL-ML	20			39.3	
32			Boring Terminated at 31 and 1/2 feet. Groundwater encountered at 27 feet.						

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LOGGED BY CLR DATE DRILLED 5/7/08 BORING DIAMETER 6" BORING NO. 20

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1–2	20-1 L		Mottled light brown, dark brown and reddish brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, roots near 2 feet, damp, loose	SM	9		102.6	8.8	
5–6	20-2 L		Color change to mottled brown, tan, and reddish brown, sligh increase in coarseness of sand, fine to medium grained, sub-rounded shaped, some well cemented / hardpan portions, broken and whole rounded pebbles scattered throughout the sample, damp to dry, very hard		50/6		112.7	8.4	20.8% Passing #200 Sieve
10–11	20-3 L		Color change to mottled reddish brown, brown and slight decrease in coarseness of sand, very fine to fine grained, sub-rounded shaped, very coarse sub-angular to sub-rounded gravels, pebbles, damp, medium dense		19		105.9	20.9	
12			Brown SAND with Silt, very fine to medium grained, sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, patches of medium and coarse grained sand near 11 feet, wet, medium dense	SP					
15–16	20-4 L		Mottled grayish brown, reddish brown, brownish orange, brown and blackish brown Fat CLAY, very fine grained, smooth texture, high plasticity, very small mica flakes scattered throughout the sample, damp to moist, very stiff	CH	23	36	77.5	46.2	
20–21	20-5 T		Color change to mottled grayish brown and reddish brown, patches of black silty clay scattered throughout the sample, damp, stiff		14			37.8	

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LOGGED BY CLR DATE DRILLED 5/7/08 BORING DIAMETER 6" BORING NO. 20

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25	20-6 T		Mottled grayish brown and reddish brown SILT, very fine to fine grained, smooth texture, mica flakes scattered throughout the sample, low plasticity, wet, stiff	ML	17			28.5	
30	20-7 T		Mottled bluish gray and reddish brown Fat CLAY, very fine grained, smooth texture, high plasticity, very small mica flakes scattered throughout the sample, damp, very stiff	CH	17			37.8	
35	20-8 T		Damp, very stiff		18	39		34.5	
37			Boring Terminated at 36 and 1/2 feet. Groundwater initially encountered at 10 and 1/2 feet, and stabilized at 12 and 1/2 feet.						

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Figure No.47
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LOGGED BY CLR DATE DRILLED 2/6/09 BORING DIAMETER 8" HS BORING NO. 21

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1	21-1 L		Brown Silty SAND, very fine to medium grained, sub-angular to sub-rounded shaped, poorly graded, small mica flakes scattered throughout the sample, trace rounded pebbles near 2 1/2 feet, rounded rock near 2 1/2 feet, damp, very loose	SM	4				
3	21-2 T		Brown SAND, fine to medium grained, sub-angular to sub-rounded shaped, poorly graded small mica flakes scattered throughout the sample, damp, very loose	SP	2				
5	21-3 L		Increase in coarseness of sand, medium to coarse grained, sub-angular to sub-rounded shaped, rounded sandstone and cherty pebbles scattered throughout the sample, damp, loose		5				
10	21-4 T		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, damp to slightly moist, very loose	SM	2				
15	21-5 L		Brown SAND with Gravels, fine to medium grained with trace coarse grains, sub-angular to sub-rounded shaped, gravels are rounded cherty pebbles, rounded sandstone pebbles, and sub-angular quartz gravels, poorly graded, damp, medium dense	SP	12				
20	21-6 T		Brown Clayey SAND, very fine to fine grained, sub-rounded shaped, poorly graded, slight sticky texture, very small mica flakes scattered throughout the sample, moist, loose	SC	7				

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LOGGED BY CLR DATE DRILLED 2/6/09 BORING DIAMETER 8" HS BORING NO. 21

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25	21-7 L		Brown SAND, fine to medium grained, trace coarse grains, sub-angular to sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, damp	SP					
26			Mottled brown and gray fat CLAY, very fine grained, very smooth texture, high plasticity, moist, stiff	CH	11				
27–29			Brown Clayey SAND, very fine to fine grained, sub-rounded shaped, poorly graded, slight sticky texture, very small mica flakes scattered throughout the sample, damp, loose	SC					
30–34	21-8 T		Brown Silty SAND, very fine to medium grained, sub-angular to sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, damp, loose	SM	8				
35	21-9 L		Brown Fat CLAY, very fine grained, very smooth texture, high plasticity, very small mica flakes scattered throughout the sample, wet, soft	CH					
36–39			Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, saturated, very loose	SM	4				
40–44	21-10 T		Color change to mottled brown and gray, significant increase in fines content, fining downward, damp to slightly moist, loose		10				
45–48	21-10 T		Color change to brown, significant increase in sand content, coarsening with depth, predominately medium grained sand, moist, medium dense		12				

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LOGGED BY CLR DATE DRILLED 2/6/09 BORING DIAMETER 8" HS BORING NO. 21

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49–51	21-12 T		Mottled gayish brown and brownish red Fat CLAY, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, damp, stiff	CH	12				
52–72			Boring terminated at 51 1/2 feet. No groundwater encountered.						

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LOGGED BY CLR DATE DRILLED 2/6/09 BORING DIAMETER 8" HS BORING NO. 22

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1–2	22-1 L		Brown Sandy CLAY, very fine to fine grained, smooth texture, low plasticity, very small mica flakes scattered throughout the sample, moist, firm	CL	8				
3–4	22-2 T		Brown Silty SAND, very fine to medium grained, sub-angular to sub-rounded shaped, poorly graded, poorly graded, very small mica flakes scattered throughout the sample, damp, very loose	SM	4				
5–9	22-3 L		Brown SAND, fine to medium grained, sub-angular to sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, trace coarse grains of sand, damp, loose	SP	8				
10–14	22-4 T		Increase in coarseness of sand, medium to coarse grained, sub-angular to sub-rounded shaped, damp, loose		7				
15	22-5 L		Mottled brown and gray Fat CLAY, very fine grained, very smooth texture, high plasticity, very small mica flakes scattered throughout the sample, damp, stiff	CH					
16–19			Brown SAND, fine to medium grained with trace coarse grains, sub-angular to sub-rounded shaped, trace rounded chert pebbles scattered throughout the sample, poorly graded, very small mica flakes scattered throughout the sample, moist, loose	SP	6				
20–24	22-6 T		Brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, moist, loose	SM	10				

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LOGGED BY CLR DATE DRILLED 2/6/09 BORING DIAMETER 8" HS BORING NO. 22

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–29	22-7 L		Mottled brown and grayish brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, moist, loose	SM	6				
30–34	22-8 T		Mottled brown and grayish brown Sandy SILT with pockets of Fat CLAY, very fine to fine grained, smooth texture, very small mica flakes scattered throughout the sample, clay pockets exhibit high plasticity, moist, soft	ML	3				
35–39	22-9 L		Mottled brown and reddish brown Fat CLAY with Sand, very fine to fine grained, smooth texture, high plasticity, very small mica flakes scattered throughout the sample, very moist to slightly wet, firm	CH	6				
40–44	22-10 T		Mottled dark tan and reddish tan CLAY with Sand, very fine to fine grained, smooth texture, manganese oxide staining scattered throughout the sample, very small mica flakes and trace rounded chert pebbles scattered throughout the sample, low plasticity, moist, very stiff	CL	20				
45–48	22-11 L		Mottled greenish brown, reddish tan and brown CLAY, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, high plasticity, damp, very stiff	CI	17				

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LOGGED BY CLR DATE DRILLED 2/6/09 BORING DIAMETER 8" HS BORING NO. 22

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49–51	22-12 T		Mottled grayish brown and reddish brown Fat CLAY, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, high plasticity, wet, firm	CH	7				
52–72			Boring terminated at 51 1/2 feet. No groundwater encountered.						

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LOGGED BY CLR DATE DRILLED 2/6/09 BORING DIAMETER 8" HS BORING NO. 23

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–2	23-1 L		Brown Sandy CLAY, very fine grained, smooth texture, low to medium plasticity, trace rootlets scattered throughout the sample, very small mica flakes and trace oxidation patches scattered throughout the sample, moist	CL	5		104.4	21.3	69.6% Passing #200 Sieve
2–3	23-2 T		Brown Silty SAND, very fine to fine grained, sub-angular to rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, moist, loose	SM					
3–5			Color change to medium reddish brown, increase in sand content, very fine to fine grained, trace mdium grained, damp, very loose		4			9.9	
5–9	23-3 L		Increase in fines content, color change to brown, moist, very loose		4		105.9	15.4	37.7% Passing #200 Sieve
9–14	23-4 T		Mottledbrown and reddish brown Sandy CLAY, very fine to fine grained, smooth texture, low to medium plasticity, grades to clay with depth, very moist to wet, firm	CL	6			19.0	61.7% Passing #200 Sieve
14–19	23-5 L		Mottled brown, tan, reddish orange, and brownish black CLAY, very fine grained, smooth texture, intermediate plasticity, small mica flakes scattered throughout the sample, damp, stiff	CI	15		101.4	25.4	93.5% Passing #200 Sieve
19–24	23-6 T		Mottled grayish brown and reddish brown Fat CLAY, very fine grained, very smooth texture, high plasticity, small mica flakes scattered throughout the sample, damp to slightly moist, firm	CH	8	62		39.0	100% Passing #200 Sieve

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LOGGED BY CLR DATE DRILLED 2/6/09 BORING DIAMETER 8" HS BORING NO. 23

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–29	23-7 L		Mottled grayish brown and reddish brown Fat CLAY, very fine grained, smooth texture, small mica flakes scattered throughout the sample, moist, stiff	CH	10	36	89.6	35.0	99.9% Passing #200 Sieve
30–34	23-8 L		Grayish brown Fat CLAY, very fine grained, very smooth texture, high plasticity, small mica flakes scattered throughout the sample, damp, stiff	CH	11		90.1	36.8	
35–39	23-9 T		Moist, stiff (groundwater symbol)		13			35.6	
40–44	23-10 L		Mottled bluish grayand brown Fat CLAY, very fine grained, very smooth and sticky texture, small mica flakes scattered throughout the sample, very moist, stiff	CH	13		83.9	41.9	
45–48	23-11 T		Damp, stiff		9	47		37.1	100% Passing #200 Sieve

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LOGGED BY CLR DATE DRILLED 2/6/09 BORING DIAMETER 8" HS BORING NO. 23

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49–51	23-12 L		Grayish brown Fat CLAY, very fine grained, very smooth texture, charcoal staining and other organics near 51 feet, oxidation veins near 51 1/2 feet, high plasticity, very small mica flakes scattered throughout the sample, very moist, stiff	CH	9		78.4	46.0	
52–72			Boring terminated at 51 1/2 feet. Groundwater encountered at 35 feet.						

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LOGGED BY CLR DATE DRILLED 2/9/09 BORING DIAMETER 8" HS BORING NO. 24

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1–2	24-1 L		Brown Sandy CLAY, very fine to fine grained, smooth texture, low to medium plasticity, very small mica flakes scattered throughout the sample, rootlets scattered throughout the sample, moist to slightly wet, firm	CL	5		111.6	17.5	56.3% Passing #200 Sieve
3	24-2 T		Color change to mottled medium brown and reddish brown, trace bits of charcoal scattered throughout the sample, moist, firm		6			17.0	
5–6	24-3 L		Color change to mottled medium grayish brown and reddish brown, very moist, firm		7		86.3	34.6	
10–11	24-4 T		Lack of charcoal, lack of rootlets, moist, stiff		9			34.2	
15–16	24-5 L		Color change to mottled brownish gray and orangish tan, moist, stiff		13		91.8	34.7	
20–21	24-6 T		Moist, firm		7			37.7	
24									

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LOGGED BY CLR DATE DRILLED 2/9/09 BORING DIAMETER 8" HS BORING NO. 24

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	24-7 L		Mottled dark brownish gray and orangish brown FAT CLAY, very fine grained, very smooth texture, slight sticky texture, very small mica flakes scattered throughout the sample, low plasticity, moist, stiff	CH	11	46	89.6	36.4	100% Passing #200 Sieve
30–31	24-8 T		Moist, firm		8			34.5	
34			Possible seep zone near 35 feet, rod is wet, auger is dry						
35–36	24-9 L		Mottled bluish gray and orangish brown Fat CLAY, very fine grained, very smooth and sticky texture, very small mica flakes scattered throughout the sample, high plasticity, moist, very stiff	CH	16		87.8	37.1	
40–41	24-10 T		Slightly moist, stiff		12	53		37.3	99.8% Passing #200 Sieve
45–46	24-11 L		Color change to bluish gray, trace dark purplish gray staining near 46 1/2 feet, very damp to slightly moist, very stiff		16		88.6	37.0	
48									

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Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49–51	24-12 T		Bluish gray Fat CLAY, very fine grained, very smooth texture, high plasticity, very small mica flakes scattered throughout the sample, trace dark purplish gray staining and trace oxidation patches scattered throughout the sample, trace organics near 51 feet, damp to slightly moist, stiff	CH	11			36.4	
52–72			Boring terminated at 51 1/2 feet. No groundwater encountered.						

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LOGGED BY CLR DATE DRILLED 2/9/09 BORING DIAMETER 8" HS BORING NO. 25

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
0–2	25-1 L		Mottled brown and yellowish brown Silty SAND, very fine to fine grainedwith trace medium grains, poorly graded rootlets near 2 feet, very small mica flakes scattered throughout the sample, damp, medium dense	SM					
2–3	25-2 T		Mottled brown and yellowish brown Clayey SAND, very fine to fine grained, trace medium grains, sub-angular to sub-rounded shaped, poorly graded, slightly sticky texture, damp, medium dense	SC	15				
3–10	25-3 L		Mottled brown, grayish brown and orangish brown Silty SAND, very fine to fine grained, sub-rounded shaped, poorly graded, very small mica flakes scattered throughout the sample, trace rootlets scattered throughout the sample, damp, dense Color change to mottled grayish brown and tannish orange, damp to slightly moist, medium dense	SM	39 17				
10–15	25-4 T		Mottled grayish brown, yellowish brown, and brownish red Silty CLAY, very fine to fine grained, smooth texture, low to medium plasticity, slightly sticky feeling, very small mica flakes scattered throughout the sample, moist, very stiff	CL	17				
15–20	25-5 L		Mottled dark gray and reddish brown CLAY, very fine grained, very smooth texture, low plasticity, very small mica flakes scattered throughout the sample, very damp to slightly moist, very stiff	CL	18				
20–24	25-6 T		Mottled greenish brown and orangish brown SILT, very fine to fine grained, very smooth and sticky texture, very small mica flakes scattered throughout the sample, moist, firm	ML	8				

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LOGGED BY CLR DATE DRILLED 2/9/09 BORING DIAMETER 8" HS BORING NO. 25

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25	25-7 L		Mottled grayish brown and orangish brown Fat CLAY, very fine grained, very smooth and stick texture, high plasticity, very small mica flakes scattered throughout the sample, very moist, stiff	CH	13				
30	25-8 T		Very moist to wet firm		8				
35	25-9 L		Color change to mottled bluish gray and dark orangish brown, very moist to slightly wet, stiff		11				
40	25-10 T		Color change to mottled dark gray, bluish gray, and dark orangish brown, trace organics near 4 1/2 feet, very moist to slightly wet, stiff		9				
45	25-11 L		Color change to mottled bluish gray and greenish gray, very moist, very stiff		16				

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Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
50	25-12 T		Mottled bluish gray and orangish gray Fat CLAY, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, high plasticity, trace dark purplish gray staining scattered throughout the sample, moist, stiff	CH	14				
52			Boring terminated at 51 1/2 feet. Groundwater encountered at 20 feet.						

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LOGGED BY CLR DATE DRILLED 2/9/09 BORING DIAMETER 8" HS BORING NO. 26

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
1–2	26-1 L		Very dark brown Sandy CLAY, very fine to fine grained, smooth texture, low to medium plasticity, very small mica flakes scattered throughout the sample, rootlets scattered throughout the sample, moist, firm	CL	7		111.1	18.7	52.8% Passing #200 Sieve
3–4	26-2 T		Trace oxidation patches scattered throughout the sample, moist, stiff		9			18.8	
5–6	26-3 L		Mottled brownish gray and brownish orange CLAY, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, low plasticity, moist, stiff	CL	10		86.2	38.4	
10–11	26-4 T		Moist, stiff		9			41.1	
15–16	26-5 L		Mottled brownish gray and brownish orange SILT, very fine grained, very smooth and sticky texture, very small mica flakes scattered throughout the sample, low plasticity, moist, stiff	ML	11	33	85.5	37.5	100% Passing #200 Sieve
20–21	26-6 T		Mottled dark gray and brownish orange CLAY, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, intermediate plasticity, moist, firm	CI	6	41		37.1	
24									

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LOGGED BY CLR DATE DRILLED 2/9/09 BORING DIAMETER 8" HS BORING NO. 26

Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
25–26	26-7 L		Mottled medium gray and brownish orange Fat CLAY, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, high plasticity, moist, very stiff	CH	16		90.7	34.4	100% Passing #200 Sieve
30–31	26-8 T		Moist, stiff		11			35.1	
35–36	26-9 L		Decrease in oxidized content, moist to very moist, very stiff		18		82.7	39.4	
40–41	26-10 T		Color change to dark gray, organics scattered throughout the sample, moist to very moist, stiff		11	53		35.8	100% Passing #200 Sieve
45–46	26-11 L		Trace oxidation patches near 46 1/2 feet, moist, very stiff		17		85.1	39.2	
48									

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Depth (feet)	Sample No. and Type	Symbol	Soil Description	Unified Soil Classification	SPT "N" Value	Plasticity Index	Dry Density (pcf)	Moisture % of Dry Wt.	Misc. Lab Results
49–51	26-12 T		Dark gray Fat CLAY, very fine grained, very smooth texture, very small mica flakes scattered throughout the sample, high plasticity, trace organics scattered throughout the sample, damp to slightly moist, stiff	CH	10			32.2	
52–72			Boring terminated at 51 1/2 feet. No groundwater encountered.						

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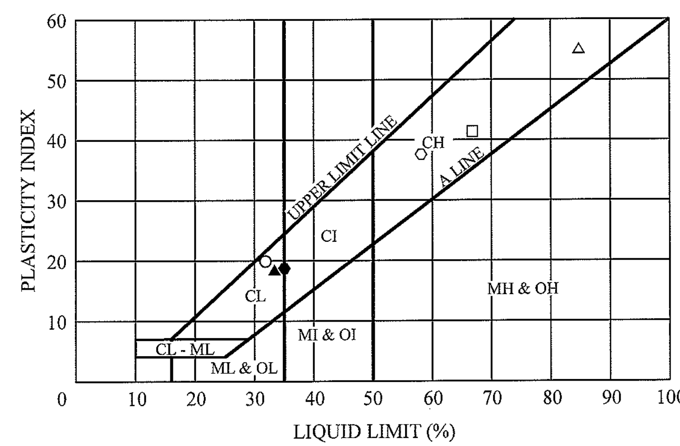
ATTERBERG LIMITS - ASTM D4318

PLASTICITY CHART



*This chart has been modified to include the intermediate classifications CI, MI and OI for clays and silts with liquid limits between 35 and 50.

SYMBOL	SAMPLE #	LL (%)	PL (%)	PI
●	2-5	NON-PLASTIC		
■	2-6	NON-PLASTIC		
▲	2-7	34	15	19
⬢	4-2-1	35	16	19
○	4-3-1	32	12	20
□	4-5-1	66	25	41
△	4-6-1	85	30	55
⬡	4-9-1	59	22	37

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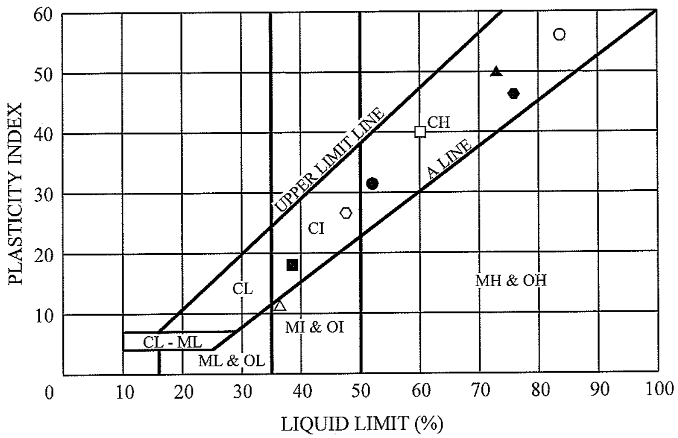
ATTERBERG LIMITS - ASTM D4318

PLASTICITY CHART



*This chart has been modified to include the intermediate classifications CI, MI and OI for clays and silts with liquid limits between 35 and 50.

SYMBOL	SAMPLE #	LL (%)	PL (%)	PI
●	4-10-1	52	21	31
■	4-11-1	39	21	18
▲	6-6-1	73	23	50
⬢	6-8-1	76	30	46
○	6-10-2	84	28	56
□	6-11-1	60	20	40
△	8-5	36	25	11
⬡	8-8	48	22	26

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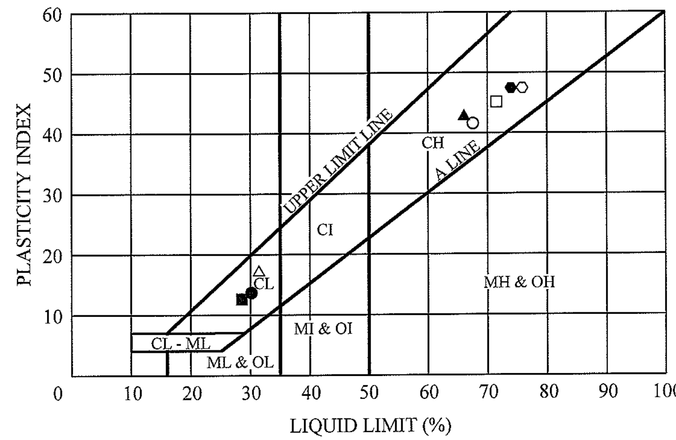
PLASTICITY CHART



*This chart has been modified to include the intermediate classifications CI, MI and OI for clays and silts with liquid limits between 35 and 50.

SYMBOL	SAMPLE #	LL (%)	PL (%)	PI
●	8-10	30	16	14
■	10-8	29	16	13
▲	10-9	66	23	43
⬢	10-10	75	28	47
○	10-11	67	25	42
□	10-12	72	27	45
△	11-1-1	32	15	17
⬡	11-4	75	28	47

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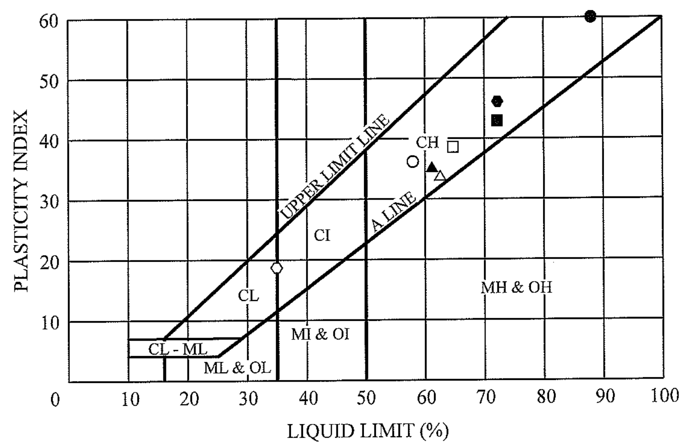
ATTERBERG LIMITS - ASTM D4318

PLASTICITY CHART



*This chart has been modified to include the intermediate classifications CI, MI and OI for clays and silts with liquid limits between 35 and 50.

SYMBOL	SAMPLE #	LL (%)	PL (%)	PI
●	11-5	88	28	60
■	11-6	72	29	43
▲	11-7	61	26	35
⬢	11-8	72	26	46
○	11-9	58	22	36
□	11-10	65	26	39
△	11-11	62	28	34
⬡	12-1-1	35	16	19

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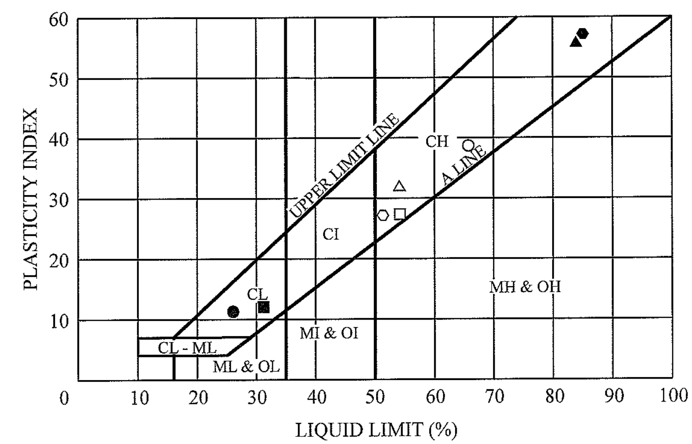
ATTERBERG LIMITS - ASTM D4318

PLASTICITY CHART



*This chart has been modified to include the intermediate classifications CI, MI and OI for clays and silts with liquid limits between 35 and 50.

SYMBOL	SAMPLE #	LL (%)	PL (%)	PI
●	12-3	26	15	11
■	12-5	31	19	12
▲	12-6	84	28	56
⬢	12-7	85	28	57
○	12-8	66	27	39
□	12-9	54	27	27
△	12-10	54	22	32
⬡	12-11	51	24	27

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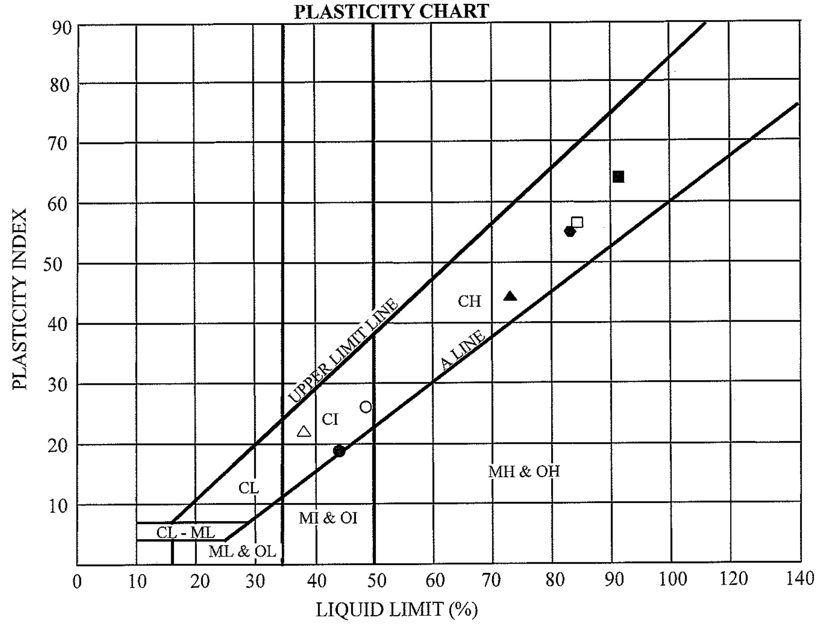
ATTERBERG LIMITS - ASTM D4318

PLASTICITY CHART



*This chart has been modified to include the intermediate classifications CI, MI and OI for clays and silts with liquid limits between 35 and 50.

SYMBOL	SAMPLE #	LL (%)	PL (%)	PI
●	13-5	44	25	19
■	13-6	91	27	64
▲	14-5	73	29	44
⬢	14-6	83	28	55
○	14-8	49	23	26
□	15-5	84	28	56
△	16-1-1	38	16	22

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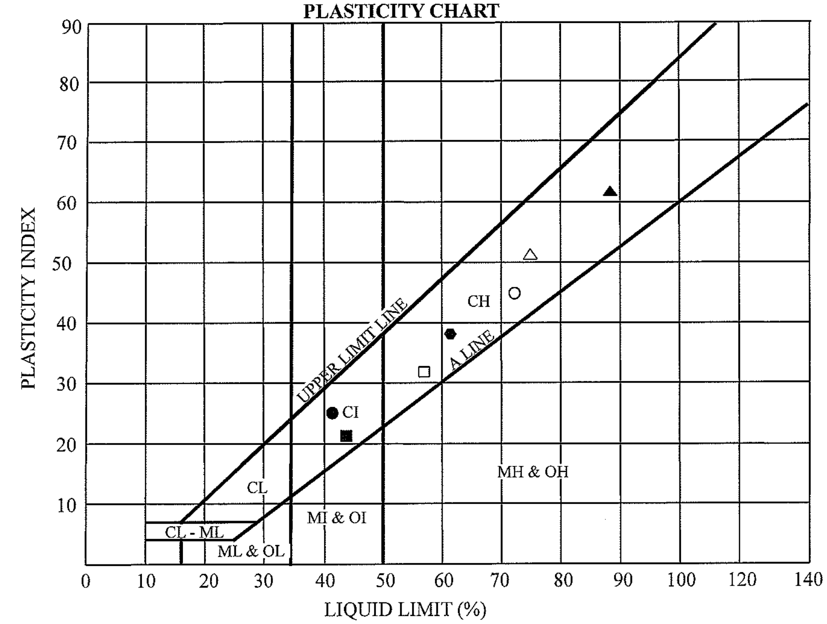
ATTERBERG LIMITS - ASTM D4318

PLASTICITY CHART



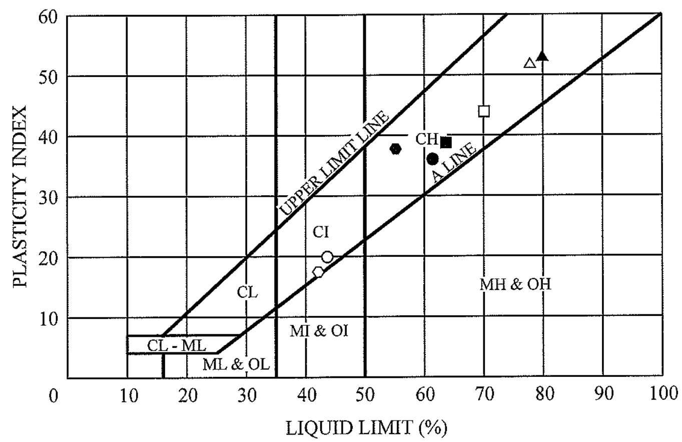
*This chart has been modified to include the intermediate classifications CI, MI and OI for clays and silts with liquid limits between 35 and 50.

SYMBOL	SAMPLE #	LL (%)	PL (%)	PI
●	16-2-1	41	16	25
■	16-3	44	23	21
▲	16-4	89	27	62
⬢	16-5	61	23	38
○	16-6	72	27	45
□	16-7	57	25	32
△	16-8	75	24	51

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Atterberg Limits** Atkinson Lane Development Watsonville, California	Figure No. 72 Project No. 0829 Date: 3/2/09

ATTERBERG LIMITS - ASTM D4318

PLASTICITY CHART



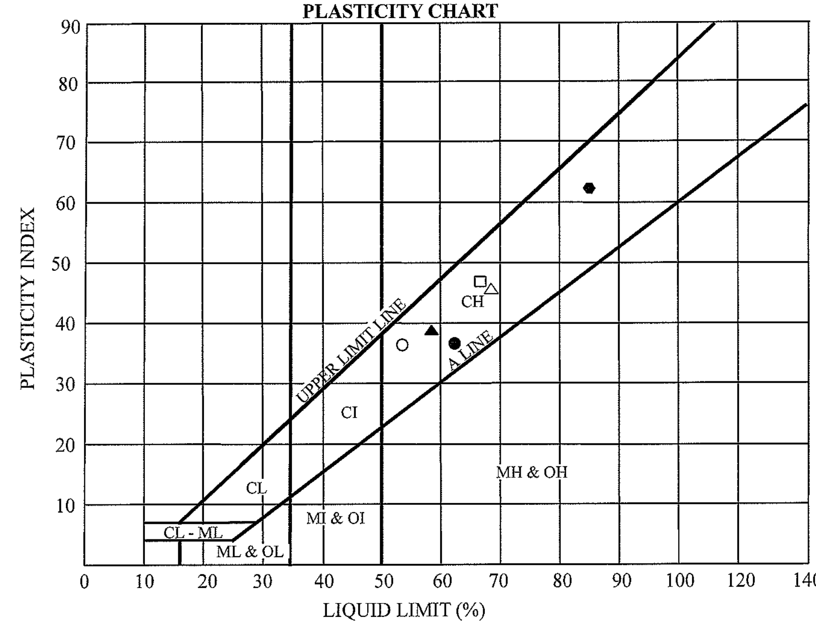
*This chart has been modified to include the intermediate classifications CI, MI and OI for clays and silts with liquid limits between 35 and 50.

SYMBOL	SAMPLE #	LL (%)	PL (%)	PI
●	16-9	61	25	36
■	16-10	64	25	39
▲	16-11	80	27	53
⬢	18-2-1	55	17	38
○	18-5	44	24	20
□	18-6	70	26	44
△	19-5-1	78	26	52
⬡	19-6	42	25	17

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Atterberg Limits** Atkinson Lane Development Watsonville, California	Figure No. 73 Project No. 0829 Date: 3/2/09

ATTERBERG LIMITS - ASTM D4318

PLASTICITY CHART



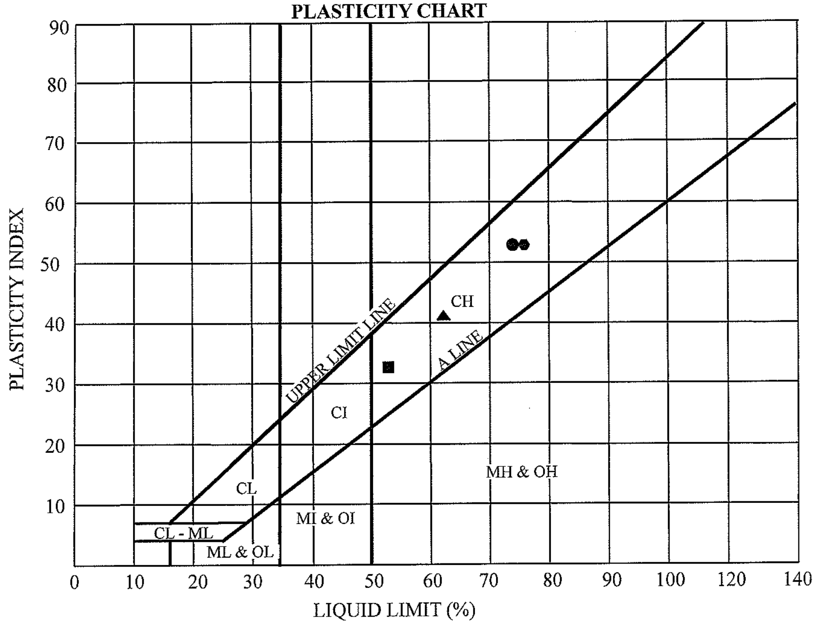
*This chart has been modified to include the intermediate classifications CI, MI and OI for clays and silts with liquid limits between 35 and 50.

SYMBOL	SAMPLE #	LL (%)	PL (%)	PI
●	20-4-1	62	26	36
■	20-6	---------NON-PLASTIC---------		
▲	20-8	59	20	39
⬢	23-6	85	23	62
○	23-7	54	18	36
□	23-11	67	20	47
△	24-7	69	23	46

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Atterberg Limits** Atkinson Lane Development Watsonville, California	Figure No. 74 Project No. 0829 Date: 3/2/09

ATTERBERG LIMITS - ASTM D4318

PLASTICITY CHART

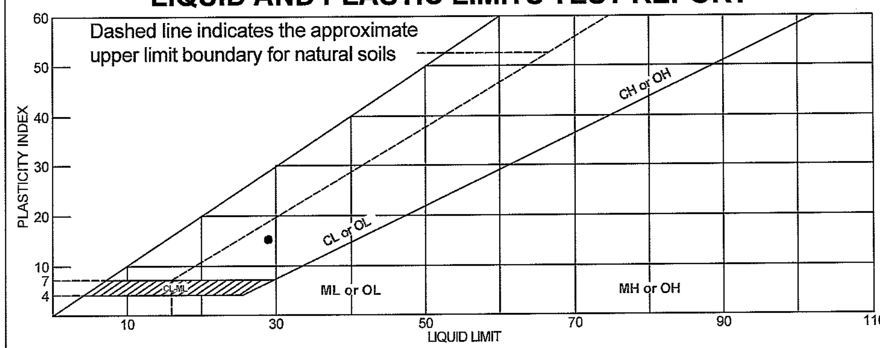


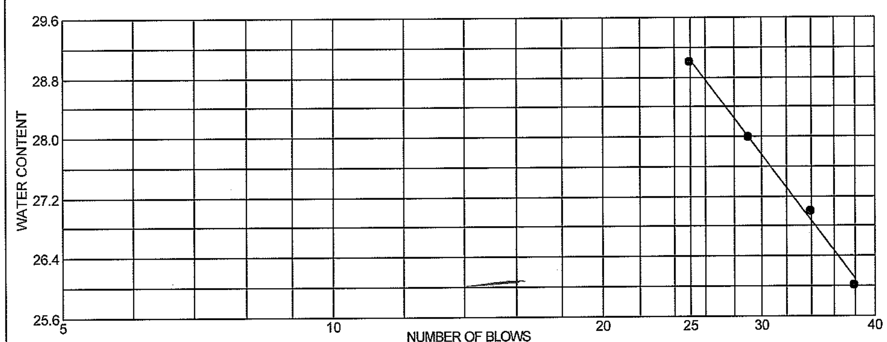
*This chart has been modified to include the intermediate classifications CI, MI and OI for clays and silts with liquid limits between 35 and 50.

SYMBOL	SAMPLE #	LL (%)	PL (%)	PI
●	24-10	75	22	53
■	26-5	53	20	33
▲	26-7	62	21	41
⬢	26-10	75	22	53

Pacific Crest Engineering Inc. 444 Airport Blvd., Suite 106 Watsonville, CA 95076	**Atterberg Limits** Atkinson Lane Development Watsonville, California	Figure No. 75 Project No. 0829 Date: 3/2/09

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown Lean Clayey SAND	29	14	15			

Project No. 416-342 **Client:** Pacific Crest Engineering, Inc.

Project: Atkinson Lane - 0829

● **Source:** 6-5-1

Remarks:

●

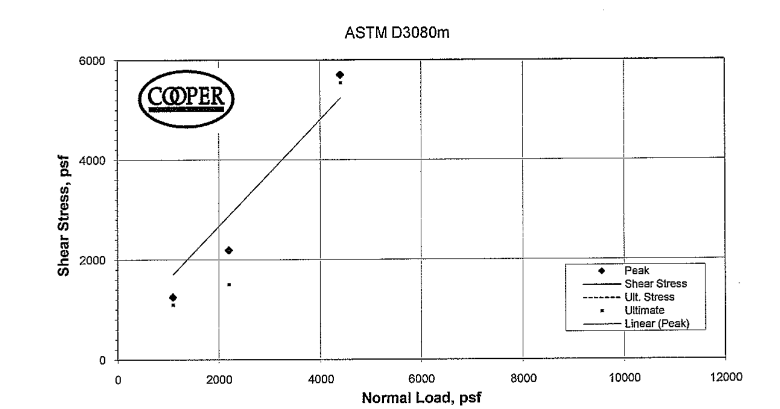
LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

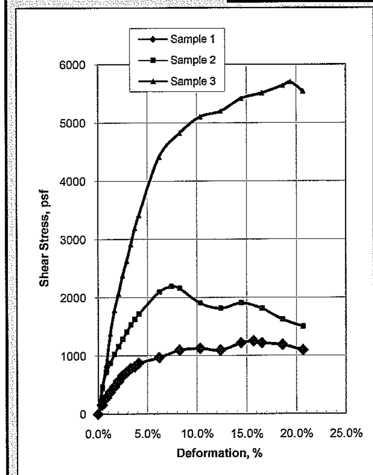
Figure

Figure No. 76
Project No. 0829
Date: 3/2/09

Direct Shear



P. Phi (degrees)	44.0	Ult. Phi (degrees)	
P. Cohesion(psf)	525	Ult. Cohesion (psf)	



	Sample Data: Initial			
	1	2	3	4
Moisture %	6.4	6.9	7.2	
Dry Dens., pcf	95.5	95.4	97.2	
Void Ratio	0.765	0.767	0.735	
Saturation %	22.7	24.5	26.3	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture %	19.7	19.9	18.1	
Dry Dens., pcf	99.5	100.8	105.1	
Void Ratio	0.694	0.672	0.603	
Saturation %	76.5	79.9	80.9	
Diameter	2.42	2.42	2.42	
Height	0.96	0.95	0.92	
Normal Stress, psf	1100	2200	4400	
Shear Stress, psf	1252	2191	5698	
Strengths picked at	15.7%	7.4%	19.4%	
Ult. Stress, psf	1096	1503	5541	
Strain Rate, in/min	0.020	0.020	0.020	

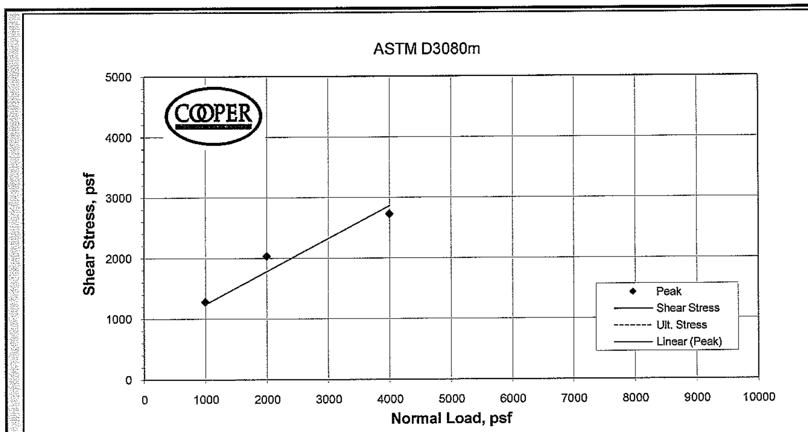
CTL #	416-342
Client:	Pacific Crest Engineering, Inc.
Project	Atkinson Lane - 0829
Tested By:	MD
Reduced By:	RU
Date:	6/2/2008

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1		4-1-1		Brown Poorly Graded SAND w/ Silt & Gravel
2		4-1-1		Brown Poorly Graded SAND w/ Silt & Gravel
3		4-1-1		Brown Poorly Graded SAND w/ Silt & Gravel
4				

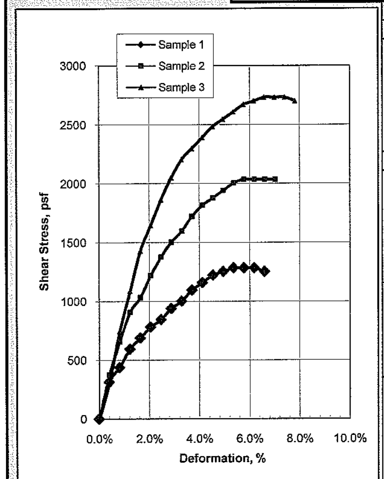
Remarks: *DS-CU* A fully undrained condition may not be attained in this test. Cap tilted during shearing of the second sample. Gravel in shear plane of sample #3.

Figure No. 77
Project No. 0829
Date: 3/2/09

Direct Shear



P. Phi (degrees)	28.0	Ult. Phi (degrees)	
P. Cohesion(psf)	700	Ult. Cohesion (psf)	



	Sample Data: Initial			
	1	2	3	4
Moisture %	18.4	18.5	19.5	
Dry Dens., pcf	104.2	104.8	102.2	
Void Ratio	0.618	0.608	0.649	
Saturation %	80.6	82.3	81.1	
Diameter	2.42	2.42	2.43	
Height	1.00	1.01	1.01	
	Sample Data: At Test			
Moisture %	20.1	19.8	20.7	
Dry Dens., pcf	105.5	109.5	107.8	
Void Ratio	0.598	0.540	0.563	
Saturation %	90.8	99.0	99.2	
Diameter	2.42	2.42	2.43	
Height	0.99	0.97	0.96	
Normal Stress, psf	1000	2000	4000	
Shear Stress, psf	1284	2035	2732	
Strengths picked at	6.2%	7.0%	7.4%	
Ult. Stress, psf				
Strain Rate, in/min	0.020	0.020	0.020	

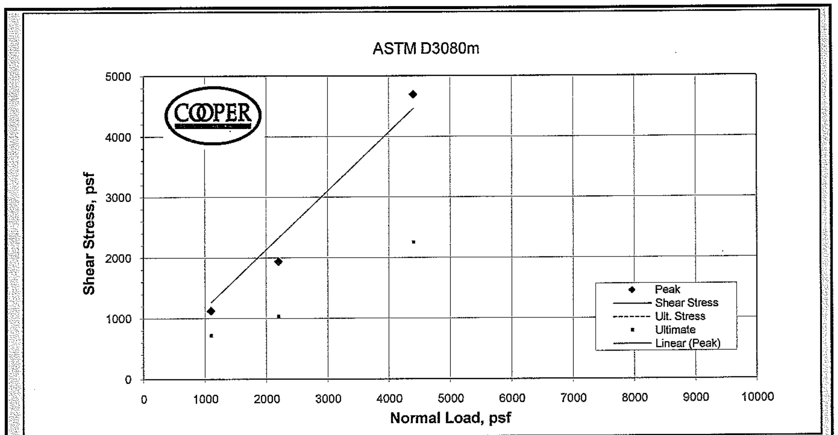
CTL #	416-342
Client:	Pacific Crest Engineering, Inc.
Project	Atkinson Lane - 0829
Tested By:	MD
Reduced By:	RU
Date:	5/30/2008

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1		6-1-1		Brown Clayey SAND
2		6-1-1		Brown Clayey SAND
3		6-1-1		Brown Clayey SAND
4				

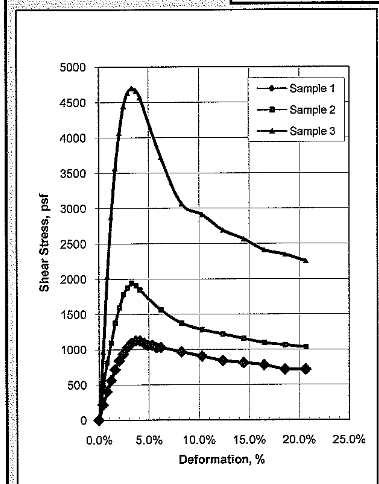
Remarks: *DS-CU* A fully undrained condition may not be attained in this test.

Figure No. 78
Project No. 0829
Date: 3/2/09

Direct Shear



P. Phi (degrees)	24.0	Ult. Phi (degrees)	
P. Cohesion(psf)	195	Ult. Cohesion (psf)	



	Sample Data: Initial			
	1	2	3	4
Moisture %	7.9	7.3	9.4	
Dry Dens., pcf	95.9	96.8	100.9	
Void Ratio	0.757	0.741	0.671	
Saturation %	28.0	26.5	38.0	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture %	21.6	22.1	19.6	
Dry Dens., pcf	94.3	98.8	102.7	
Void Ratio	0.787	0.706	0.642	
Saturation %	74.1	84.4	82.6	
Diameter	2.42	2.42	2.42	
Height	1.02	0.98	0.98	
Normal Stress, psf	1100	2200	4400	
Shear Stress, psf	1127	1941	4696	
Strengths picked at	4.1%	3.3%	3.3%	
Ult. Stress, psf	720	1033	2254	
Strain Rate, in/min	0.020	0.020	0.020	

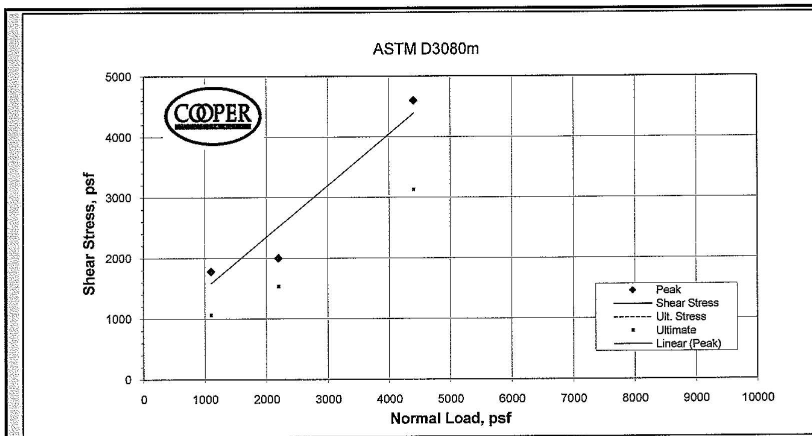
CTL #	416-342
Client:	Pacific Crest Engineering, Inc.
Project	Atkinson Lane - 0829
Tested By:	MD
Reduced By:	RU
Date:	6/9/2008

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1		9-2-1		Olive SAND
2		9-2-1		Olive SAND
3		9-2-1		Olive SAND
4				

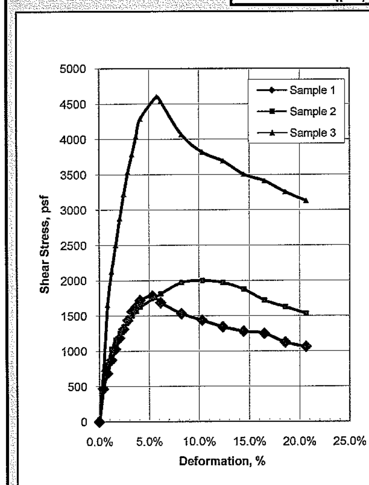
Remarks: *DS-CU* A fully undrained condition may not be attained in this test.

Figure No. 79
Project No. 0829
Date: 3/2/09

Direct Shear



P. Phi (degrees)	36.0	Ult. Phi (degrees)	
P. Cohesion(psf)	650	Ult. Cohesion (psf)	



	Sample Data: Initial			
	1	2	3	4
Moisture %	13.7	14.1	15.1	
Dry Dens., pcf	112.7	110.7	114.9	
Void Ratio	0.495	0.523	0.467	
Saturation %	74.9	73.0	87.1	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.01	
	Sample Data: At Test			
Moisture %	14.9	16.0	15.6	
Dry Dens., pcf	114.2	114.7	118.1	
Void Ratio	0.475	0.470	0.427	
Saturation %	84.7	92.1	98.5	
Diameter	2.42	2.42	2.42	
Height	0.99	0.96	0.98	
Normal Stress, psf	1100	2200	4400	
Shear Stress, psf	1785	2004	4602	
Strengths picked at	5.4%	10.3%	5.8%	
Ult. Stress, psf	1064	1534	3131	
Strain Rate, in/min	0.020	0.020	0.020	

CTL #	416-342
Client:	Pacific Crest Engineering, Inc.
Project	Atkinson Lane - 0829
Tested By:	MD
Reduced By:	RU
Date:	6/4/2008

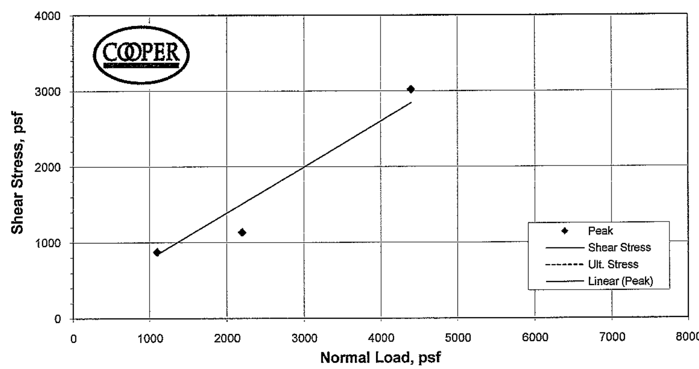
Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1		13-2-1		Yellowish Brown Clayey SAND
2		13-2-1		Yellowish Brown Clayey SAND
3		13-2-1		Yellowish Brown Clayey SAND
4				

Remarks: *DS-CU* A fully undrained condition may not be attained in this test.

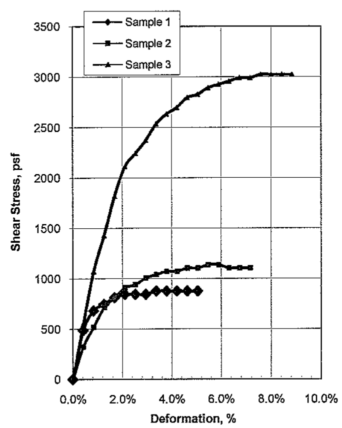
Figure No. 80
Project No. 0829
Date: 3/2/09

Direct Shear

ASTM D3080m



P. Phi (degrees)	28.0	Ult. Phi (degrees)	
P. Cohesion(psf)	175	Ult. Cohesion (psf)	



Sample Data: Initial	1	2	3	4
Moisture %	8.6	8.3	9.1	
Dry Dens., pcf	110.9	103.1	114.9	
Void Ratio	0.519	0.635	0.467	
Saturation %	44.7	35.1	52.3	
Diameter	2.38	2.38	2.38	
Height	1.00	1.00	1.00	
Sample Data: At Test				
Moisture %	17.1	18.5	15.2	
Dry Dens., pcf	111.8	107.2	117.5	
Void Ratio	0.507	0.572	0.434	
Saturation %	90.8	87.4	94.5	
Diameter	2.38	2.38	2.38	
Height	0.99	0.96	0.98	
Normal Stress, psf	1100	2200	4400	
Shear Stress, psf	878	1138	3023	
Strengths picked at	5.1%	5.9%	8.8%	
Ult. Stress, psf				
Strain Rate, in/min	0.020	0.020	0.020	

CTL #	416-342
Client:	Pacific Crest Engineering, Inc.
Project	Atkinson Lane - 0829
Tested By:	MD
Reduced By:	RU
Date:	6/5/2008

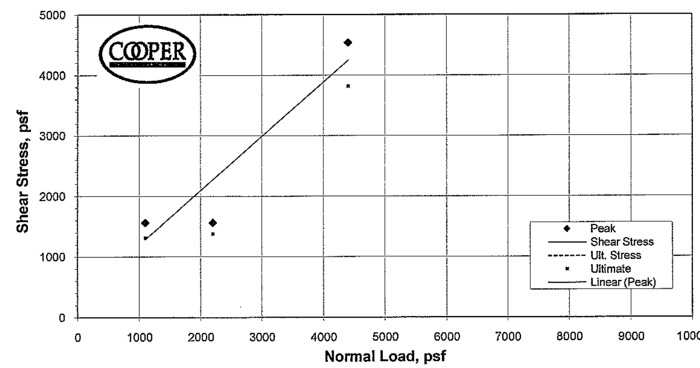
Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1		14-1-1		Brown Clayey SAND (Cemented)
2		14-1-1		Brown Clayey SAND (Cemented)
3		14-1-1		Brown Clayey SAND (Cemented)
4				

Remarks: *DS-CU* A fully undrained condition may not be attained in this test.

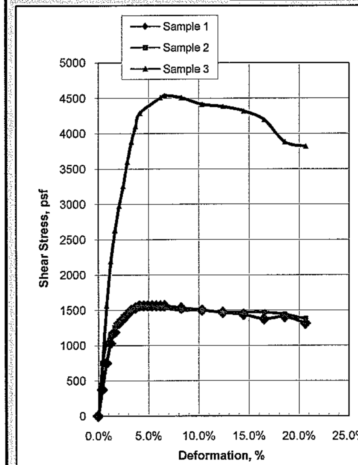
Figure No. 81
Project No. 0829
Date: 3/2/09

Direct Shear

ASTM D3080m



P. Phi (degrees)	40.0	Ult. Phi (degrees)	
P. Cohesion(psf)	300	Ult. Cohesion (psf)	



Sample Data: Initial	1	2	3	4
Moisture %	11.5	11.1	11.7	
Dry Dens., pcf	107.0	103.8	112.1	
Void Ratio	0.575	0.624	0.503	
Saturation %	54.1	48.0	63.0	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.00	
Sample Data: At Test				
Moisture %	18.6	18.5	16.5	
Dry Dens., pcf	107.9	105.0	113.5	
Void Ratio	0.562	0.606	0.485	
Saturation %	89.2	82.6	91.6	
Diameter	2.42	2.42	2.42	
Height	0.99	0.99	0.99	
Normal Stress, psf	1100	2200	4400	
Shear Stress, psf	1565	1565	4540	
Strengths picked at	6.6%	4.1%	6.6%	
Ult. Stress, psf	1315	1378	3819	
Strain Rate, in/min	0.020	0.020	0.020	

CTL #	416-342
Client:	Pacific Crest Engineering, Inc.
Project	Atkinson Lane - 0829
Tested By:	MD
Reduced By:	RU
Date:	6/10/2008

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1		17-1-1		Black Clayey SAND
2		17-1-1		Black Clayey SAND
3		17-1-1		Black Clayey SAND
4				

Remarks: *DS-CU* A fully undrained condition may not be attained in this test.

Figure No. 82
Project No. 0829
Date: 3/2/09

R-value Test Report (Caltrans 301)

Job No.: 416-343 | Date: 06/03/08

Client: Pacific Crest Engineering, Inc. | Tested: MD

Project: Atkinson Lane - 0829 | Reduced: RU

Sample: R1 from B-4 | Checked: DC

Soil Type: Grayish Brown Silty SAND w/ pockets of Clay

Initial Moisture, 8.1%

R-value by Stabilometer: 30

Expansion Pressure: 20 psf

Specimen Number	A	B	C	D
Exudation Pressure, psi	402	223	733	
Prepared Weight, grams	1200	1200	1200	
Final Water Added, grams/cc	35	55	25	
Weight of Soil & Mold, grams	3141	3269	3128	
Weight of Mold, grams	2120	2111	2080	
Height After Compaction, in.	2.29	2.65	2.33	
Moisture Content, %	11.2	13.0	10.3	
Dry Density, pcf	121.4	117.1	123.5	
Expansion Pressure, psf	17.2	21.5	4.3	
Stabilometer @ 1000				
Stabilometer @ 2000	64	126	35	
Turns Displacement	3.75	3.75	3.9	
R-value	44	17	66	

Remarks:

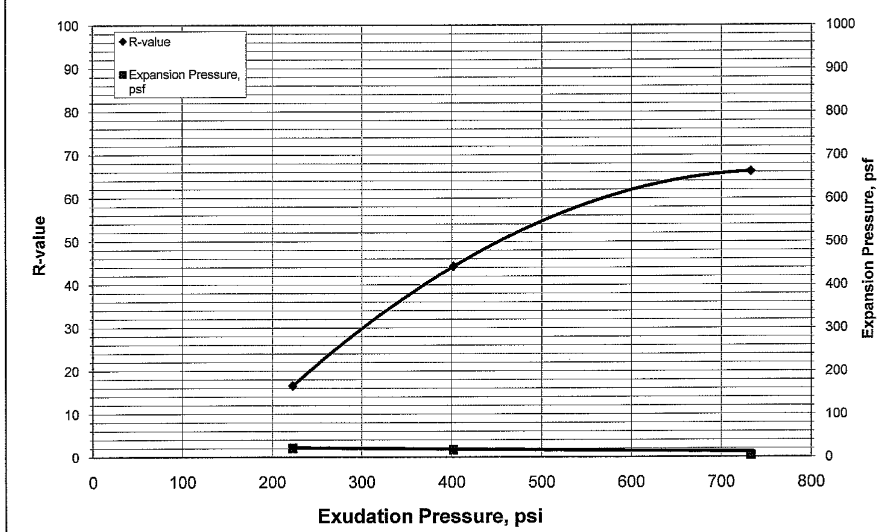


Figure No. 83
Project No. 0829
Date: 3/2/09

R-value Test Report (Caltrans 301)

Job No.: 416-343 | Date: 06/02/08

Client: Pacific Crest Engineering, Inc. | Tested: MD

Project: Atkinson Lane - 0829 | Reduced: RU

Sample: R2 from B-1 | Checked: DC

Soil Type: Grayish Brown Clayey SAND (Silty)

Initial Moisture, 8.6%

R-value by Stabilometer: 50

Expansion Pressure: 20 psf

Specimen Number	A	B	C	D
Exudation Pressure, psi	273	422	231	
Prepared Weight, grams	1200	1200	1200	
Final Water Added, grams/cc	46	30	59	
Weight of Soil & Mold, grams	3132	3134	3220	
Weight of Mold, grams	2067	2081	2109	
Height After Compaction, in.	2.44	2.44	2.6	
Moisture Content, %	12.8	11.3	13.9	
Dry Density, pcf	117.2	117.4	113.5	
Expansion Pressure, psf	12.9	51.6	17.2	
Stabilometer @ 1000				
Stabilometer @ 2000	72	32	112	
Turns Displacement	4.1	4.34	3.84	
R-value	41	69	23	

Remarks:

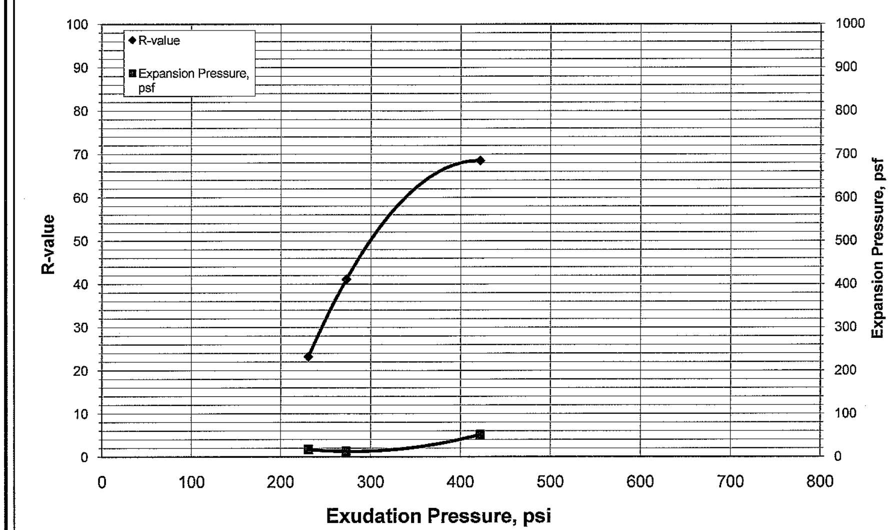


Figure No. 84
Project No. 0829
Date: 3/2/09

COOPER TESTING LABORATORY

R-value Test Report (Caltrans 301)

Job No.:	416-343	Date:	06/02/08
Client:	Pacific Crest Engineering, Inc.	Tested	MD
Project:	Atkinson Lane - 0829	Reduced	RU
Sample	R3 from B-18	Checked	DC

Soil Type: Mottled Grayish Brown Clayey SAND

Initial Moisture,	15.3%
R-value by Stabilometer	<5
Expansion Pressure	psf

Specimen Number	A	B	C	D
Exudation Pressure, psi	350			
Prepared Weight, grams	1200			
Final Water Added, grams/cc	85			
Weight of Soil & Mold, grams	3070			
Weight of Mold, grams	2085			
Height After Compaction, in.	2.42			
Moisture Content, %	23.5			
Dry Density, pcf	99.8			
Expansion Pressure, psf	159.1			
Stabilometer @ 1000				
Stabilometer @ 2000	140			
Turns Displacement	3.24			
R-value	10			

Remarks:
Soil extruded from the mold giving a false exudation pressure. Per Caltrans, the R-Value test was terminated and an R-Value of less than 5 was reported.

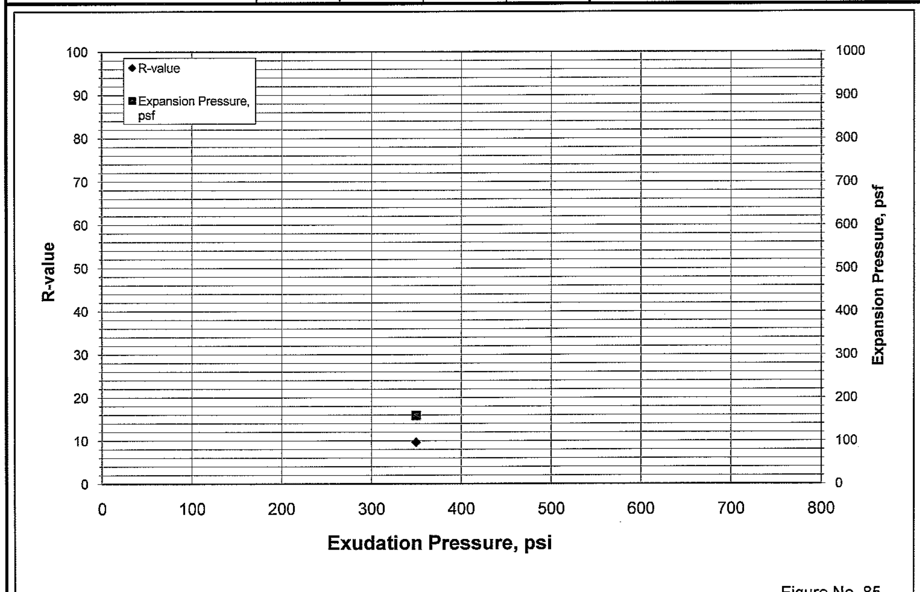


Figure No. 85
Project No. 0829
Date: 3/2/09

COOPER TESTING LABORATORY

R-value Test Report (Caltrans 301)

Job No.:	416-343	Date:	05/27/08
Client:	Pacific Crest Engineering, Inc.	Tested	MD
Project:	Atkinson Lane - 0829	Reduced	RU
Sample	R4 from B-9	Checked	DC

Soil Type: Grayish Brown Clayey SAND (Silty)

Initial Moisture,	8.4%
R-value by Stabilometer	74
Expansion Pressure	0 psf

Specimen Number	A	B	C	D
Exudation Pressure, psi	214	405	800	
Prepared Weight, grams	1200	1200	1200	
Final Water Added, grams/cc	40	26	17	
Weight of Soil & Mold, grams	3184	3198	3152	
Weight of Mold, grams	2190	2089	2109	
Height After Compaction, in.	2.51	2.56	2.46	
Moisture Content, %	12.1	10.8	10.0	
Dry Density, pcf	107.0	118.4	116.7	
Expansion Pressure, psf	0.0	0.0	0.0	
Stabilometer @ 1000				
Stabilometer @ 2000	28	20	18	
Turns Displacement	5.2	5.3	5	
R-value	69	78	80	

Remarks:

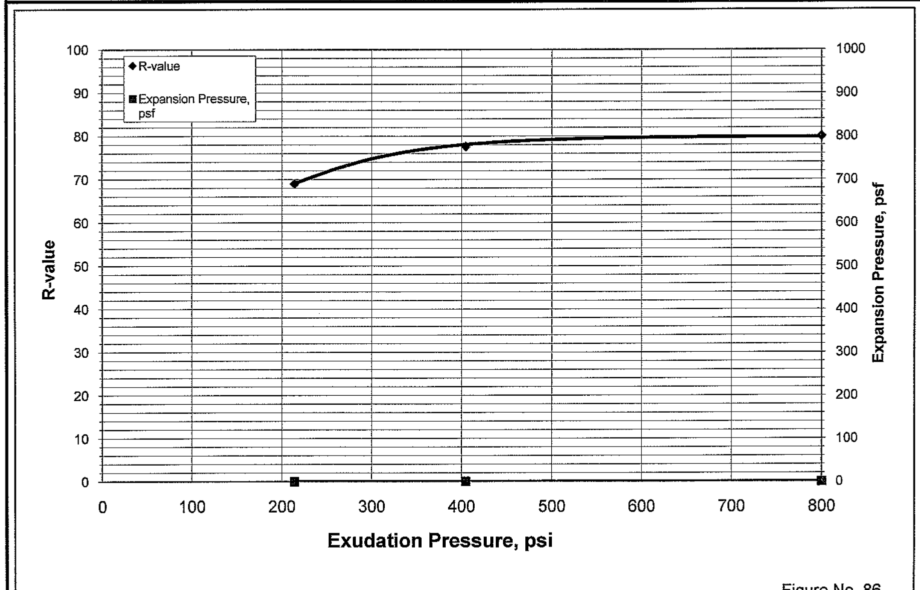


Figure No. 86
Project No. 0829
Date: 3/2/09

R-value Test Report (Caltrans 301)

Job No.:	416-343	Date:	05/30/08
Client:	Pacific Crest Engineering, Inc.	Tested	MD
Project:	Atkinson Lane - 0829	Reduced	RU
Sample	R5 from B-13	Checked	DC
Soil Type:	Brown Clayey SAND		

Initial Moisture, 9.5%

R-value by Stabilometer: 16

Expansion Pressure: 5 psf

Specimen Number	A	B	C	D
Exudation Pressure, psi	160	237	500	
Prepared Weight, grams	1200	1200	1200	
Final Water Added, grams/cc	66	45	25	
Weight of Soil & Mold, grams	3189	3195	3141	
Weight of Mold, grams	2089	2100	2104	
Height After Compaction, in.	2.68	2.56	2.4	
Moisture Content, %	15.5	13.6	11.8	
Dry Density, pcf	107.6	114.0	117.1	
Expansion Pressure, psf	12.9	8.6	8.6	
Stabilometer @ 1000				
Stabilometer @ 2000	146	132	94	
Turns Displacement	4.4	4.3	4	
R-value	5	11	29	

Remarks:

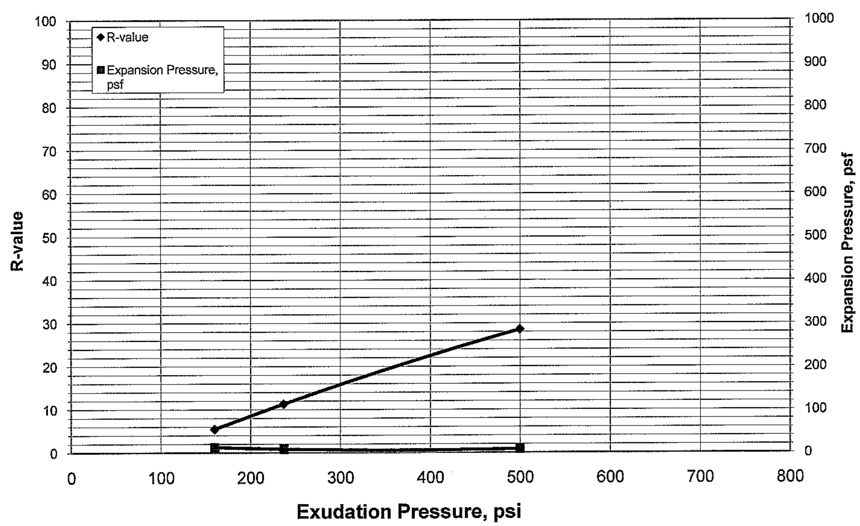


Figure No. 87
Project No. 0829
Date: 3/2/09

R-value Test Report (Caltrans 301)

Job No.:	416-343	Date:	06/03/08
Client:	Pacific Crest Engineering, Inc.	Tested	MD
Project:	Atkinson Lane - 0829	Reduced	RU
Sample	R6 from B-17	Checked	DC
Soil Type:	Brown Sandy CLAY		

Initial Moisture, 16.5%

R-value by Stabilometer: <5

Expansion Pressure: psf

Specimen Number	A	B	C	D
Exudation Pressure, psi	580			
Prepared Weight, grams	1200			
Final Water Added, grams/cc	65			
Weight of Soil & Mold, grams	3088			
Weight of Mold, grams	2099			
Height After Compaction, in.	2.44			
Moisture Content, %	22.9			
Dry Density, pcf	99.9			
Expansion Pressure, psf	4.3			
Stabilometer @ 1000				
Stabilometer @ 2000	134			
Turns Displacement	3			
R-value	14			

Remarks:
Soil extruded from the mold giving a false exudation pressure. Per Caltrans, the R-Value test was terminated and an R-Value of less than 5 was reported.

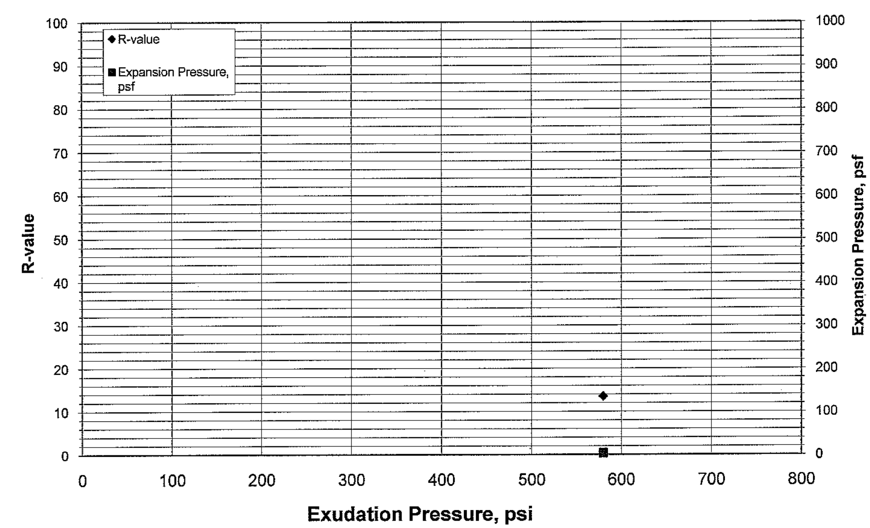


Figure No. 88
Project No. 0829
Date: 3/2/09

Expansion Index

UBC 29-2 ___
ASTM D-4829 _X_

CTL Job No.: 416-345 | Boring: | Date: 6/2/2008
Client: Pacific Crest | Sample: EXPOT - 1 near B-4 | By: PJ
Project Name: | Depth:
Project No: 829
Visual Description: Brown SAND w/ Clay

Processing:

Percent Passing #4 Sieve

Total Air Dry Weight:	N/A
Wt. Retained on #4 Sieve:	N/A
% Retained	N/A
% Passing #4 Sieve:	N/A

Sample Dimensions
Height (in.)= 1.001 Diameter (in.) = 4.017

Moisture Calcs

	Initial	Final
Tare #		
Wet Wt. + Tare, (gm)	606.6	648
Dry Wt. + Tare, (gm)	571.3	571.3
Tare Wt., (gm)	233.1	233.1
Wt. Of Water, (gm)	35.3	76.7
% Water	10.4	22.7

Remolding:

Tamp two lifts, 15 blows/lift @ slightly below optimum moisture content

	Initial	Final	
Ring & Sample:	573.1	614.5	grams
Ring:	199.6	199.6	grams
Remolded Wet Wt.:	373.5	414.9	grams
Wet Density	112.2	122.3	pcf
Dry Density	101.6	99.7	pcf
% Sat. = (2.7)(dry dens.)(m/c) / 168.48 - (dry dens.)	42.8	88.7	UBC 49<Sat%<51 / ASTM (40-60%)

Expansion Test:

Date	Time	Dial	Delta h, %
5/29/2008	15:51	0.0000	0.000
	16:49	-0.0150	1.499
5/30/2008	7:45	-0.0188	1.878
	11:40	-0.0189	1.888
		Total Dial	1.9

Tested with 1 psi Surcharge
Remarks:

Expansion Index — **Results**

$\frac{\text{initial dial - final dial}}{\text{initial sample height}}$ x 1000

Uncorrected EI = 19
Corrected EI= 15

This test is a simplified index test and may not show the full potential for expansion and/or shrinkage. Use result with caution! See ASTM D 3877

Note: Per ASTM D4829 if the degree of saturation is within the range of 40-60%, EI @ 50% can be calculated as follows:

$EI_{50} = EI_{meas} - (50 - S_{meas}) \frac{65 + EI_{meas}}{220 - S_{meas}}$

Figure No. 89
Project No. 0829
Date: 3/2/09

Expansion Index

UBC 29-2 ___
ASTM D-4829 _X_

CTL Job No.: 416-345 | Boring: | Date: 6/2/2008
Client: Pacific Crest | Sample: EXPOT - 2 near B-1 | By: PJ
Project Name: Atkinson Lane | Depth:
Project No: 829
Visual Description: Brown Sandy CLAY

Processing:

Percent Passing #4 Sieve

Total Air Dry Weight:	N/A
Wt. Retained on #4 Sieve:	N/A
% Retained	N/A
% Passing #4 Sieve:	N/A

Sample Dimensions
Height (in.)= 1.001 Diameter (in.) = 4.017

Moisture Calcs

	Initial	Final
Tare #		
Wet Wt. + Tare, (gm)	621.3	663.7
Dry Wt. + Tare, (gm)	578.7	578.7
Tare Wt., (gm)	250.9	250.9
Wt. Of Water, (gm)	42.6	85
% Water	13.0	25.9

Remolding:

Tamp two lifts, 15 blows/lift @ slightly below optimum moisture content

	Initial	Final	
Ring & Sample:	566.1	608.5	grams
Ring:	195.7	195.7	grams
Remolded Wet Wt.:	370.4	412.8	grams
Wet Density	111.2	117.4	pcf
Dry Density	98.4	93.3	pcf
% Sat. = (2.7)(dry dens.)(m/c) / 168.48 - (dry dens.)	49.3	86.8	UBC 49<Sat%<51 / ASTM (40-60%)

Expansion Test:

Date	Time	Dial	Delta h, %
5/23/2008	16:06	0.0000	0.000
	17:10	-0.0335	3.347
5/24/2008	9:31	-0.0505	5.045
	13:12	-0.0511	5.105
5/25/2008	14:06	-0.0528	5.275
5/26/2008	13:30	-0.0539	5.385
5/27/2008	8:41	-0.0547	5.465
	17:31	-0.0551	5.504
28-May	7:49	-0.0556	5.554
		Total Dial	5.6

Tested with 1 psi Surcharge
Remarks:

Expansion Index — **Results**

$\frac{\text{initial dial - final dial}}{\text{initial sample height}}$ x 1000

Uncorrected EI = 56
Corrected EI= 55

This test is a simplified index test and may not show the full potential for expansion and/or shrinkage. Use result with caution! See ASTM D 3877

Note: Per ASTM D4829 if the degree of saturation is within the range of 40-60%, EI @ 50% can be calculated as follows:

$EI_{50} = EI_{meas} - (50 - S_{meas}) \frac{65 + EI_{meas}}{220 - S_{meas}}$

Figure No. 90
Project No. 0829
Date: 3/2/09

Expansion Index

UBC 29-2 ___
ASTM D-4829 _X_

CTL Job No.: 416-345 | Boring: | Date: 6/2/2008
Client: Pacific Crest | Sample: EXPOT - 3 near B-18 | By: PJ
Project Name: | Depth:
Project No: 829
Visual Description: Brown SAND w/ Clay

Processing:

Percent Passing #4 Sieve

Total Air Dry Weight:	N/A
Wt. Retained on #4 Sieve:	N/A
% Retained	N/A
% Passing #4 Sieve:	N/A

Sample Dimensions

Height (in.)= 1.001 Diameter (in.) = 4.017

Moisture Calcs

	Initial	Final
Tare #		
Wet Wt. + Tare, (gm)	630.9	656.4
Dry Wt. + Tare, (gm)	586.2	586.2
Tare Wt., (gm)	238.1	238.1
Wt. Of Water, (gm)	44.7	70.2
% Water	12.8	20.2

Remolding:

Tamp two lifts, 15 blows/lift @ slightly below optimum moisture content

	Initial	Final	
Ring & Sample:	588.5	614.0	grams
Ring:	195.7	195.7	grams
Remolded Wet Wt.:	392.8	418.3	grams
Wet Density	118.0	123.7	pcf
Dry Density	104.5	103.0	pcf
% Sat. = (2.7)(dry dens.)(m/c) / 168.48 - (dry dens.)	56.7	85.6	UBC 49<Sat%<51 / ASTM (40-60%)

Expansion Test:

Date	Time	Dial	Delta h, %
5/29/2008	15:52	0.0000	0.000
	16:49	-0.0113	1.129
5/30/2008	7:45	-0.0151	1.508
	11:40	-0.0151	1.508
		Total Dial	1.5

Tested with 1 psi Surcharge
Remarks:

Expansion Index

Results

$\frac{\text{initial dial - final dial}}{\text{initial sample height}} \times 1000$

Uncorrected EI = 15
Corrected EI= 18

This test is a simplified index test and may not show the full potential for expansion and/or shrinkage. Use result with caution! See ASTM D 3877

Note: Per ASTM D4829 if the degree of saturation is within the range of 40-60%, EI @ 50% can be calculated as follows:

$EI_{50} = EI_{meas} - (50 - S_{meas}) \frac{65 + EI_{meas}}{220 - S_{meas}}$

Figure No. 91
Project No. 0829
Date: 3/2/09

Expansion Index

UBC 29-2 ___
ASTM D-4829 _X_

CTL Job No.: 416-345 | Boring: | Date: 6/9/2008
Client: Pacific Crest | Sample: EXPOT - 4 near B-9 | By: PJ
Project Name: Atkinson Lane | Depth:
Project No: 829
Visual Description: Brown Clayey SAND

Processing:

Percent Passing #4 Sieve

Total Air Dry Weight:	N/A
Wt. Retained on #4 Sieve:	N/A
% Retained	N/A
% Passing #4 Sieve:	N/A

Sample Dimensions

Height (in.)= 1.001 Diameter (in.) = 4.017

Moisture Calcs

	Initial	Final
Tare #		
Wet Wt. + Tare, (gm)	901.7	926.0
Dry Wt. + Tare, (gm)	859.3	859.3
Tare Wt., (gm)	511.7	511.7
Wt. Of Water, (gm)	42.4	66.7
% Water	12.2	19.2

Remolding:

Tamp two lifts, 15 blows/lift @ slightly below optimum moisture content

	Initial	Final	
Ring & Sample:	585.7	610.1	grams
Ring:	195.7	195.7	grams
Remolded Wet Wt.:	390	414.4	grams
Wet Density	117.1	122.6	pcf
Dry Density	104.4	102.9	pcf
% Sat. = (2.7)(dry dens.)(m/c) / 168.48 - (dry dens.)	53.6	81.2	UBC 49<Sat%<51 / ASTM (40-60%)

Expansion Test:

Date	Time	Dial	Delta h, %
6/2/2008	17:30	0.0000	0.000
6/2/2008	17:58	-0.0083	0.829
6/4/2008	7:31	-0.0150	1.499
6/4/2008	16:17	-0.0151	1.508
		Total Dial	1.5

Tested with 1 psi Surcharge
Remarks:

Expansion Index

Results

$\frac{\text{initial dial - final dial}}{\text{initial sample height}} \times 1000$

Uncorrected EI = 15
Corrected EI= 17

This test is a simplified index test and may not show the full potential for expansion and/or shrinkage. Use result with caution! See ASTM D 3877

Note: Per ASTM D4829 if the degree of saturation is within the range of 40-60%, EI @ 50% can be calculated as follows:

$EI_{50} = EI_{meas} - (50 - S_{meas}) \frac{65 + EI_{meas}}{220 - S_{meas}}$

Figure No. 92
Project No. 0829
Date: 3/2/09

Expansion Index

UBC 29-2
ASTM D-4829 X

CTL Job No.: 416-345 | Boring: | Date: 6/9/2008
Client: Pacific Crest | Sample: EXPOT - 5 near B-13 | By: PJ
Project Name: Atkinson Lane | Depth:
Project No: 829
Visual Description: Brown Clayey SAND

Processing:

Percent Passing #4 Sieve

Total Air Dry Weight:	N/A
Wt. Retained on #4 Sieve:	N/A
% Retained	N/A
% Passing #4 Sieve:	N/A

Sample Dimensions
Height (in.)= 1.000 Diameter (in.) = 4.017

Moisture Calcs

	Initial	Final
Tare #		
Wet Wt. + Tare, (gm)	764.5	789.5
Dry Wt. + Tare, (gm)	729.7	729.7
Tare Wt., (gm)	362.4	362.4
Wt. Of Water, (gm)	34.8	59.8
% Water	9.5	16.3

Remolding:

Tamp two lifts, 15 blows/lift @ slightly below optimum moisture content

	Initial	Final	
Ring & Sample:	598.6	612.8	grams
Ring:	196.5	196.5	grams
Remolded Wet Wt.:	402.1	416.3	grams
Wet Density	120.9	124.1	pcf
Dry Density	110.4	106.8	pcf
% Sat. = (2.7)(dry dens.)(m/c) / 168.48 - (dry dens.)	48.6	76.0	UBC 49<Sat%<51 ASTM (40-60%)

Expansion Test:

Date	Time	Dial	Delta h, %
6/2/2008	17:30	0.0000	0.000
6/2/2008	17:57	-0.0036	0.360
6/4/2008	7:31	-0.0079	0.790
6/4/2008	16:10	-0.0080	0.800
		Total Dial	0.8

Tested with 1 psi Surcharge
Remarks:

Expansion Index
$\frac{\text{initial dial - final dial}}{\text{initial sample height}}$ x 1000

Results
Uncorrected EI = 8
Corrected EI= 7

This test is a simplified index test and may not show the full potential for expansion and/or shrinkage. Use result with caution! See ASTM D 3877

Note: Per ASTM D4829 if the degree of saturation is within the range of 40-60%, EI @ 50% can be calculated as follows:

$$EI_{50} = EI_{meas} - (50 - S_{meas}) \frac{65 + EI_{meas}}{220 - S_{meas}}$$

Figure No. 93
Project No. 0829
Date: 3/2/09

Expansion Index

UBC 29-2
ASTM D-4829 X

CTL Job No.: 416-345 | Boring: | Date: 6/2/2008
Client: Pacific Crest | Sample: EXPOT - 6 near B-17 | By: PJ
Project Name: Atkinson Lane | Depth:
Project No: 829
Visual Description: Brown Clayey SAND

Processing:

Percent Passing #4 Sieve

Total Air Dry Weight:	N/A
Wt. Retained on #4 Sieve:	N/A
% Retained	N/A
% Passing #4 Sieve:	N/A

Sample Dimensions
Height (in.)= 1.002 Diameter (in.) = 4.017

Moisture Calcs

	Initial	Final
Tare #		
Wet Wt. + Tare, (gm)	597.7	645.9
Dry Wt. + Tare, (gm)	554.0	554.0
Tare Wt., (gm)	230.7	230.7
Wt. Of Water, (gm)	43.7	91.9
% Water	13.5	28.4

Remolding:

Tamp two lifts, 15 blows/lift @ slightly below optimum moisture content

	Initial	Final	
Ring & Sample:	564.5	612.8	grams
Ring:	197.5	197.5	grams
Remolded Wet Wt.:	367	415.3	grams
Wet Density	110.1	115.6	pcf
Dry Density	97.0	90.0	pcf
% Sat. = (2.7)(dry dens.)(m/c) / 168.48 - (dry dens.)	49.5	88.1	UBC 49<Sat%<51 ASTM (40-60%)

Expansion Test:

Date	Time	Dial	Delta h, %
5/23/2008	14:47	0.0000	0.000
	17:07	-0.0651	6.497
5/24/2008	9:30	-0.0730	7.285
	13:12	-0.0736	7.345
5/25/2008	14:05	-0.0755	7.535
5/26/2008	13:30	-0.0765	7.635
5/27/2008	8:42	-0.0768	7.665
	17:31	-0.0771	7.695
28-May	7:49	-0.0776	7.745
		Total Dial	7.7

Tested with 1 psi Surcharge
Remarks:

Expansion Index
$\frac{\text{initial dial - final dial}}{\text{initial sample height}}$ x 1000

Results
Uncorrected EI = 77
Corrected EI= 77

This test is a simplified index test and may not show the full potential for expansion and/or shrinkage. Use result with caution! See ASTM D 3877

Note: Per ASTM D4829 if the degree of saturation is within the range of 40-60%, EI @ 50% can be calculated as follows:

$$EI_{50} = EI_{meas} - (50 - S_{meas}) \frac{65 + EI_{meas}}{220 - S_{meas}}$$

Figure No. 94
Project No. 0829
Date: 3/2/09

COOPER TESTING LABORATORY

Corrosivity Test Summary

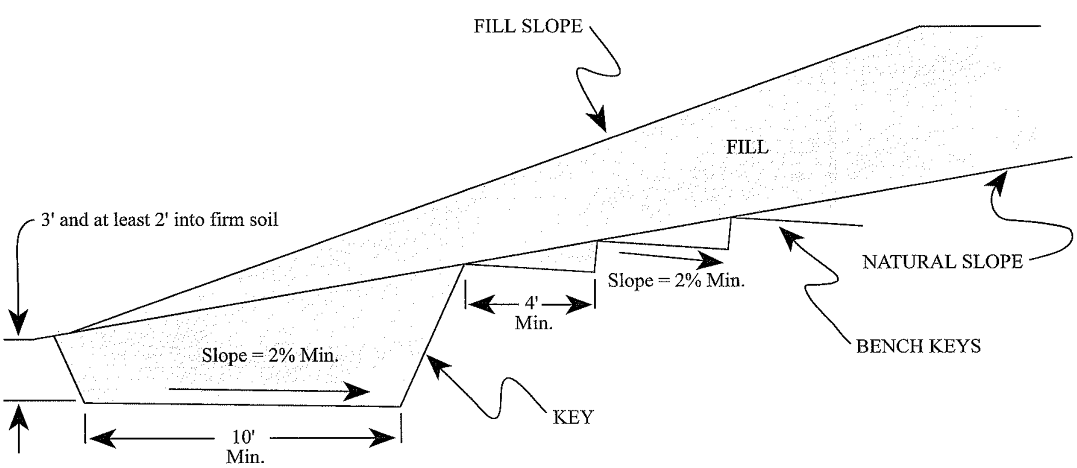
CTL #: 416-342 Date: 6/5/2008 Tested By: PJ Checked: PJ
Client: Pacific Crest Engineering Project: Atkinson Lane Proj. No: 0829
Remarks:

Sample Location or ID			Resistivity @ 15.5 °C (Ohm-cm)			Chloride	Sulfate		pH	ORP	Moisture	Soil Visual Description
Boring	Sample, No.	Depth, ft.	As Rec.	Minimum	Saturated	mg/kg Dry Wt.	mg/kg Dry Wt.	% Dry Wt.		(Redox) mv	As Received %	
			ASTM G57	Cal 643	ASTM G57	Cal 422-mod.	Cal 417-mod.	Cal 417-mod.	Cal 643	SM 2580B	ASTM D2216	
-	1-1-1	-	-	1254	-	3	431	0.0431	6.5	-	15.7	Brown Clayey SAND
-	2-1-1	-	-	4736	-	4	<5	<0.0005	6.3	-	8.8	Brown Clayey SAND
-	6-1-1	-	-	1198	-	18	13	0.0013	6.2	-	17.2	Brown Clayey SAND
-	13-1-1	-	-	1637	-	14	<5	<0.0005	6.6	-	16.7	Reddish Brown Sandy CLAY
-	15-1-1	-	-	6306	-	6	<5	<0.0005	6.7	-	14.6	Reddish Brown Clayey SAND

Figure No. 95
Project No. 0829
Date: 3/2/09

Pacific Crest Engineering Inc.
444 Airport Blvd., Suite 106
Watsonville, CA 95076

Keyway Detail
Atkinson Lane Development
Watsonville, California

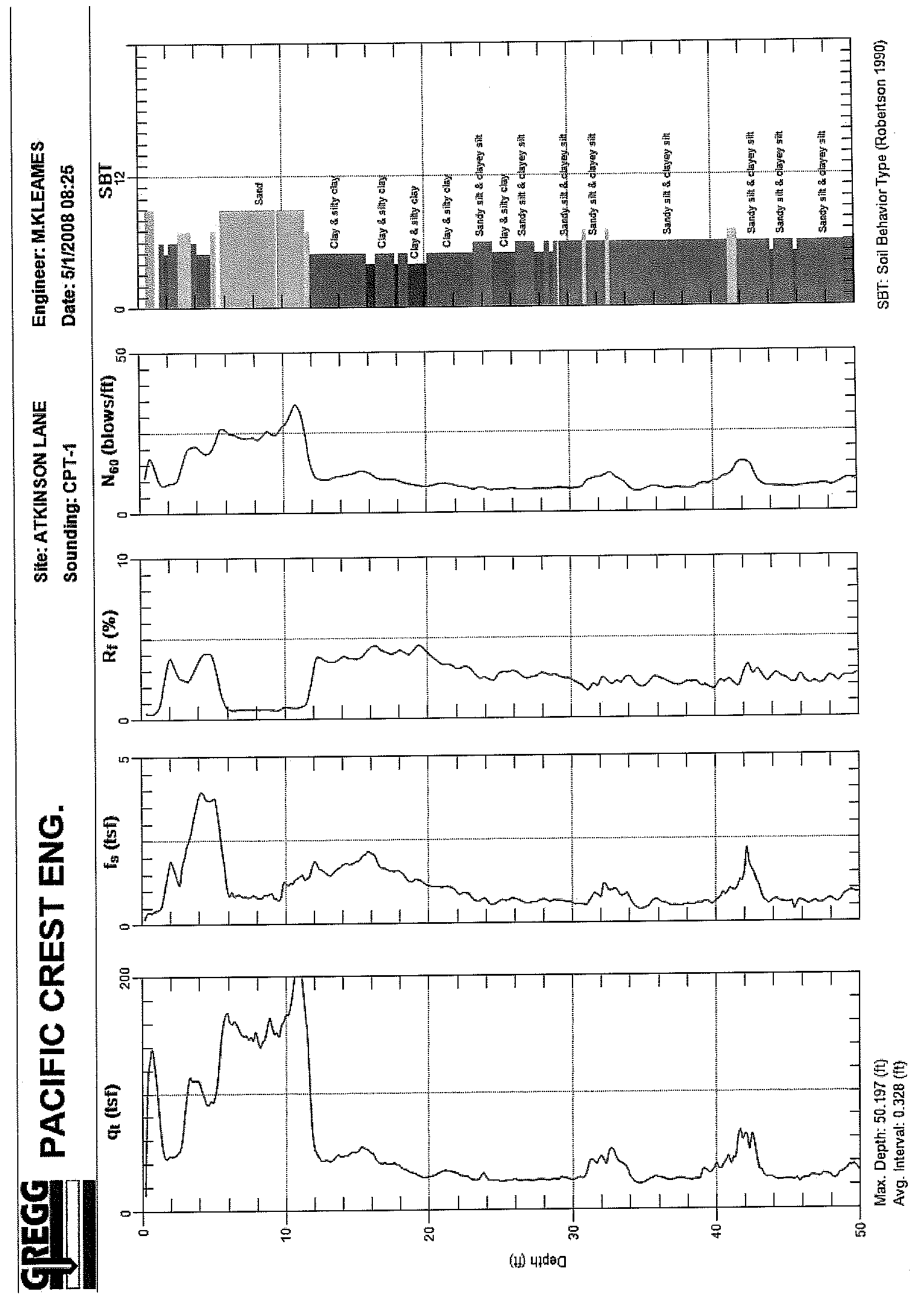


TYPICAL KEY AND BENCHES
not to scale

Figure No. 96
Project No. 0829
Date: 3/2/09

APPENDIX B

CPT Soundings and Data Summary

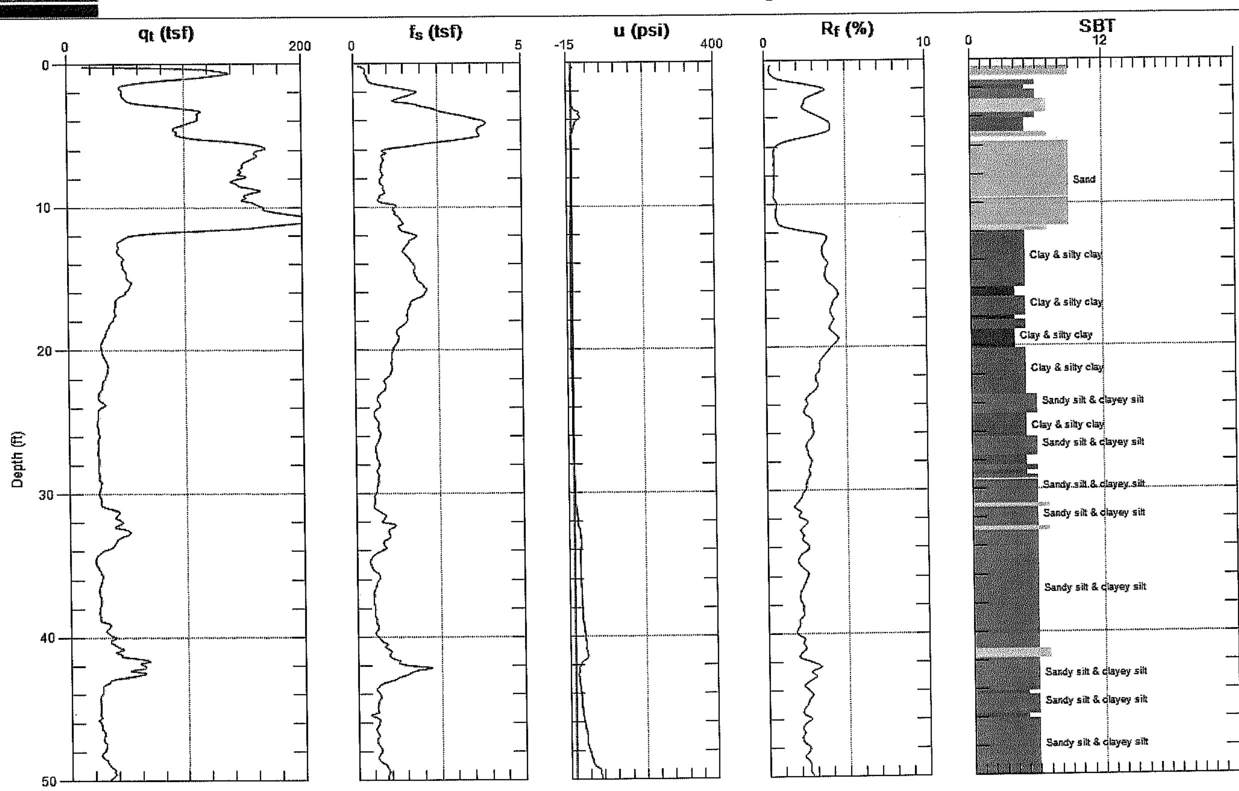


GREGG

PACIFIC CREST ENG.

Site: ATKINSON LANE
Sounding: CPT-1

Engineer: M.KLEAMES
Date: 5/1/2008 08:25



Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

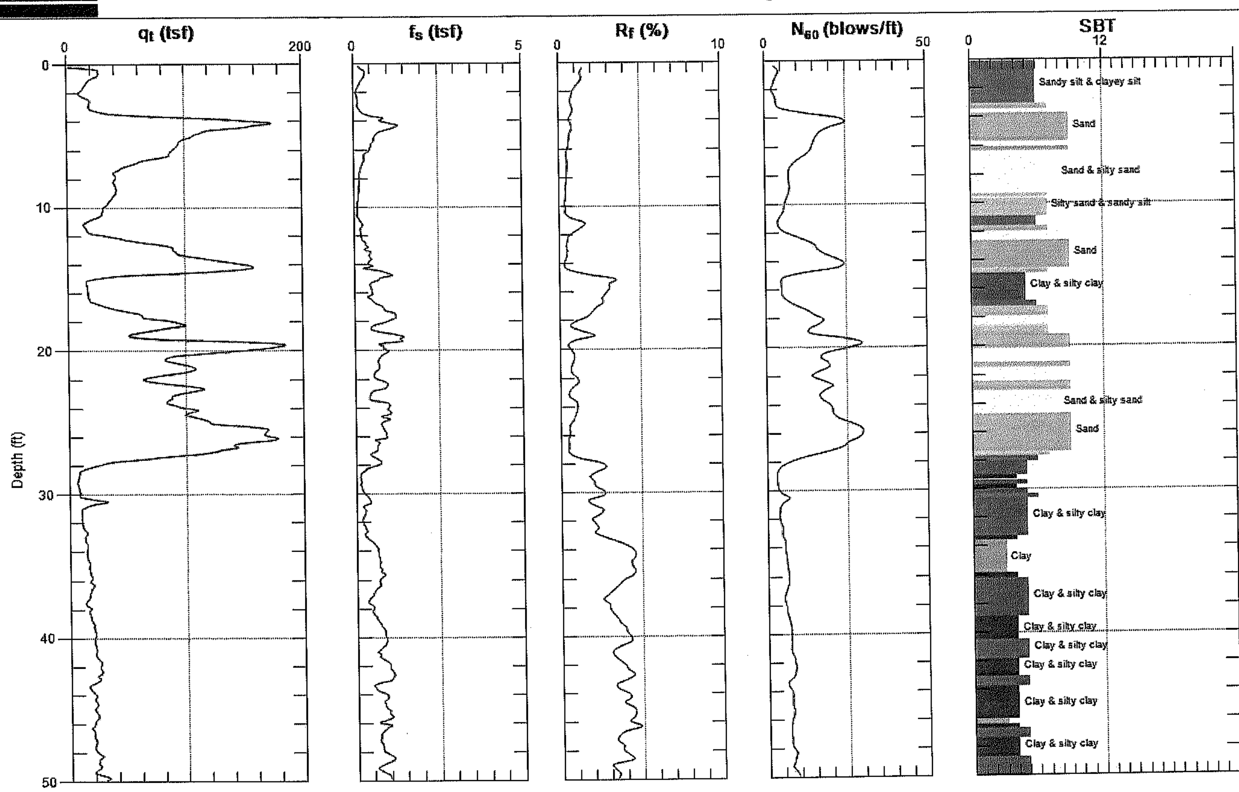
SBT: Soil Behavior Type (Robertson 1990)

GREGG

PACIFIC CREST ENG.

Site: ATKINSON LANE
Sounding: CPT-2

Engineer: M.KLEAMES
Date: 5/1/2008 10:21



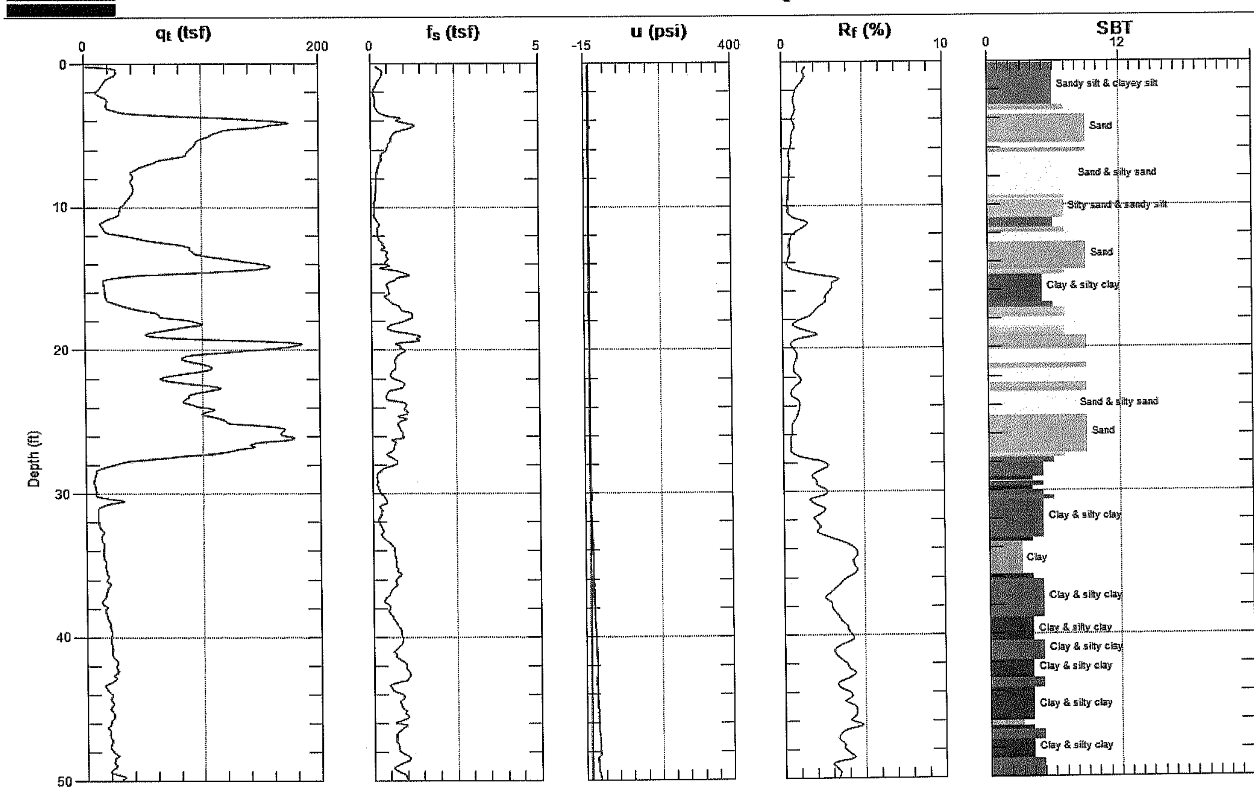
Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENG.

Site: ATKINSON LANE
Sounding: CPT-2

Engineer: M.KLEAMES
Date: 5/1/2008 10:21



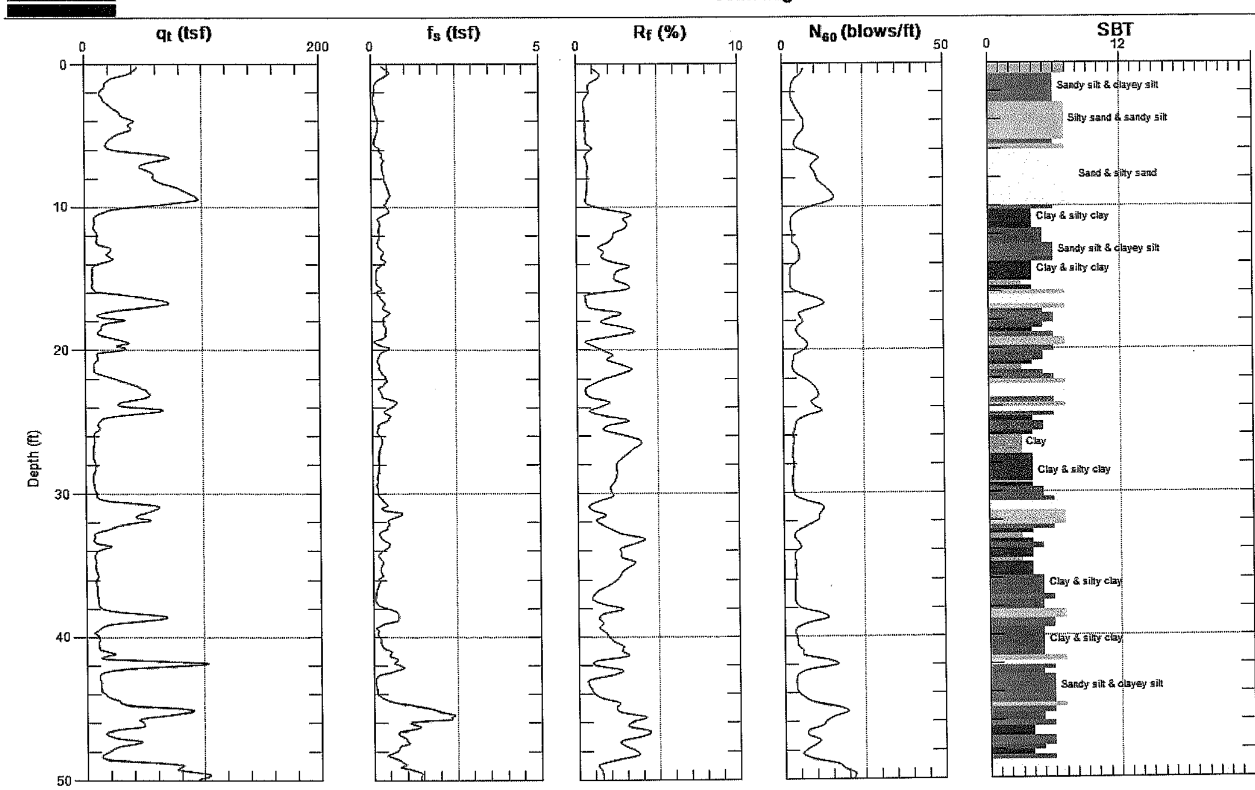
Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENG.

Site: ATKINSON LANE
Sounding: CPT-3

Engineer: M.KLEAMES
Date: 5/1/2008 11:07

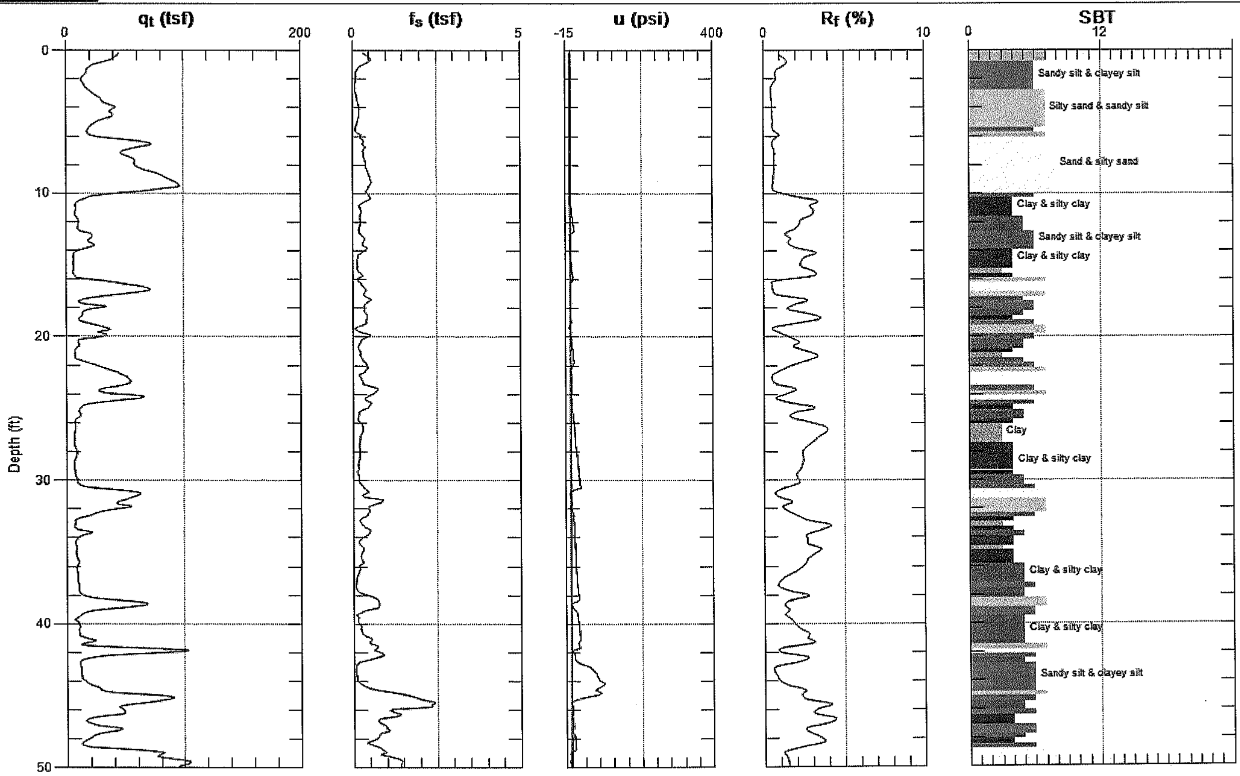


Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENG.

Site: ATKINSON LANE
Sounding: CPT-3
Engineer: M.KLEAMES
Date: 5/1/2008 11:07

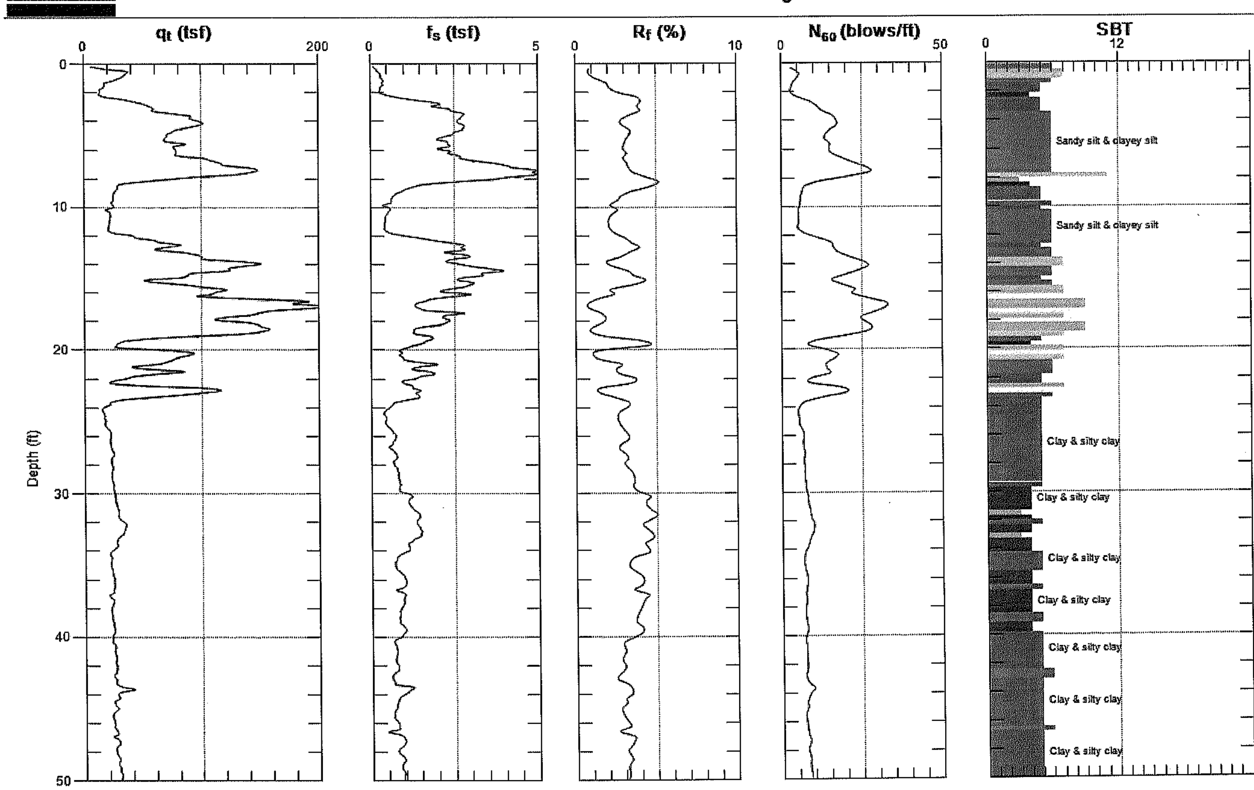


Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENG.

Site: ATKINSON LANE
Sounding: CPT-4
Engineer: M.KLEAMES
Date: 5/1/2008 12:12



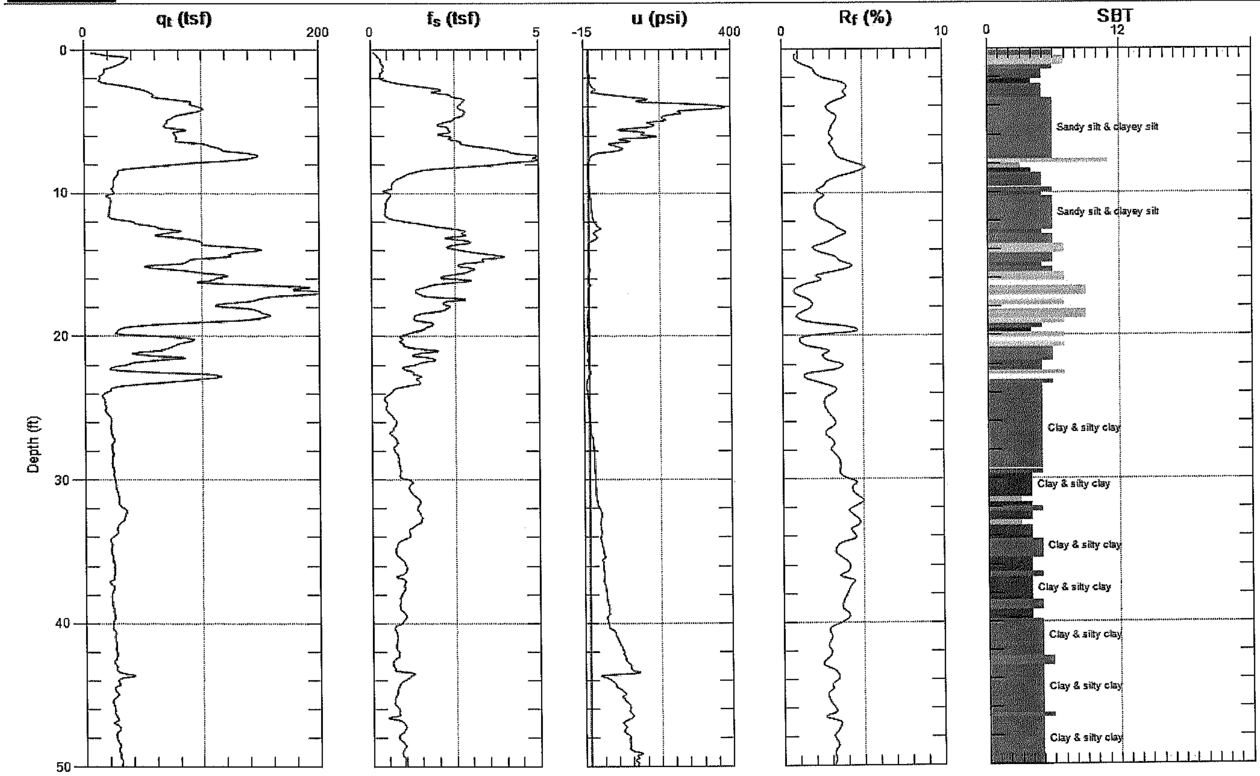
Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENG.

Site: ATKINSON LANE
Sounding: CPT-4

Engineer: M.KLEAMES
Date: 5/1/2008 12:12



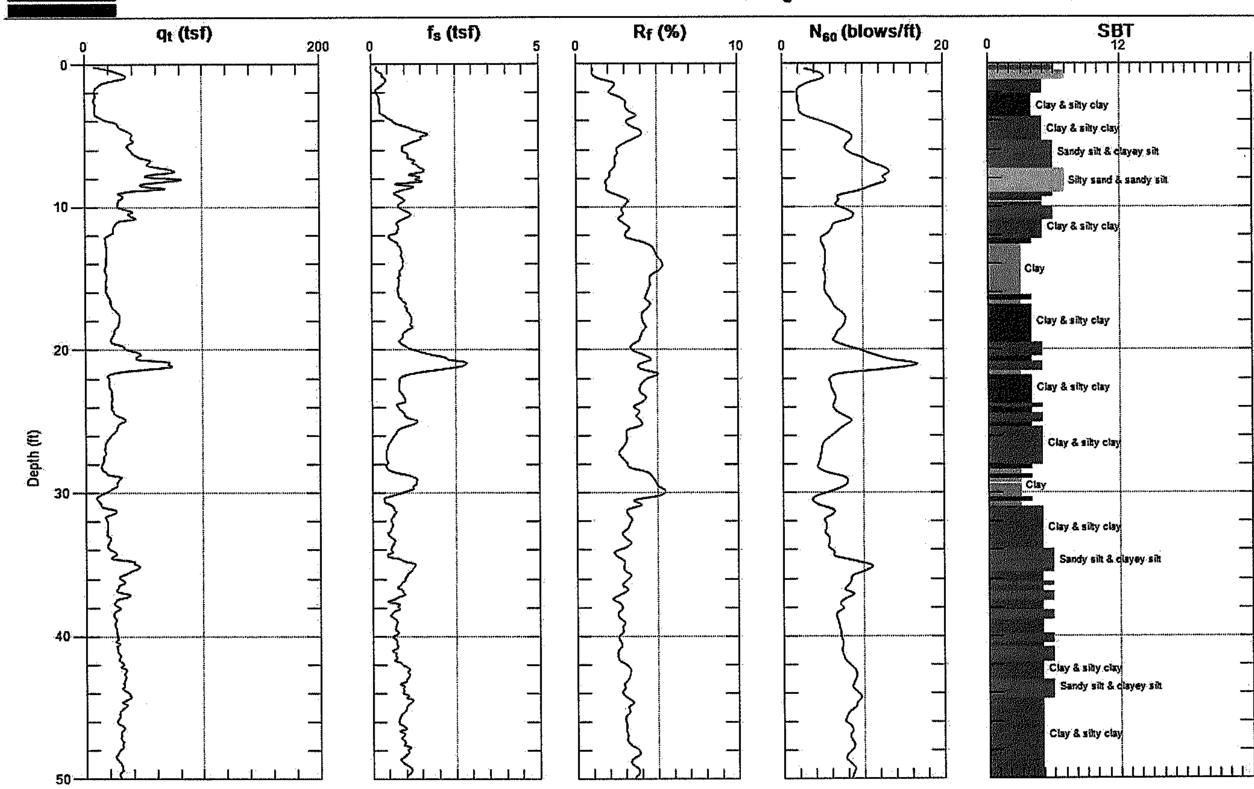
Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-5

Engineer: E.MITCHELL
Date: 2/12/2009 09:40

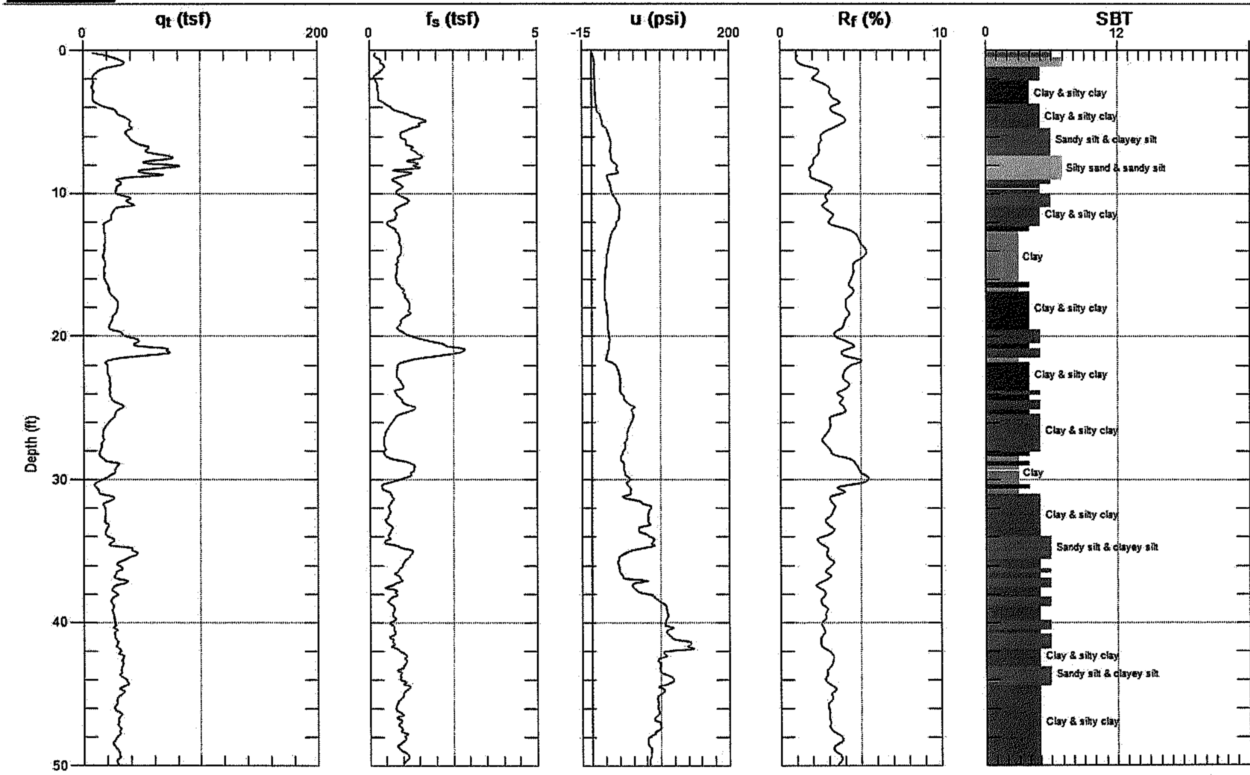


Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-5
Engineer: E.MITCHELL
Date: 2/12/2009 09:40

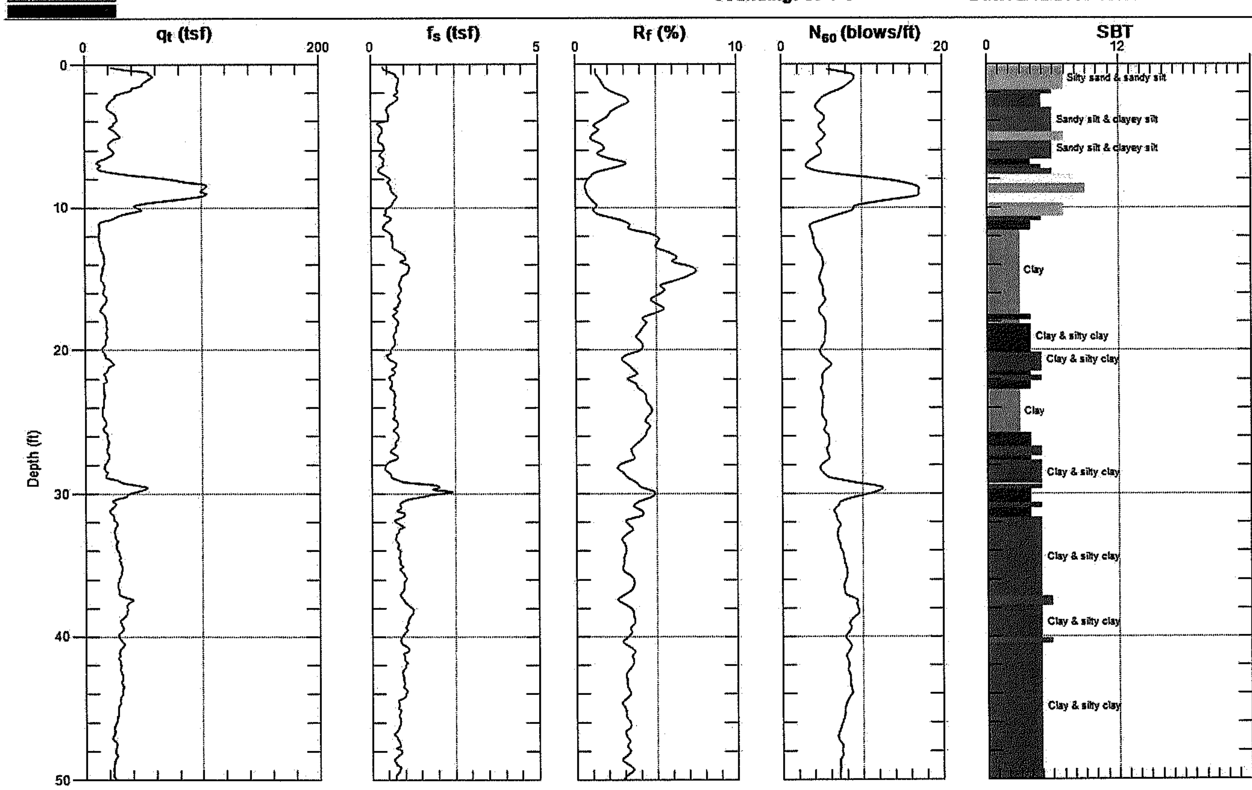


Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-6
Engineer: E.MITCHELL
Date: 2/12/2009 10:30



Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

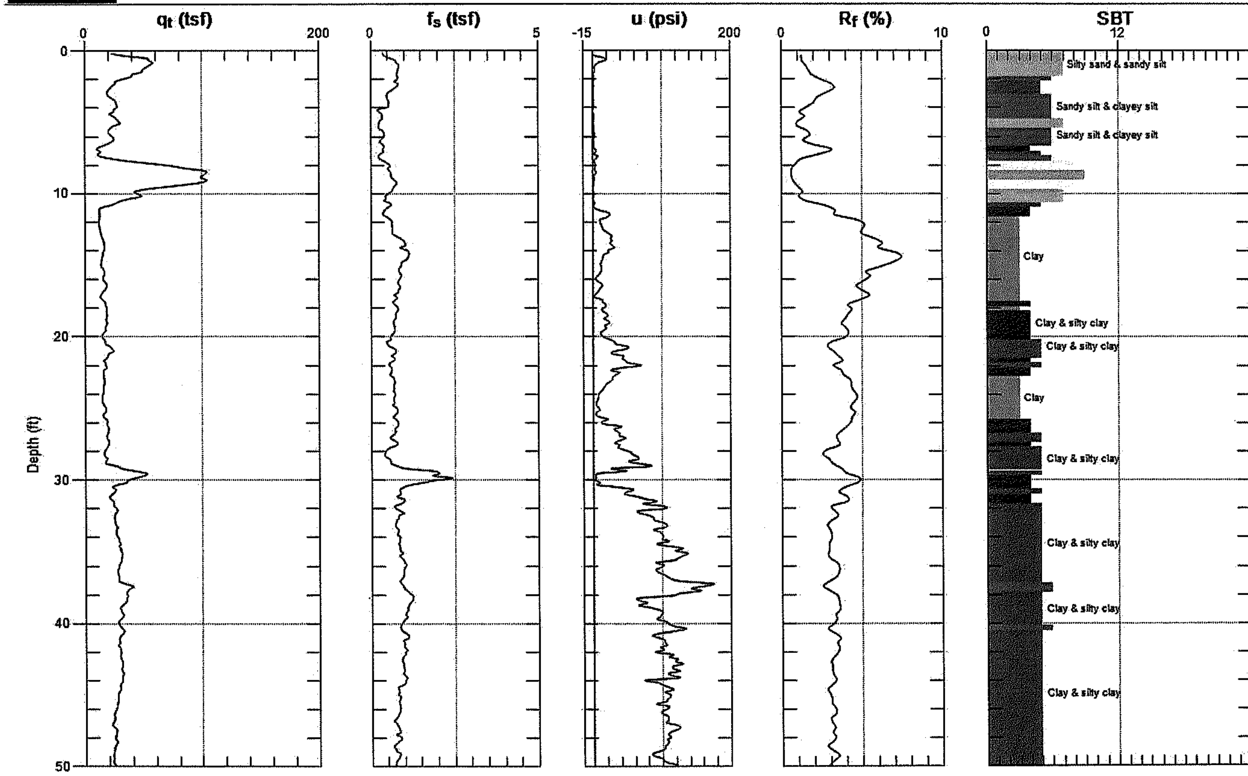
SBT: Soil Behavior Type (Robertson 1990)

GREGG

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-6

Engineer: E.MITCHELL
Date: 2/12/2009 10:30



Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

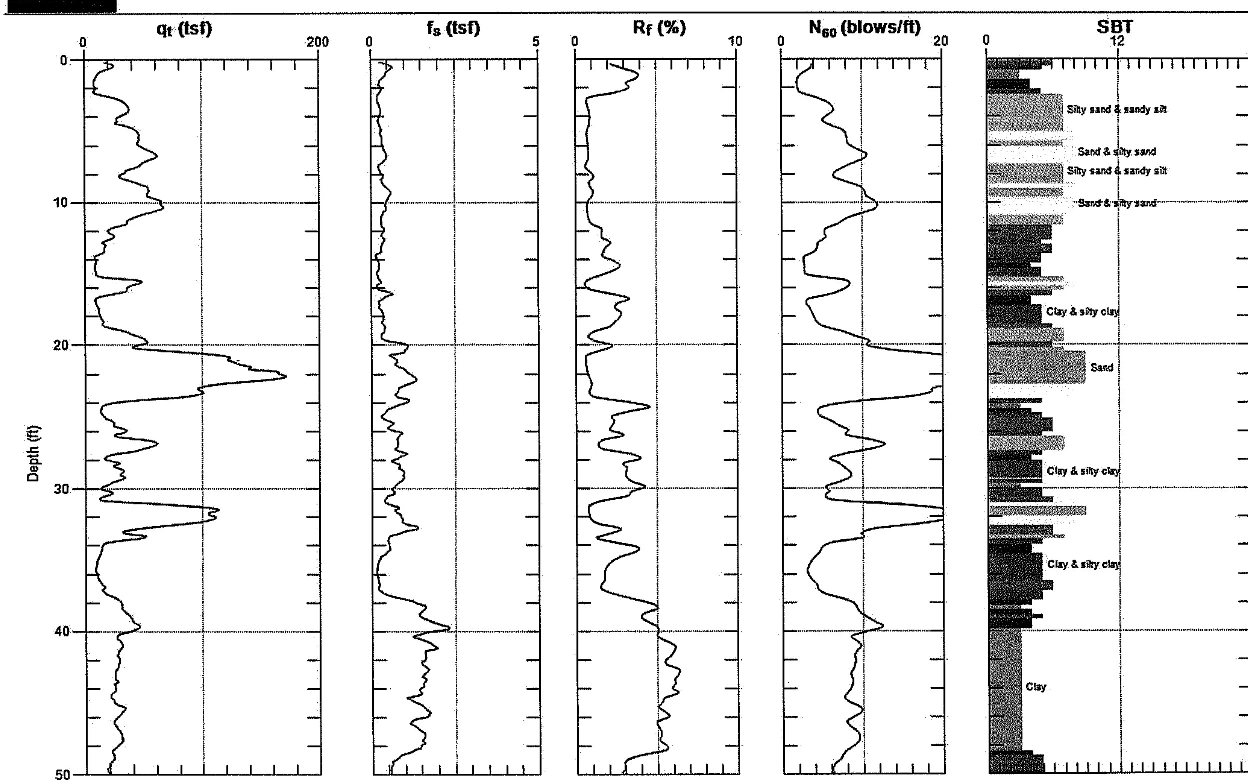
SBT: Soil Behavior Type (Robertson 1990)

GREGG

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-7

Engineer: E.MITCHELL
Date: 2/12/2009 11:34



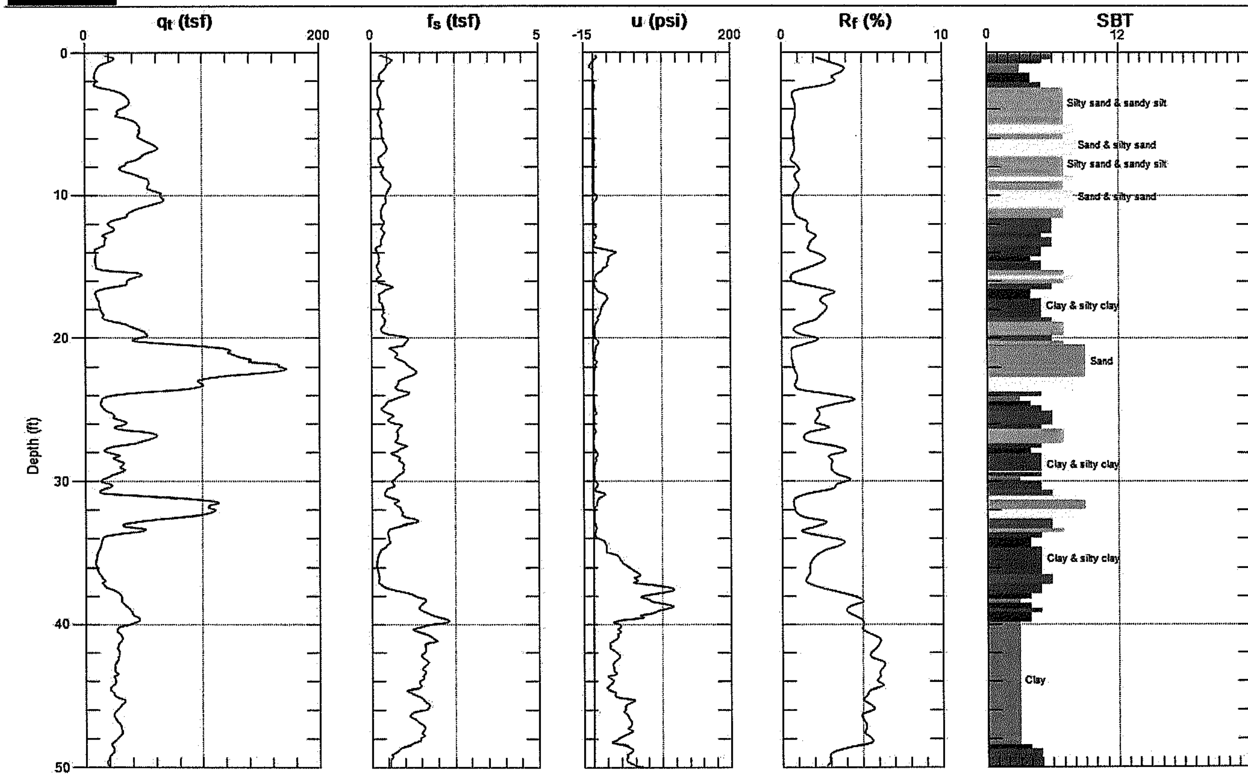
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-7

Engineer: E.MITCHELL
Date: 2/12/2009 11:34



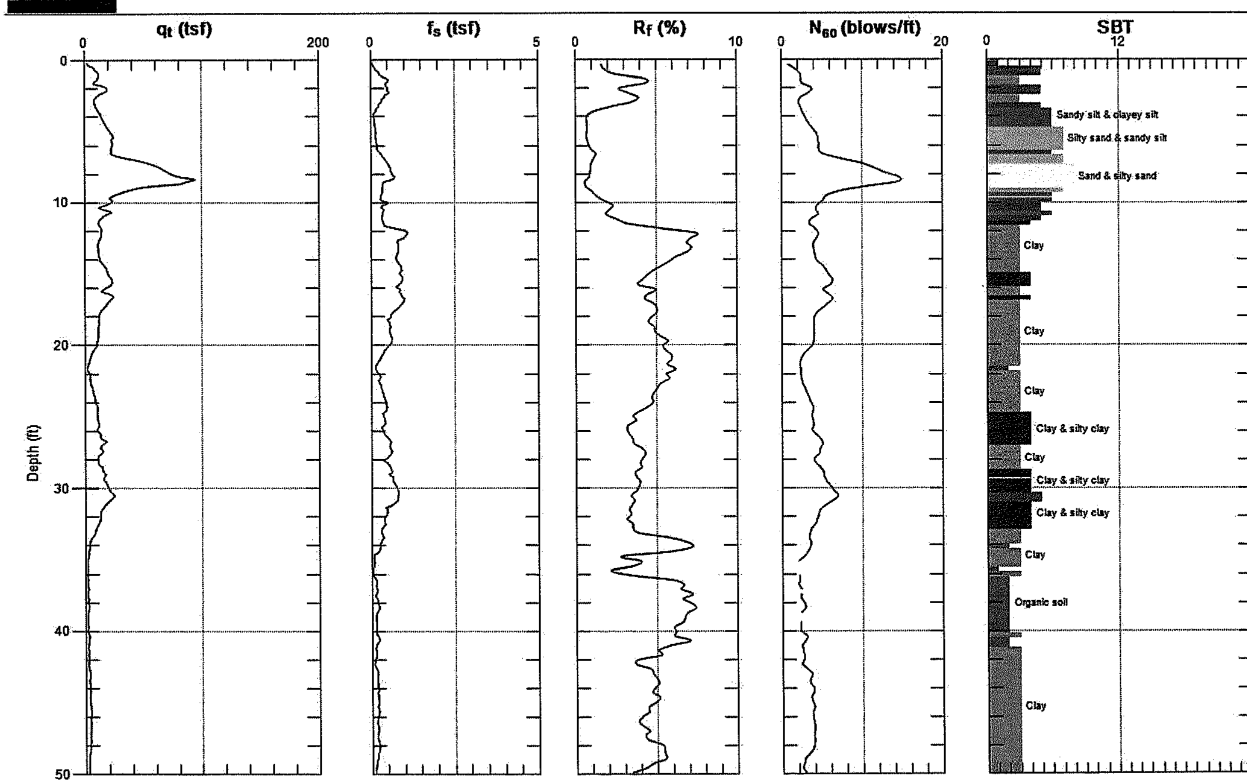
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-8

Engineer: E.MITCHELL
Date: 2/12/2009 12:56



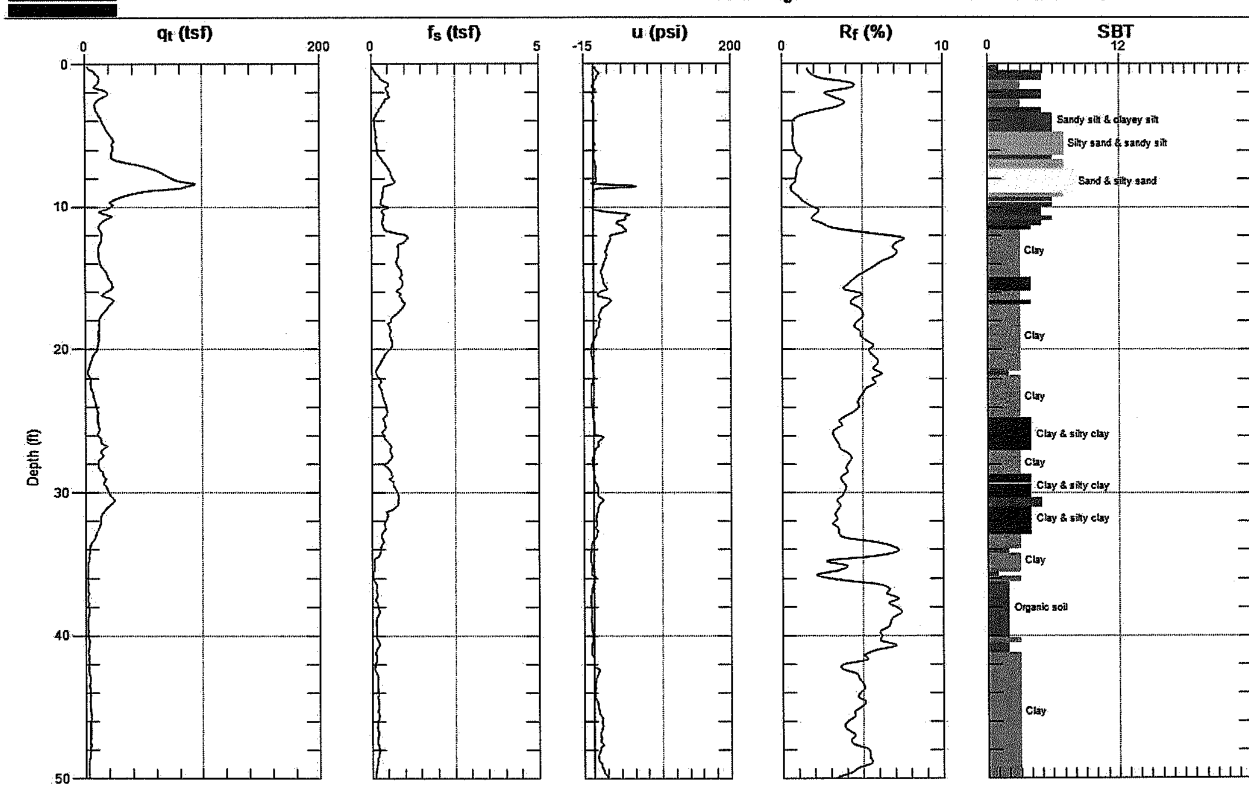
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE | Engineer: E.MITCHELL
Sounding: CPT-8 | Date: 2/12/2009 12:56



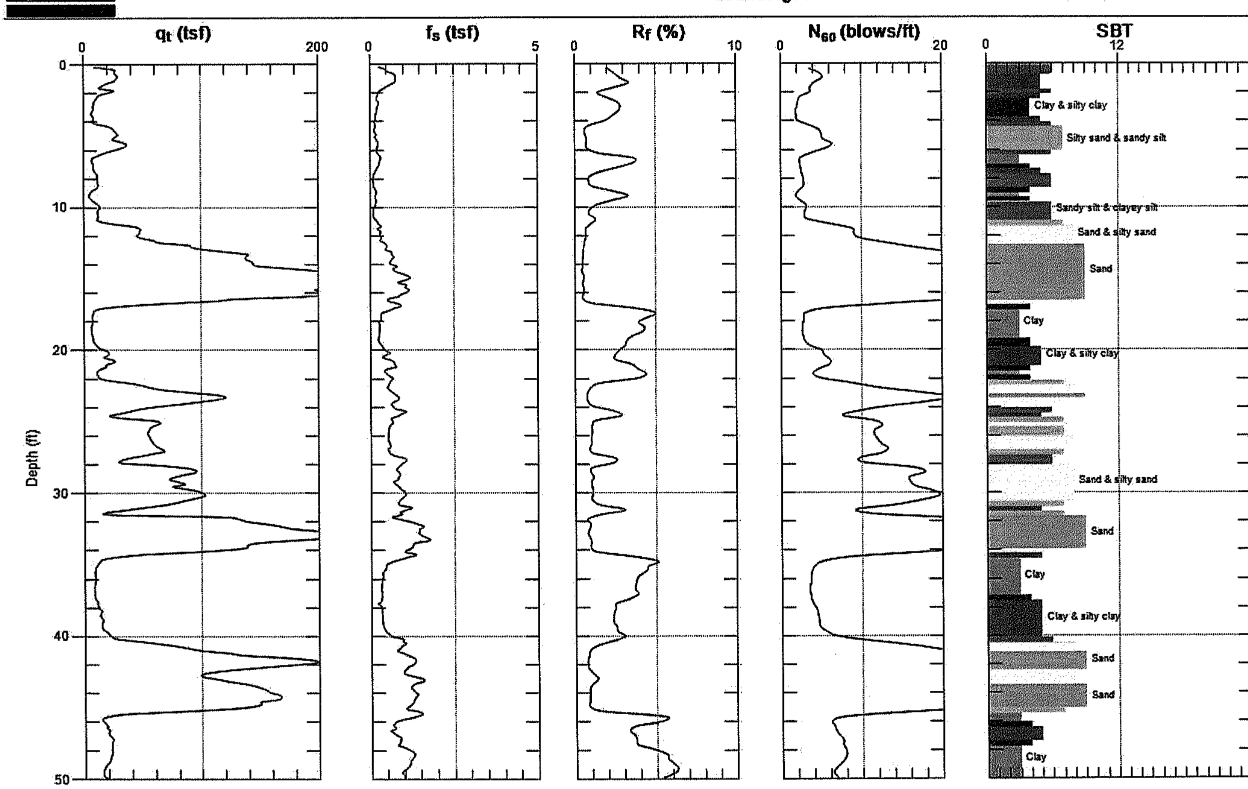
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE | Engineer: E.MITCHELL
Sounding: CPT-9 | Date: 2/12/2009 01:53



Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

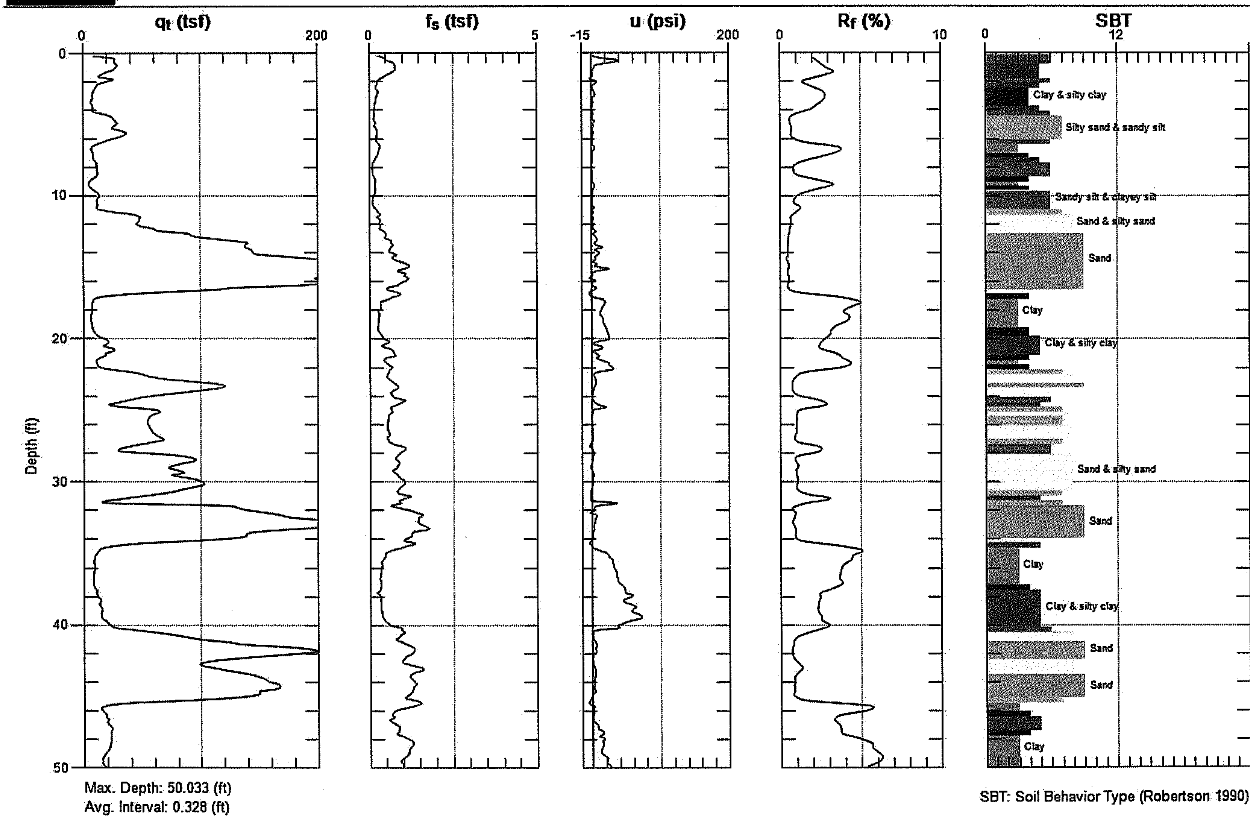
SBT: Soil Behavior Type (Robertson 1990)

GREGG

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-9

Engineer: E.MITCHELL
Date: 2/12/2009 01:53

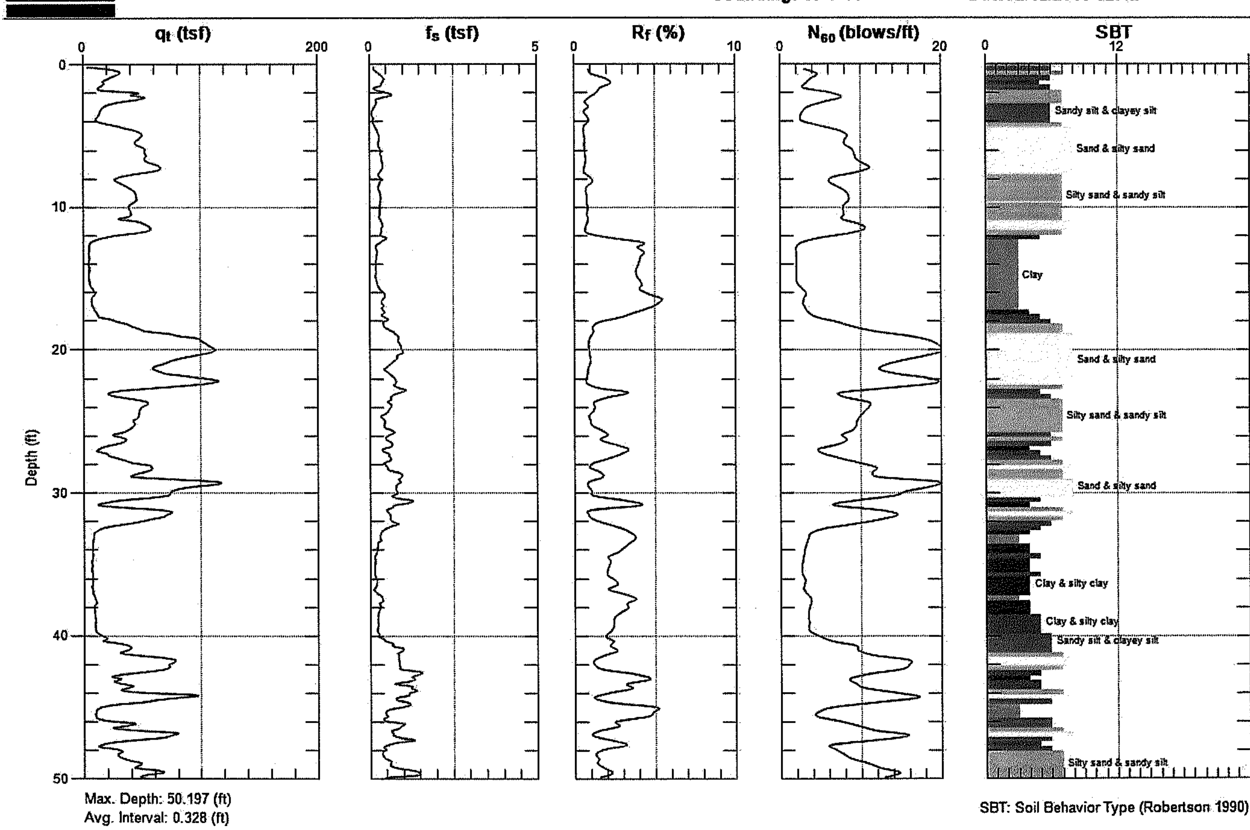


GREGG

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-10

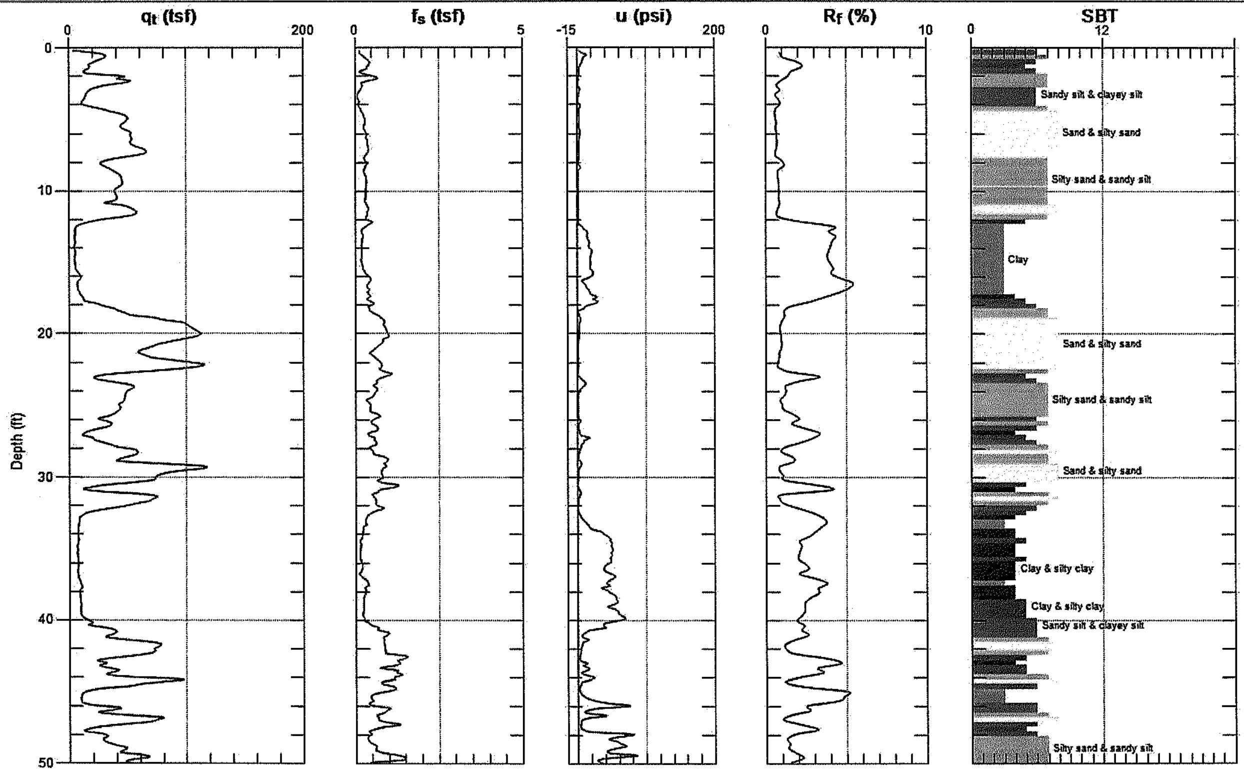
Engineer: E.MITCHELL
Date: 2/12/2009 02:42



GREGG

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE | Engineer: E.MITCHELL
Sounding: CPT-10 | Date: 2/12/2009 02:42



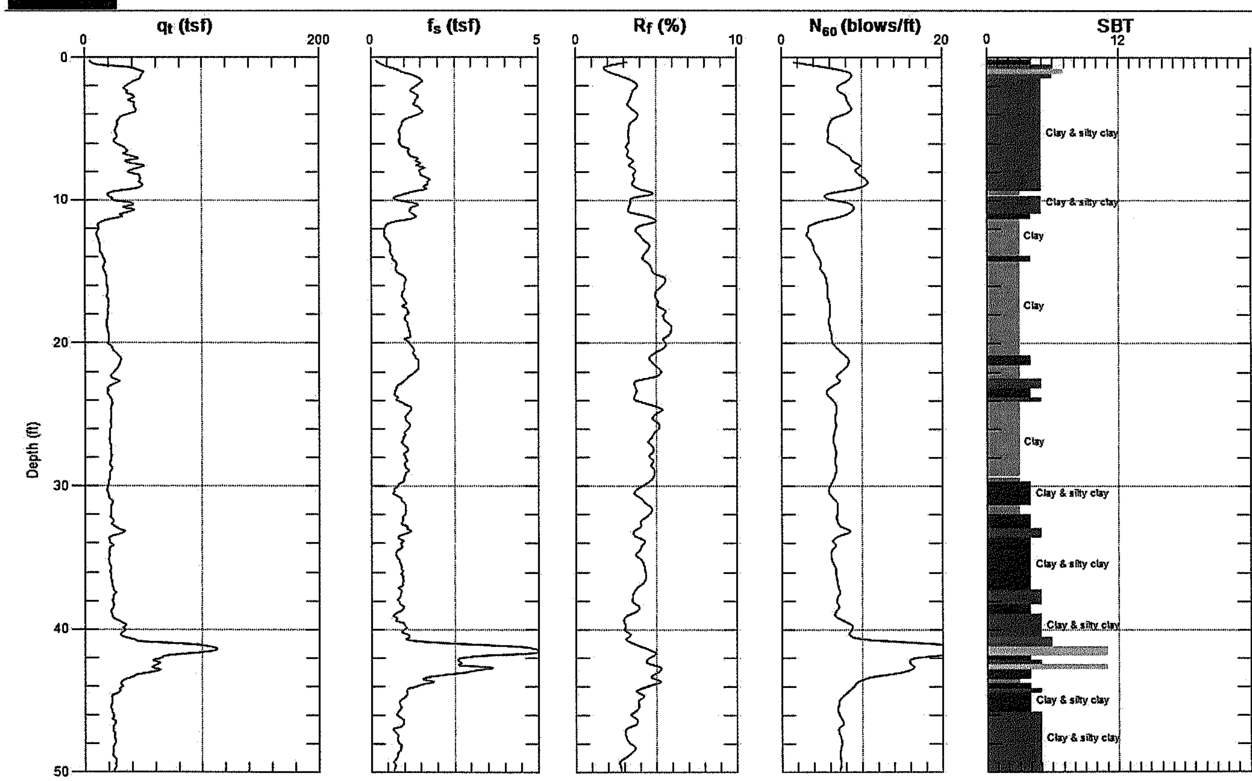
Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE | Engineer: E.MITCHELL
Sounding: CPT-11 | Date: 2/12/2009 03:42

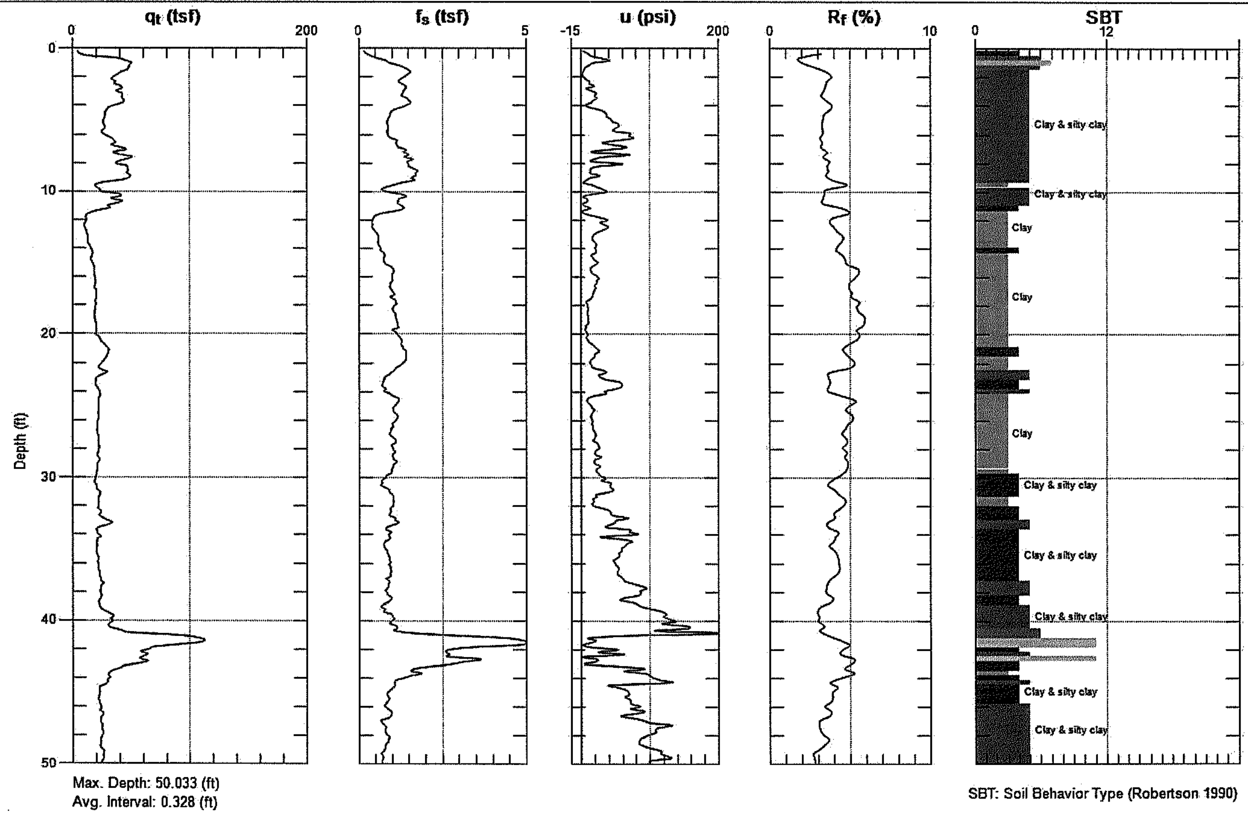


Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

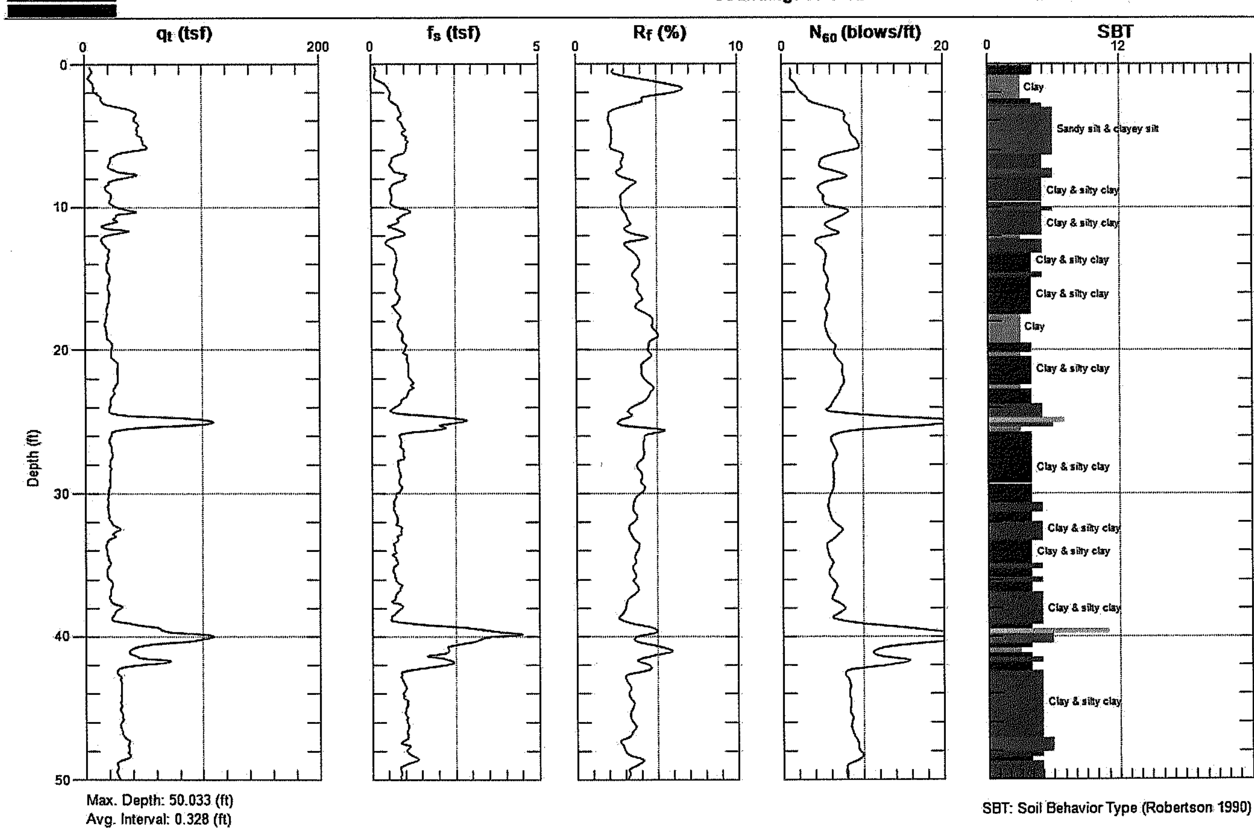
PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-11
Engineer: E.MITCHELL
Date: 2/12/2009 03:42



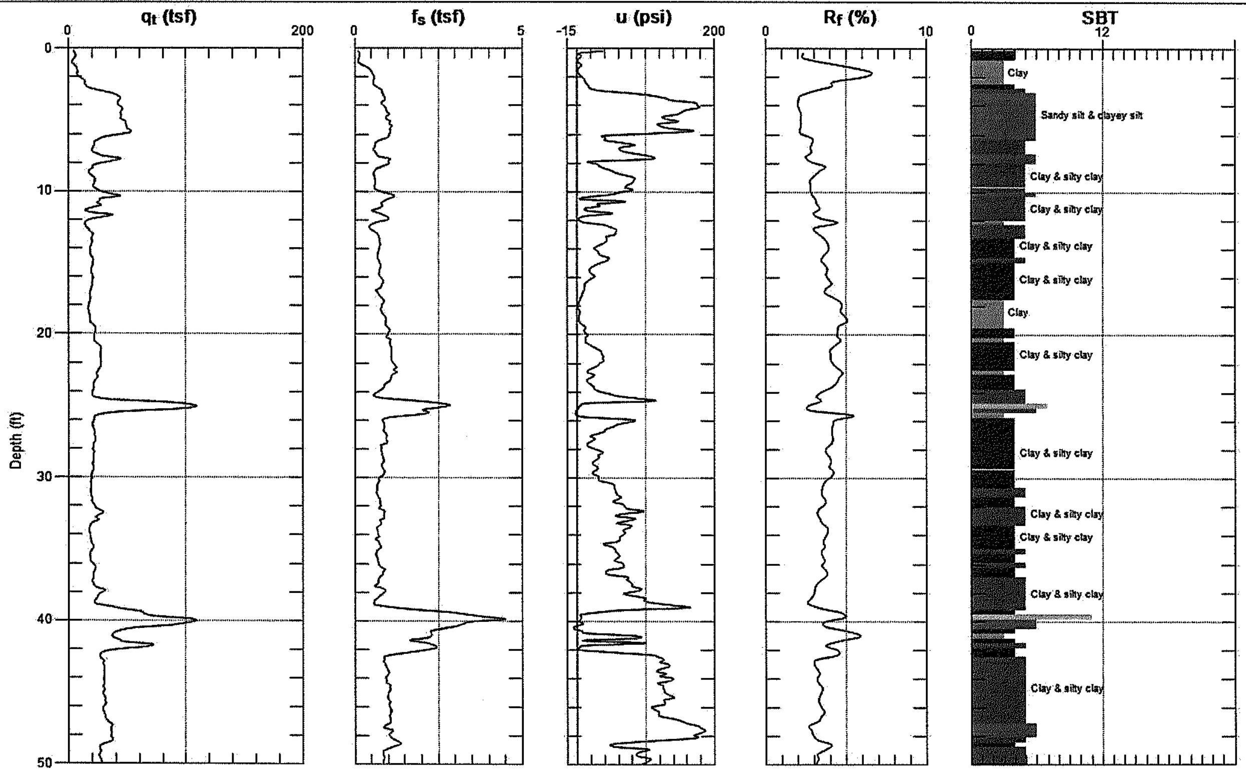
PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-12
Engineer: E.MITCHELL
Date: 2/12/2009 04:40



GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-12
Engineer: E.MITCHELL
Date: 2/12/2009 04:40

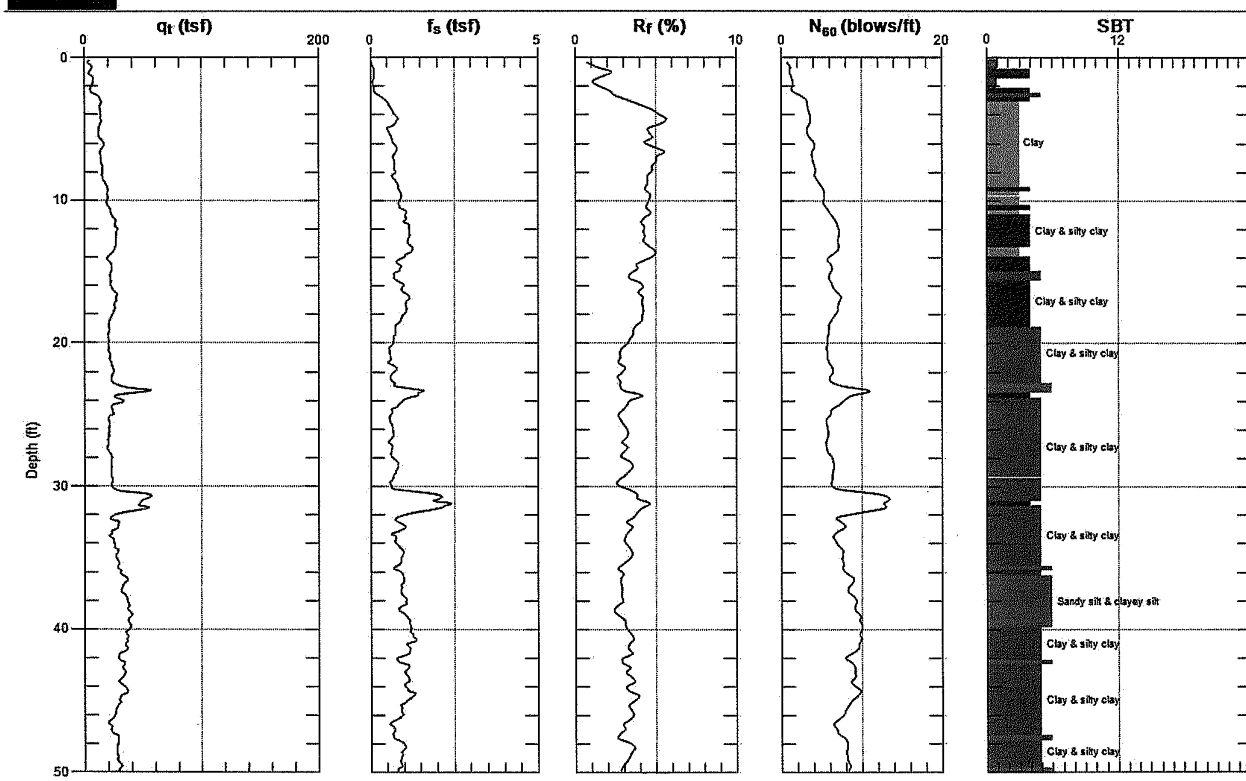


Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-13
Engineer: E.MITCHELL
Date: 2/13/2009 08:13



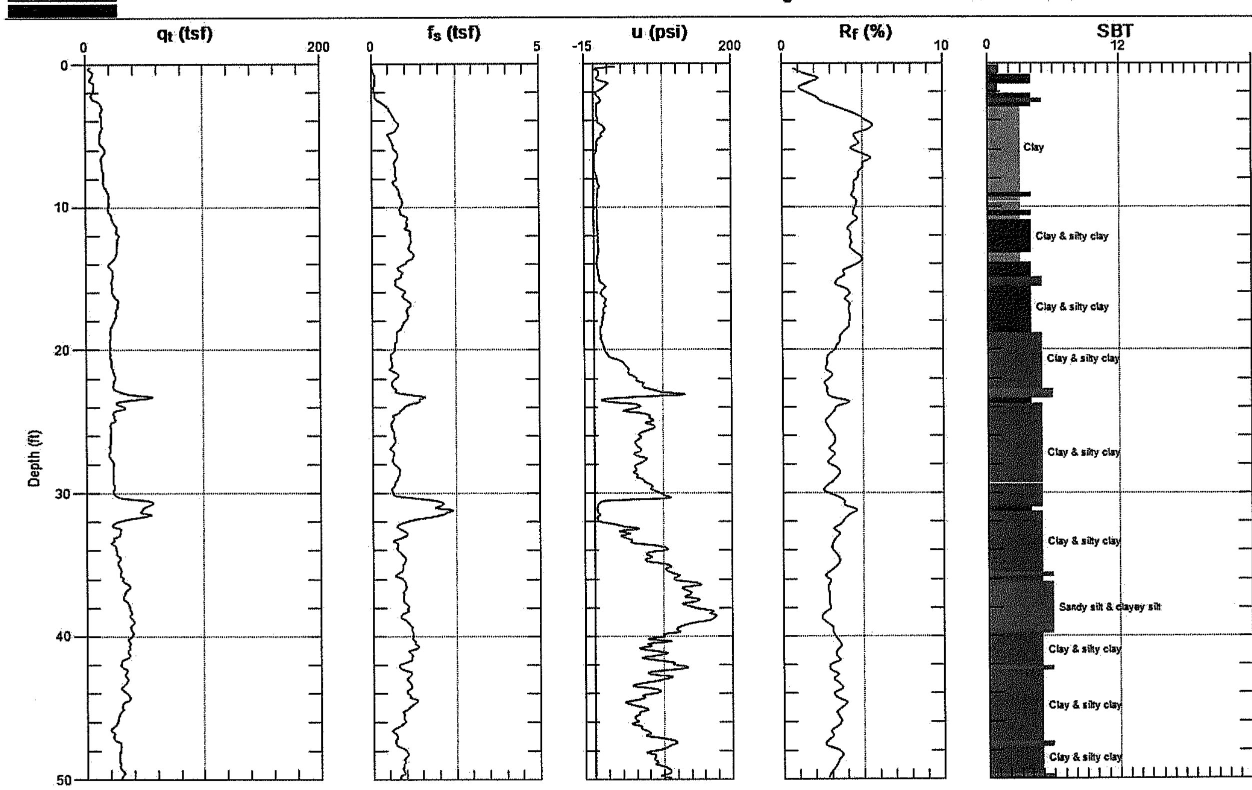
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG **PACIFIC CREST ENGINEERING**

Site: ATKINSON LANE
Sounding: CPT-13

Engineer: E.MITCHELL
Date: 2/13/2009 08:13



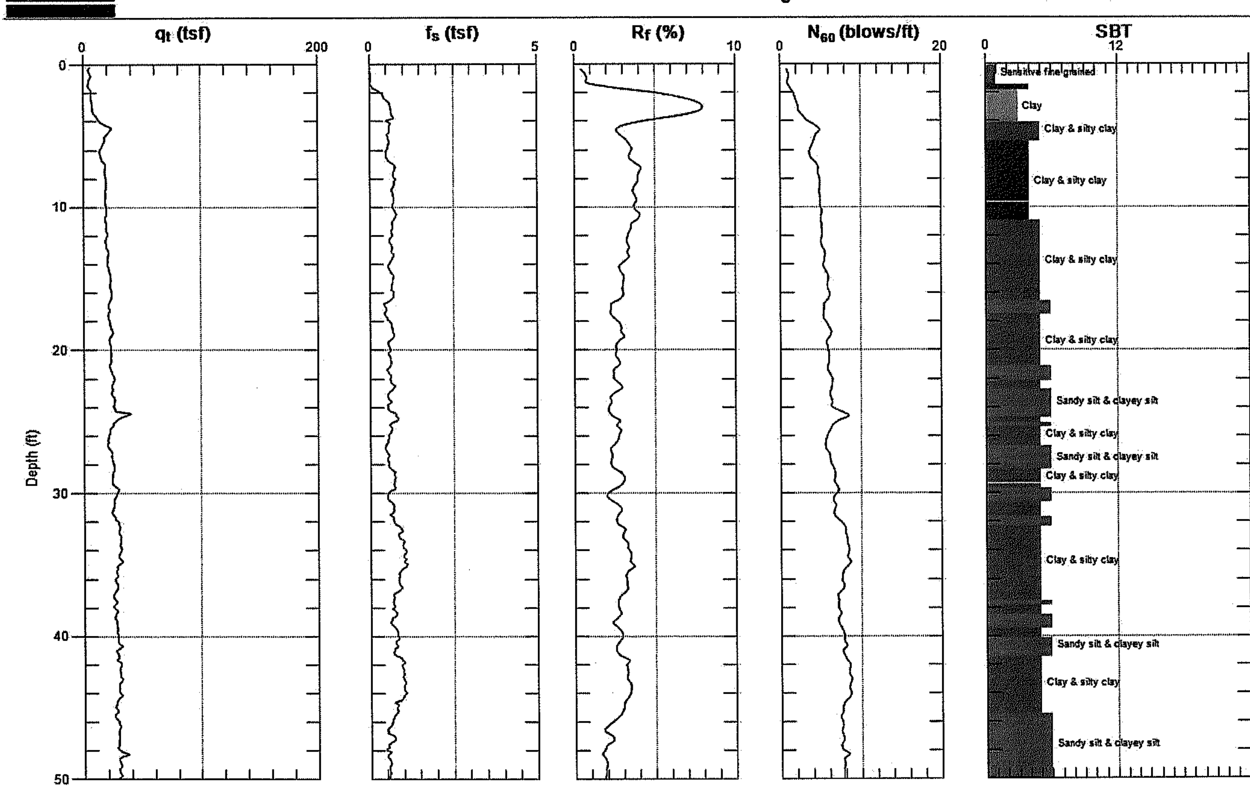
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG **PACIFIC CREST ENGINEERING**

Site: ATKINSON LANE
Sounding: CPT-14

Engineer: E.MITCHELL
Date: 2/13/2009 09:02



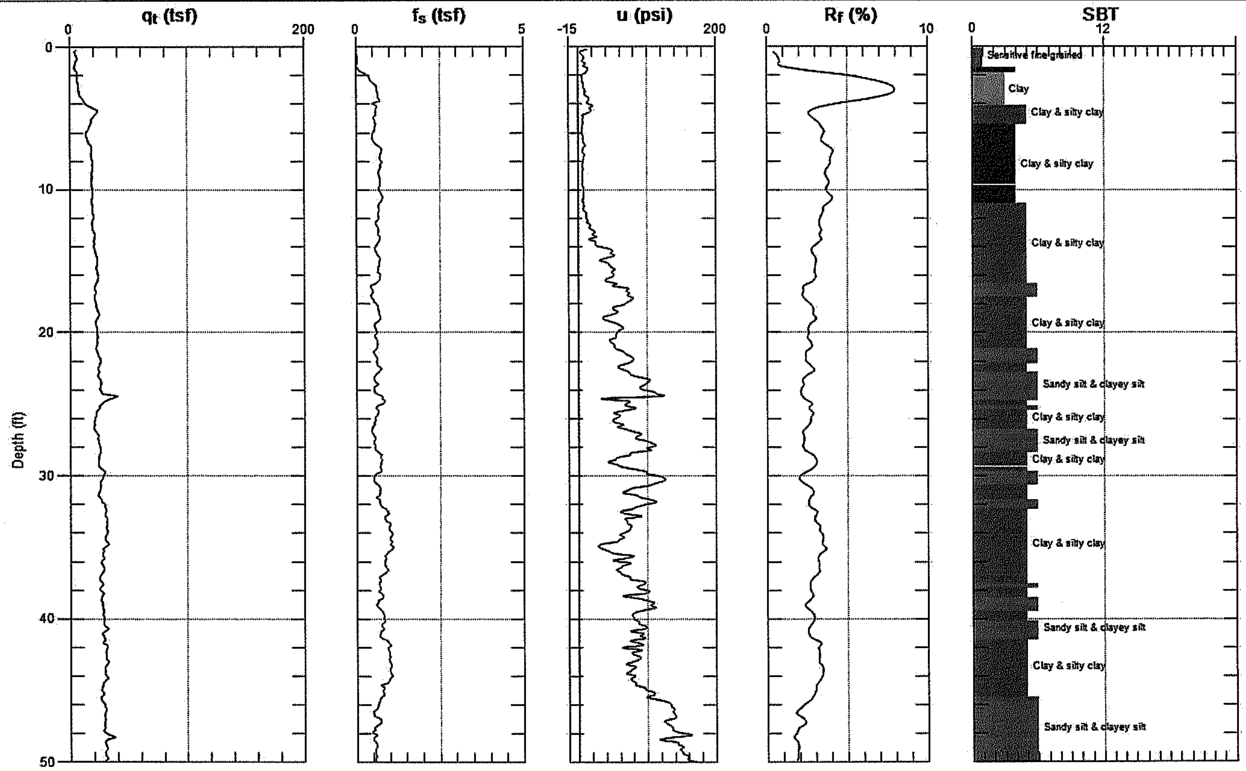
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG **PACIFIC CREST ENGINEERING**

Site: ATKINSON LANE
Sounding: CPT-14

Engineer: E.MITCHELL
Date: 2/13/2009 09:02



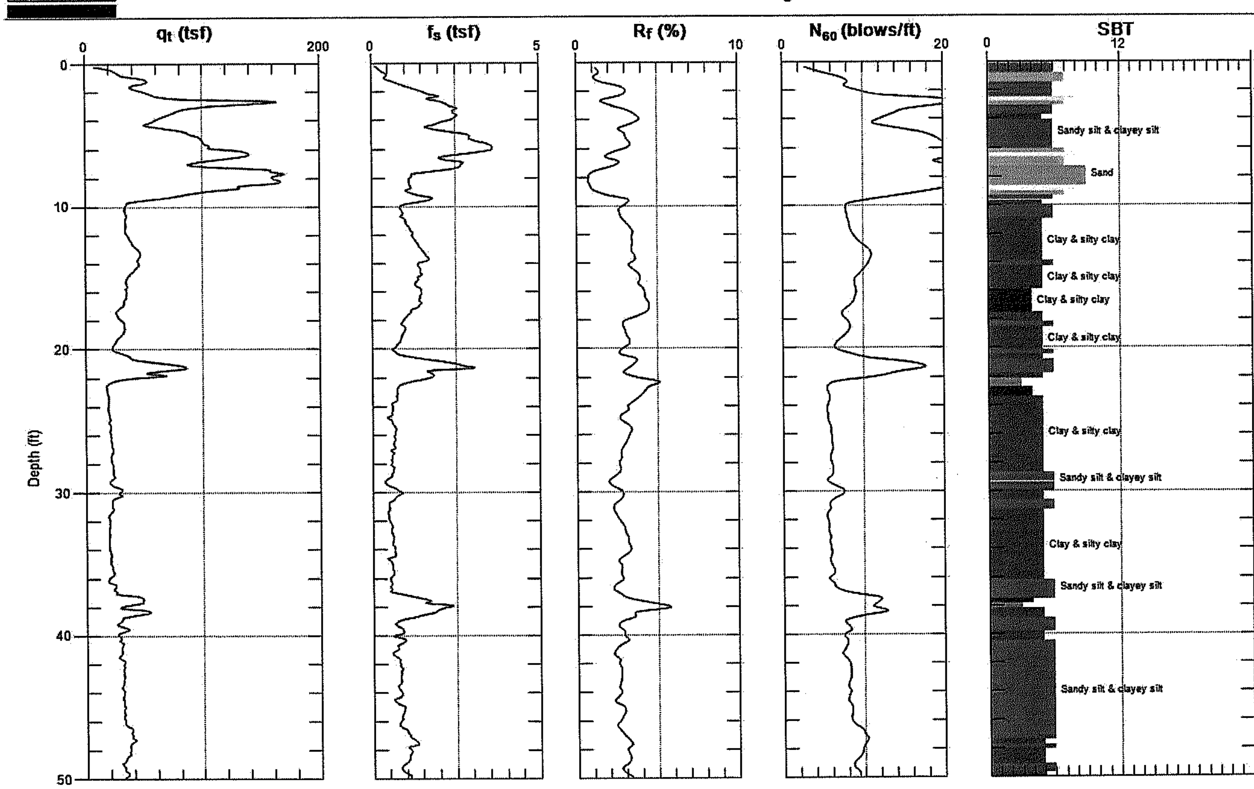
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG **PACIFIC CREST ENGINEERING**

Site: ATKINSON LANE
Sounding: CPT-15

Engineer: E.MITCHELL
Date: 2/13/2009 09:49

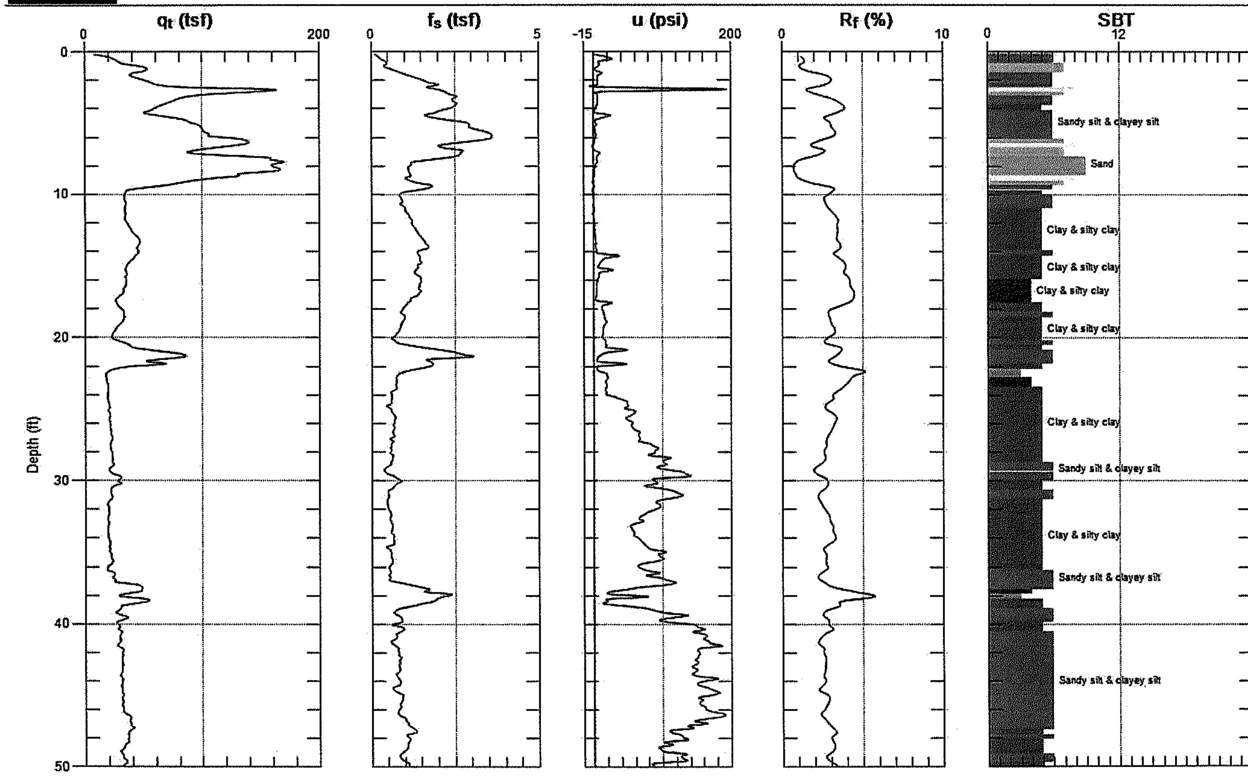


Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-15
Engineer: E.MITCHELL
Date: 2/13/2009 09:49

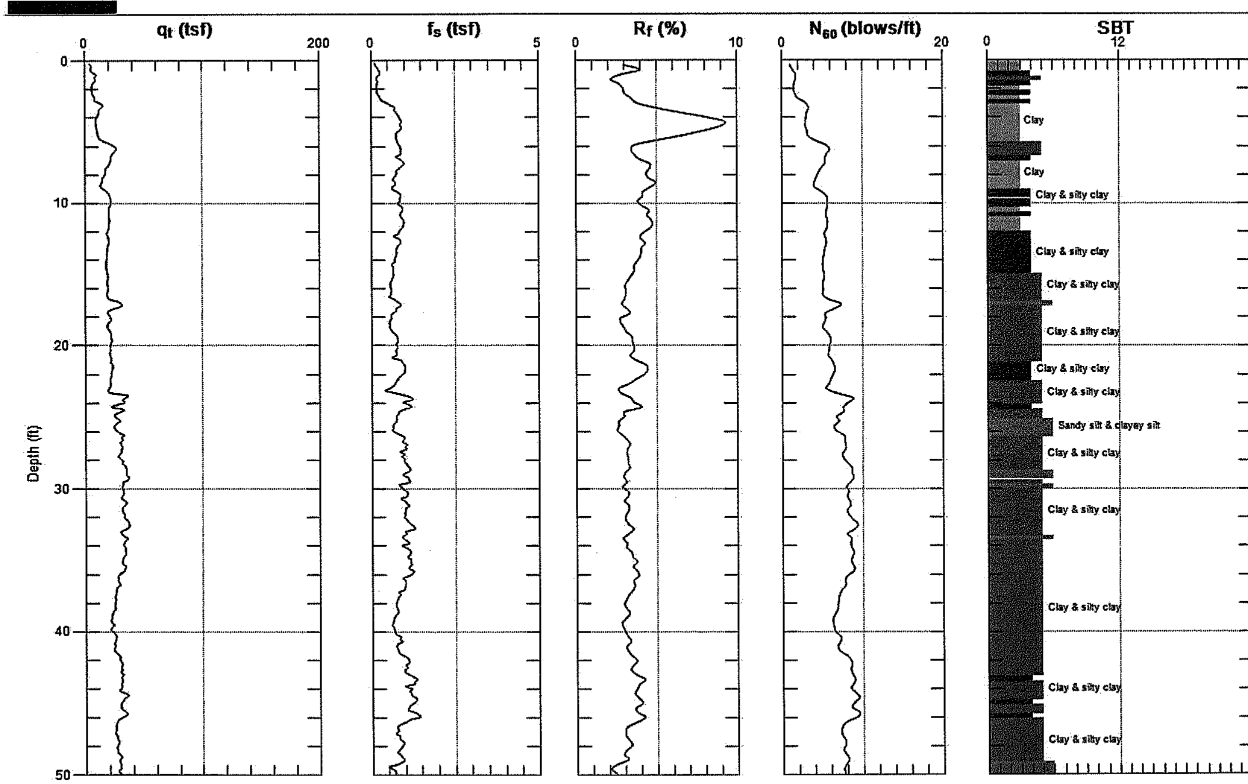


Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-16
Engineer: E.MITCHELL
Date: 2/13/2009 11:18



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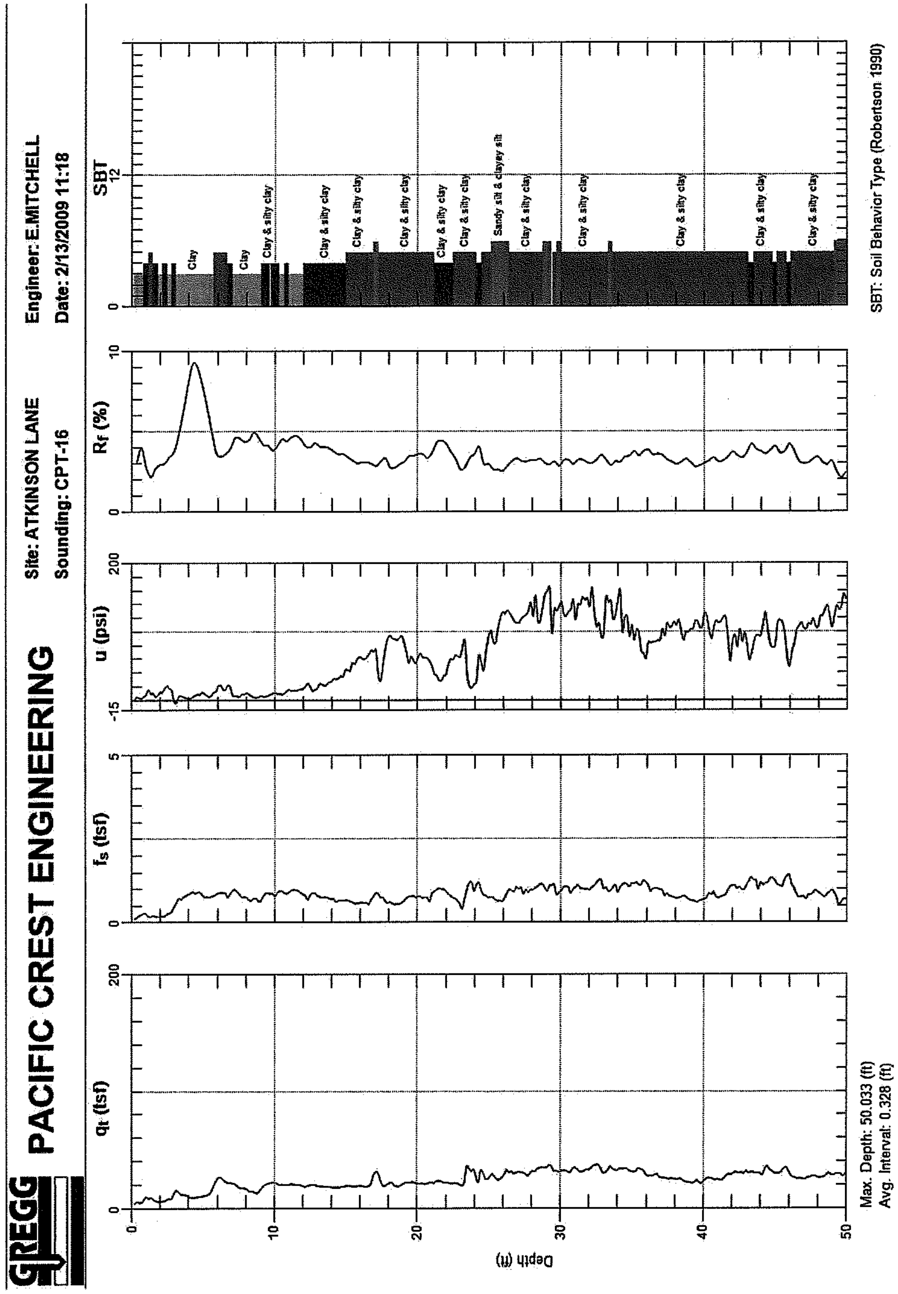
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)



GREGG

GREGG DRILLING & TESTING, INC.
GEOTECHNICAL AND ENVIRONMENTAL INVESTIGATION SERVICES

February 16, 2009

Pacific Crest Engineering
Attn: Elizabeth Mitchell
444 Airport Blvd., Suite 106
Watsonville, California 95076

Subject: CPT Site Investigation
Atkinson Lane
Watsonville, California
GREGG Project Number: 09-021MA

Dear Ms. Mitchell:

The following report presents the results of GREGG Drilling & Testing's Cone Penetration Test investigation for the above referenced site. The following testing services were performed:

1	Cone Penetration Tests	(CPTU)	☒
2	Pore Pressure Dissipation Tests	(PPD)	☒
3	Seismic Cone Penetration Tests	(SCPTU)	☐
4	Resistivity Cone Penetration Tests	(RCPTU)	☐
5	UVOST Laser Induced Fluorescence	(UVOST)	☐
6	Groundwater Sampling	(GWS)	☐
7	Soil Sampling	(SS)	☐
8	Vapor Sampling	(VS)	☐
9	Vane Shear Testing	(VST)	☐
10	SPT Energy Calibration	(SPTE)	☐

A list of reference papers providing additional background on the specific tests conducted is provided in the bibliography following the text of the report. If you would like a copy of any of these publications or should you have any questions or comments regarding the contents of this report, please do not hesitate to contact our office at (925) 313-5800.

Sincerely,
GREGG Drilling & Testing, Inc.

Mary Walden
Operations Manager

Cone Penetration Test Sounding Summary

-Table 1-

CPT Sounding Identification	Date	Termination Depth (Feet)	Depth of Groundwater Samples (Feet)	Depth of Soil Samples (Feet)	Depth of Pore Pressure Dissipation Tests (Feet)
CPT-05	2/12/09	50	-	-	-
CPT-06	2/12/09	50	-	-	-
CPT-07	2/12/09	50	-	-	15.9, 21.5, 31.7
CPT-08	2/12/09	50	-	-	-
CPT-09	2/12/09	50	-	-	27.1
CPT-10	2/12/09	50	-	-	-
CPT-11	2/12/09	50	-	-	-
CPT-12	2/12/09	50	-	-	-
CPT-13	2/13/09	50	-	-	-
CPT-14	2/13/09	50	-	-	-
CPT-15	2/13/09	50	-	-	-
CPT-16	2/13/09	50	-	-	-

GREGG DRILLING & TESTING, INC.
GEOTECHNICAL AND ENVIRONMENTAL INVESTIGATION SERVICES

Bibliography

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Zemo, D.A., T.A. Delfino, J.D. Gallinatti, V.A. Baker and L.R. Hilpert, "Field Comparison of Analytical Results from Discrete-Depth Groundwater Samplers" BAT EnviroProbe and QED HydroPunch, Sixth national Outdoor Action Conference, Las Vegas, Nevada Proceedings, 1992, pp 299-312.

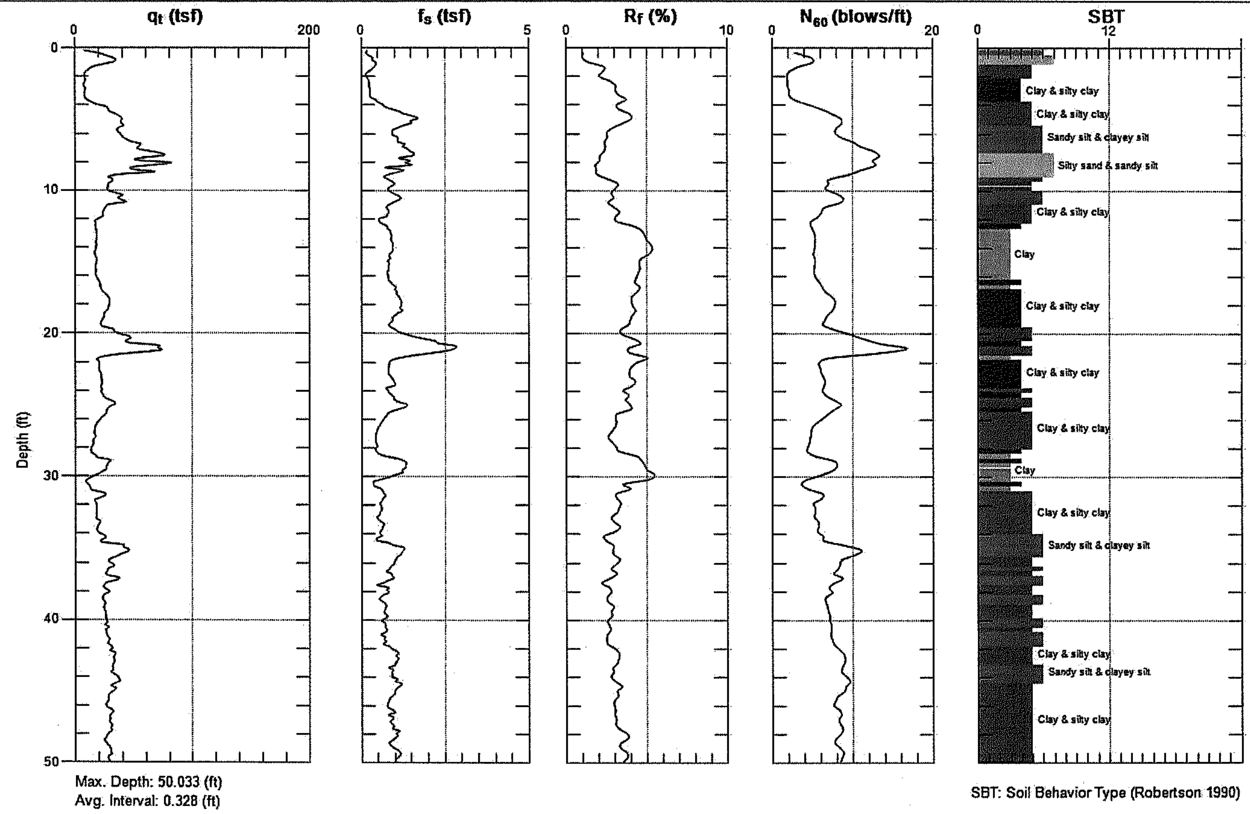
Copies of ASTM Standards are available through www.astm.org

950 Howe Rd • Martinez, California 94553 • (925) 313-5800 • FAX (925) 313-0302
OTHER OFFICES: LOS ANGELES • HOUSTON • SOUTH CAROLINA
www.greggdrilling.com

GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-5

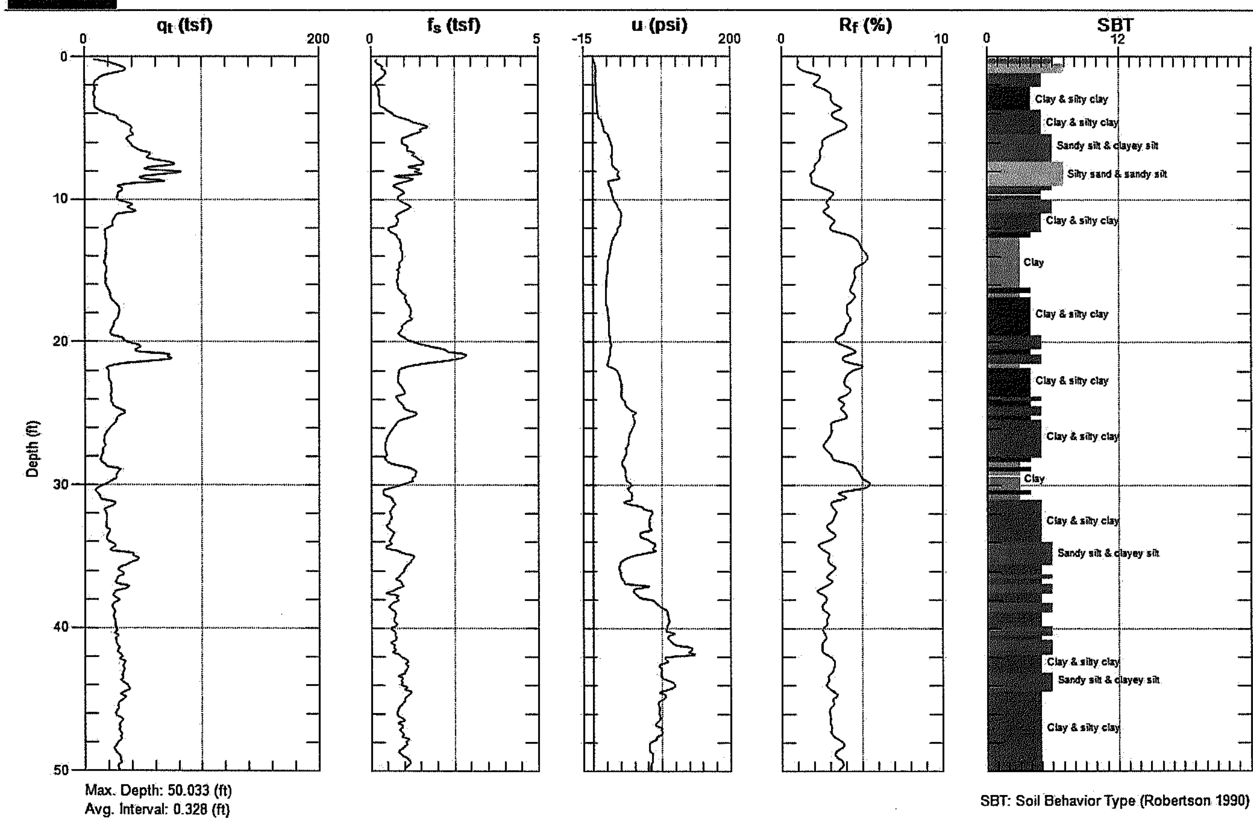
Engineer: E.MITCHELL
Date: 2/12/2009 09:40



GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-5

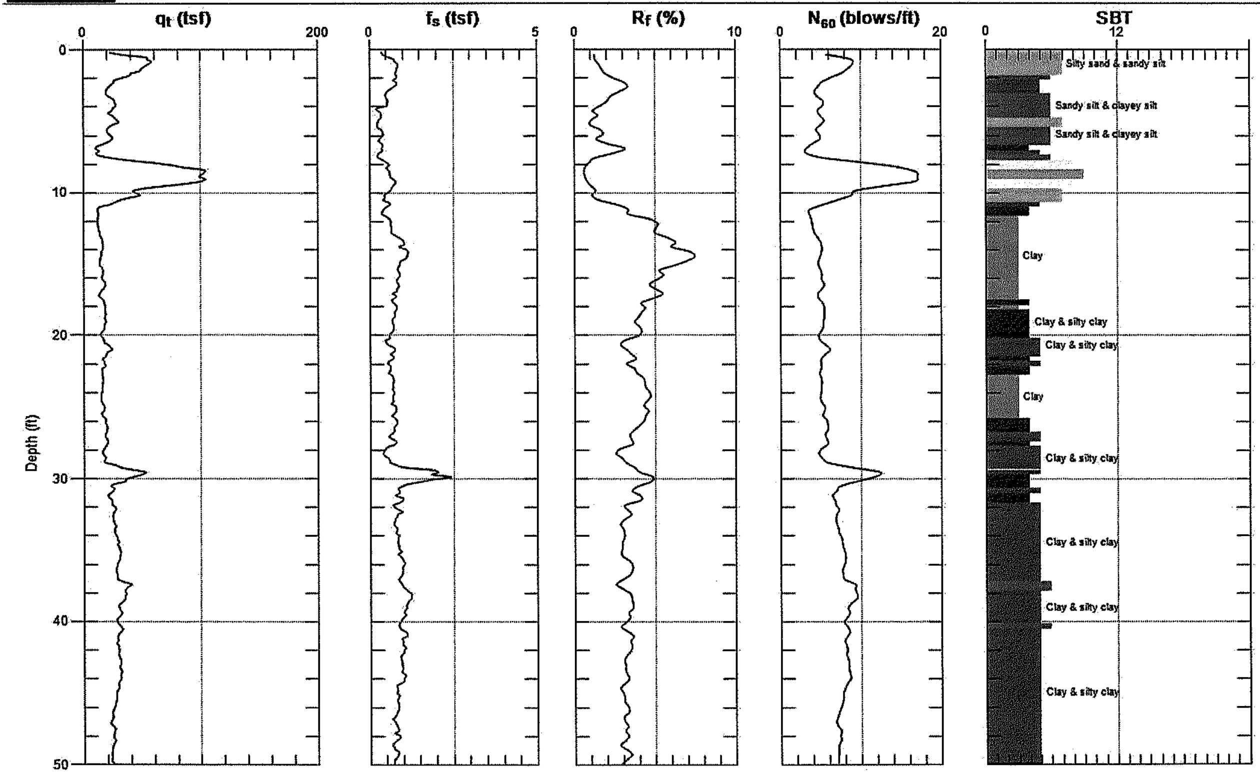
Engineer: E.MITCHELL
Date: 2/12/2009 09:40



GREGG

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE | Engineer: E.MITCHELL
Sounding: CPT-6 | Date: 2/12/2009 10:30



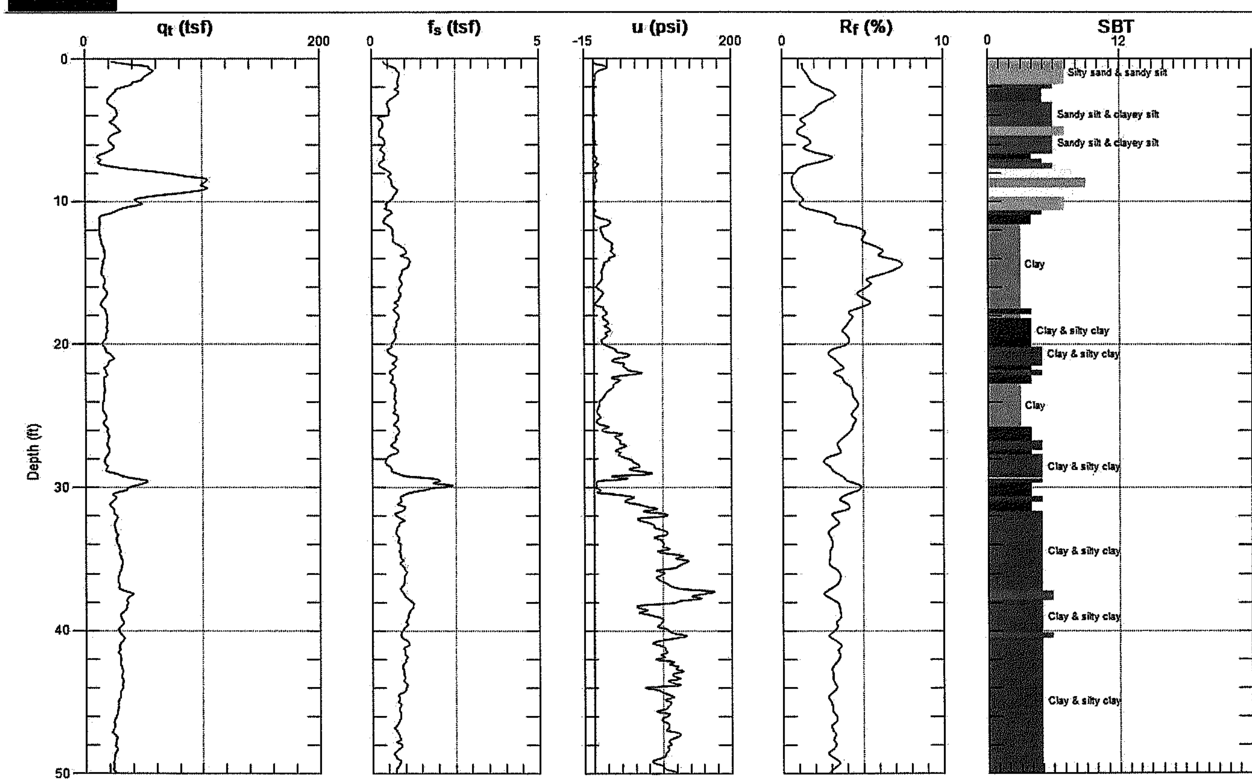
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE | Engineer: E.MITCHELL
Sounding: CPT-6 | Date: 2/12/2009 10:30

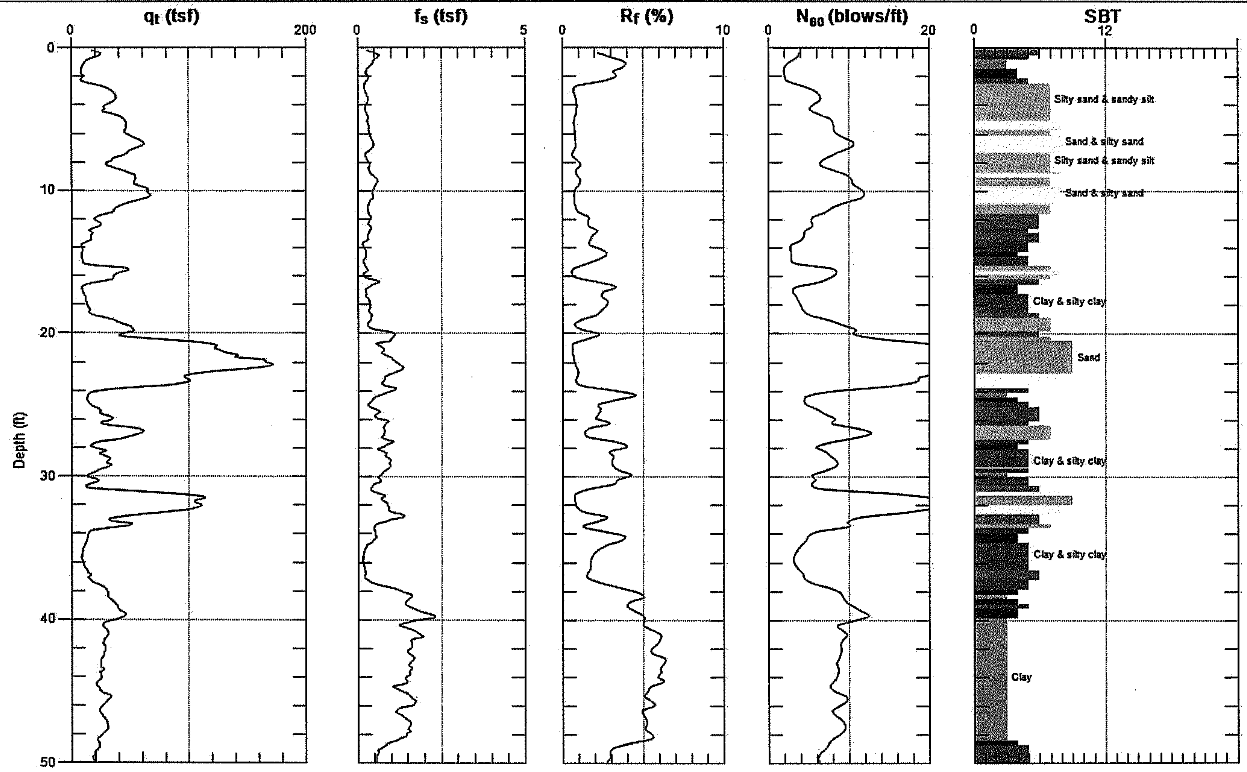


Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-7
Engineer: E.MITCHELL
Date: 2/12/2009 11:34

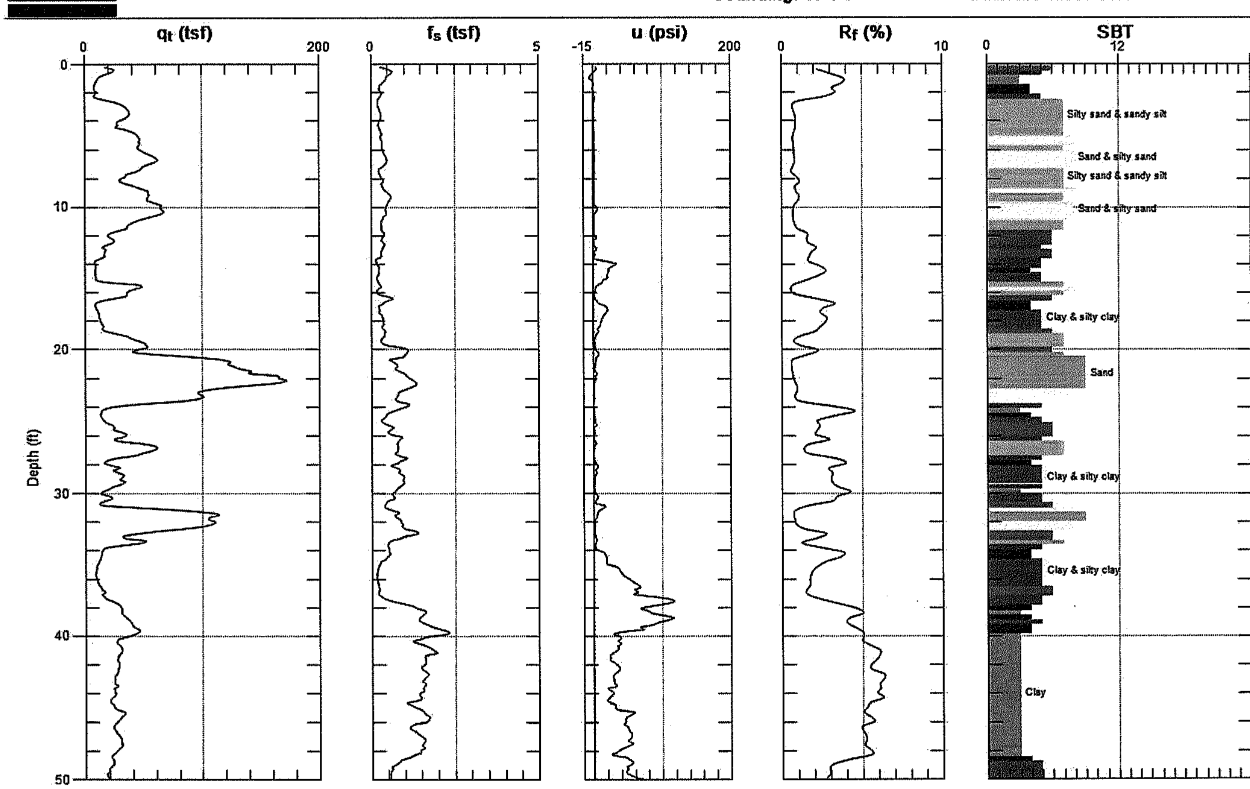


Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-7
Engineer: E.MITCHELL
Date: 2/12/2009 11:34



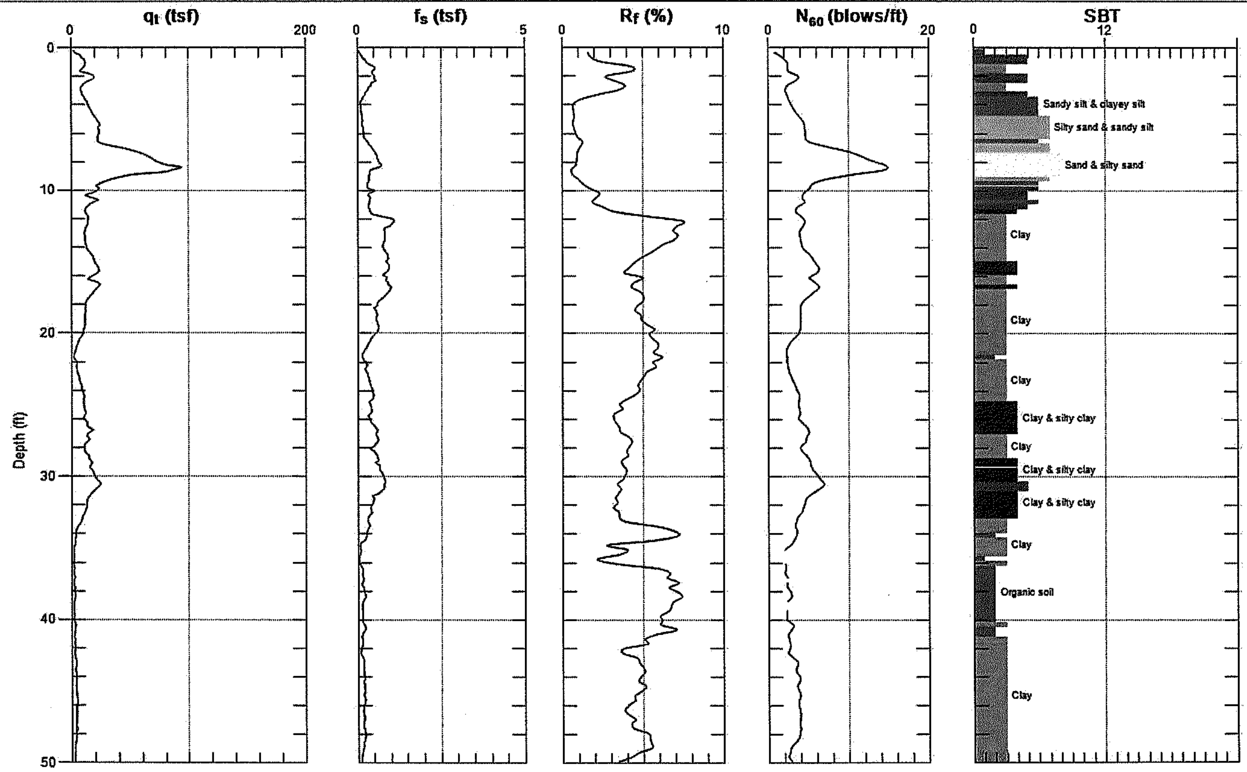
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-8

Engineer: E.MITCHELL
Date: 2/12/2009 12:56



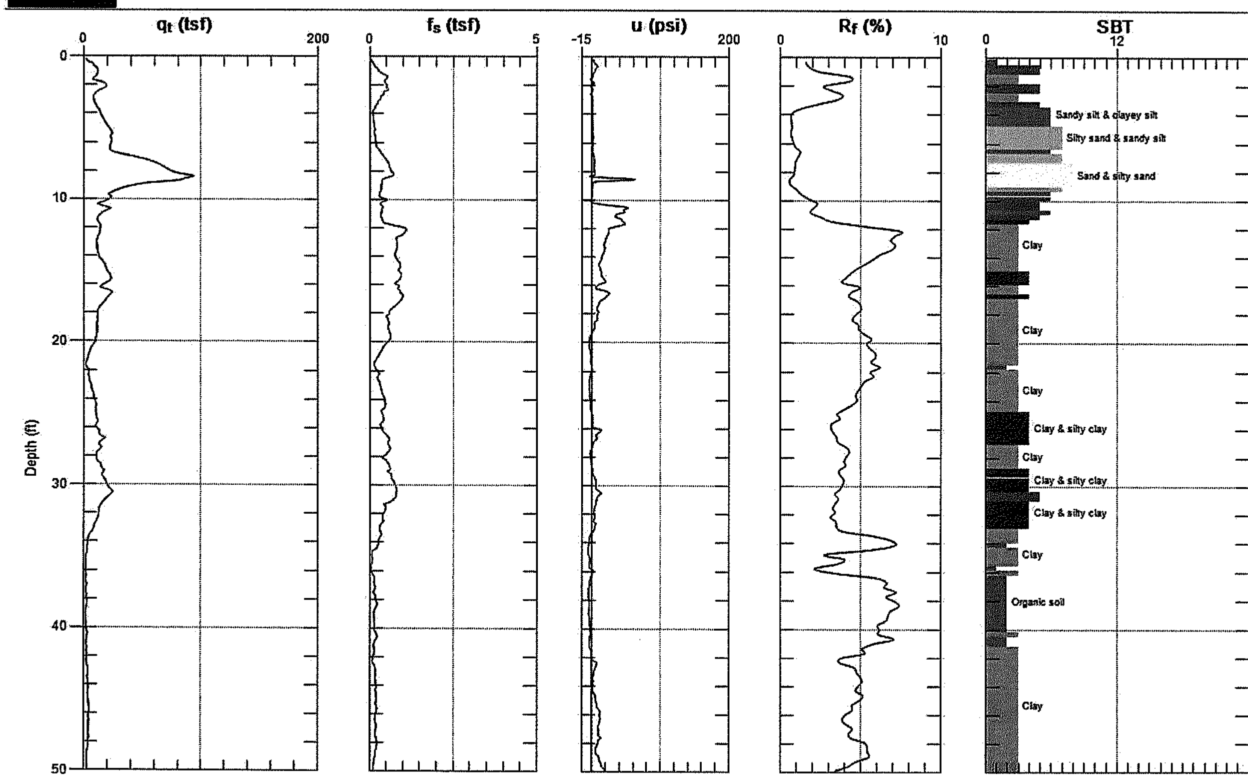
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-8

Engineer: E.MITCHELL
Date: 2/12/2009 12:56



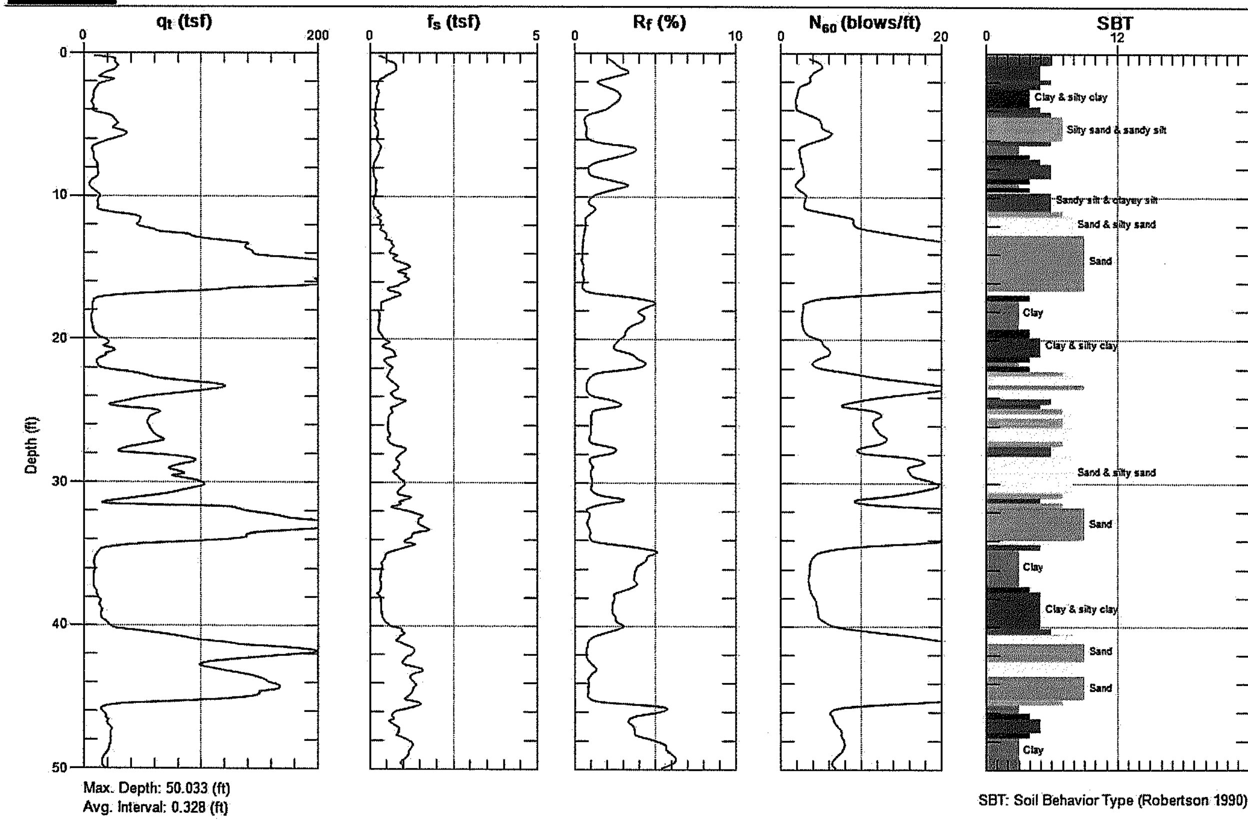
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-9

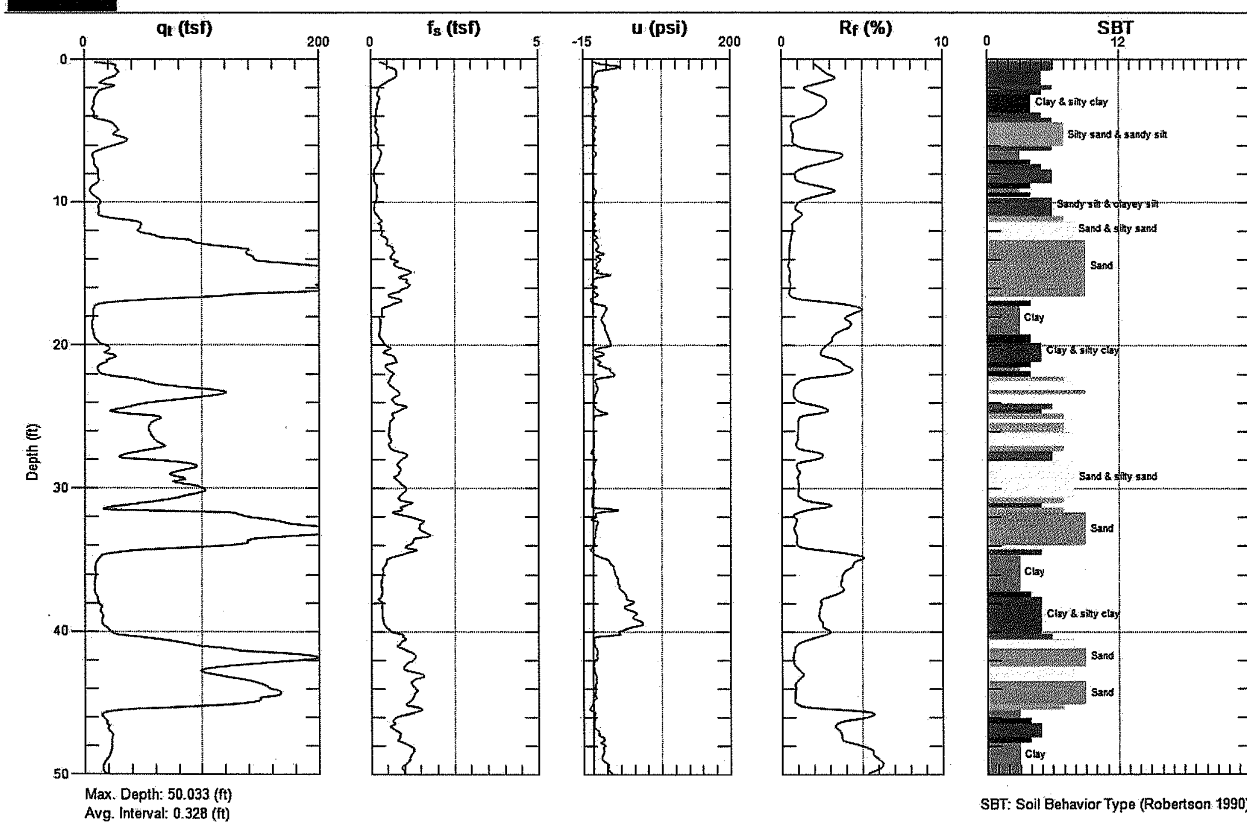
Engineer: E.MITCHELL
Date: 2/12/2009 01:53



PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-9

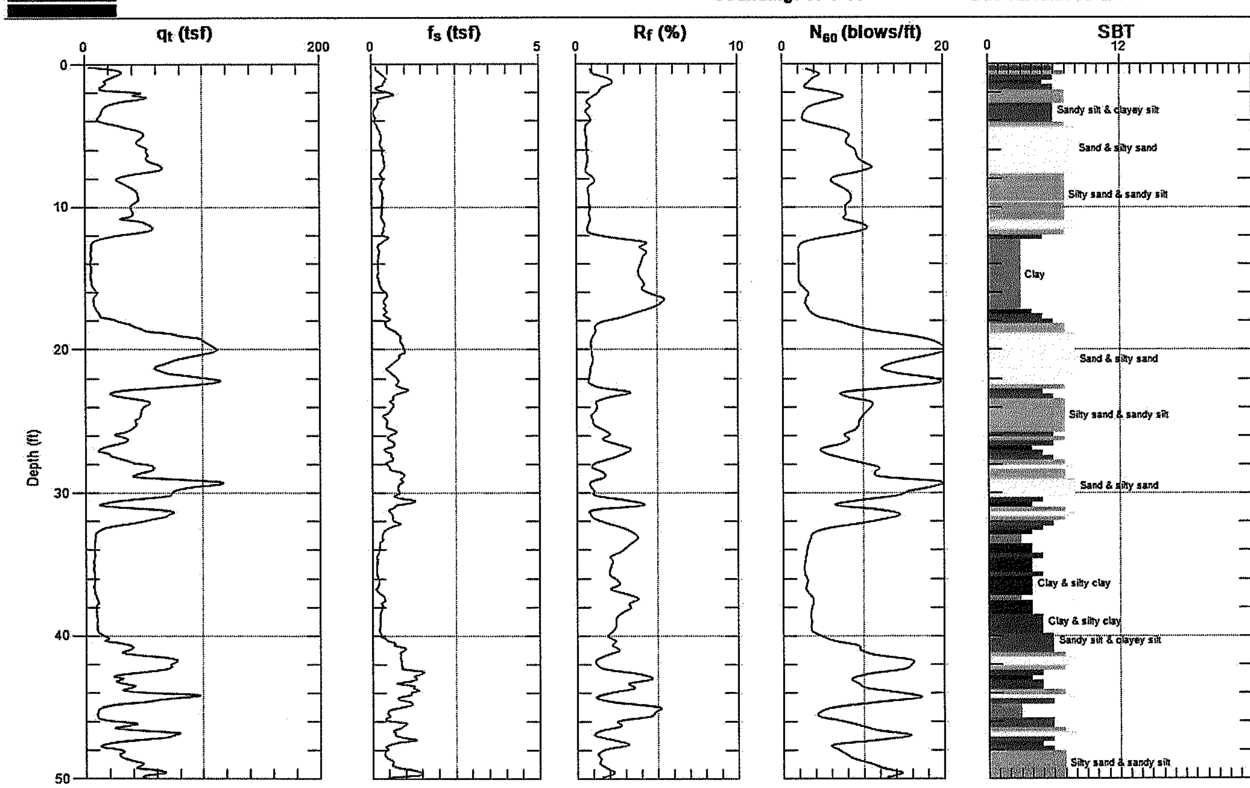
Engineer: E.MITCHELL
Date: 2/12/2009 01:53



GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-10

Engineer: E.MITCHELL
Date: 2/12/2009 02:42



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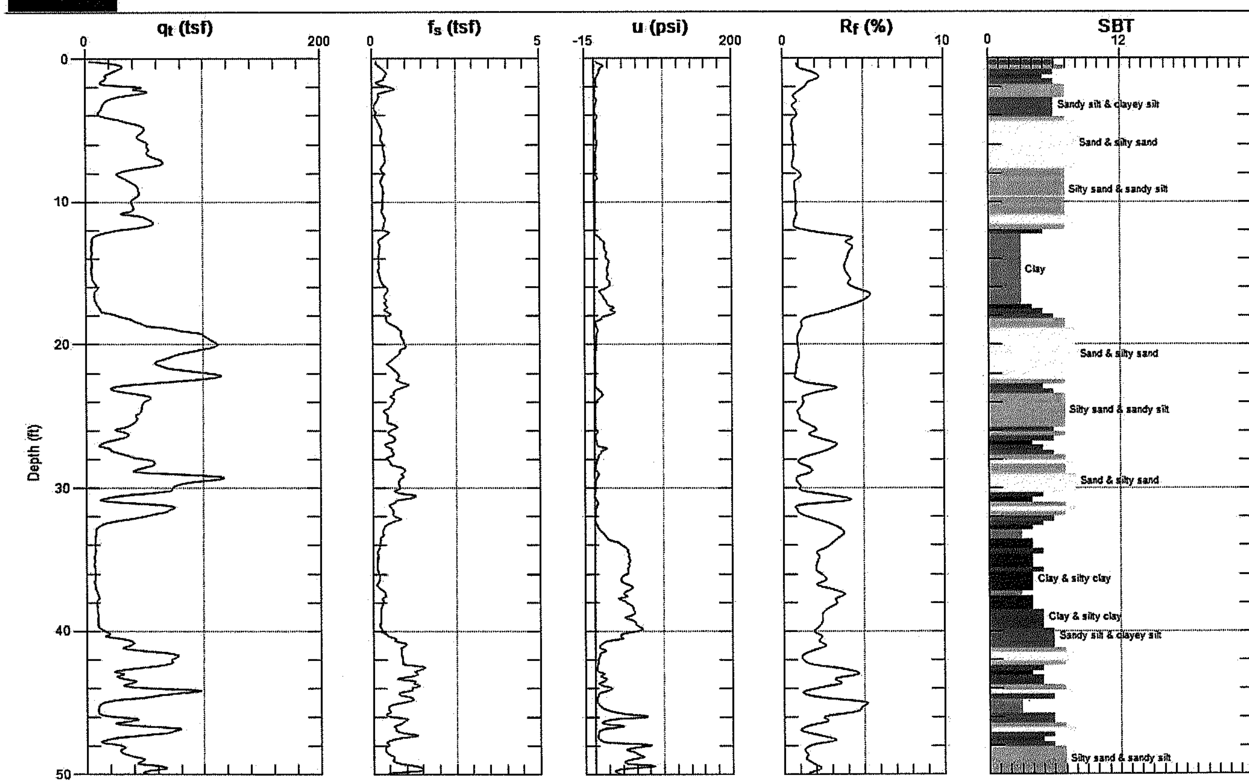
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-10

Engineer: E.MITCHELL
Date: 2/12/2009 02:42



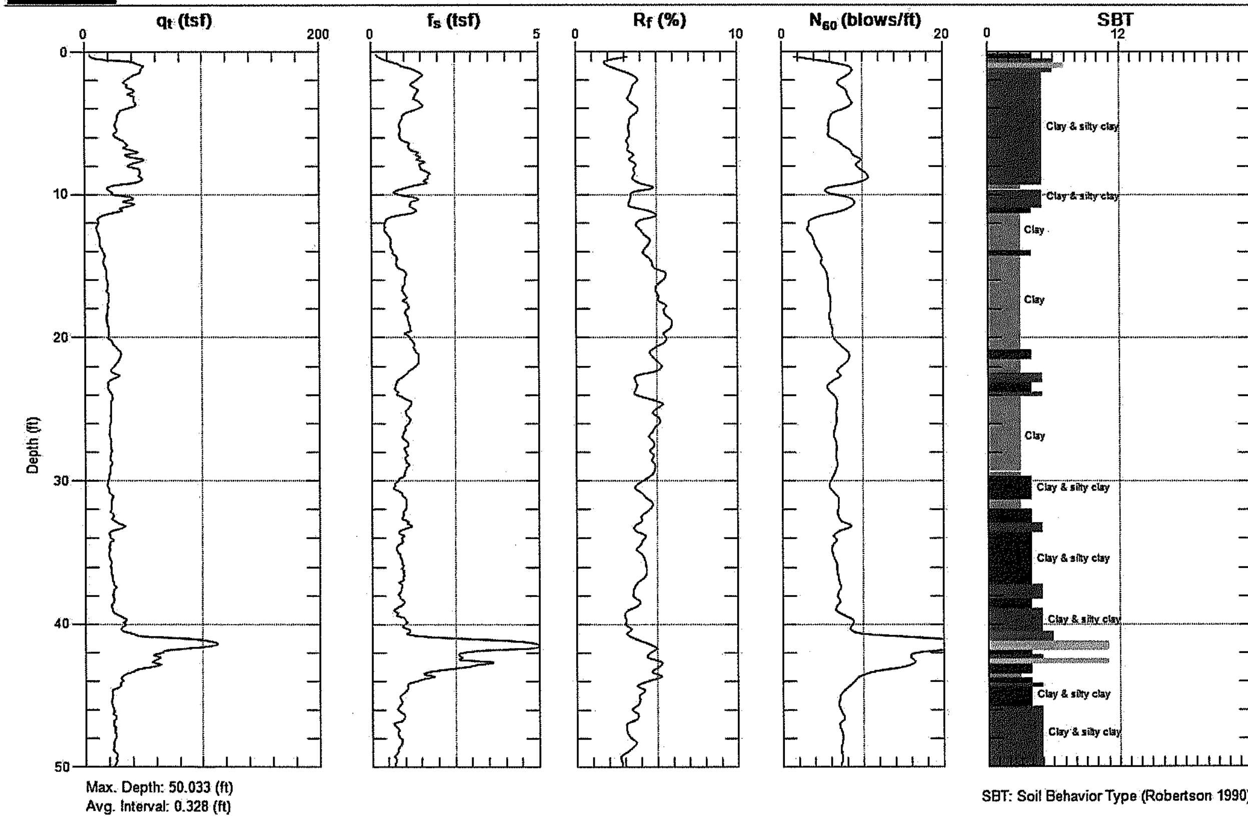
Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG **PACIFIC CREST ENGINEERING**

Site: ATKINSON LANE
Sounding: CPT-11

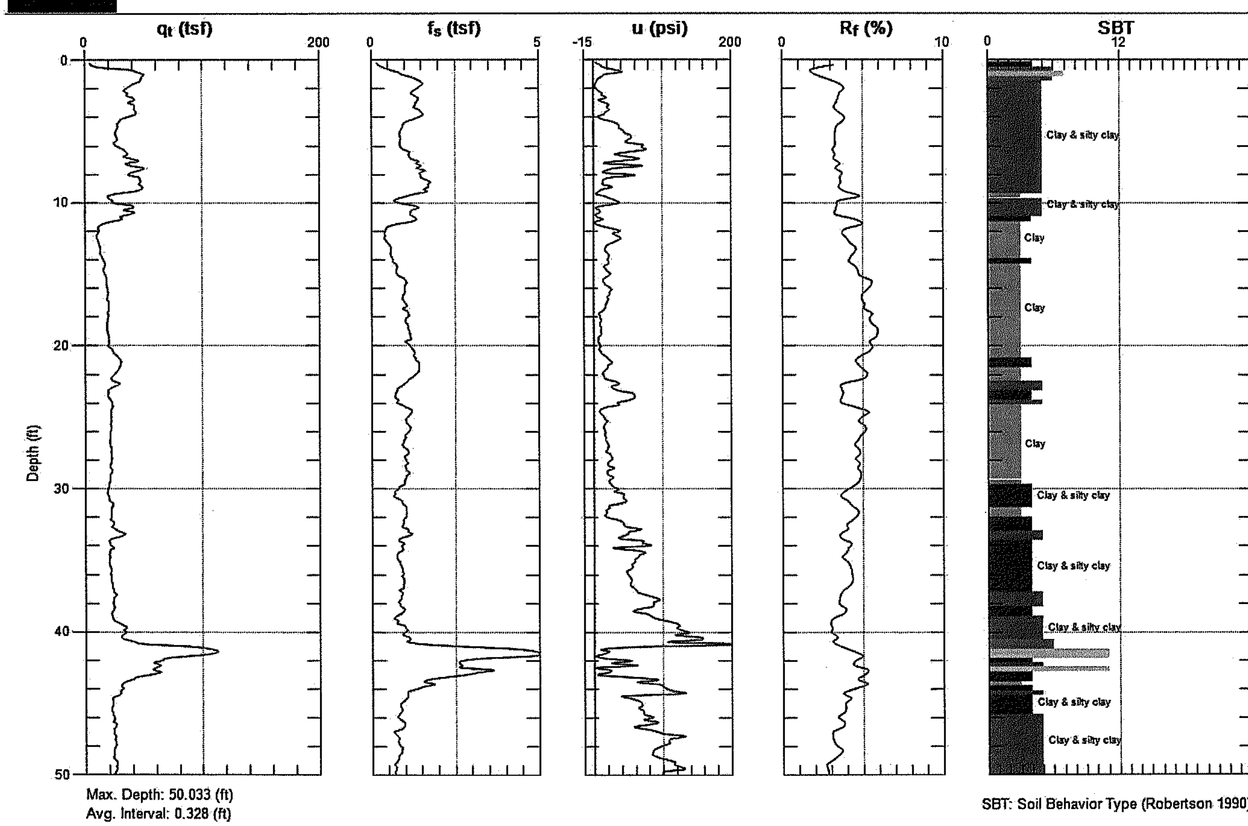
Engineer: E.MITCHELL
Date: 2/12/2009 03:42



GREGG **PACIFIC CREST ENGINEERING**

Site: ATKINSON LANE
Sounding: CPT-11

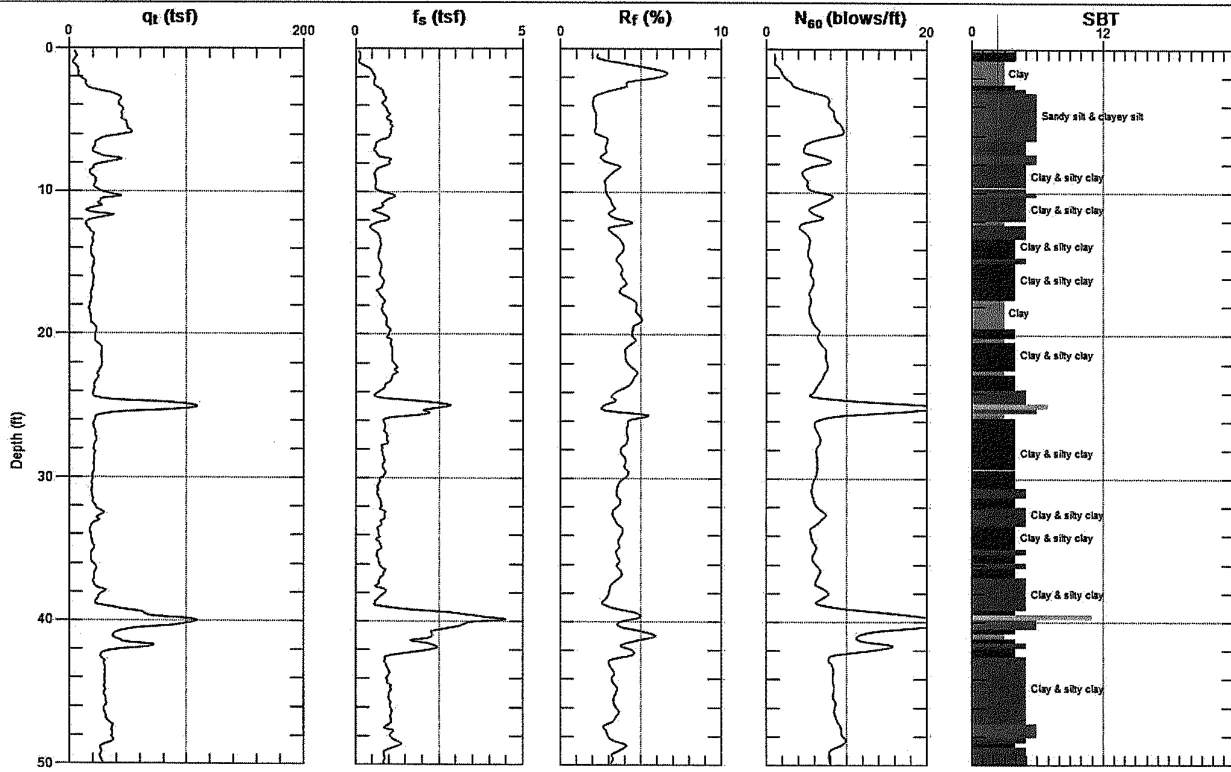
Engineer: E.MITCHELL
Date: 2/12/2009 03:42



PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-12

Engineer: E.MITCHELL
Date: 2/12/2009 04:40



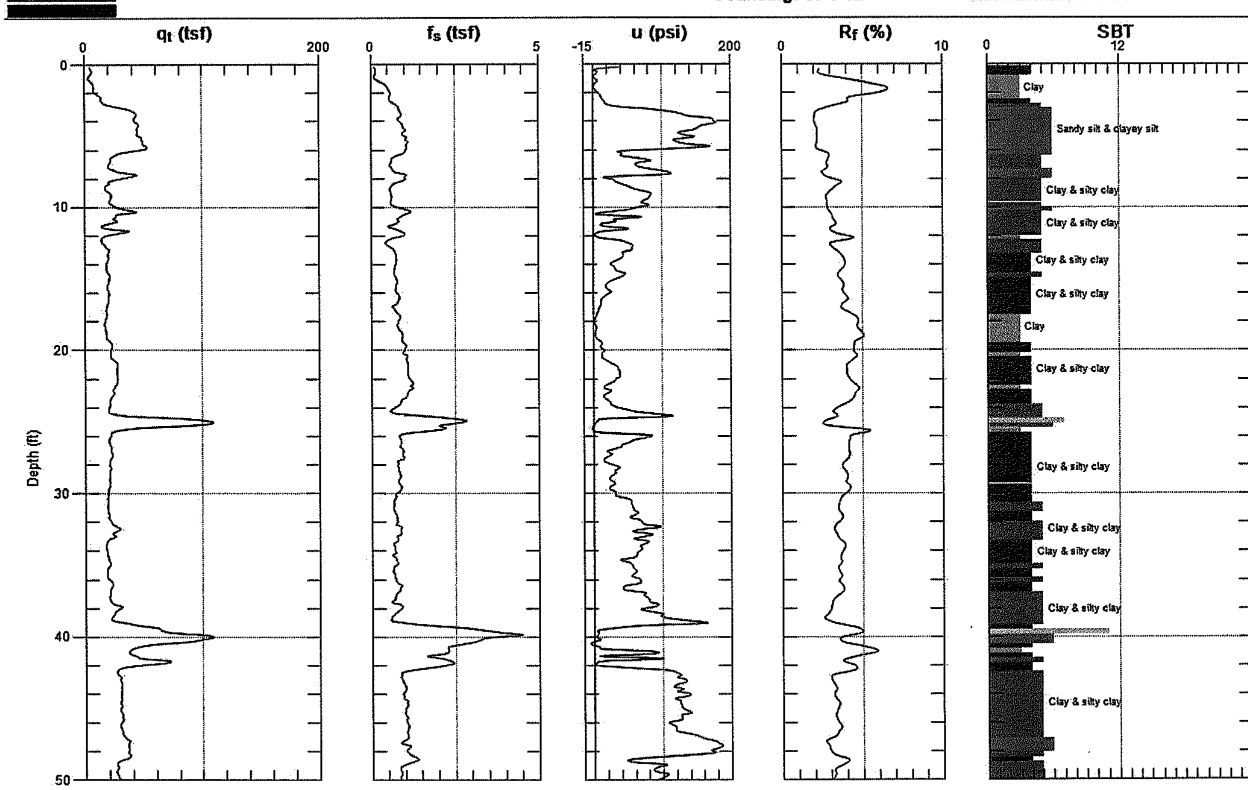
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-12

Engineer: E.MITCHELL
Date: 2/12/2009 04:40

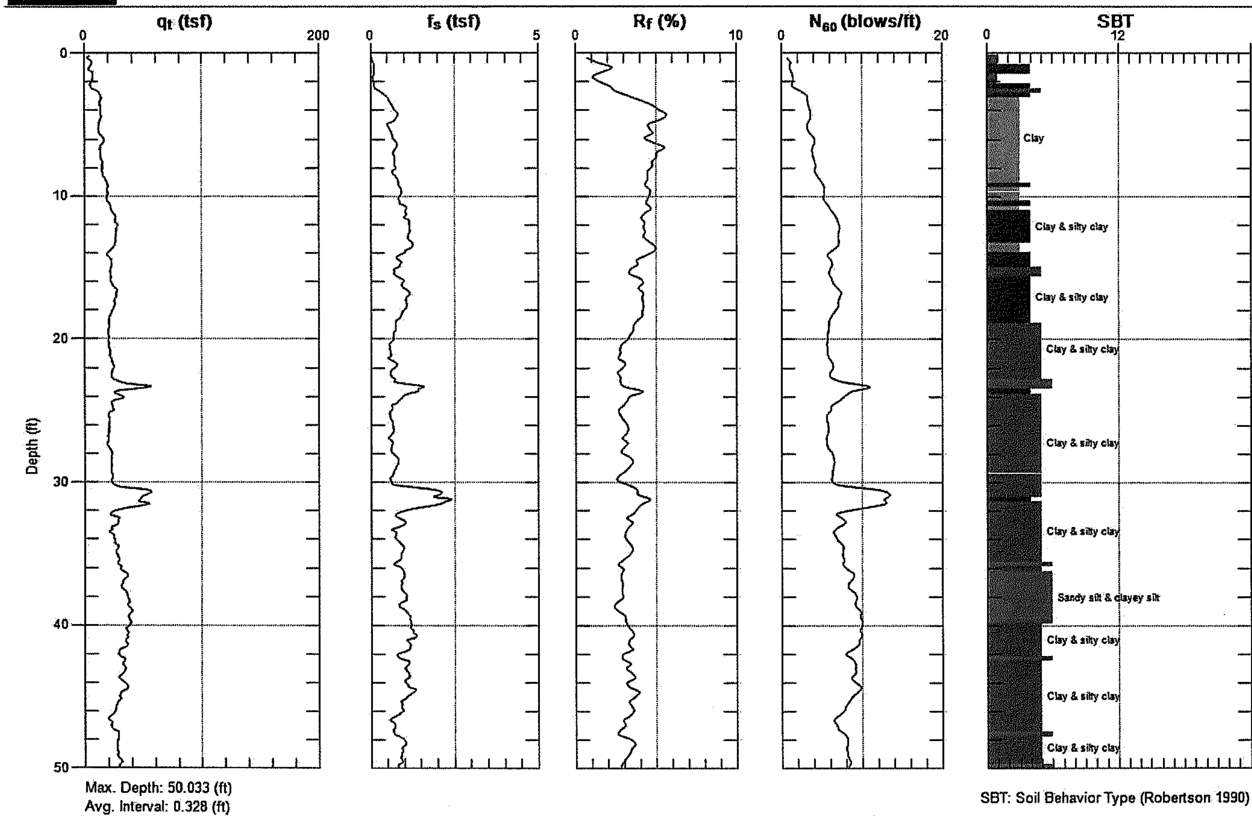


Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

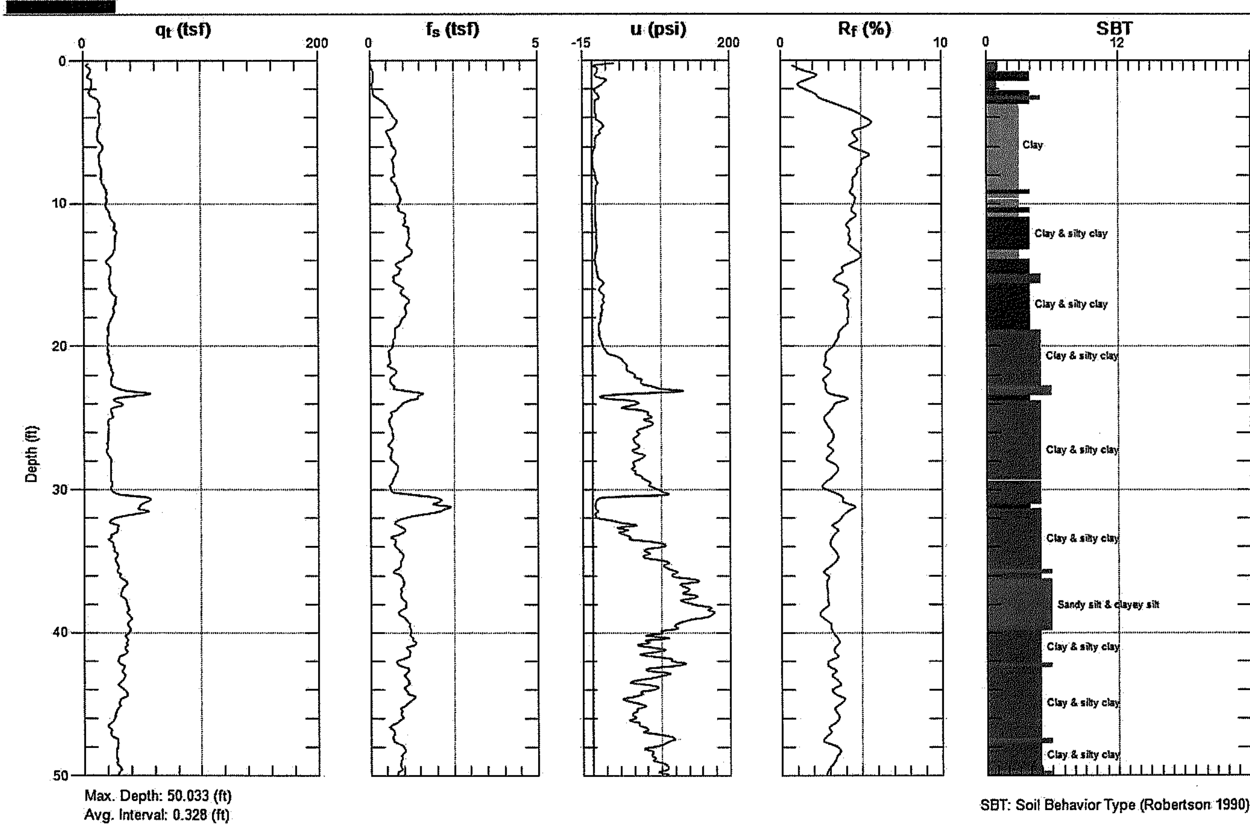
PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-13
Engineer: E.MITCHELL
Date: 2/13/2009 08:13



PACIFIC CREST ENGINEERING

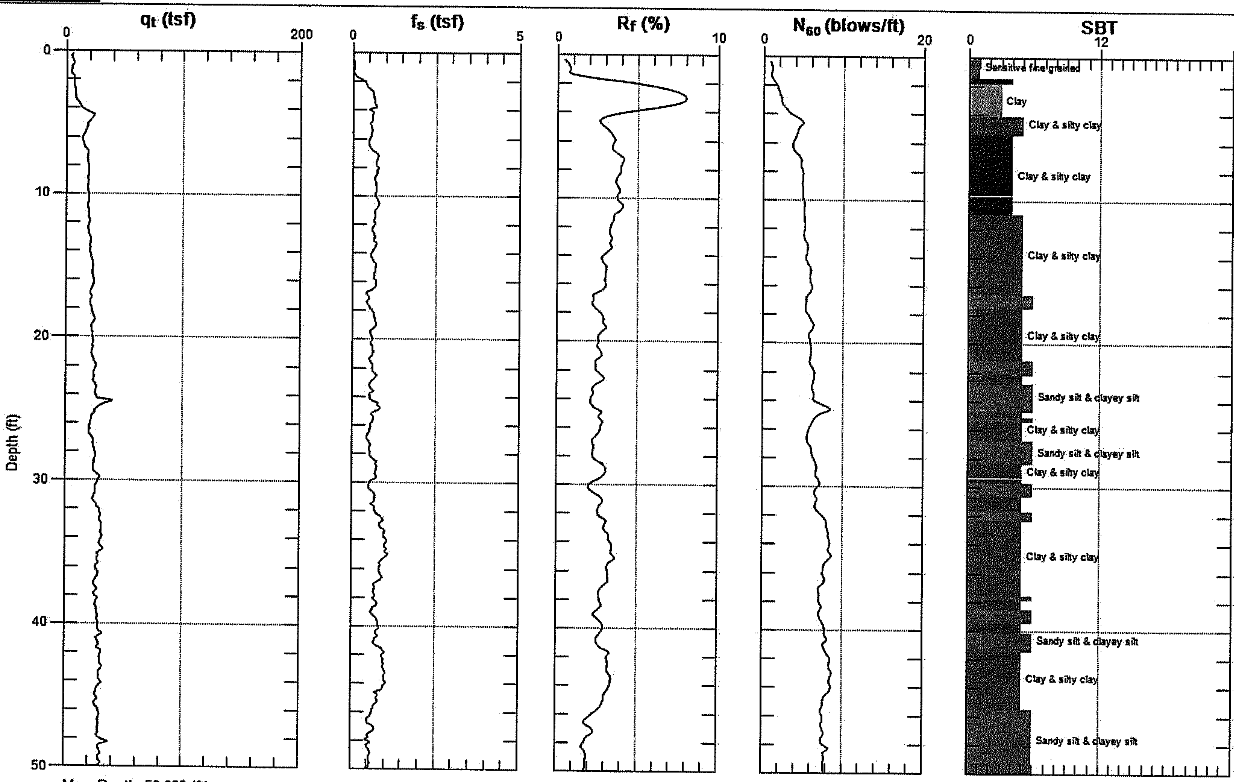
Site: ATKINSON LANE
Sounding: CPT-13
Engineer: E.MITCHELL
Date: 2/13/2009 08:13



GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-14

Engineer: E.MITCHELL
Date: 2/13/2009 09:02



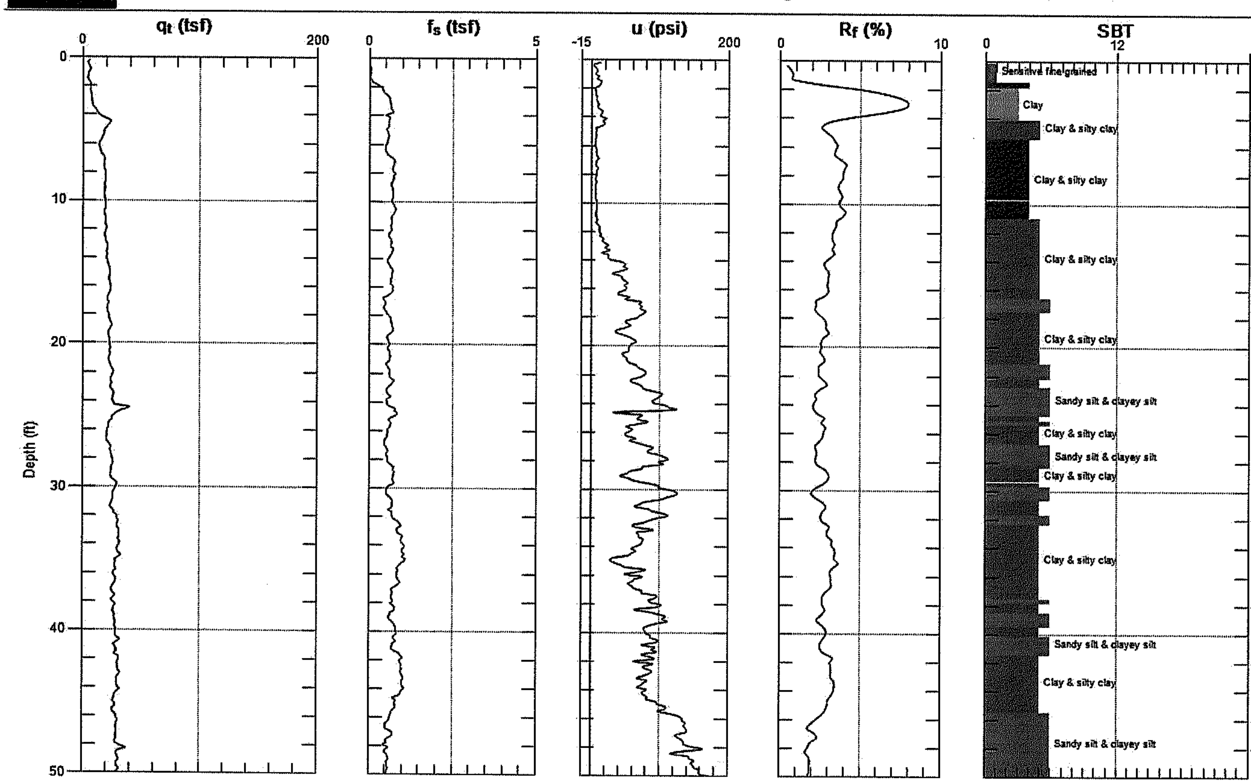
Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-14

Engineer: E.MITCHELL
Date: 2/13/2009 09:02

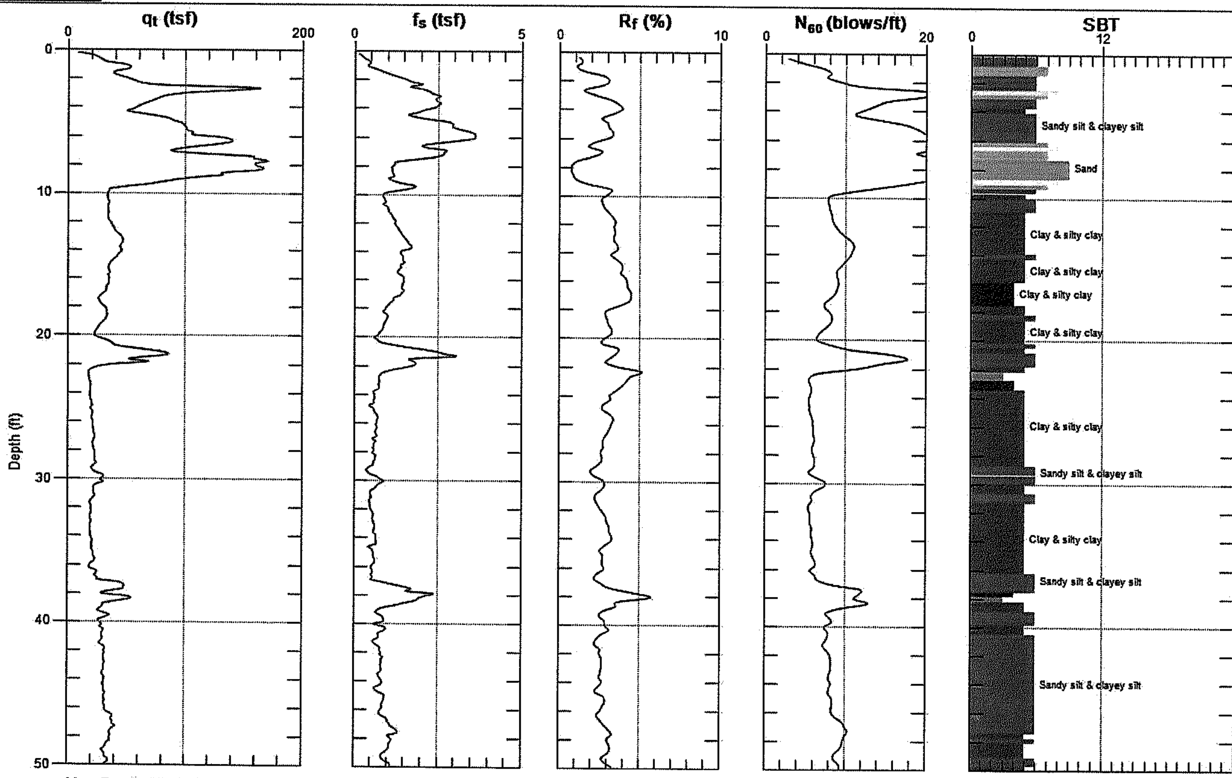


Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE | Engineer: E.MITCHELL
Sounding: CPT-15 | Date: 2/13/2009 09:49

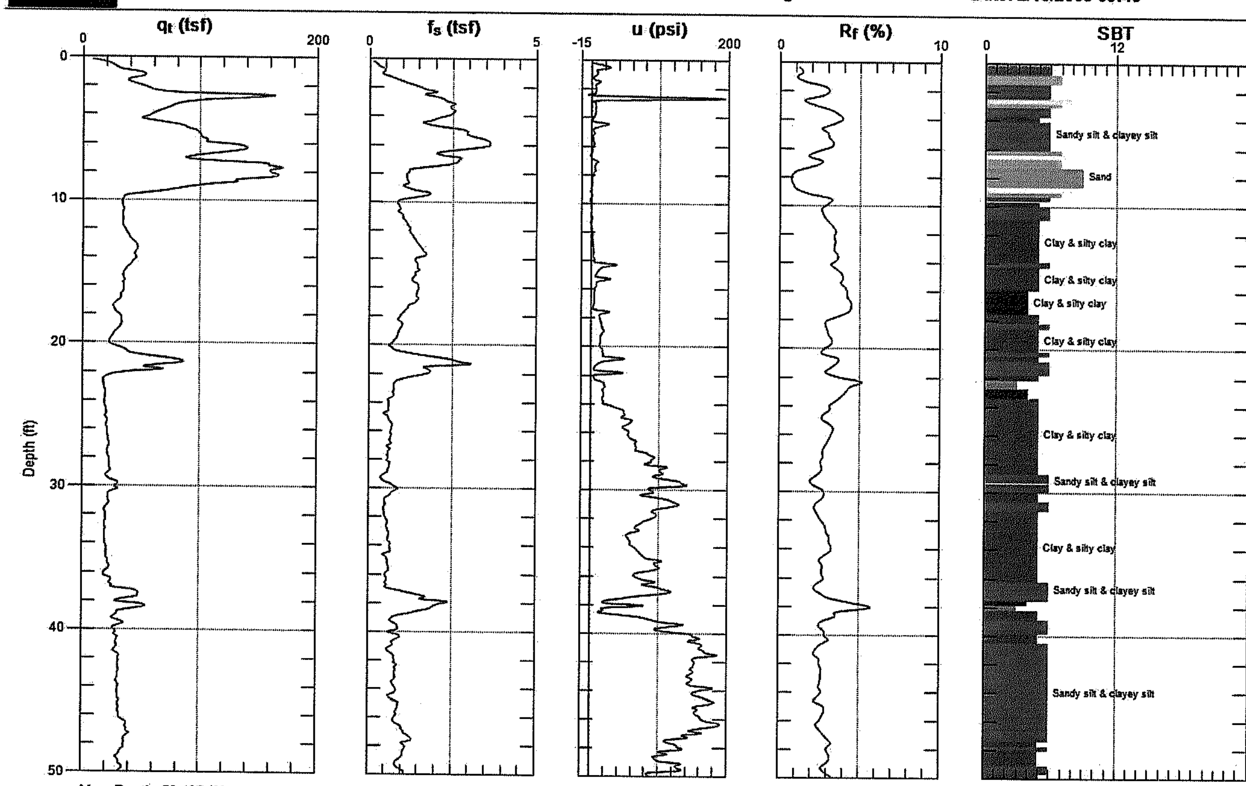


Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG PACIFIC CREST ENGINEERING

Site: ATKINSON LANE | Engineer: E.MITCHELL
Sounding: CPT-15 | Date: 2/13/2009 09:49

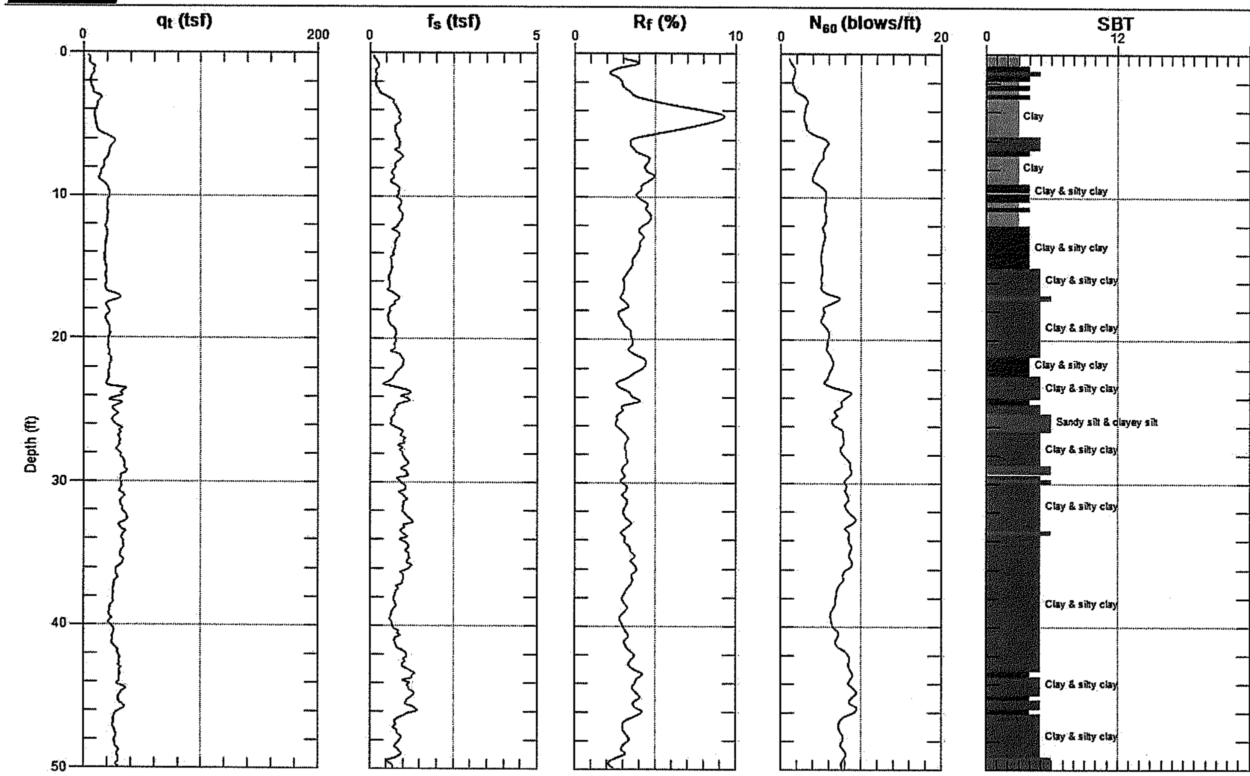


Max. Depth: 50.197 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-16
Engineer: E.MITCHELL
Date: 2/13/2009 11:18

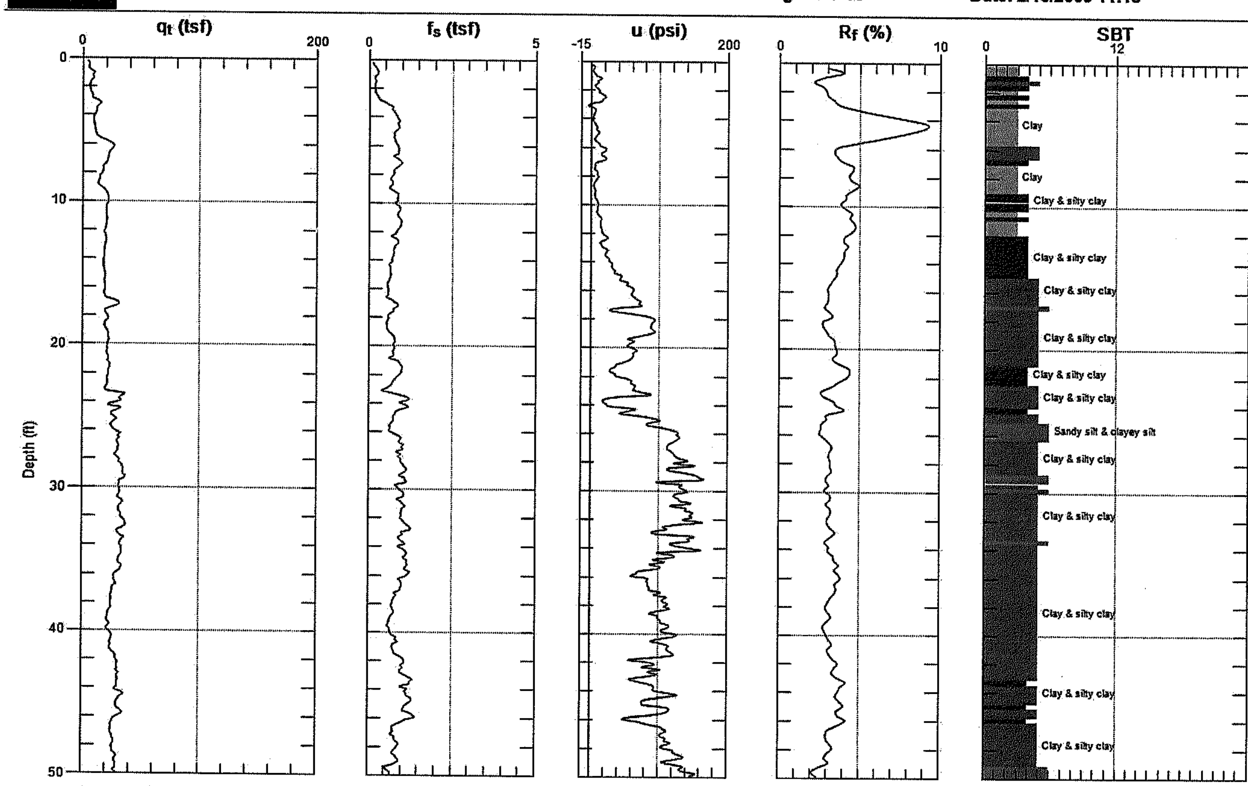


Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PACIFIC CREST ENGINEERING

Site: ATKINSON LANE
Sounding: CPT-16
Engineer: E.MITCHELL
Date: 2/13/2009 11:18



Max. Depth: 50.033 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

RBF Consulting
March 2, 2009

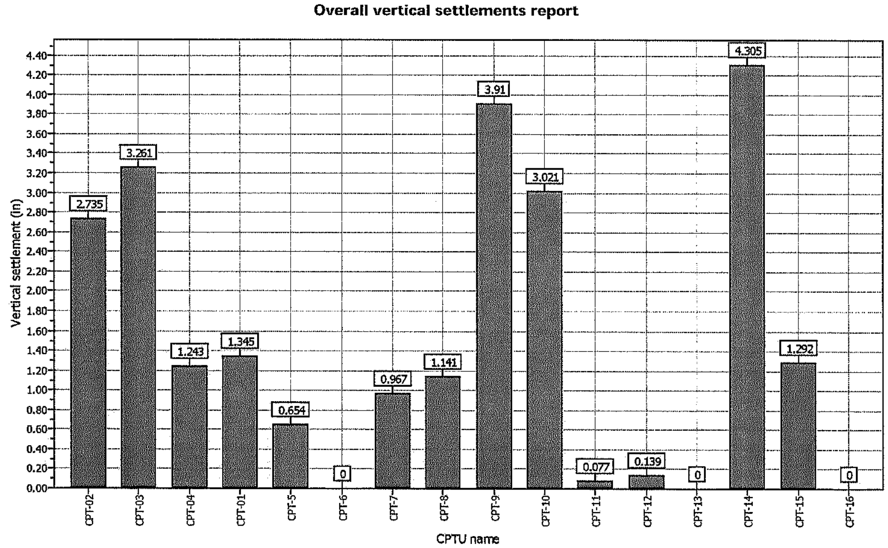
Project No. 0829-SZ77-H62

APPENDIX C

Preliminary Liquefaction and Lateral Spreading Analysis

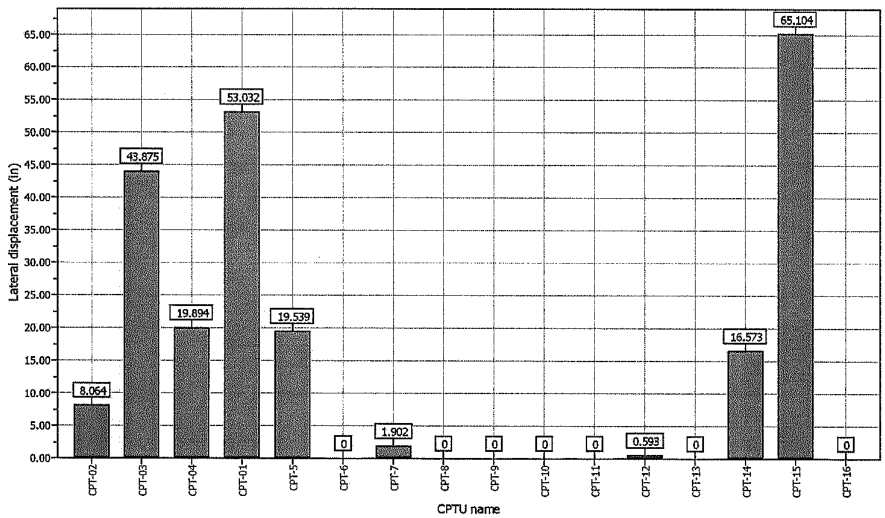
GEOLOGISMIKI Geotechnical Software

Overall vertical settlements report



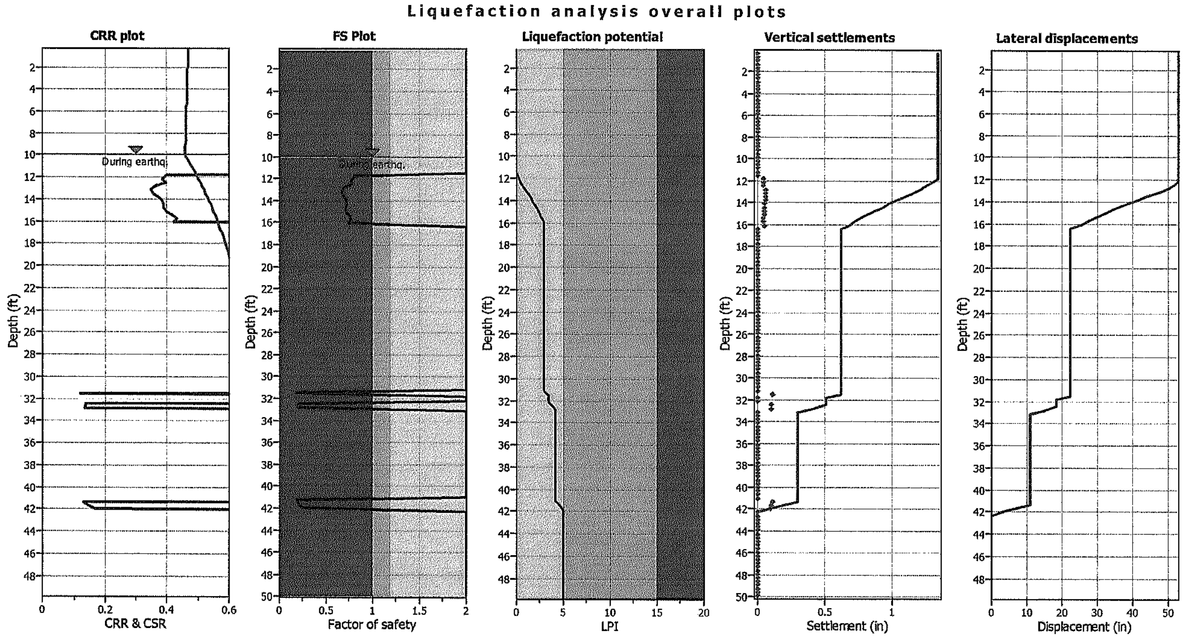
GEOLOGISMIKI
Geotechnical Software

Overall lateral displacements report



CPT name: CPT-01

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Fill height:	N/A	Limit depth:	N/A

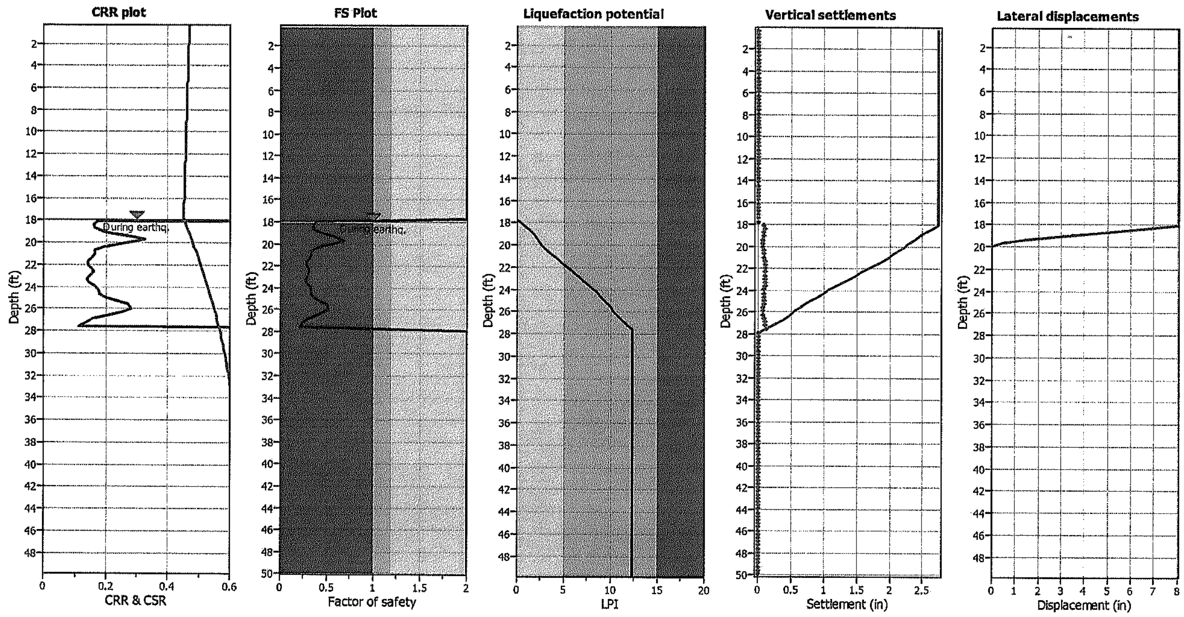
F.S. color scheme
- Liquefied
- Marginally liquefied
- Non-liquefied

LPI color scheme
- Very high risk
- High risk
- Low risk

This software is licensed to: Pacific Crest Engineering

CPT name: CPT-02

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	18.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	28.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme
- Liquefied
- Marginally liquefied
- Non-liquefied

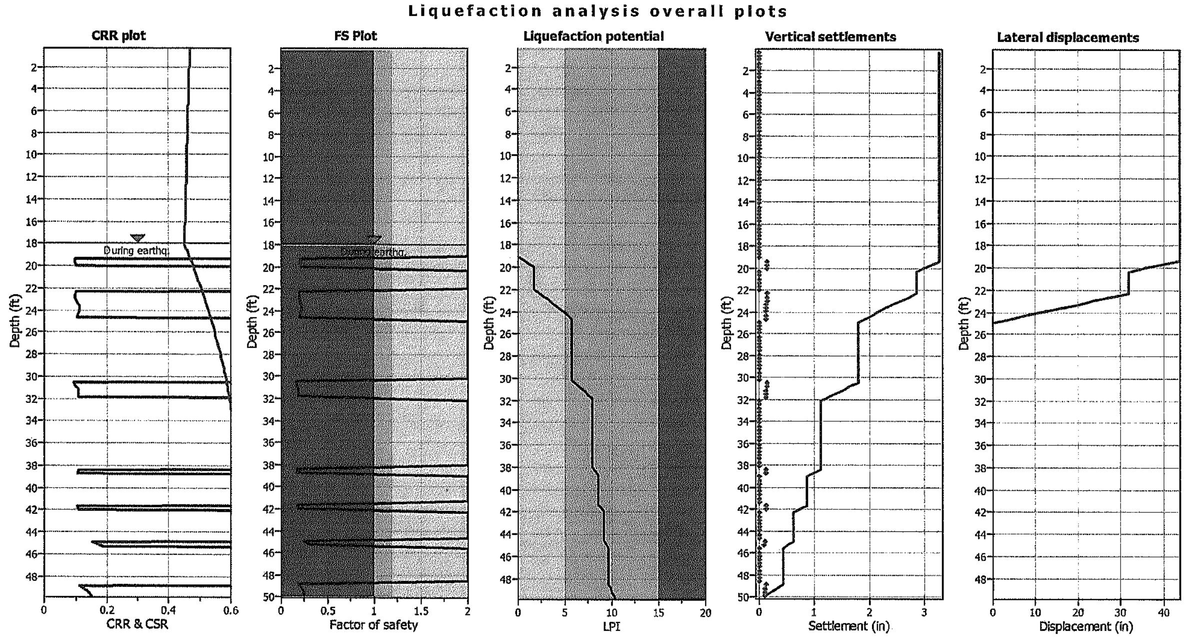
LPI color scheme
- Very high risk
- High risk
- Low risk

CLiq v.1.3.0.48 - CPT Liquefaction Assessment Software - Report created on: 3/2/2009, 3:19:48 PM
Project file: H:\PF\2008\0829\Liquefaction\Lateral Displacement CPT 1 to 16 limit depth to 2H.clq

This software is licensed to: Pacific Crest Engineering

CPT name: CPT-03

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	18.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	27.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme
- Liquefied
- Marginally liquefied
- Non-liquefied

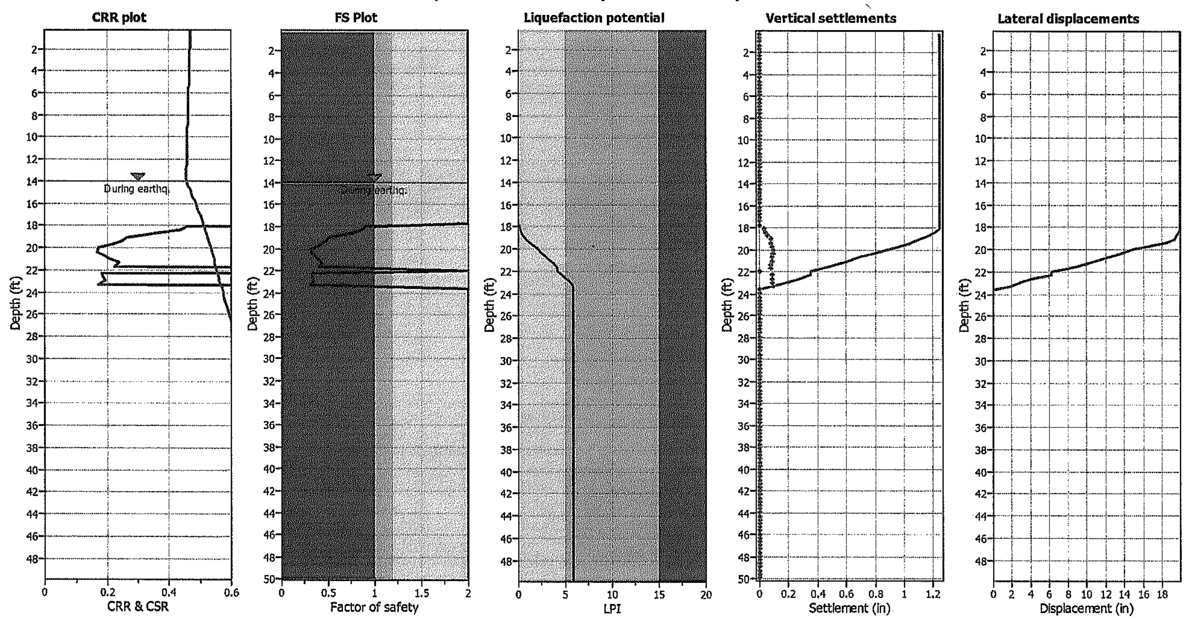
LPI color scheme
- Very high risk
- High risk
- Low risk

CLiq v.1.3.0.48 - CPT Liquefaction Assessment Software - Report created on: 3/2/2009, 3:19:49 PM
Project file: H:\PF\2008\0829\Liquefaction\Lateral Displacement CPT 1 to 16 limit depth to 2H.clq

This software is licensed to: Pacific Crest Engineering

CPT name: CPT-04

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	14.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme: Liquefied; Marginally liquefied; Non-liquefied

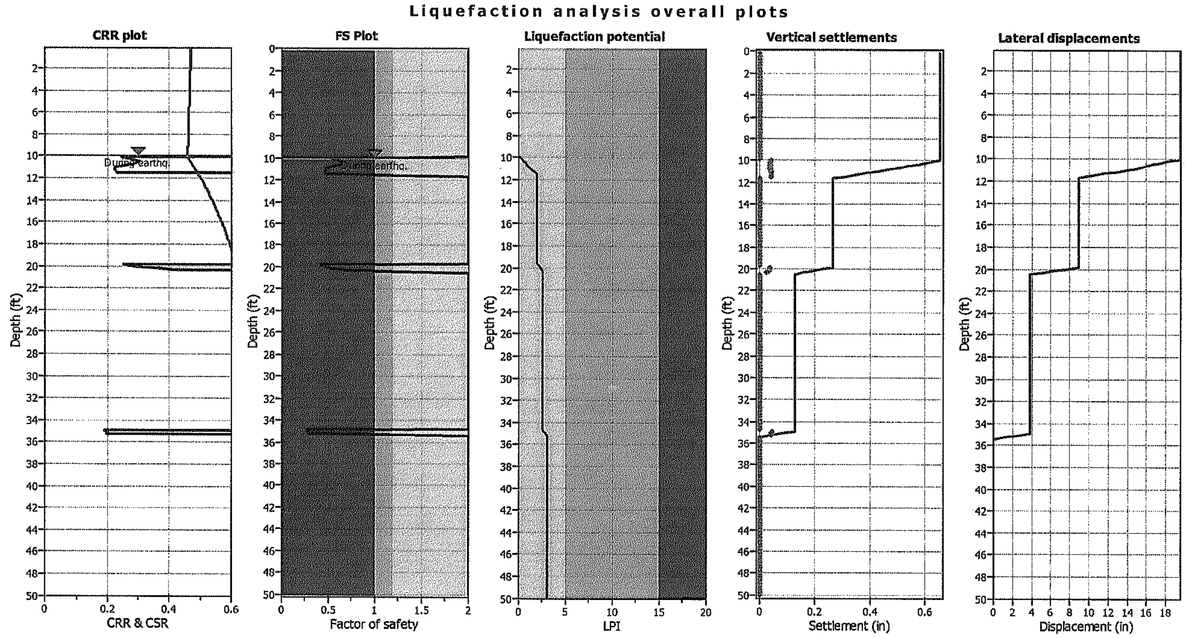
LPI color scheme: Very high risk; High risk; Low risk

CLiq v.1.3.0.48 - CPT Liquefaction Assessment Software - Report created on: 3/2/2009, 3:19:50 PM
Project file: H:\PF\2008\0829\Liquefaction\Lateral Displacement CPT 1 to 16 limit depth to 2H.clq

This software is licensed to: Pacific Crest Engineering

CPT name: CPT-5

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	10.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme: Liquefied; Marginally liquefied; Non-liquefied

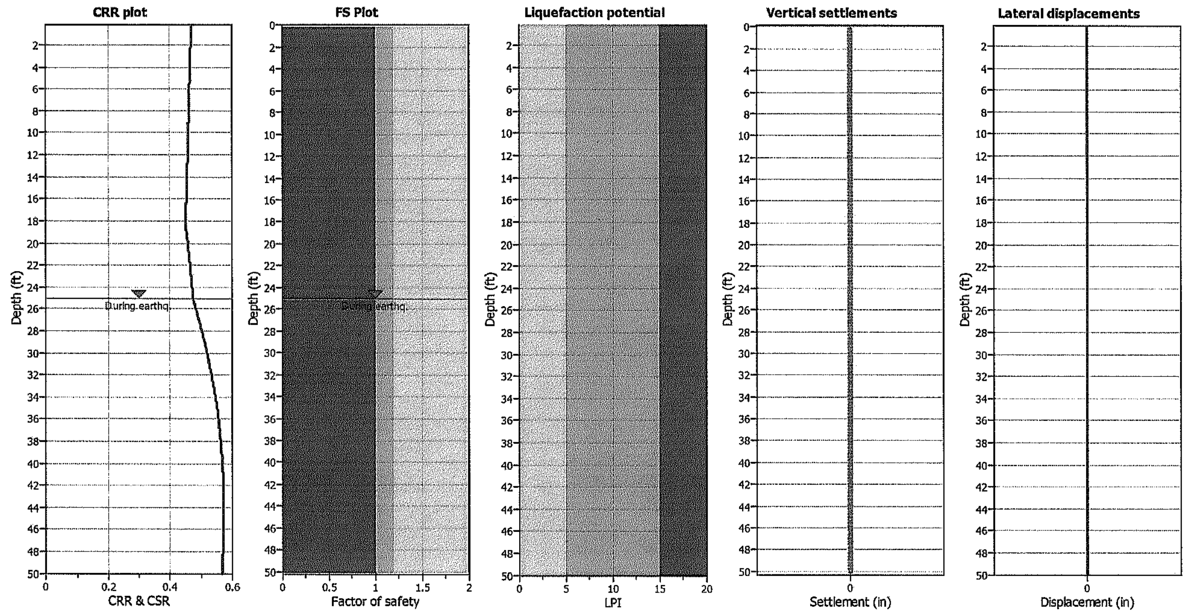
LPI color scheme: Very high risk; High risk; Low risk

CLiq v.1.3.0.48 - CPT Liquefaction Assessment Software - Report created on: 3/2/2009, 3:19:54 PM
Project file: H:\PF\2008\0829\Liquefaction\Lateral Displacement CPT 1 to 16 limit depth to 2H.clq

This software is licensed to: Pacific Crest Engineering

CPT name: CPT-6

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	25.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme
- Liquefied
- Marginally liquefied
- Non-liquefied

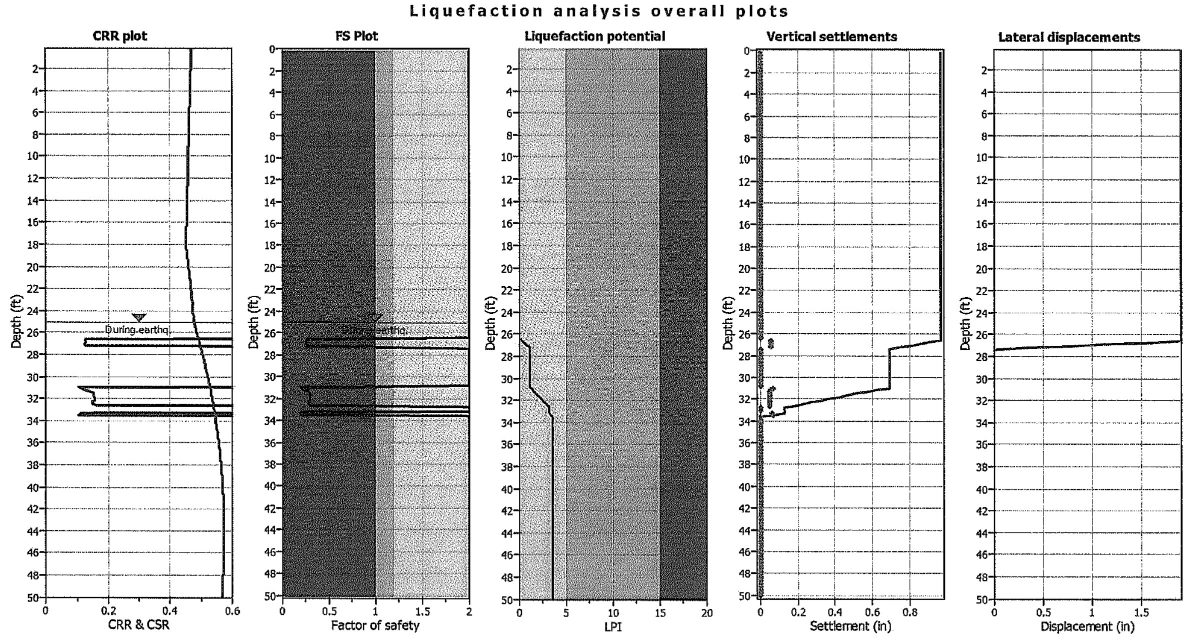
LPI color scheme
- Very high risk
- High risk
- Low risk

CLiq v.1.3.0.48 - CPT Liquefaction Assessment Software - Report created on: 3/2/2009, 3:19:56 PM
Project file: H:\PF\2008\0829\Liquefaction\Lateral Displacement CPT 1 to 16 limit depth to 2H.clq

This software is licensed to: Pacific Crest Engineering

CPT name: CPT-7

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	25.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme
- Liquefied
- Marginally liquefied
- Non-liquefied

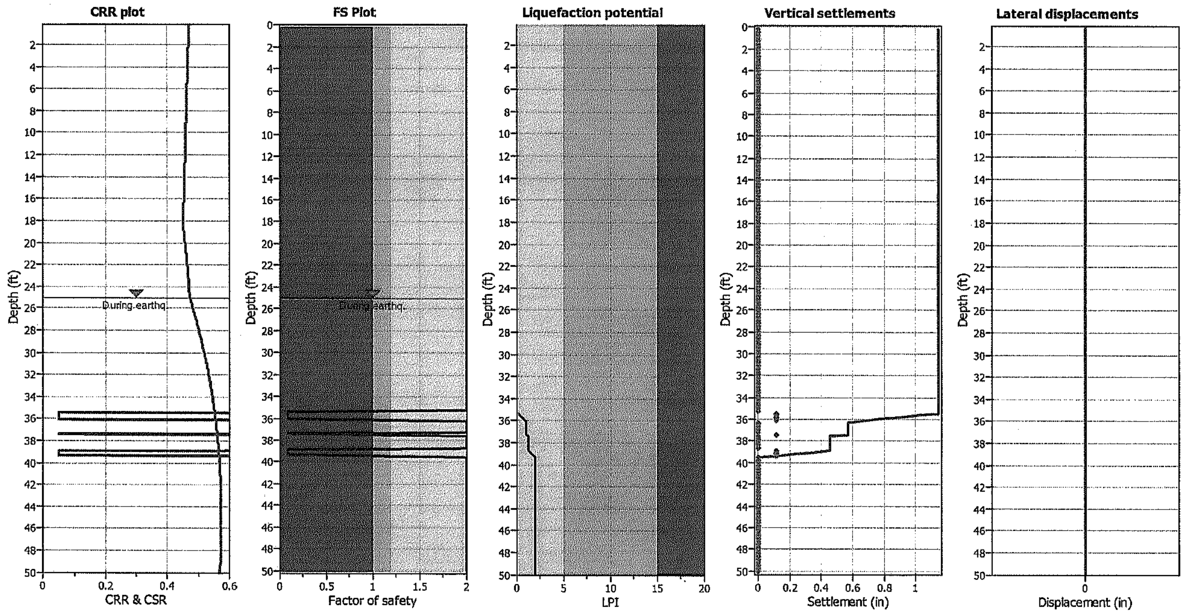
LPI color scheme
- Very high risk
- High risk
- Low risk

CLiq v.1.3.0.48 - CPT Liquefaction Assessment Software - Report created on: 3/2/2009, 3:19:58 PM
Project file: H:\PF\2008\0829\Liquefaction\Lateral Displacement CPT 1 to 16 limit depth to 2H.clq

This software is licensed to: Pacific Crest Engineering

CPT name: CPT-8

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	25.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme
- Liquefied
- Marginally liquefied
- Non-liquefied

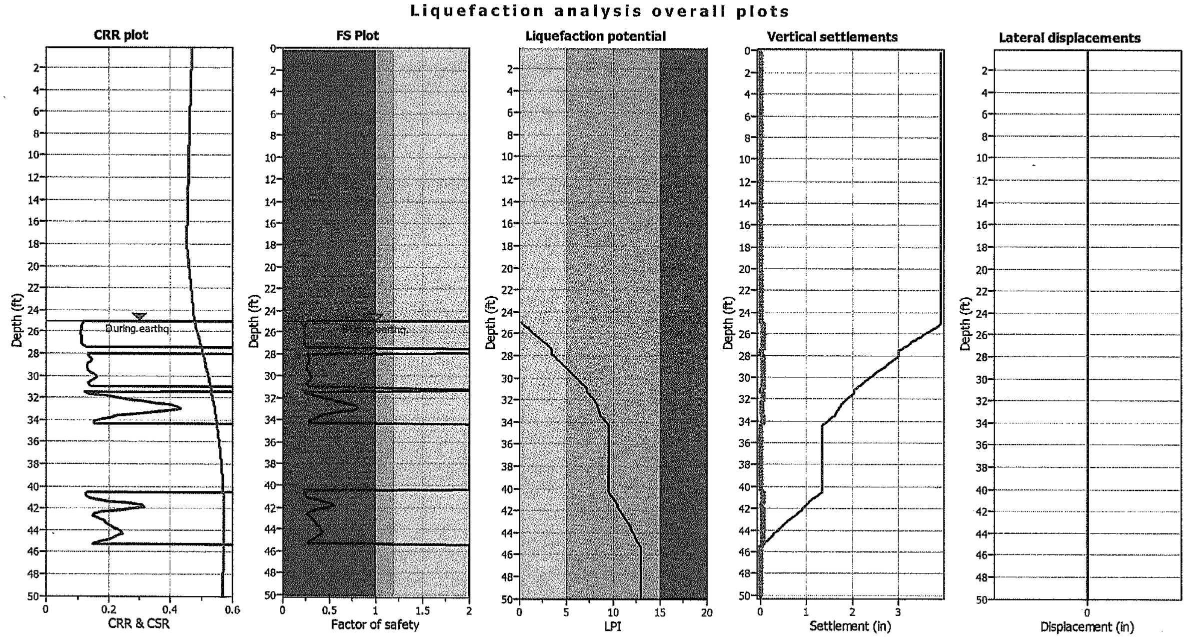
LPI color scheme
- Very high risk
- High risk
- Low risk

CLiq v.1.3.0.48 - CPT Liquefaction Assessment Software - Report created on: 3/2/2009, 3:20:01 PM
Project file: H:\PF\2008\0829\Liquefaction\Lateral Displacement CPT 1 to 16 limit depth to 2H.clq

This software is licensed to: Pacific Crest Engineering

CPT name: CPT-9

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	25.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme
- Liquefied
- Marginally liquefied
- Non-liquefied

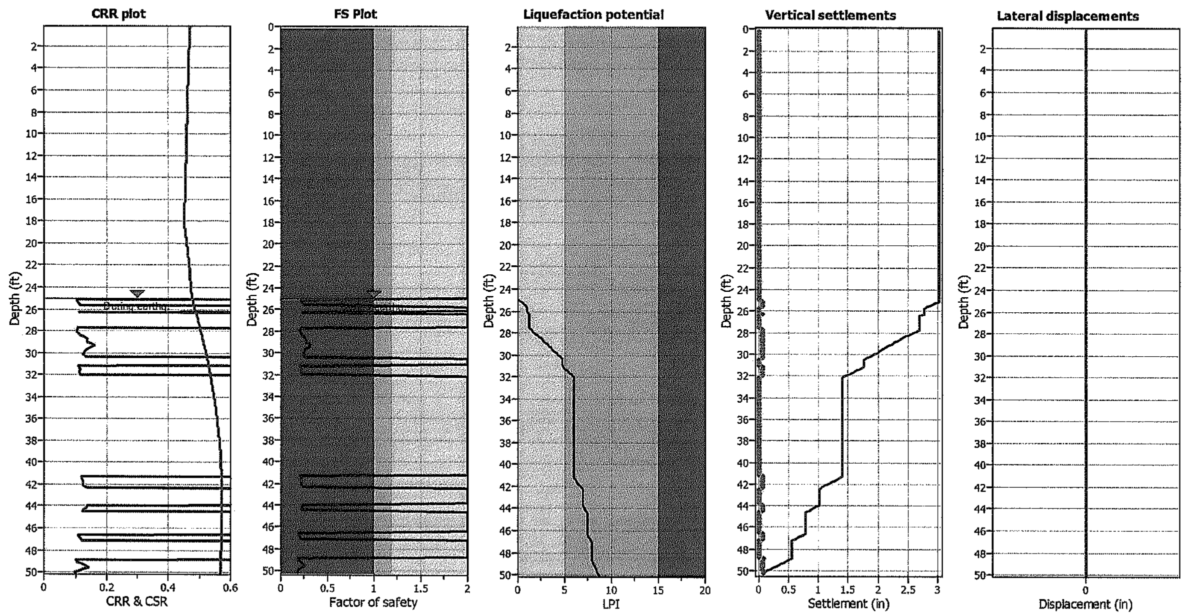
LPI color scheme
- Very high risk
- High risk
- Low risk

CLiq v.1.3.0.48 - CPT Liquefaction Assessment Software - Report created on: 3/2/2009, 3:20:03 PM
Project file: H:\PF\2008\0829\Liquefaction\Lateral Displacement CPT 1 to 16 limit depth to 2H.clq

This software is licensed to: Pacific Crest Engineering

CPT name: CPT-10

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	25.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme
- Liquefied
- Marginally liquefied
- Non-liquefied

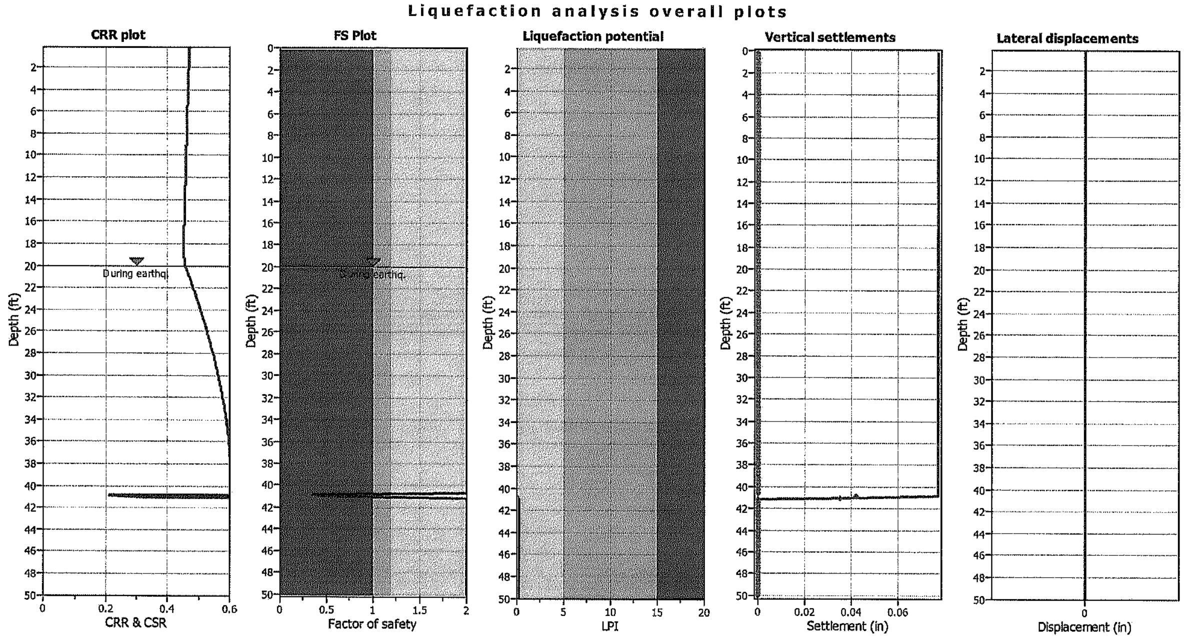
LPI color scheme
- Very high risk
- High risk
- Low risk

CLiq v.1.3.0.48 - CPT Liquefaction Assessment Software - Report created on: 3/2/2009, 3:20:06 PM
Project file: H:\PF\2008\0829\Liquefaction\Lateral Displacement CPT 1 to 16 limit depth to 2H.clq

This software is licensed to: Pacific Crest Engineering

CPT name: CPT-11

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme
- Liquefied
- Marginally liquefied
- Non-liquefied

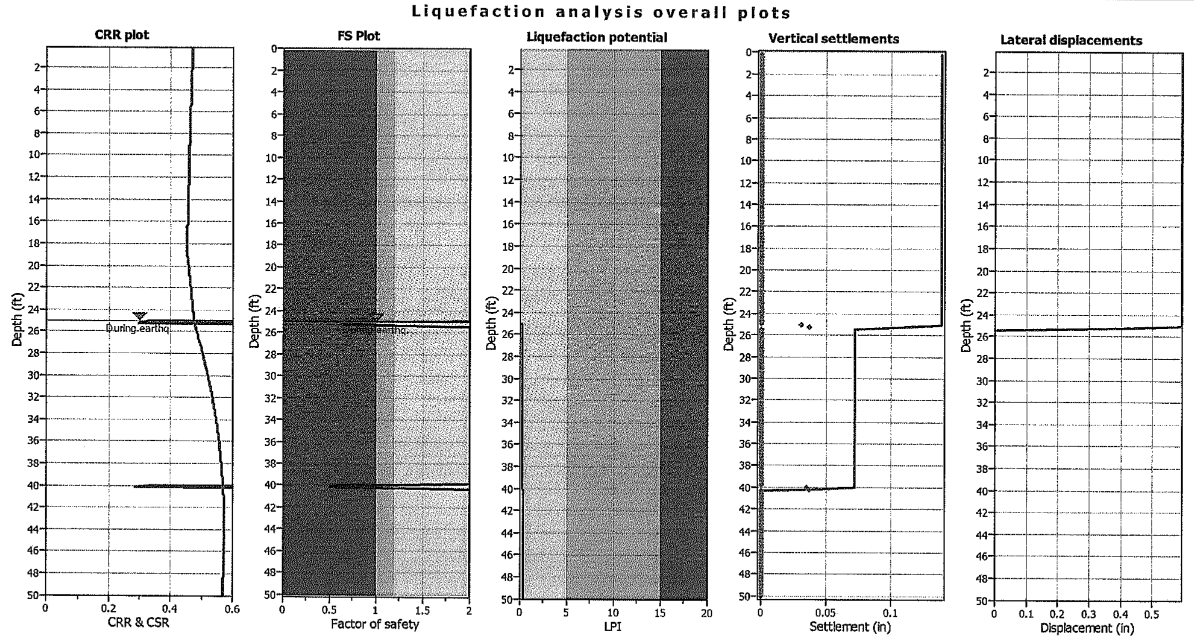
LPI color scheme
- Very high risk
- High risk
- Low risk

CLiq v.1.3.0.48 - CPT Liquefaction Assessment Software - Report created on: 3/2/2009, 3:20:08 PM
Project file: H:\PF\2008\0829\Liquefaction\Lateral Displacement CPT 1 to 16 limit depth to 2H.clq

This software is licensed to: Pacific Crest Engineering

CPT name: CPT-12

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	25.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	35.00 ft	Fill height:	N/A	Limit depth:	N/A

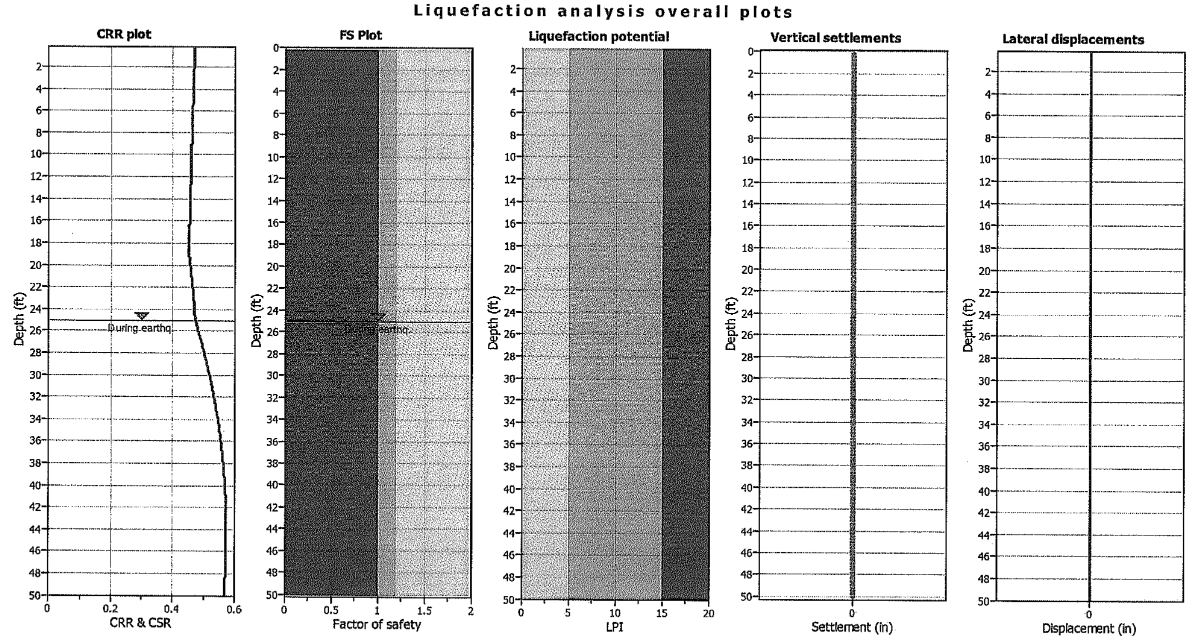
F.S. color scheme
- Liquefied
- Marginally liquefied
- Non-liquefied

LPI color scheme
- Very high risk
- High risk
- Low risk

This software is licensed to: Pacific Crest Engineering

CPT name: CPT-13

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	25.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	35.00 ft	Fill height:	N/A	Limit depth:	N/A

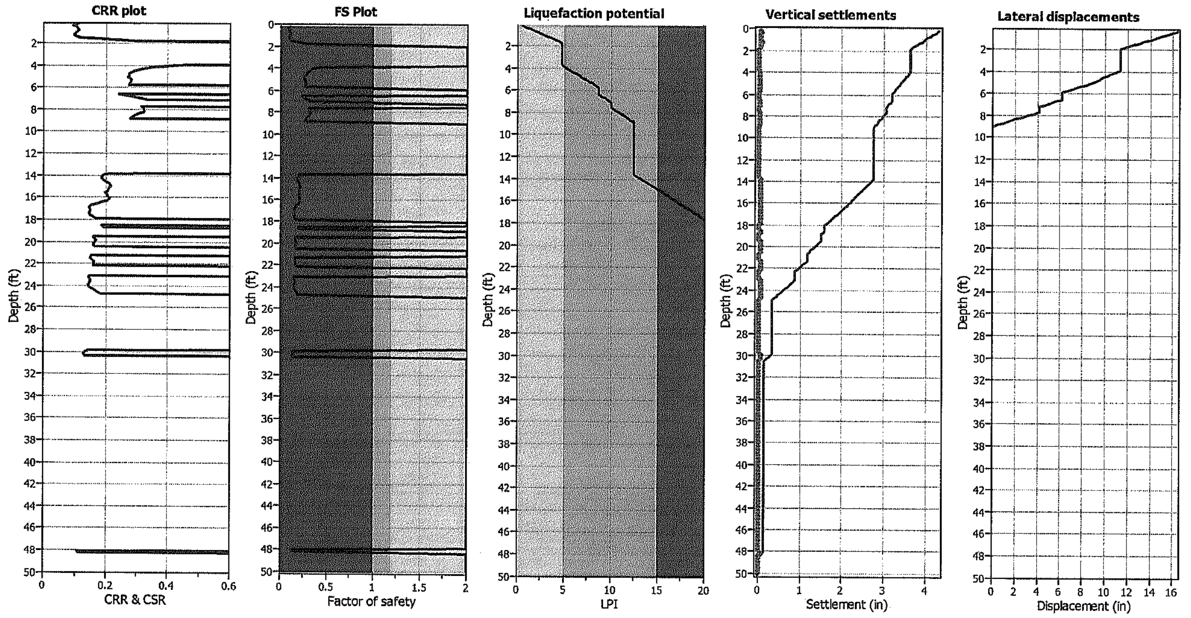
F.S. color scheme
- Liquefied
- Marginally liquefied
- Non-liquefied

LPI color scheme
- Very high risk
- High risk
- Low risk

This software is licensed to: Pacific Crest Engineering

CPT name: CPT-14

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	0.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	6.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Liquefied
- Marginally liquefied
- Non-liquefied

LPI color scheme

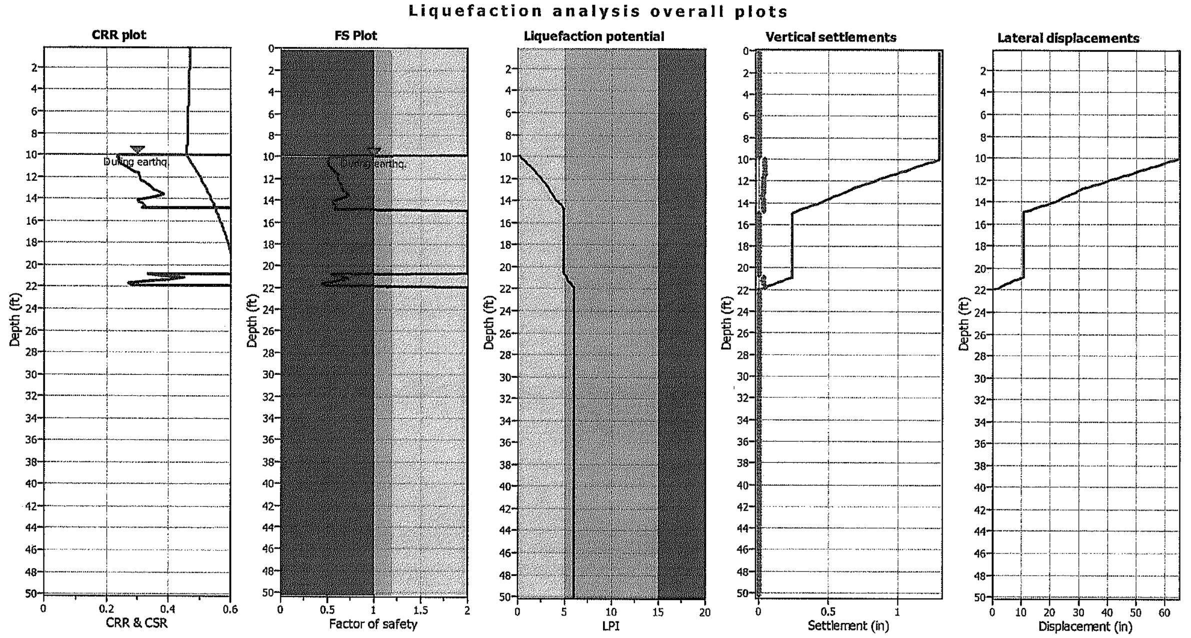
- Very high risk
- High risk
- Low risk

CLiq v.1.3.0.48 - CPT Liquefaction Assessment Software - Report created on: 3/2/2009, 3:20:20 PM
Project file: H:\PF\2008\0829\Liquefaction\Lateral Displacement CPT 1 to 16 limit depth to 2H.clq

This software is licensed to: Pacific Crest Engineering

CPT name: CPT-15

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Liquefied
- Marginally liquefied
- Non-liquefied

LPI color scheme

- Very high risk
- High risk
- Low risk

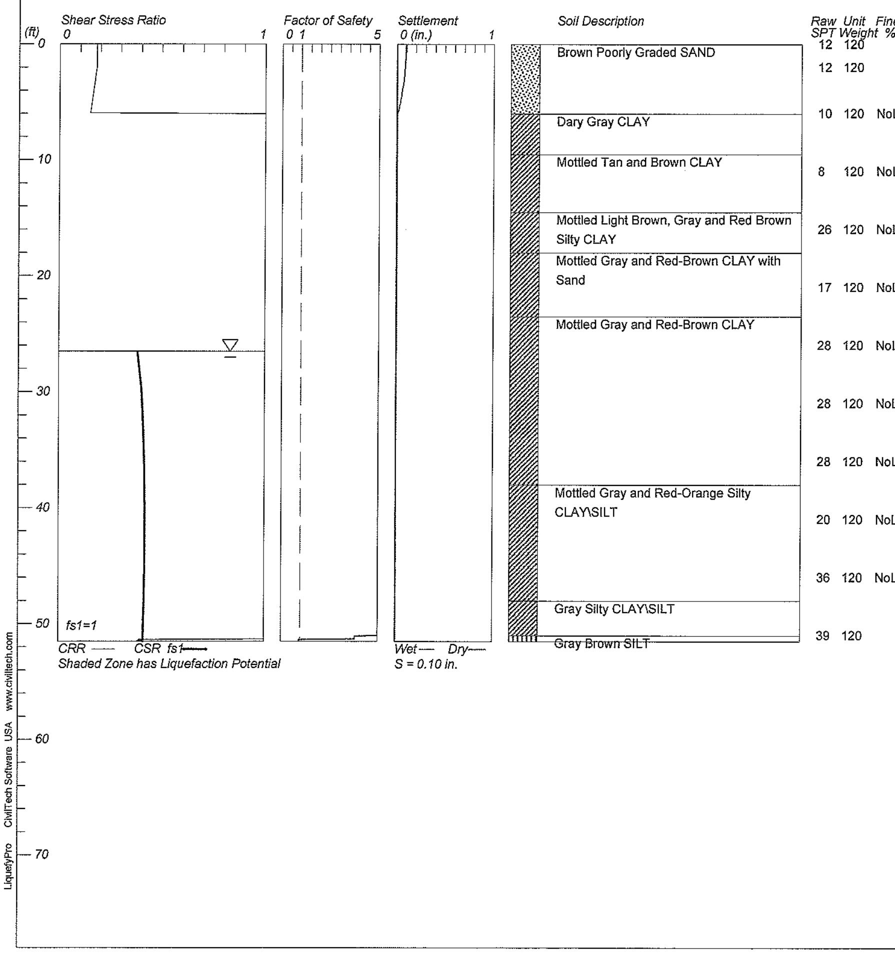
CLiq v.1.3.0.48 - CPT Liquefaction Assessment Software - Report created on: 3/2/2009, 3:21:03 PM
Project file: H:\PF\2008\0829\Liquefaction\Lateral Displacement CPT 1 to 16 limit depth to 2H.clq

LIQUEFACTION ANALYSIS

Atkinson Lane

Hole No.=B-4 Water Depth=26.5 ft

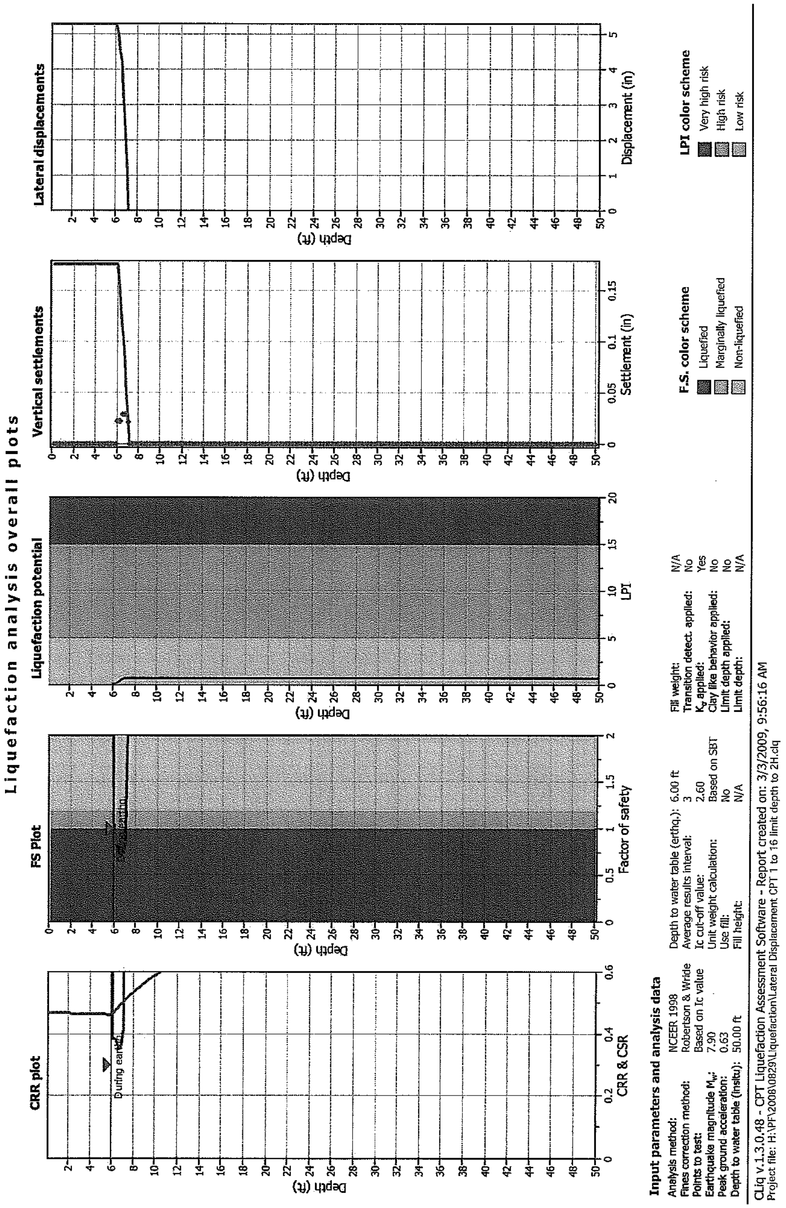
Magnitude=7.9
Acceleration=0.63g



CivilTech Corporation   Boring No.4   Plate A-1

This software is licensed to: Pacific Crest Engineering   CPT name: CPT-16

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER 1998	Depth to water table (erthq.):	6.00 ft	Fill weight:	N/A
Fines correction method:	Robertson & Wride	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	No
Peak ground acceleration:	0.63	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme
- Liquefied
- Marginally liquefied
- Non-liquefied

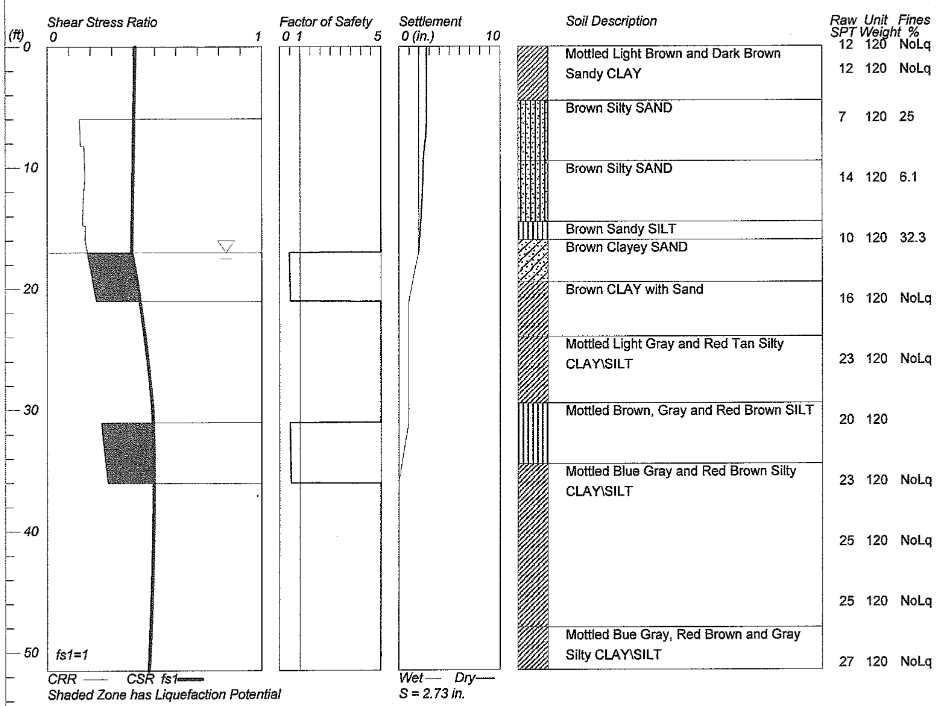
LPI color scheme
- Very high risk
- High risk
- Low risk

CLiq v.1.3.0.48 - CPT Liquefaction Assessment Software - Report created on: 3/3/2009, 9:56:16 AM
Project file: H:\PF\2008\0829\Liquefaction\Lateral Displacement CPT 1 to 16 limit depth to 2H.clq

LIQUEFACTION ANALYSIS
Atkinson Lane

Hole No.=B-6 *Water Depth=17 ft*

Magnitude=7.9
Acceleration=0.63g

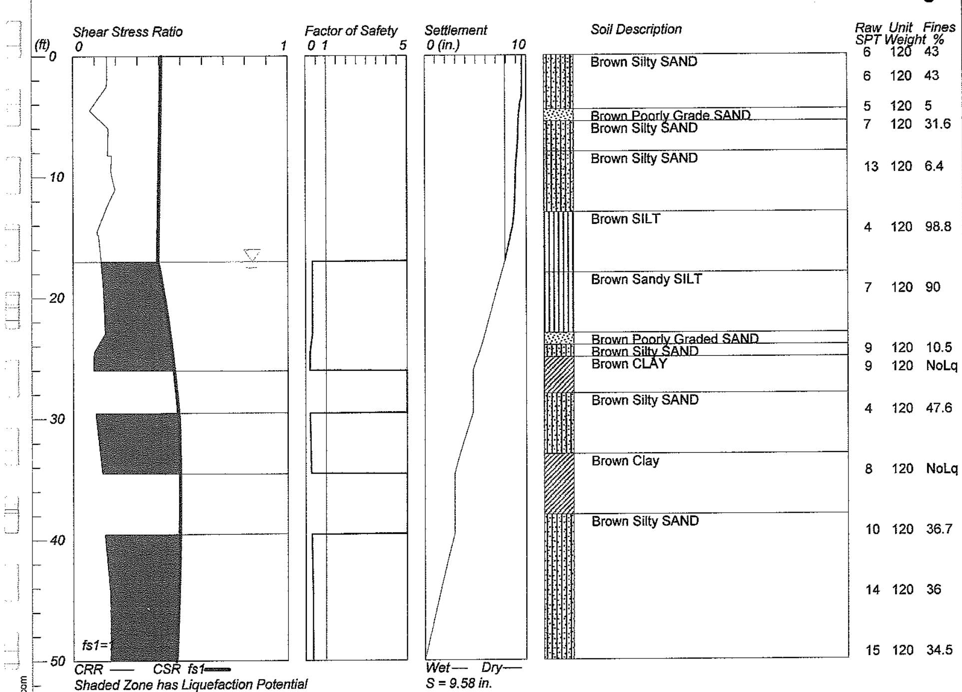


Pacific Crest Engineering Inc. **Boring No.6** **Plate A-1**

LIQUEFACTION ANALYSIS
Atkinson Lane

Hole No.=B-8 *Water Depth=17 ft*

Magnitude=7.9
Acceleration=0.63g

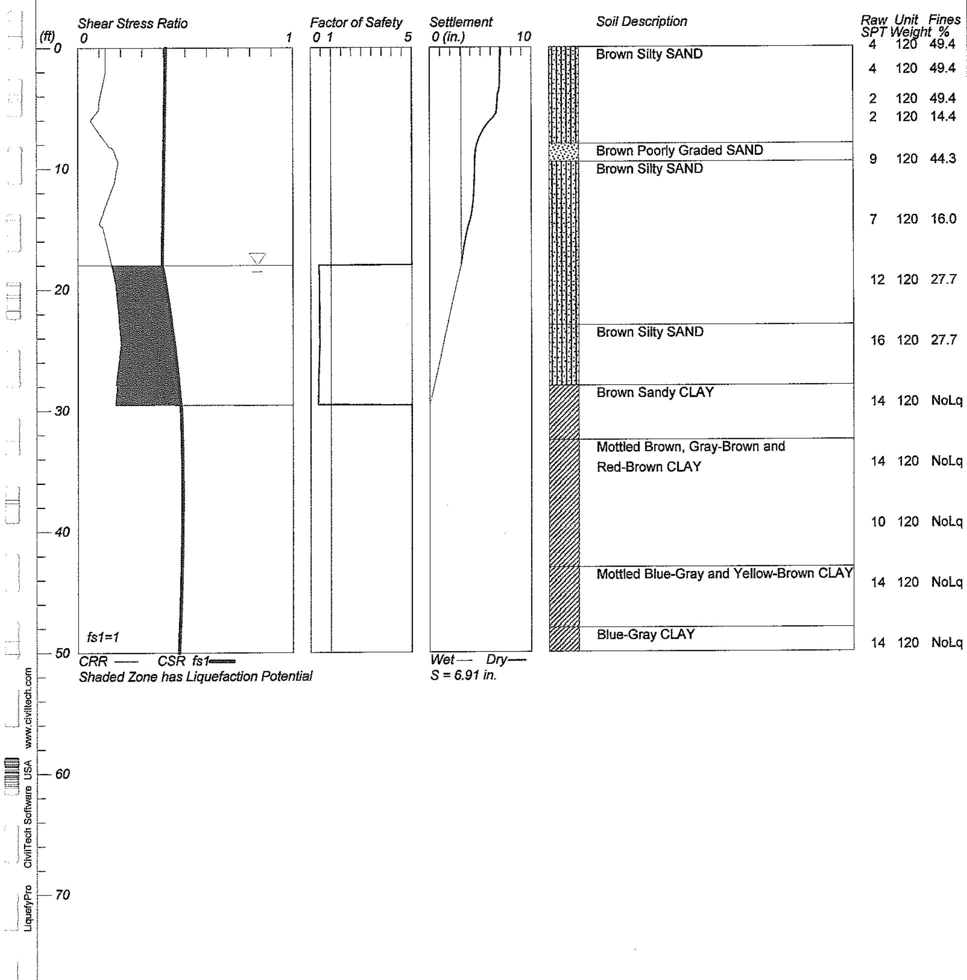


Pacific Crest Engineering Inc. **Boring No.8** **Plate A-1**

LIQUEFACTION ANALYSIS
Atkinson Lane

Hole No.=B-10   Water Depth=18 ft

Magnitude=7.9
Acceleration=0.63g

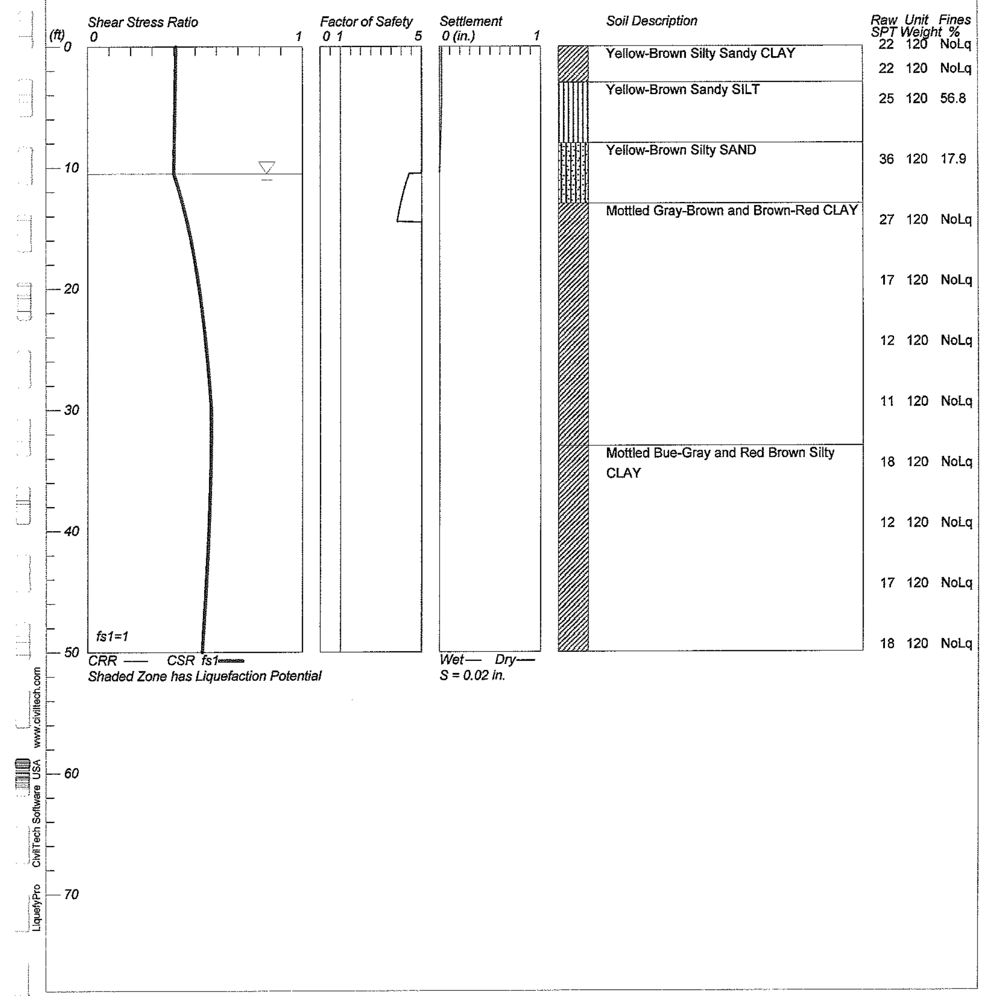


Pacific Crest Engineering Inc.   **Boring No.10**   **Plate A-1**

LIQUEFACTION ANALYSIS
Atkinson Lane

Hole No.=B-11   Water Depth=10.5 ft

Magnitude=7.9
Acceleration=0.63g

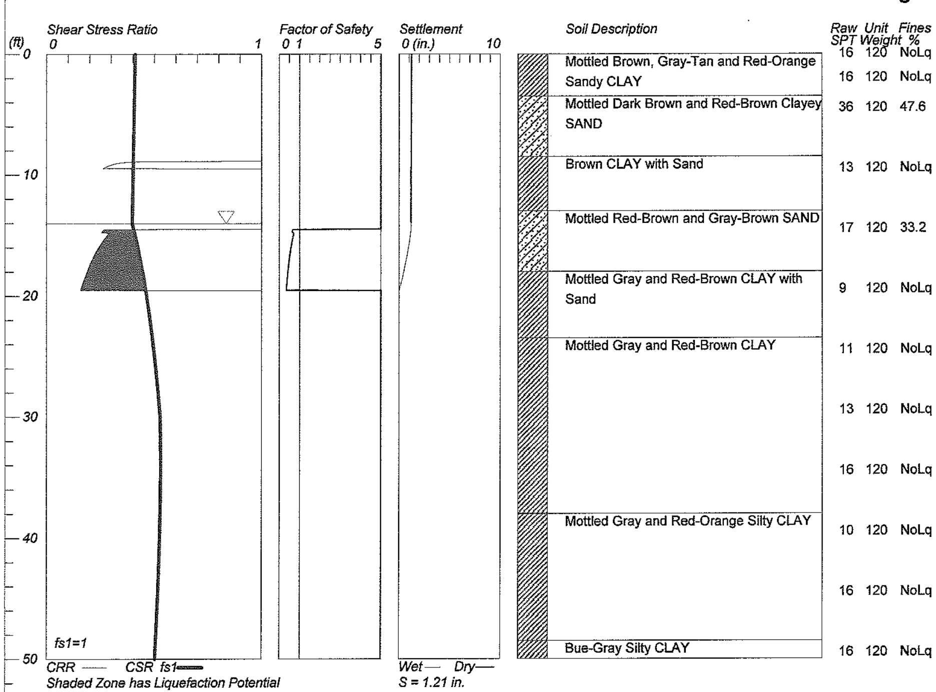


Pacific Crest Engineering Inc.   **Boring No.11**   **Plate A-1**

LIQUEFACTION ANALYSIS
Atkinson Lane

Hole No.=B-12   Water Depth=14 ft

Magnitude=7.9
Acceleration=0.63g

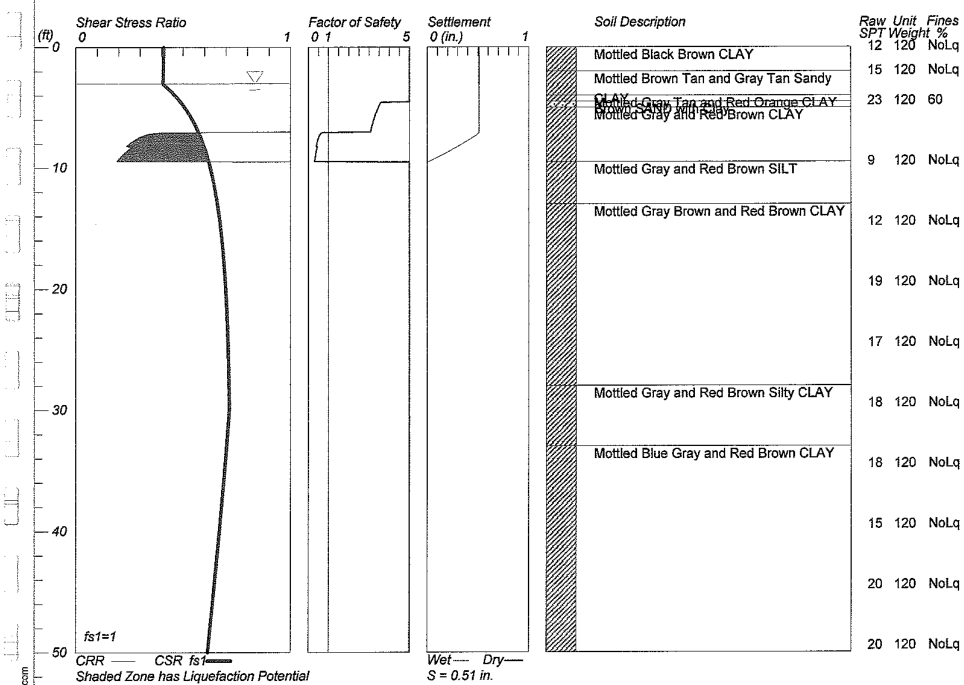


Pacific Crest Engineering Inc.   **Boring No.12**   **Plate A-1**

LIQUEFACTION ANALYSIS
Atkinson Lane

Hole No.=B-16   Water Depth=3 ft

Magnitude=7.9
Acceleration=0.63g



Pacific Crest Engineering Inc.   **Boring No.16**   **Plate A-1**

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LIQUEFACTION ANALYSIS CALCULATION SHEET

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Input File Name: H:\PF\2008\0829\Liquefaction\B-4.liq
Title: Atkinson Lane
Subtitle: Boring No.4

Surface Elev.=
Hole No.=B-4
Depth of Hole= 51.5 ft
Water Table during Earthquake= 26.5 ft
Water Table during In-Situ Testing= 36.5 ft
Max. Acceleration= 0.63 g
Earthquake Magnitude= 7.9

Input Data:
Surface Elev.=
Hole No.=B-4
Depth of Hole=51.5 ft
Water Table during Earthquake= 26.5 ft
Water Table during In-Situ Testing= 36.5 ft
Max. Acceleration=0.63 g
Earthquake Magnitude=7.9

Earthquake Magnitude=7.9
2. Settlement Analysis Method: Ishihara / Yoshimine*
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1
Plot one CSR curve (fs1=1)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.0	12.0	120.0	0.0
2.0	12.0	120.0	0.0
6.0	10.0	120.0	NoLiq
11.0	8.0	120.0	NoLiq
16.0	26.0	120.0	NoLiq
21.0	17.0	120.0	NoLiq
26.0	28.0	120.0	NoLiq
31.0	28.0	120.0	NoLiq
36.0	28.0	120.0	NoLiq
41.0	20.0	120.0	NoLiq
46.0	36.0	120.0	NoLiq

51.0	39.0	120.0	0.0

Output Results:
Settlement of saturated sands=0.01 in.
Settlement of dry sands=0.09 in.
Total settlement of saturated and dry sands=0.10 in.
Differential Settlement=0.048 to 0.063 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.18	0.41	5.00	0.01	0.09	0.10
2.00	0.18	0.41	5.00	0.01	0.08	0.08
4.00	0.17	0.41	5.00	0.01	0.05	0.06
6.00	2.00	0.40	5.00	0.01	0.00	0.01
8.00	2.00	0.40	5.00	0.01	0.00	0.01
10.00	2.00	0.40	5.00	0.01	0.00	0.01
12.00	2.00	0.40	5.00	0.01	0.00	0.01
14.00	2.00	0.40	5.00	0.01	0.00	0.01
16.00	2.00	0.39	5.00	0.01	0.00	0.01
18.00	2.00	0.39	5.00	0.01	0.00	0.01
20.00	2.00	0.39	5.00	0.01	0.00	0.01
22.00	2.00	0.39	5.00	0.01	0.00	0.01
24.00	2.00	0.39	5.00	0.01	0.00	0.01
26.00	2.00	0.38	5.00	0.01	0.00	0.01
28.00	2.00	0.39	5.00	0.01	0.00	0.01
30.00	2.00	0.41	5.00	0.01	0.00	0.01
32.00	2.00	0.41	5.00	0.01	0.00	0.01
34.00	2.00	0.41	5.00	0.01	0.00	0.01
36.00	2.00	0.42	5.00	0.01	0.00	0.01
38.00	2.00	0.42	5.00	0.01	0.00	0.01
40.00	2.00	0.42	5.00	0.01	0.00	0.01
42.00	2.00	0.42	5.00	0.01	0.00	0.01
44.00	2.00	0.42	5.00	0.01	0.00	0.01
46.00	2.00	0.42	5.00	0.01	0.00	0.01
48.00	2.00	0.42	5.00	0.01	0.00	0.01
50.00	2.00	0.42	5.00	0.01	0.00	0.01

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

CRRm Cyclic resistance ratio from soils
CSRfs Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRfs
S_sat Settlement from saturated sands
S_dry Settlement from dry sands
S_all Total settlement from saturated and dry sands
NoLiq No-Liquefy Soils

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LIQUEFACTION ANALYSIS CALCULATION SHEET

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Input File Name: H:\PF\2008\0829\Liquefaction\B-6.liq
Title: Atkinson Lane
Subtitle: Boring No.6

Surface Elev.=
Hole No.=B-6
Depth of Hole= 51.5 ft
Water Table during Earthquake= 17.0 ft
Water Table during In-Situ Testing= 27.0 ft
Max. Acceleration= 0.63 g
Earthquake Magnitude= 7.9

Input Data:
Surface Elev.=
Hole No.=B-6
Depth of Hole=51.5 ft
Water Table during Earthquake= 17.0 ft
Water Table during In-Situ Testing= 27.0 ft
Max. Acceleration=0.63 g
Earthquake Magnitude=7.9

Earthquake Magnitude=7.9
2. Settlement Analysis Method: Ishihara / Yoshimine*
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1
Plot one CSR curve (fs1=1)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.0	12.0	120.0	NoLiq
2.0	12.0	120.0	NoLiq
6.0	7.0	120.0	25.0
11.0	14.0	120.0	6.1
16.0	10.0	120.0	32.3
21.0	16.0	120.0	NoLiq
26.0	23.0	120.0	NoLiq
31.0	20.0	120.0	32.3
36.0	23.0	120.0	NoLiq
41.0	25.0	120.0	NoLiq
46.0	25.0	120.0	NoLiq
51.0	27.0	120.0	NoLiq

Output Results:
Settlement of saturated sands=1.94 in.
Settlement of dry sands=0.80 in.
Total settlement of saturated and dry sands=2.73 in.
Differential Settlement=1.367 to 1.805 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.41	5.00	1.94	0.80	2.73
2.00	2.00	0.41	5.00	1.94	0.80	2.73
4.00	2.00	0.41	5.00	1.94	0.80	2.73
6.00	0.15	0.40	5.00	1.94	0.80	2.73
8.00	0.15	0.40	5.00	1.94	0.63	2.57
10.00	0.17	0.40	5.00	1.94	0.46	2.40
12.00	0.17	0.40	5.00	1.94	0.38	2.31
14.00	0.17	0.40	5.00	1.94	0.25	2.19
16.00	0.18	0.39	5.00	1.94	0.09	2.02
18.00	0.20	0.40	0.49*	1.68	0.00	1.68
20.00	0.22	0.42	0.51*	1.19	0.00	1.19
22.00	2.00	0.44	5.00	0.95	0.00	0.95
24.00	2.00	0.46	5.00	0.95	0.00	0.95
26.00	2.00	0.47	5.00	0.95	0.00	0.95
28.00	2.00	0.48	5.00	0.95	0.00	0.95
30.00	2.00	0.49	5.00	0.95	0.00	0.95
32.00	0.26	0.49	0.52*	0.76	0.00	0.76
34.00	0.27	0.50	0.54*	0.37	0.00	0.37
36.00	0.28	0.50	0.57*	0.01	0.00	0.01
38.00	2.00	0.50	5.00	0.00	0.00	0.00
40.00	2.00	0.50	5.00	0.00	0.00	0.00
42.00	2.00	0.49	5.00	0.00	0.00	0.00
44.00	2.00	0.49	5.00	0.00	0.00	0.00
46.00	2.00	0.49	5.00	0.00	0.00	0.00
48.00	2.00	0.48	5.00	0.00	0.00	0.00
50.00	2.00	0.48	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

CRRm	Cyclic resistance ratio from soils
CSRfs	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRfs
S_sat	Settlement from saturated sands
S_dry	Settlement from dry sands
S_all	Total settlement from saturated and dry sands
NoLiq	No-Liquefy Soils

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LIQUEFACTION ANALYSIS CALCULATION SHEET

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Input File Name: H:\PF\2008\0829\Liquefaction\B-8.liq
Title: Atkinson Lane
Subtitle: Boring No.8

Surface Elev.=
Hole No.=B-8
Depth of Hole= 50.0 ft
Water Table during Earthquake= 17.0 ft
Water Table during In-Situ Testing= 27.0 ft
Max. Acceleration= 0.63 g
Earthquake Magnitude= 7.9

Input Data:
Surface Elev.=
Hole No.=B-8
Depth of Hole=50.0 ft
Water Table during Earthquake= 17.0 ft
Water Table during In-Situ Testing= 27.0 ft
Max. Acceleration=0.63 g
Earthquake Magnitude=7.9

Earthquake Magnitude=7.9
2. Settlement Analysis Method: Ishihara / Yoshimine*
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1
Plot one CSR curve (fs1=1)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.0	6.0	120.0	43.0
2.0	6.0	120.0	43.0
4.5	5.0	120.0	5.0
6.0	7.0	120.0	31.6
9.5	13.0	120.0	6.4
14.5	4.0	120.0	98.8
19.5	7.0	120.0	90.0
24.5	9.0	120.0	10.5
26.0	9.0	120.0	NoLiq
29.5	4.0	120.0	47.6
34.5	8.0	120.0	NoLiq

39.5	10.0	120.0	36.7
44.5	14.0	120.0	36.0
49.5	15.0	120.0	34.5

Output Results:
Settlement of saturated sands=7.89 in.
Settlement of dry sands=1.69 in.
Total settlement of saturated and dry sands=9.58 in.
Differential Settlement=4.790 to 6.323 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.16	0.41	5.00	7.89	1.69	9.58
2.00	0.16	0.41	5.00	7.89	1.67	9.57
4.00	0.10	0.41	5.00	7.89	1.49	9.38
6.00	0.16	0.40	5.00	7.89	1.32	9.21
8.00	0.16	0.40	5.00	7.89	1.20	9.09
10.00	0.18	0.40	5.00	7.89	1.05	8.95
12.00	0.17	0.40	5.00	7.89	0.98	8.87
14.00	0.12	0.40	5.00	7.89	0.77	8.67
16.00	0.12	0.39	5.00	7.89	0.27	8.16
18.00	0.13	0.40	0.33*	7.55	0.00	7.55
20.00	0.14	0.42	0.34*	6.88	0.00	6.88
22.00	0.15	0.44	0.33*	6.24	0.00	6.24
24.00	0.11	0.46	0.25*	5.57	0.00	5.57
26.00	0.09	0.47	0.20*	4.75	0.00	4.75
28.00	2.00	0.48	5.00	4.72	0.00	4.72
30.00	0.11	0.49	0.22*	4.55	0.00	4.55
32.00	0.12	0.49	0.24*	3.80	0.00	3.80
34.00	0.13	0.50	0.27*	3.09	0.00	3.09
36.00	2.00	0.50	5.00	2.91	0.00	2.91
38.00	2.00	0.50	5.00	2.91	0.00	2.91
40.00	0.15	0.50	0.30*	2.77	0.00	2.77
42.00	0.16	0.49	0.32*	2.17	0.00	2.17
44.00	0.17	0.49	0.35*	1.61	0.00	1.61
46.00	0.17	0.49	0.35*	1.07	0.00	1.07
48.00	0.17	0.48	0.36*	0.53	0.00	0.53
50.00	0.17	0.48	0.36*	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

CRRm Cyclic resistance ratio from soils
CSRfs Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRfs
S_sat Settlement from saturated sands
S_dry Settlement from dry sands
S_all Total settlement from saturated and dry sands
NoLiq No-Liquefy Soils

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LIQUEFACTION ANALYSIS CALCULATION SHEET

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Input File Name: H:\PF\2008\0829\Liquefaction\B-10.liq
Title: Atkinson Lane
Subtitle: Boring No.10

Surface Elev.=
Hole No.=B-10
Depth of Hole= 50.0 ft
Water Table during Earthquake= 18.0 ft
Water Table during In-Situ Testing= 28.0 ft
Max. Acceleration= 0.63 g
Earthquake Magnitude= 7.9

Input Data:
Surface Elev.=
Hole No.=B-10
Depth of Hole=50.0 ft
Water Table during Earthquake= 18.0 ft
Water Table during In-Situ Testing= 28.0 ft
Max. Acceleration=0.63 g
Earthquake Magnitude=7.9

Earthquake Magnitude=7.9
2. Settlement Analysis Method: Ishihara / Yoshimine*
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1
Plot one CSR curve (fs1=1)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.0	4.0	120.0	49.4
2.0	4.0	120.0	49.4
4.5	2.0	120.0	49.4
6.0	2.0	120.0	14.4
9.5	9.0	120.0	44.3
14.5	7.0	120.0	16.0
19.5	12.0	120.0	27.7
24.5	16.0	120.0	27.7
29.5	14.0	120.0	NoLiq
34.5	14.0	120.0	NoLiq
39.5	10.0	120.0	NoLiq

Depth ft	SPT	gamma pcf	Fines %
44.5	14.0	120.0	NoLiq
49.5	14.0	120.0	NoLiq

Output Results:
Settlement of saturated sands=3.08 in.
Settlement of dry sands=3.83 in.
Total settlement of saturated and dry sands=6.91 in.
Differential Settlement=3.456 to 4.562 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.13	0.41	5.00	3.08	3.83	6.91
2.00	0.13	0.41	5.00	3.08	3.81	6.89
4.00	0.10	0.41	5.00	3.08	3.58	6.66
6.00	0.06	0.40	5.00	3.08	2.92	6.01
8.00	0.14	0.40	5.00	3.08	1.54	4.63
10.00	0.18	0.40	5.00	3.08	1.33	4.42
12.00	0.15	0.40	5.00	3.08	1.24	4.33
14.00	0.11	0.40	5.00	3.08	0.96	4.05
16.00	0.13	0.39	5.00	3.08	0.39	3.47
18.00	0.16	0.39	0.40*	3.08	0.00	3.08
20.00	0.18	0.41	0.43*	2.51	0.00	2.51
22.00	0.19	0.43	0.44*	1.97	0.00	1.97
24.00	0.20	0.44	0.45*	1.46	0.00	1.46
26.00	0.19	0.46	0.42*	0.95	0.00	0.95
28.00	0.18	0.47	0.39*	0.42	0.00	0.42
30.00	2.00	0.48	5.00	0.00	0.00	0.00
32.00	2.00	0.48	5.00	0.00	0.00	0.00
34.00	2.00	0.49	5.00	0.00	0.00	0.00
36.00	2.00	0.49	5.00	0.00	0.00	0.00
38.00	2.00	0.49	5.00	0.00	0.00	0.00
40.00	2.00	0.49	5.00	0.00	0.00	0.00
42.00	2.00	0.48	5.00	0.00	0.00	0.00
44.00	2.00	0.48	5.00	0.00	0.00	0.00
46.00	2.00	0.48	5.00	0.00	0.00	0.00
48.00	2.00	0.48	5.00	0.00	0.00	0.00
50.00	2.00	0.47	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

CRRm	Cyclic resistance ratio from soils
CSRfs	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRfs
S_sat	Settlement from saturated sands
S_dry	Settlement from dry sands
S_all	Total settlement from saturated and dry sands
NoLiq	No-Liquefy Soils

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Input File Name: H:\PF\2008\0829\Liquefaction\B-11.liq
Title: Atkinson Lane
Subtitle: Boring No.11

Surface Elev.=
Hole No.=B-11
Depth of Hole= 50.0 ft
Water Table during Earthquake= 10.5 ft
Water Table during In-Situ Testing= 20.5 ft
Max. Acceleration= 0.63 g
Earthquake Magnitude= 7.9

Input Data:
Surface Elev.=
Hole No.=B-11
Depth of Hole=50.0 ft
Water Table during Earthquake= 10.5 ft
Water Table during In-Situ Testing= 20.5 ft
Max. Acceleration=0.63 g
Earthquake Magnitude=7.9

Earthquake Magnitude=7.9
2. Settlement Analysis Method: Ishihara / Yoshimine*
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio,   Ce = 1.25
7. Borehole Diameter,   Cb= 1
8. Sampling Method,   Cs= 1
9. User request factor of safety (apply to CSR) ,   User= 1
Plot one CSR curve (fs1=1)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.0	22.0	120.0	NoLiq
2.0	22.0	120.0	NoLiq
4.5	25.0	120.0	56.8
9.5	36.0	120.0	17.9
14.5	27.0	120.0	NoLiq
19.5	17.0	120.0	NoLiq
24.5	12.0	120.0	NoLiq
29.5	11.0	120.0	NoLiq
34.5	18.0	120.0	NoLiq
39.5	12.0	120.0	NoLiq
44.5	17.0	120.0	NoLiq

49.5	18.0	120.0	NoLiq

Output Results:
Settlement of saturated sands=0.00 in.
Settlement of dry sands=0.02 in.
Total settlement of saturated and dry sands=0.02 in.
Differential Settlement=0.010 to 0.013 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.41	5.00	0.00	0.02	0.02
2.00	2.00	0.41	5.00	0.00	0.02	0.02
4.00	2.00	0.41	5.00	0.00	0.02	0.02
6.00	1.75	0.40	5.00	0.00	0.02	0.02
8.00	1.75	0.40	5.00	0.00	0.01	0.01
10.00	1.75	0.40	5.00	0.00	0.00	0.00
12.00	1.75	0.43	4.11	0.00	0.00	0.00
14.00	1.75	0.46	3.84	0.00	0.00	0.00
16.00	2.00	0.48	5.00	0.00	0.00	0.00
18.00	2.00	0.50	5.00	0.00	0.00	0.00
20.00	2.00	0.52	5.00	0.00	0.00	0.00
22.00	2.00	0.53	5.00	0.00	0.00	0.00
24.00	2.00	0.55	5.00	0.00	0.00	0.00
26.00	2.00	0.56	5.00	0.00	0.00	0.00
28.00	2.00	0.57	5.00	0.00	0.00	0.00
30.00	2.00	0.58	5.00	0.00	0.00	0.00
32.00	2.00	0.58	5.00	0.00	0.00	0.00
34.00	2.00	0.57	5.00	0.00	0.00	0.00
36.00	2.00	0.57	5.00	0.00	0.00	0.00
38.00	2.00	0.57	5.00	0.00	0.00	0.00
40.00	2.00	0.56	5.00	0.00	0.00	0.00
42.00	2.00	0.56	5.00	0.00	0.00	0.00
44.00	2.00	0.55	5.00	0.00	0.00	0.00
46.00	2.00	0.55	5.00	0.00	0.00	0.00
48.00	2.00	0.54	5.00	0.00	0.00	0.00
50.00	2.00	0.53	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2,   CSR is limited to 2)

Units   Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

CRRm   Cyclic resistance ratio from soils
CSRfs   Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.   Factor of Safety against liquefaction, F.S.=CRRm/CSRfs
S_sat   Settlement from saturated sands
S_dry   Settlement from dry sands
S_all   Total settlement from saturated and dry sands
NoLiq   No-Liquefy Soils

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Input File Name: H:\PF\2008\0829\Liquefaction\B-12.liq
Title: Atkinson Lane
Subtitle: Boring No.12

Surface Elev.=
Hole No.=B-12
Depth of Hole= 50.0 ft
Water Table during Earthquake= 14.0 ft
Water Table during In-Situ Testing= 24.0 ft
Max. Acceleration= 0.63 g
Earthquake Magnitude= 7.9

Input Data:
Surface Elev.=
Hole No.=B-12
Depth of Hole=50.0 ft
Water Table during Earthquake= 14.0 ft
Water Table during In-Situ Testing= 24.0 ft
Max. Acceleration=0.63 g
Earthquake Magnitude=7.9

Earthquake Magnitude=7.9
2. Settlement Analysis Method: Ishihara / Yoshimine*
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1
Plot one CSR curve (fs1=1)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.0	16.0	120.0	NoLiq
2.0	16.0	120.0	NoLiq
4.5	36.0	120.0	47.6
9.5	13.0	120.0	NoLiq
14.5	17.0	120.0	33.2
19.5	9.0	120.0	NoLiq
24.5	11.0	120.0	NoLiq
29.5	13.0	120.0	NoLiq
34.5	16.0	120.0	NoLiq
39.5	10.0	120.0	NoLiq
44.5	16.0	120.0	NoLiq

49.5	16.0	120.0	NoLiq

Output Results:
Settlement of saturated sands=1.18 in.
Settlement of dry sands=0.03 in.
Total settlement of saturated and dry sands=1.21 in.
Differential Settlement=0.606 to 0.799 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.41	5.00	1.18	0.03	1.21
2.00	2.00	0.41	5.00	1.18	0.03	1.21
4.00	2.00	0.41	5.00	1.18	0.03	1.21
6.00	1.75	0.40	5.00	1.18	0.02	1.21
8.00	1.75	0.40	5.00	1.18	0.02	1.20
10.00	2.00	0.40	5.00	1.18	0.00	1.18
12.00	2.00	0.40	5.00	1.18	0.00	1.18
14.00	2.00	0.40	5.00	1.18	0.00	1.18
16.00	0.24	0.42	0.57*	0.92	0.00	0.92
18.00	0.19	0.44	0.42*	0.44	0.00	0.44
20.00	2.00	0.46	5.00	0.00	0.00	0.00
22.00	2.00	0.48	5.00	0.00	0.00	0.00
24.00	2.00	0.49	5.00	0.00	0.00	0.00
26.00	2.00	0.51	5.00	0.00	0.00	0.00
28.00	2.00	0.52	5.00	0.00	0.00	0.00
30.00	2.00	0.53	5.00	0.00	0.00	0.00
32.00	2.00	0.53	5.00	0.00	0.00	0.00
34.00	2.00	0.53	5.00	0.00	0.00	0.00
36.00	2.00	0.53	5.00	0.00	0.00	0.00
38.00	2.00	0.53	5.00	0.00	0.00	0.00
40.00	2.00	0.52	5.00	0.00	0.00	0.00
42.00	2.00	0.52	5.00	0.00	0.00	0.00
44.00	2.00	0.52	5.00	0.00	0.00	0.00
46.00	2.00	0.51	5.00	0.00	0.00	0.00
48.00	2.00	0.51	5.00	0.00	0.00	0.00
50.00	2.00	0.50	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units   Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

CRRm	Cyclic resistance ratio from soils
CSRfs	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRfs
S_sat	Settlement from saturated sands
S_dry	Settlement from dry sands
S_all	Total settlement from saturated and dry sands
NoLiq	No-Liquefy Soils

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Input File Name: H:\PF\2008\0829\Liquefaction\B-16.liq
Title: Atkinson Lane
Subtitle: Boring No.16

Surface Elev.=
Hole No.=B-16
Depth of Hole= 50.0 ft
Water Table during Earthquake= 3.0 ft
Water Table during In-Situ Testing= 13.0 ft
Max. Acceleration= 0.63 g
Earthquake Magnitude= 7.9

Input Data:
Surface Elev.=
Hole No.=B-16
Depth of Hole=50.0 ft
Water Table during Earthquake= 3.0 ft
Water Table during In-Situ Testing= 13.0 ft
Max. Acceleration=0.63 g
Earthquake Magnitude=7.9

Earthquake Magnitude=7.9
2. Settlement Analysis Method: Ishihara / Yoshimine*
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1
Plot one CSR curve (fs1=1)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.0	12.0	120.0	NoLiq
2.0	15.0	120.0	NoLiq
4.5	23.0	120.0	60.0
9.5	9.0	120.0	NoLiq
14.5	12.0	120.0	NoLiq
19.5	19.0	120.0	NoLiq
24.5	17.0	120.0	NoLiq
29.5	18.0	120.0	NoLiq
34.5	18.0	120.0	NoLiq
39.5	15.0	120.0	NoLiq
44.5	20.0	120.0	NoLiq

49.5	20.0	120.0	NoLiq

Output Results:
Settlement of saturated sands=0.51 in.
Settlement of dry sands=0.00 in.
Total settlement of saturated and dry sands=0.51 in.
Differential Settlement=0.254 to 0.335 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.41	5.00	0.51	0.00	0.51
2.00	2.00	0.41	5.00	0.51	0.00	0.51
4.00	2.00	0.46	5.00	0.51	0.00	0.51
6.00	1.75	0.54	3.23	0.51	0.00	0.51
8.00	0.25	0.59	0.42*	0.34	0.00	0.34
10.00	2.00	0.63	5.00	0.00	0.00	0.00
12.00	2.00	0.65	5.00	0.00	0.00	0.00
14.00	2.00	0.67	5.00	0.00	0.00	0.00
16.00	2.00	0.68	5.00	0.00	0.00	0.00
18.00	2.00	0.69	5.00	0.00	0.00	0.00
20.00	2.00	0.70	5.00	0.00	0.00	0.00
22.00	2.00	0.70	5.00	0.00	0.00	0.00
24.00	2.00	0.71	5.00	0.00	0.00	0.00
26.00	2.00	0.71	5.00	0.00	0.00	0.00
28.00	2.00	0.71	5.00	0.00	0.00	0.00
30.00	2.00	0.71	5.00	0.00	0.00	0.00
32.00	2.00	0.71	5.00	0.00	0.00	0.00
34.00	2.00	0.70	5.00	0.00	0.00	0.00
36.00	2.00	0.69	5.00	0.00	0.00	0.00
38.00	2.00	0.68	5.00	0.00	0.00	0.00
40.00	2.00	0.67	5.00	0.00	0.00	0.00
42.00	2.00	0.66	5.00	0.00	0.00	0.00
44.00	2.00	0.65	5.00	0.00	0.00	0.00
46.00	2.00	0.64	5.00	0.00	0.00	0.00
48.00	2.00	0.63	5.00	0.00	0.00	0.00
50.00	2.00	0.61	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

CRRm	Cyclic resistance ratio from soils
CSRfs	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRfs
S_sat	Settlement from saturated sands
S_dry	Settlement from dry sands
S_all	Total settlement from saturated and dry sands
NoLiq	No-Liquefy Soils

APPENDIX D

Feasibility Level Engineering Geology Report

ZINN GEOLOGY
3085 Carriker Lane, Suite B
Soquel, California 95073
Tel. 831.476.8443 Fax 831.476.1491
enzinn@cruzio.com

GEOLOGICAL FEASIBILITY INVESTIGATION

Atkinson Lane Development For Specific Plan/Master Plan
Watsonville, California

Job #2008010-G-SC
29 June 2008 (Revised 2 March 2009)

3085 Carriker Lane, Suite B
Soquel, California 95073
ZINN GEOLOGY
Tel. 831.476.8443 Fax 831.476.1491
enzinn@cruzio.com

29 June 2008 (Revised 2 March 2009) Job #2008010-G-SC

Pacific Crest Engineering
Attention: Michael Kleames
444 Airport Boulevard, Suite 106
Watsonville, CA 95076-2062

Re: Geological feasibility investigation
Atkinson Lane Development Specific Plan/Master Plan
Watsonville, California

Dear Mr. Kleames:

Our geologic report for the project referenced above is attached. This report documents geologic conditions at the study area and addresses in a preliminary fashion the potential hazards to the proposed development. Based on the information gathered and analyzed in the steps outlined in the report, it is our opinion that the proposed development is geologically feasible, and will be subject to "ordinary" risks as defined in Appendix B, provided our recommendations are followed. Appendix B should be reviewed in detail by all future professionals, developers and all property owners to determine whether an "ordinary" risk as defined in the appendix is acceptable. If this level of risk is unacceptable to them, then the geologic hazards in question should be mitigated to reduce the corresponding risks to an acceptable level.

Portions of the study area bordering Corralitos Creek appear to subjected to a greater than ordinary risk due to flooding hazards, as portrayed upon Figure 5.

The subject property is located in an area of high seismic activity and will be subject to strong seismic shaking in the future. The controlling seismogenic source for the subject property is the Zayante-Vergeles fault, 1.5 kilometers to the northeast. The design earthquake on this fault should be a M_w 7.0. Expected duration of strong shaking for this event is about 16 seconds. Although it yields lower seismic shaking values, the expected duration of strong shaking for a M_w 7.9 earthquake on the San Andreas fault is about 38 seconds. Deterministic analysis for the site yields a mean peak ground acceleration of 0.63 g with an associated effective peak acceleration of 0.47, and a mean peak ground acceleration plus one dispersion of 0.94 g.

Most of the study area is subject to a low potential for landsliding to occur within the design life of most structures, corresponding to an ordinary risk for this hazard. However, it is our opinion that the Corralitos Creek embankment can be prone to failure if undercut by the creek or subjected to strong seismic shaking on nearby faults. Hence, development should be set back from the crest of the embankment to mitigate the risk and lower it to ordinary. It should be noted, though, that if the prescribed setback mitigation measures for the flooding hazard and liquefaction-induced lateral spreading hazard (see below) are pursued, the risk due to the landsliding hazard will also be reduced to ordinary.

Based upon our qualitative analysis, we conclude that liquefaction and lateral spreading may occur during the lifetime of the proposed developments and will create a greater than ordinary risk if is not adequately mitigated. We hasten to add, however, that our analysis is qualitative in nature. If at any time the project geotechnical engineer performs a more robust quantitative liquefaction analysis that concludes that liquefaction is not a potential hazard, we will defer to that conclusion. We have plotted several prescriptive lateral spreading set back lines as dictated by Pacific Crest Engineering upon our geological map (see Plate 1), as requested by Pacific Crest Engineering.

Readers of this report, particularly design professionals, should read the body of the text for a more substantial discussion of the above-listed conclusions, and the accompanying recommendations.

If you have any questions or comments regarding this report, please contact us at your earliest convenience.

Sincerely

Zinn Geology

PROFESSIONAL GEOLOGIST
ERIK N. ZINN
No. 2139
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

By: Erik N. Zinn
Principal Geologist
C.E.G. No. 2139

TABLE OF CONTENTS

NOTE: Plates and figures must accompany text of report in order for report to be considered complete.

INTRODUCTION

This report presents the results of our geological feasibility investigation for the future proposed developments for the undeveloped farm land east of Atkinson Lane in Watsonville, California. The area studied for this project is bound by Corralitos Creek and existing residential development along Atkinson Lane, Paloma Way, Brewington Avenue, and Brookhaven Lane. The site is being considered for future residential development by the County of Santa Cruz (Figure 1 and Plate 1).

The purpose of this investigation was to evaluate the geologic feasibility of constructing an entire residential development for the study area, complete with the typical types of attendant utilities such as storm drains, sewers, water supply lines and other various types of utilities. We have investigated in a preliminary fashion the potential geologic hazards relevant to the proposed development.

SCOPE OF INVESTIGATION

Work performed during this study included:

1. A review of geologic and geotechnical engineering literature pertinent to the subject property, including an attempt to review existing geological and geotechnical engineering reports for the surrounding developed areas available at the County of Santa Cruz and City of Watsonville planning departments.

2. Examination and interpretation historical vertical stereo pair aerial photographs.

3. Geologic reconnaissance of the property and surrounding area, including site-specific geological mapping.

4. Review of small-diameter boring and cone penetrometer testing sounding data obtained by Pacific Crest Engineering Inc. [PCEI] and locations of their borings and soundings upon the digital base map provided to us by RBF Consulting.

5. Deterministic seismic hazards analysis.

6. Analysis and interpretation of the geologic data and preparation of this report.

No subsurface investigation was performed at this site by our firm.

REGIONAL GEOLOGIC SETTING

The study area lies in the Watsonville lowlands, on the western flank of the Santa Cruz Mountains, in the central portion of the Coast Ranges physiographic province of California (Figure 2). This portion of the Coast Ranges is formed by a series of rugged, linear ridges and valleys following the pronounced northwest to southeast structural grain of central California geology. The Santa Cruz Mountains are mostly underlain by a large, elongate prism of granitic and metamorphic basement rocks, known collectively as the Salinian Block. These rocks are separated from contrasting basement rock types to the northeast and southwest by the San Andreas and San Gregorio-Nacimiento strike-slip fault systems, respectively. Overlying the granitic basement rocks is a sequence of dominantly marine sedimentary rocks of Paleocene to Pliocene age and non-marine sediments of Pliocene to Pleistocene age (Figure 1).

Throughout the Cenozoic Era, this portion of California has been dominated by tectonic forces associated with lateral or "transform" motion between the North American and Pacific lithospheric plates, producing long, northwest-trending faults such as the San Andreas and San Gregorio, with horizontal displacements measured in tens to hundreds of miles. Accompanying the northwest direction of the horizontal (strike-slip) movement of the plates have been episodes of compressive stress, reflected by repeated episodes of uplift, deformation, erosion and subsequent redeposition of sedimentary rocks. Near the crest of the Santa Cruz Mountains, this tectonic deformation is most evident in the sedimentary rocks older than the middle Miocene, and consists of steeply dipping folds, overturned bedding, faulting, jointing, and fracturing. Along the coast, the ongoing tectonic activity is most evident in the formation of a series of uplifted marine terraces. The Loma Prieta earthquake of 1989 is the most recent reminder of the geologic unrest in the region.

The Quaternary history of the Watsonville lowlands has been dominated by fluvial, marine and eolian deposition because the central Monterey Bay region has been relatively stable, while the northern Monterey Bay region has been tectonically uplifted. The earth materials in the vicinity of the study area are mostly fluvial and alluvial fan sediments graded to one or more Sangamon highstands of sea level (Dupré; 1975a & b, 1984, 1990; Dupré and Tinsley, 1980).

REGIONAL SEISMIC SETTING

California's broad system of strike-slip faulting has had a long and complex history. Some of these faults present a seismic hazard to the subject property. The most important of these are the San Andreas, Zayante(-Vergeles) and Monterey Bay-Tularcitos fault zones (Figures 2 and 3). These faults are considered to be capable of producing large magnitude earthquakes (Cao et al., 2003). Each fault is discussed below. Locations of epicenters associated with the faults are shown in Figure 3.

San Andreas Fault

The San Andreas fault is active and represents the major seismic hazard in northern California (Working Group on Northern California Earthquake Potential [NCEP], 1996). The main trace of the San Andreas fault trends northwest-southeast and extends over 700 miles from the Gulf of California through the Coast Ranges to Point Arena, where the fault extends offshore.

Geologic evidence suggests that the San Andreas fault has experienced right-lateral, strike-slip movement throughout the latter portion of Cenozoic time (the past 20 to 30 million years), with cumulative offset of hundreds of miles. Surface rupture during historical earthquakes, fault creep, and historical seismicity confirm that the San Andreas fault and its branches, the Hayward, Calaveras, and San Gregorio faults, are all active today.

Historical earthquakes along the San Andreas fault and its branches have caused significant seismic shaking in the Monterey Bay area. The two largest historically recent earthquakes on the San Andreas to affect the area were the moment magnitude (M_w) 7.9 San Francisco earthquake of 18 April 1906 (actually centered near Olema) and the M_w 6.9 Loma Prieta earthquake of 17 October 1989. The San Francisco earthquake caused severe seismic shaking and structural damage to many buildings in the Monterey Bay area. The Loma Prieta earthquake appears to have caused more intense seismic shaking than the 1906 event in localized areas of the Santa Cruz Mountains, even though its regional effects were not as extensive. There were also significant earthquakes in northern California along or near the San Andreas fault in 1838, 1865 and possibly 1890 (Sykes and Nishenko, 1984; NCEP, 1996).

Geologists have recognized that the San Andreas fault system can be divided into segments with "characteristic" earthquakes of different magnitudes and recurrence intervals (Working Group on California Earthquake Probabilities [WG], 1988 and 1990). A study by NCEP in 1996 has redefined the segments and the characteristic earthquakes for the San Andreas fault system in northern and central California. Two "locked" overlapping segments of the San Andreas fault system represent the greatest potential hazard to the property.

The first segment is defined by the rupture that occurred from Cape Mendocino to San Juan Bautista along the San Andreas fault during the great M_w 7.9 earthquake of 1906. The NCEP (1996) has hypothesized that this "1906 rupture" segment experiences earthquakes with comparable magnitudes at intervals of about two hundred years.

The second segment is defined by the rupture zone of the M_w 6.9 Loma Prieta earthquake. Although it is uncertain whether this "Santa Cruz Mountains" segment has a characteristic earthquake independent of great San Andreas fault earthquakes, the NCEP (1996) has assumed an "idealized" earthquake of M_w 7.0 with the same right-lateral slip as the 1989 Loma Prieta earthquake but having an independent segment recurrence interval of 138 years and a multi-segment recurrence interval of 400 years.

The 2002 WG (2003) segmentation model is largely similar to that adopted by NCEP in 1996, although they have added more complexity to the model, and have reduced the forecasted magnitudes for the different segments. The 2002 California probabilistic seismic hazard maps issued by the California Geological Survey (Cao et al., 2003) appear to have largely adopted the earthquake magnitudes issued by the 2002 WG. The most significant change in modeling the San Andreas Fault Zone by Cao et al. (2003) is the elimination of a singular listing of the penultimate event, the 1906 Mw 7.9 earthquake (although such an event can be derived by looking at the aggregate probability of the individual segments rupturing together, as they did in 1906).

In spite of the increasing complexity of the models addressing different size earthquakes with different recurrence intervals on the sundry segments of this fault, it is undeniable that the 1906

M_w 7.9 earthquake still eclipses all the other events which have occurred on the San Andreas fault in this region. Keeping this in mind, it is important that any site-specific seismic analyses performed for development on the property take the 1906 event into account, particularly since the empirical evidence presented by field researchers indicates the 1906 event recurs every several centuries.

Zayante (-Vergeles) Fault

The Zayante fault lies west of the San Andreas fault and trends about 50 miles northwest from the Watsonville lowlands into the Santa Cruz Mountains. The southern extension of the Zayante fault, known as the Vergeles fault, merges with the San Andreas fault south of San Juan Bautista.

The Zayante-Vergles fault has a long, well-documented geological history of vertical movement (Clark and Reitman, 1973), probably accompanied by right-lateral, strike-slip movement (Hall et al., 1974; Ross and Brabb, 1973). Stratigraphic and geomorphic evidence indicates the Zayante-Vergles fault has undergone late Pleistocene and Holocene movement and is potentially active (Buchanan-Banks et al., 1978; Coppersmith, 1979).

Some historical seismicity may be related to the Zayante-Vergles fault (Griggs, 1973). For instance, the Zayante-Vergles fault may have undergone sympathetic fault movement during the 1906 earthquake centered on the San Andreas fault, although this evidence is equivocal (Coppersmith, 1979). Seismic records strongly suggest that a section of the Zayante-Vergles fault approximately 3 miles long underwent sympathetic movement in the 1989 earthquake. The earthquake hypocenters tentatively correlated to the Zayante-Vergles fault occurred at a depth of 5 miles; no instances of surface rupture on the fault have been reported.

In summary, the Zayante-Vergles fault should be considered potentially active. The NCEP (1996) considers it capable of generating a magnitude 6.8 earthquake with an effective recurrence interval of 10,000 years. Alternatively, Cao et al. (2003) considers this fault capable of generating a maximum earthquake of Mw 7.0, with no stated recurrence interval.

Monterey Bay-Tularcitos Fault Zone

The Monterey Bay-Tularcitos fault zone is 6 to 9 miles wide, about 25 miles long, and consists of many en échelon faults identified during shipboard seismic reflection surveys (Greene, 1977). The fault zone trends northwest-southeast and intersects the coast in the vicinity of Seaside and Ford Ord. At this point, several onshore fault traces have been tentatively correlated with offshore traces in the heart of the Monterey Bay-Tularcitos fault zone (Greene, 1977; Clark et al., 1974; Burkland and Associates, 1975). These onshore faults are, from southwest to northeast, the Tularcitos-Navy, Berwick Canyon, Chupines, Seaside, and Ord Terrace faults. Only the larger of these faults, the Tularcitos-Navy and Chupines, are shown on Figure 2. It must be emphasized that these correlations between onshore and offshore portions of the Monterey Bay-Tularcitos fault zone are only tentative; for example, no concrete geologic evidence for connecting the Navy and Tularcitos faults under the Carmel Valley alluvium has been observed, nor has a direct connection between these two faults and any offshore trace been found.

Outcrop evidence indicates a variety of strike-slip and dip-slip movement associated with onshore and offshore traces. Earthquake studies suggest the Monterey Bay-Tularcitos fault zone is predominantly right-lateral, strike-slip in character (Greene, 1977). Stratigraphically, both offshore and onshore fault traces in this zone have displaced Quaternary beds and, therefore, are considered potentially active (Buchanan-Banks et al., 1978). One offshore trace, which aligns with the trend of the Navy fault, has displaced Holocene beds and is therefore active by definition (Buchanan-Banks et al., 1978).

Seismically, the Monterey Bay-Tularcitos fault zone may be historically active. The largest historical earthquakes *tentatively* located in the Monterey Bay-Tularcitos fault zone are two events, estimated at 6.2 on the Richter Scale, in October 1926 (Greene, 1977). Because of possible inaccuracies in locating the epicenters of these earthquakes, it is possible that they actually occurred on the nearby San Gregorio fault zone (Greene, 1977). Another earthquake in April 1890 might be attributed to the Monterey Bay-Tularcitos fault zone (Burkland and Associates, 1975).

The NCEP (1996) has assigned an earthquake of M_w 7.1 with an effective recurrence interval of 2,600 years to the Monterey Bay-Tularcitos fault zone, based on Holocene offshore offsets. Petersen et al. (1996) have a similar earthquake magnitude, but for a recurrence interval of 2,841 years. Their earthquake is based on a composite slip rate of 0.5 millimeters per year (after Rosenberg and Clark, 1995).

Cao et al. (2003) has developed a model for the Monterey Bay fault zone that combines slip rates of the different segments, resulting in a composite slip rate of 0.5 mm per year and a forecasted earthquake of Mw 7.3, with no stated recurrence interval. The Cao et al. (2003) model adopted implicitly assumes that all the assessed segments in the Monterey Bay fault zone each have an independent slip rate of 0.1 mm per year (based upon the one slip rate developed by Rosenberg and Clark, 1995 for the Tularcitos segment), and essentially assigns the composite slip rate to the Tularcitos trace of the Monterey Bay fault zone.

SITE GEOLOGIC SETTING

The Geologic Map (Plate 1) and Geological Cross Sections (Plate 2) graphically depict relevant geologic information for the study area. See also the Local Geology Map (Figure 4), Flood Insurance Rate Index Map (Figure 5), Fault Index Map (Figure 6) and Liquefaction Susceptibility Map (Figure 7) for information of a more general nature.

Topography

The study area consists of gently rolling hills descending east to the nearly flat flood-plain of Corralitos Creek. The rolling hills are extensively cultivated, primarily by strawberry crops, with wild grasses and stands of eucalyptus and oak making up the balance. Grading in the form of disturbances related to tilling and minor road cuts and fill prisms are typically less than several feet high and sloped at least 2:1 (horizontal:vertical). The Corralitos Creek flood-plain is vegetated with varied crops. Most of the flood plain generally slopes very gently to the north toward Corralitos Creek, with the exception of a small pond near the western edge of the study area. Existing grading in this terrain is primarily restricted to tilling related to farming practices and spots along the creek where the natural levees have been enhanced with fill. The total thickness of the levee fill is unknown, but likely exceeds ten feet. The creek has incised between 10 and 32 feet below the natural flood plain and the rolling hills respectively.

Earth Materials

The study area sits within the Watsonville Lowlands, a nominally subsiding basin dominated by river and creek deposition in conjunction with fluctuating sea levels, caused by cycles of continental glaciation, for about the last one million years. This interplay has given rise to a series of fluvial (creek) deposits interlayered with and overlain by sand dune and marine terrace deposits. The most detailed regional geologic mapping in the Watsonville Lowlands region has been performed by Dupré and Tinsley (1980, see Figure 4), and our following descriptions of the earth materials and their distribution in the study area closely follows the work performed by them. There are other more modern geological citations available for this region, such as Brabb et al. (1997) and Wagner et al. (2002), but all of those publications have simply compiled the most detailed original work done in the region by Dupré and Tinsley (1980) rather than reflecting an original body of work that sheds new light on the deposits in the Watsonville Lowlands.

The overall thickness of the unconsolidated flood-plain deposits in the study area is about 100 feet (Pajaro Valley Water Management Agency [PVWMA], 1995). The alluvial deposits in turn overlie Pleistocene terrace deposits and Aromas Sand. The total thickness of the Quaternary sediments in the study area is about 775 feet. The Quaternary sedimentary package is underlain by about 1800 feet of Tertiary sedimentary rocks, and ultimately granitic basement rock.

The rolling hills terrain and the entire flood-plain are probably underlain at some depth by the mid-Quaternary age Aromas Sand, a sequence of fluvial and dune sediments. The Aromas Sand is a heterogeneous sequence of relatively well consolidated eolian and fluvial sand, silt, clay and gravel.

Basin deposits, levee deposits, younger flood-plain deposits, and older flood-plain deposits (respectively shown as Qb, Qyfa, Qyf and Qof on Plate 3) are exposed at the ground surface in the vicinity of the study area (see Figure 4). They are chiefly composed of unconsolidated, interfingering and interbedded layers of clay, silt and fine sand.

As noted earlier, the mapping performed by Dupré and Tinsley (1980) is the most detailed map to date of Quaternary deposits in this area. The results of the small diameter borings and cone penetrometer soundings performed by and PCEI for this investigation are mostly consistent with the regional research portrayed upon Figure 4. Turning to our cross section for the site (Plate 2), we note that the site is predominantly underlain by older flood-plain deposits and the fluvial facies of the Watsonville Terrace Deposits (Qwf on the map and sections), composed of three stratigraphic subunits, a sand package, underlain by a clay package, with silt package appearing to underlie everything across the site to the depths explored for this project. As may be noted on the geological cross sections, the lateral and vertical variations are extremely complex within the generalized subunits, as is typically found in dynamic fluvial environments. Additionally, it should be noted that the complexity of the stratigraphy appears to be directly correlative to the spacing and array between the borings and the soundings. In our opinion, a plausible assumption is that the site stratigraphy is very complex, with very few, if any specific stratigraphic beds being continuous across the site, as is typically found in dynamic fluvial environments.

The older flood-plain deposits appear to thicken to the north and east across the site, which is consistent with the model of a backfilling basin starting in the Late Pleistocene and continuing through today. Corralitos Creek and the Pajaro River are essentially "drowning" in their own sediment loads as the Pacific Ocean continues to rise and encroach inland through the millennia. Near the western edge of the site, a pond has been created and backfilled also. It is unclear at this stage if the formation of the pond has arisen from natural backfilling and flooding by Corralitos Creek or if it formed as result of the rim of fill that lines its' eastern periphery.

The contacts between the different units and subunits portrayed on the cross section (Plate 2) are largely conjectural outside of the immediate drilling and sounding areas, due to the distance between the subsurface investigations and the lateral and vertical variations in the underlying fluvial stratigraphy. Nonetheless, we have attempted to extrapolate the contacts beyond the immediate subsurface work utilizing the results of our mapping, aerial photo analysis and geological synthesis to bring some geological perspective to the geometric relationship between the different units and subunits.

Minor pockets of artificial fill are scattered across the site, based upon our site reconnaissance and aerial photo analysis. Although we have shown some fill on our geologic site map, we have not attempted to map its' distribution in cross section because of the prohibitively small scale used for this phase of the project.

Drainage and Groundwater

Drainage across the site is primarily by sheet flow across the uplands and flood plain to the north and east. As noted earlier, a fill berm partially blocks drainage from the pond along the western edge of the site.

Groundwater was encountered to within six feet of the ground surface by PCEI during their drilling program. No seeps were observed on the site.

It has always been our understanding that the regionally persistent groundwater in the Watsonville area is more than 100 feet below the ground surface, due to overdraft of the underlying aquifers. The ground water encountered by PCEI in their drilling program may have been seasonally-perched groundwater, or shallow groundwater resulting from spring irrigation on the property.

Nonetheless, for the purposes of liquefaction analysis, PCEI appears to have assumed a groundwater table that starts at an elevation near the thalweg of Corralitos Creek and that progressively descends to the south, away from the creek. PCEI appears to have discounted the groundwater encountered above this elevation in the field in their borings and soundings as water perched seasonally within laterally discontinuous transmissve beds. This seems reasonably conservative from a geological perspective, considering the above-listed information procured from their field investigation.

GEOLOGIC HAZARDS

In our opinion, the primary geologic hazards that could potentially impact the proposed developments for this project are flooding, seismic shaking, landsliding, liquefaction-induced settlement and liquefaction-induced lateral spreading. We considered the possibility that the site could be impacted by faulting, but the nearest mapped active fault is the Zayante-Vergeles fault, located approximately 4000 feet northeast of the study area.

Flooding Hazard

Portions of the proposed development area are located within Federal Emergency Management Agency (FEMA) flood zones X and AE (FEMA, 2006) (see Figure 5).

All of Zone AE is an area that can be inundated to some extent by the calculated 100-year flood. As such, we do not recommend that the development be placed within this zone, if avoidable. As may be noted on Figure 5, this zone encroaches the flood plain beyond the centerline of Corralitos Creek as much as 439 feet (in the extreme northeastern corner of the study area).

Portions of Zone X shown on Figure 5 portray a "buffer zone" beyond Zone AE that is subject to inundation by the 500-year flood, or inundation less than one foot by floods with lower recurrence interval. Similar to the recommendation for Zone AE above, we do not recommend that the development be placed within this zone, if avoidable.

As may be noted on Figure 5, base flood elevations have been determined by FEMA for the stretch of the study area bounded by Corralitos Creek. Future planning and design work for the layout of the proposed developments should rely upon site-specific surveying that is tied into FEMA benchmarks, with the boundaries of the flood zone accurately portrayed on an adequate topographic base map prepared by a Registered Land Surveyor or Civil Engineer, so that the hazard and risk due to flooding can be adequately assessed. If during the course of development structures are placed within the flood zones at grade, the risk due to flooding will clearly be greater than ordinary. If that is case, the elevation of the bottom of the lowest horizontal structural member of the lowest floor should be at or above the base flood elevation, as required by FEMA. However, with that said, we strongly recommend that future structures be altogether left out of the mapped flood zones if possible, which will adequately mitigate the risk due to the flooding by lowering it to ordinary.

Seismic Shaking Hazard

Seismic shaking on the subject properties will be intense during the next major earthquake along local fault systems. A common measure of the intensity of ground shaking is the Modified

Mercalli Intensity Scale (Table 1), a subjective measure of the effect of ground shaking on man-made structures and the earth's surface. Intensity varies with distance from the causative fault, but can also vary greatly with local geologic setting. Lawson et al. (1908) lists a Rossi-Forel Intensity of VII to VIII for the subject properties as a result of the 1906 earthquake, although it should be emphasized that this estimate is based on a small number of field observations in an area sparsely

TABLE 1
Modified Mercalli Intensity Scale

The modified Mercalli scale measures the intensity of ground shaking as determined from observations of an earthquake's effect on people, structures, and the Earth's surface. Richter magnitude is not reflected. This scale assigns to an earthquake event a Roman numeral from I to XII as follows:

I	Not felt by people, except rarely under especially favorable circumstances.
II	Felt indoors only by persons at rest, especially on upper floors. Some hanging objects may swing.
III	Felt indoors by several. Hanging objects may swing slightly. Vibration like passing of light trucks. Duration estimated. May not be recognized as an earthquake.
IV	Felt indoors by many, outdoors by few. Hanging objects swing. Vibration like passing of heavy trucks; or sensation of a jolt like a heavy ball striking the walls. Standing automobiles rock. Windows, dishes, doors rattle. Wooden walls and frame may creak.
V	Felt indoors and outdoors by nearly everyone; direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset; some dishes and glassware broken. Doors swing; shutters, pictures move. Pendulum clocks stop, start, change rate. Swaying of tall trees and poles sometimes noticed.
VI	Felt by all. Damage slight. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks and books fall off shelves; pictures off walls. Furniture moved or overturned. Weak plaster and masonry cracked.
VII	Difficult to stand. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary buildings; considerable in badly designed or poorly built buildings. Noticed by drivers of automobiles. Hanging objects quiver. Furniture broken. Weak chimneys broken. Damage to masonry; fall of plaster, loose bricks, stones, tiles, and unbraced parapets. Small slides and caving in along sand or gravel banks. Large bells ring.
VIII	People frightened. Damage slight in specially designed structures; considerable in ordinary substantial buildings, partial collapse; great in poorly built structures. Steering of automobiles affected. Damage or partial collapse to some masonry and stucco. Failure of some chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed pilings broken off. Branches broken from trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes.
IX	General panic. Damage considerable in specially designed structures; great in substantial buildings, with some collapse. General damage to foundations; frame structures, if not bolted, shifted off foundations and thrown out of plumb. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground; liquefaction.
X	Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Landslides on river banks and steep slopes considerable. Water splashed onto banks of canals, rivers, lakes. Sand and mud shifted horizontally on beaches and flat land. Rails bent slightly.
XI	Few, if any masonry structures remain standing. Bridges destroyed. Broad fissures in ground; earth slumps and landslides widespread. Underground pipelines completely out of service. Rails bent greatly.
XII	Damage nearly total. Waves seen on ground surfaces. Large rock masses displaced. Lines of sight and level distorted. Objects thrown upward into the air.

populated in 1906. Preliminary estimates of Modified Mercalli intensities at the subject properties during the Loma Prieta earthquake are about VII (Stover et al., 1990). Refer to Table 1 for the relevant portion of the Modified Mercalli Scale. Modified Mercalli Intensities of VII to VIII are possible (see Table 1 for a description of the Mercalli Intensity Scale).

Deterministic Seismic Shaking Analysis

For the purpose of evaluating deterministic peak ground accelerations for the site, we have considered four seismic sources, the San Andreas, Monterey Bay - Tularcitos and Zayante (-Vergeles) fault zones. While other faults or fault zones in this region may be active, their potential contributions to deterministic seismic hazards at the site are overshadowed by this fault. Table 2 shows the moment magnitude of the characteristic or maximum earthquake, estimated recurrence interval and the distance from the site for each of this fault system. We took the fault data from "Database of potential sources for earthquakes larger than magnitude 6 in Northern California" (WGONCEP, 1996), Petersen et al. (1996) and Cao et al.(2003). Also shown on Table 2 are calculated on-site accelerations from the listed earthquake derived using several different methods. These accelerations are based on attenuation relationships derived from the analysis of historical earthquakes. Because the historical data can be interpreted in different ways, there are a number of different attenuation relationships available. We have employed a fairly conservative attenuation relationship for rock/shallow soil sites in deriving the acceleration values listed in Table 2.

TABLE 2
Faults, Earthquakes and Deterministic Seismic Shaking Data

Fault	Moment Magnitude of Characteristic or Maximum Earthquake (M_w)	Estimated Recurrence Interval (years)	Distance from Site (km)	Estimated Mean Peak Ground Acceleration (g)[1]	Estimated Mean + One Dispersion Ground Acceleration (g)[1]	Maximum Considered Earthquake Ground Motion[2] (g)
Zayante-Vergeles	7.0	10,000	1.5	0.63	0.94	0.95
Monterey Bay - Tularcitos	7.3	2841	25.3	0.24	0.35	0.36
San Andreas (1906 rupture)	7.9	210	6.3	0.46	0.68	0.69

[1] Sadigh et al., 1997
[2] FEMA, 1998

The "maximum considered earthquake ground motion," as defined by FEMA (1998), is also listed in Table 2. FEMA (1998) and the National Earthquake Hazards Reduction Program suggest that in regions of high seismicity, such as coastal California, the appropriate design level for ground shaking is the deterministically derived mean peak horizontal ground acceleration multiplied by 1.5. Applying this method to the subject properties results in ground shaking parameters roughly equivalent to the deterministically derived mean values plus one dispersion.

If the deterministically derived accelerations are used for engineering analysis on the subject properties, we recommend utilizing the attenuation relationship developed by Sadigh et al. (1997) for deep soil. It is important to note that predicting seismic shaking intensity is a field that is dominated heavily by theory, with a paucity of near-field station readings in deep soil settings. It should also be noted that the accelerations listed in Table 2 are only average values. Therefore, we caution that the listed values are approximations, rather than precise predictions. Actual measured "free-field" accelerations may be larger.

Based on the results listed in Table 2, the mean peak ground acceleration expected at the property will be approximately 0.63 g, the maximum earthquake ground motion (mean acceleration plus one dispersion) expected at the subject properties will be approximately 0.94 g, based on a M_w 7.0 earthquake centered on the Zayante-Vergeles fault zone 1.5 kilometers northeast of the site.

Naeim and Anderson (1993) found that "effective peak acceleration" (EPA) is more typically about 75 percent of the peak acceleration. Effective peak acceleration is comparable to "repeatable high ground acceleration" (after Ploessel and Slossen, 1974) and is generally considered to represent the large number of lower amplitude peaks on an accelerogram recording. This suggests that the mean peak horizontal ground acceleration of 0.63 g would generate an EPA of approximately 0.47 g.

The duration of strong shaking is dependent on magnitude. Dobry et al. (1978) have suggested a relationship between magnitude and duration of "significant" or strong shaking expressed by the formula:

$\log D = 0.432\,M - 1.83$ (where D is the duration and M is the magnitude).

On the basis of the above relationship, the duration of strong shaking associated with a magnitude 7.0 earthquake (the characteristic earthquake for the Zayante-Vergeles fault zone) is estimated to be about 16 seconds. In contrast, the duration of strong shaking associated with a magnitude 7.9 earthquake (the characteristic earthquake for the San Andreas fault) is estimated to be about 38 seconds. Considering the recurrence intervals of the San Andreas and Zayante-Vergeles faults, the proposed residences are much more likely to experience the characteristic event on the San Andreas, with lower peak accelerations than the design earthquake on the Zayante-Vergeles but lasting about two times as long (see Table 2). Bear in mind that the duration of strong seismic shaking may be even more critical as a design parameter than the peak acceleration itself.

Landsliding Hazard

Most of the study area is subject to a low potential for landsliding to occur within the design life of most structures, corresponding to an ordinary risk for this hazard. However, the Corralitos Creek embankment is fairly steep and ranges in height between 10 and 32 feet above the thalweg of the creek, and is underlain by Pleistocene age sediments that can be prone to failure if undercut by the creek or subjected to strong seismic shaking on nearby faults. Keeping this mind, we recommend that structures be sited at least 50-feet away from the crest of the embankment to avoid siting them within an area that could conceivably be affected by landsliding within the next 50-years.

In summary, it is our opinion that the proposed development will be subject to a greater than ordinary risk related to the landsliding hazard if the recommended mitigation measure is not pursued. It should also be noted, though, that if the prescribed setback mitigation measures for the flooding hazard and liquefaction-induced lateral spreading hazard (see next section) are pursued, the risk due to the landsliding hazard will also be reduced to ordinary.

Liquefaction and Lateral Spreading Hazards

The physical process of seismically induced liquefaction is well understood (Youd, 1973; Seed and Idriss, 1982; National Research Council, 1985). During an earthquake seismic waves travel through the earth and vibrate the ground. In cohesionless, granular materials having low relative density (loose sands for example), this vibration can disturb the particle framework, thus leading to increased compaction of the material and reduction of pore space between the framework grains. If the sediment is saturated, water occupying the pore spaces resists this compaction and exerts pore pressure that reduces the contact stress between the sediment grains. With continued shaking, transfer of intergranular stress to pore water can generate pore pressures great enough to cause the sediment to lose its strength and change from a solid state to a liquefied state. This mechanical transformation can cause various kinds of ground failure at or near the ground surface.

The liquefaction process typically occurs at depths less than 50 feet below the ground surface, although liquefaction can occur at deeper intervals, given the right conditions. The most susceptible zone occurs at depths shallower than 30 feet below the ground surface. Diminished susceptibility as depth increases is due to the increased firmness of deeper sedimentary materials, which can be attributed mainly to two factors: 1) increased overburden pressure resulting from the load of overlying sediment layers, and 2) increased geologic age. These two factors tend to create a denser packing of sediment grains in the deeper sedimentary materials, which thus are less likely to experience the additional compaction and elevated pore pressures that are necessary to induce loss of shear strength and liquefaction during an earthquake.

Liquefaction can lead to several types of ground failure, depending on slope conditions and the geologic and hydrologic setting (Seed, 1968; Youd, 1973; Tinsley et al, 1985). The four most common types of ground failure are: 1) lateral spreads, 2) flow failures, 3) ground oscillation and 4) loss of bearing strength. Sand boils (injections of fluidized sediment) commonly accompany these different types of ground failure and form sand volcanoes at the ground surface or convolute layering and sand dikes in subsurface sediment layers.

Detailed studies of different earthquakes and associated liquefaction events (Lawson, 1908; Youd and Hoose, 1978; Tinsley and Dupré, 1992; Obermeier, 1989; Ziony, 1985; Youd and Wieczorek, 1982; Muir and Scott, 1982) has shown the following:

1. Lateral spreading is generally limited to unconsolidated late Holocene fluvial, basin, estuarine and channel-fill deposits. The toes of the lateral spreads are typically located in the faces of active channel margins. The heads of lateral spreads are typically located between the contact of young channel deposits with either overbank deposits of equivalent age, or overbank deposits of older Holocene units. Lateral spread fissures tend to follow the flow directions of the fluvial deposits.

2. Lateral spread fissures have occurred as far as 7 miles away from the main channel of a river in fluvial environments (Obermeier, 1989), and have been mapped up to 0.5 miles in length. The lateral spreads appear to occur most commonly on slopes with gradients of 0.3 to 3 degrees. During the 1989 Loma Prieta earthquake, lateral spread failures occurred as far as 150 meters from the active stream channel of the Pajaro River (in the Watsonville region to the north). The 1989 Loma Prieta earthquake induced failures had lateral displacements of a few millimeters to 2 meters and vertical displacements that were typically less than 30 centimeters. Extensive damage due to liquefaction and lateral spreading appears to have occurred along the main channel of the Salinas River during the 1906 earthquake. At the Salinas River bridge crossing (Hilltown), the foundation piles at the south end of the bridge moved 6 to 7 feet southward, and an oil pipeline crossing the bridge was buckled due to 7 feet of shortening. The pipeline was also extensively damaged where it was buried near the active channel of the river.

The subject site does not appear to have experienced liquefaction historically (Lawson, 1908; Youd and Hoose, 1978; Dupré and Tinsley, 1980). The site is located in an area of Quaternary earth materials described as having low and moderate liquefaction susceptibility by Dupré and Tinsley (1980) (Figure 7). No liquefaction or lateral spreading was reported to have occurred during the 1989 Loma Prieta earthquake on the subject site, or directly nearby. The different types of ground failure associated with liquefaction often leave geomorphic evidence after the event in the form of scarps, and open (or infilled) ground cracks, and sand volcanoes. This type of evidence can be readily observed via site reconnaissance or aerial photo analysis on undisturbed ground long after the liquefaction has occurred. However, if the ground surface is disturbed by subsequent grading activity (such as farm-related tilling), the ground information is erased.

We did not observe evidence of differential settlement, lurch cracking or lateral spreading during our aerial photo analysis or our site reconnaissance. However, any evidence of past liquefaction may have been obscured by the farming and cultural activities at the site.

In spite of the paucity of historical evidence of damage related to liquefaction-induced settlement, Pacific Crest Engineering has performed liquefaction and settlement analyses for the site. The underlying soils analyzed for this project appeared to meet the preliminary screening criteria for liquefiable soils, considering the relatively soft and loose density of the sediments, presence of shallow groundwater, and abundance of nearby faults capable of generating large magnitude earthquakes. After analyzing the soils, Pacific Crest Engineering concluded that some of the sand and silt beds underlying the proposed development area are susceptible to liquefaction (using conservative assumptions). The most liquefiable deposits appear to have been related to the older flood-plain deposits near the Corralitos Creek embankment. Additionally, it appears that the some sections of the Pleistocene age Watsonville Terrace Deposits are also potentially liquefiable, which is slightly contradictory to the regional liquefaction susceptibility map by Dupré and Tinsley (1980).

Calculated lateral spreading displacements by Pacific Crest Engineering range between 0 and 65 inches, with the bulk of the soils experiencing liquefaction-related lateral spreading occurring creek-ward of a line set back approximately 150-feet from the top the Corralitos Creek bank (see Plate 1).

The area of the pond also appears to be an area of concern with respect to liquefaction and lateral spreading, as indicated by the preliminary analysis by Pacific Crest Engineering. As a result of their analysis, they have recommended that proposed developments be set back at least 50-feet from the high water mark of the pond or the edge of the riparian/wetlands boundary, whichever is greater.

A recent peer-reviewed journal paper by Youd et al. (2009) has addressed the apparent discrepancy between calculated/predicted lateral spreading displacements and actual observed displacements in the field after an earthquake. The researchers for this paper studied liquefaction and lateral spreading sites in Turkey that were subjected to the M_w 7.5 1999 Kocaeli, Turkey Earthquake. The findings from their study that are germane to this project are as follows:

1. Fine-grained sediments that should have liquified using the criteria of Bray and Sancio (2006) did not display lateral spread displacements;
2. The absence of lateral spread at the sites studied was due to either: (a) the tendency for nonplastic silts at low confining stress to dilate during shear; or (b) the inherent undrained shear strength of liquefied plastic silts and clays;
3. Zero-displacement lateral spread sites previously studied and analyzed by prior researchers, such Youd et al. (2002) were discarded even though those sites may have been underlain by liquefiable sediments, which subsequently results in an overestimation of lateral spread displacement calculations;
4. Sites with complex liquefiable stratigraphy (such as the Atkinson Lane site) may record negligible lateral spread displacements in the field during earthquakes due to the discontinuous lenses of sediment with sufficient shear resistance in the discontinuities to prevent the lateral spread.

In summary, liquefaction occurs where young, unconsolidated, saturated sands and silts are subjected to intense seismic shaking. Although only some of the earth materials in the proposed area of development are not considered to have high liquefaction potential by regional researchers, the site-specific analysis by Pacific Crest Engineering indicates that the potential is high for liquefaction to occur within the design life of the proposed development for at least a portion of all the sediment packages across the site. Additionally, the presence of liquefiable sediments that may be exposed in the Corralitos Creek embankment leads us to conclude that there may also be a high potential for lateral spreading to impact proposed developments that are close to the embankment. However, a recent paper by Youd et al. (2009) appears to indicate that calculated lateral spread displacements may be higher than the actual field measured displacements, particularly for fine-grained sediments in complex stratigraphic sites.

Based upon our qualitative analysis, we conclude that liquefaction and lateral spreading may occur during the lifetime of the proposed developments and will create a greater than ordinary risk if is not adequately mitigated. We hasten to add, however, that our analysis is qualitative in nature. If at any time the project geotechnical engineer performs a more robust quantitative liquefaction analysis that concludes that liquefaction is not a potential hazard, we will defer to that conclusion.

At the request of Pacific Crest Engineering, we have plotted a lateral spreading hazard set back boundary upon our geological map (See Plate 1). We have also taken the liberty of plotting the 50-foot setback line encircling the pond area, using the high water mark on the orthophoto base as a guide for the line (see Plate 1).

CONCLUSIONS

Based on the information gathered and analyzed in the steps outlined above, it is our opinion that the proposed development is geologically feasible, and will be subject to "ordinary" risks as defined in Appendix B, provided our recommendations are followed. Appendix B should be reviewed in detail by all future professionals, developers and all property owners to determine whether an "ordinary" risk as defined in the appendix is acceptable. If this level of risk is unacceptable to them, then the geologic hazards in question should be mitigated to reduce the corresponding risks to an acceptable level.

Portions of the study area bordering Corralitos Creek appear to subjected to a greater than ordinary risk due to flooding hazards, as portrayed upon Figure 5.

The subject property is located in an area of high seismic activity and will be subject to strong seismic shaking in the future. The controlling seismogenic source for the subject property is the Zayante-Vergeles fault, 1.5 kilometers to the northeast. The design earthquake on this fault should be a M_w 7.0. Expected duration of strong shaking for this event is about 16 seconds. Although it yields lower seismic shaking values, the expected duration of strong shaking for a M_w 7.9 earthquake on the San Andreas fault is about 38 seconds. Deterministic analysis for the site yields a mean peak ground acceleration of 0.63 g with an associated effective peak acceleration of 0.47, and a mean peak ground acceleration plus one dispersion of 0.94 g.

Most of the study area is subject to a low potential for landsliding to occur within the design life of most structures, corresponding to an ordinary risk for this hazard. However, it is our opinion that the Corralitos Creek embankment can be prone to failure if undercut by the creek or subjected to strong seismic shaking on nearby faults. Hence, development should be set back from the crest of the embankment to mitigate the risk and lower it to ordinary. It should be noted, though, that if the prescribed setback mitigation measures for the flooding hazard and liquefaction-induced lateral spreading hazard (see below) are pursued, the risk due to the landsliding hazard will also be reduced to ordinary.

Based upon our qualitative analysis, we conclude that liquefaction and lateral spreading may occur during the lifetime of the proposed developments and will create a greater than ordinary risk if is not adequately mitigated. We hasten to add, however, that our analysis is qualitative in nature. If at any time the project geotechnical engineer performs a more robust quantitative liquefaction analysis that concludes that liquefaction is not a potential hazard, we will defer to that conclusion. We have plotted several prescriptive lateral spreading set back lines as dictated by Pacific Crest Engineering upon our geological map (see Plate 1), as requested by Pacific Crest Engineering.

RECOMMENDATIONS

1. As may be noted on Figure 5, base flood elevations have been determined by FEMA for the stretch of the study area bounded by Corralitos Creek. Future planning and design work for the layout of the proposed developments should rely upon site-specific surveying that is tied into FEMA benchmarks, with the boundaries of the flood zone accurately portrayed on an adequate topographic base map prepared by a Registered Land Surveyor or Civil Engineer, so that the hazard and risk due to flooding can be adequately assessed.

   We strongly recommend that future structures be altogether left out of the mapped flood zones if possible, which will adequately mitigate the risk due to the flooding by lowering it to ordinary. If during the course of development structures are placed within the flood zones at grade, the risk due to flooding will clearly be greater than ordinary. If that is case, the elevation of the bottom of the lowest horizontal structural member of the lowest floor should be at or above the base flood elevation, as required by FEMA.

2. With respect to the risk related to the landsliding of the creek embankment, we recommend that structures be sited at least 50-feet away from the crest of the embankment. It should also be noted, though, that if the prescribed setback mitigation measures for the flooding hazard and liquefaction-induced lateral spreading hazard (see below) are pursued, the risk due to the landsliding hazard will also be reduced to ordinary.

3. The project geotechnical engineer should perform a quantitative analysis of liquefaction-induced hazards, such as settlement and lateral spreading. Foundations and structural elements for the proposed developments should also be designed to resist the forces generated by liquefaction and lateral spreading, unless a more robust quantitative analysis by the project geotechnical engineer indicates that this is unnecessary. All proposed development should lie behind the prescriptive lateral spreading hazard line that is set back 150-feet from the top of the creek bank, as dictated by Pacific Crest Engineering. Additionally, all proposed development should be set back at least 50-feet from the pond high water line or riparian/wetland boundary, as recommended by Pacific Crest Engineering.

4. The project engineers and designers should review our seismic shaking parameters and choose a value appropriate for their particular analyses if necessary.

5. We recommend that all drainage from improved surfaces such as walkways, patios, roofs, and driveways be collected and dispersed on site in such a way as to avoid ponding on the ground adjacent to a building site or spilling directly onto steep slopes without some form of erosion protection. Gutters should be utilized on rooftops, channeling drainage to appropriate storm drain facilities, the pond, or Corralitos Creek.

INVESTIGATIVE LIMITATIONS

1. Our services consist of professional opinions and recommendations made in accordance with generally accepted engineering geology principles and practices. No warranty, expressed or implied including any implied warranty of merchantability or fitness for the purpose is made or intended in connection with our services or by the proposal for consulting or other services, or by the furnishing of oral or written reports or findings.

2. The analysis and recommendations submitted in this report are based on the geologic information derived from the steps outlined in the scope of services section of this report. The information is derived from necessarily limited natural and artificial exposures. Consequently, the conclusions and recommendations should be considered preliminary.

3. The conclusions and recommendations noted in this report are based on probability and in no way imply the site will not possibly be subjected to ground failure or seismic shaking so intense that structures will be severely damaged or destroyed. The report does suggest that building structures at the subject site, in compliance with the recommendations noted in this report, is an "ordinary" risk as defined in Appendix B.

4. This report is issued with the understanding that it is the duty and responsibility of the owner or his representative or agent to ensure that the recommendations contained in this report are brought to the attention of the architect and engineer for the project, incorporated into the plans and specifications, and that the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

5. The findings of this report are valid as of the present date. However, changes in the conditions of property and its environs can occur with the passage of time, whether they be due to natural processes or to the works of man. In addition, changes in applicable or appropriate standards occur whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated, wholly or partially, by changes outside our control. Therefore, the conclusions and recommendations contained in this report cannot be considered valid beyond a period of two years from the date of this report without review by a representative of this firm.

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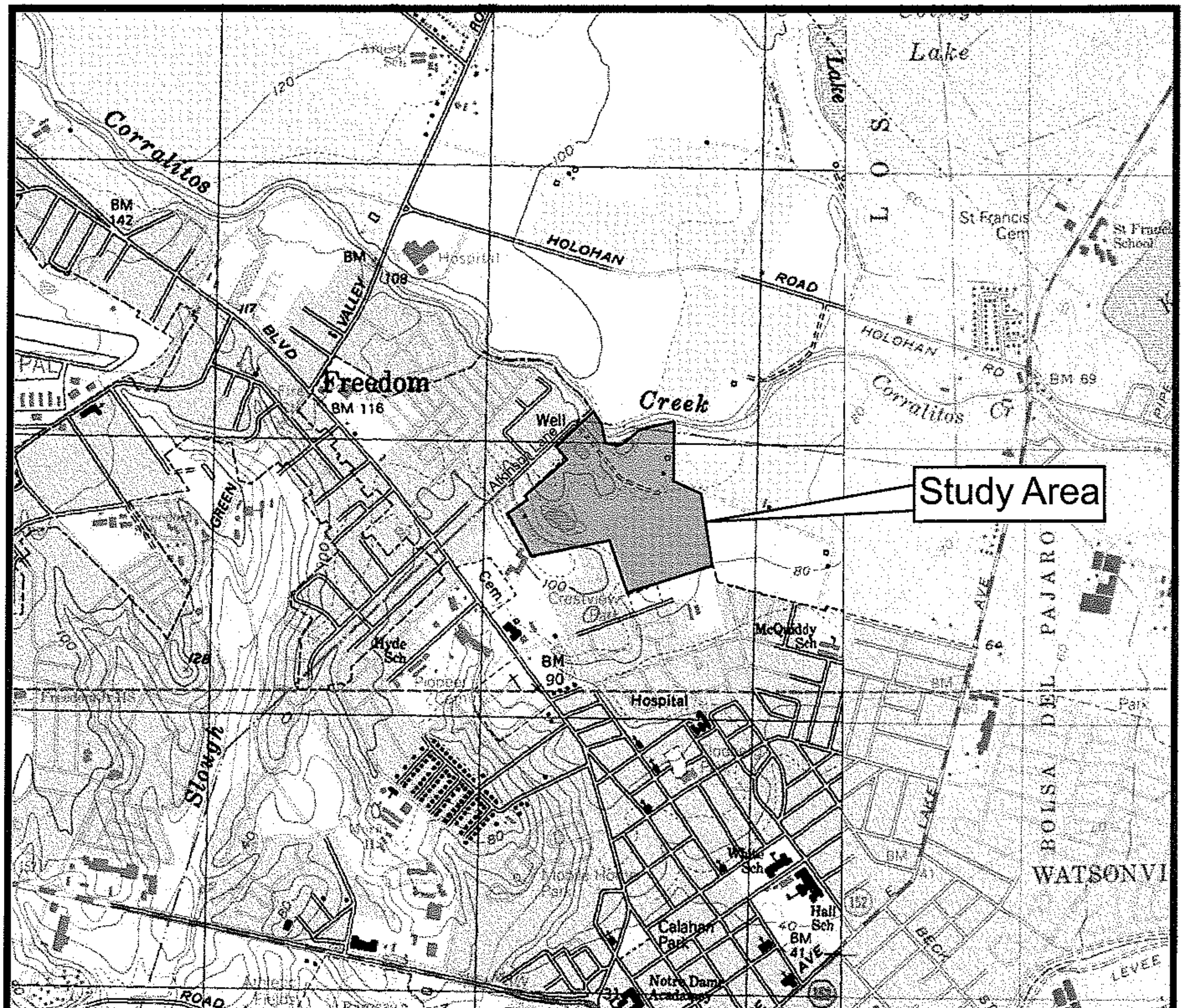
APPENDIX A

FIGURES



BASE MAP: U.S. Geological Survey, 1954 (photorevised 1995), Watsonville West Quadrangle, California, 7.5' topographic series, scale 1:24,000 and U.S. Geologic Survey, 1955 (photorevised 1995), Wastonville East Quadrangle, California 7.5' topographic series 1:24,000.

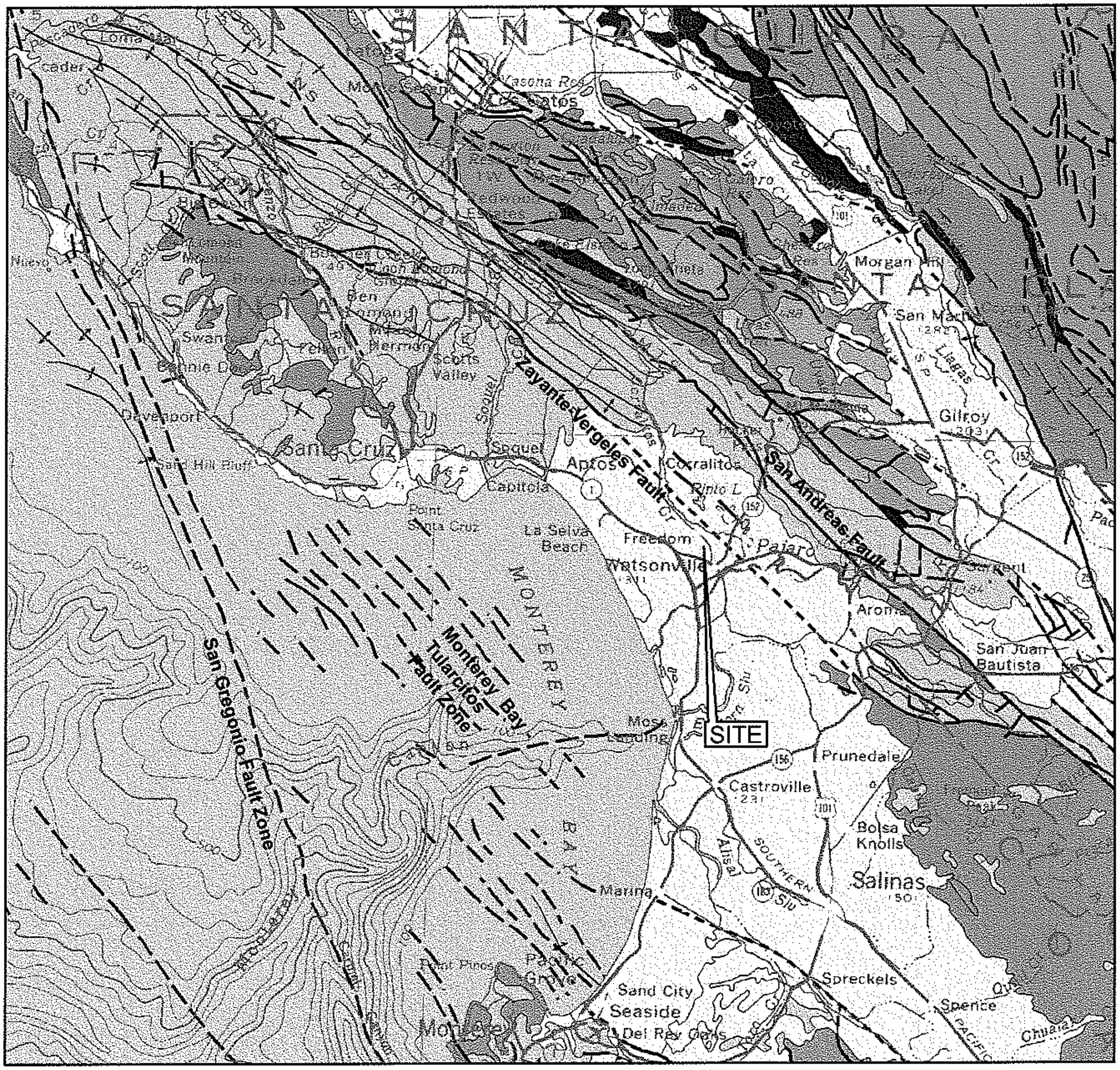
SCALE 1:24,000

1000 0 1000 2000 feet

ZINN GEOLOGY

Topographic Index Map
Atkinson Lane EIR
Atkinson Lane
Watsonville, California

FIGURE #
1
JOB #
2008010-G-SC



Reference: Jennings, C.W., 1977, Geologic Map of California: California Department of Conservation, Division of Mines and Geology, scale 1:750,000.
Digital Data: Saucedo, G.J., Bedford, D.R., Raines, G.L., Miller, R.J., and Wentworth, C.M., 2000, GIS Data for the Geologic Map of California: California Department of Conservation, Division of Mines and Geology, CD-ROM 2000-007, ver. 2.0.

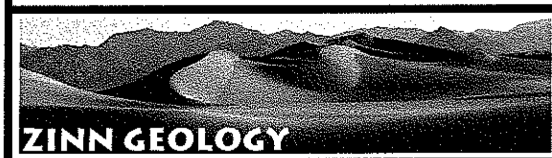
EXPLANATION

Geologic Units
- Quaternary Deposits
- Quaternary Volcanics
- Tertiary Sedimentary Rocks
- Tertiary Volcanic Rocks
- Pre-Tertiary Sedimentary Rocks
- Pre-Tertiary Volcanic Rocks
- Grantic Intrusive Rocks
- Franciscan Complex
- Ultramafic Rocks
- Pre-Tertiary Metamorphic Rock
- Pre-Cambrian Metamorphic and Igneous Rocks

Symbols
- contact
- fault, certain
- fault,approx. located
- fault, concealed or inferred
- anticline
- monocline
- syncline

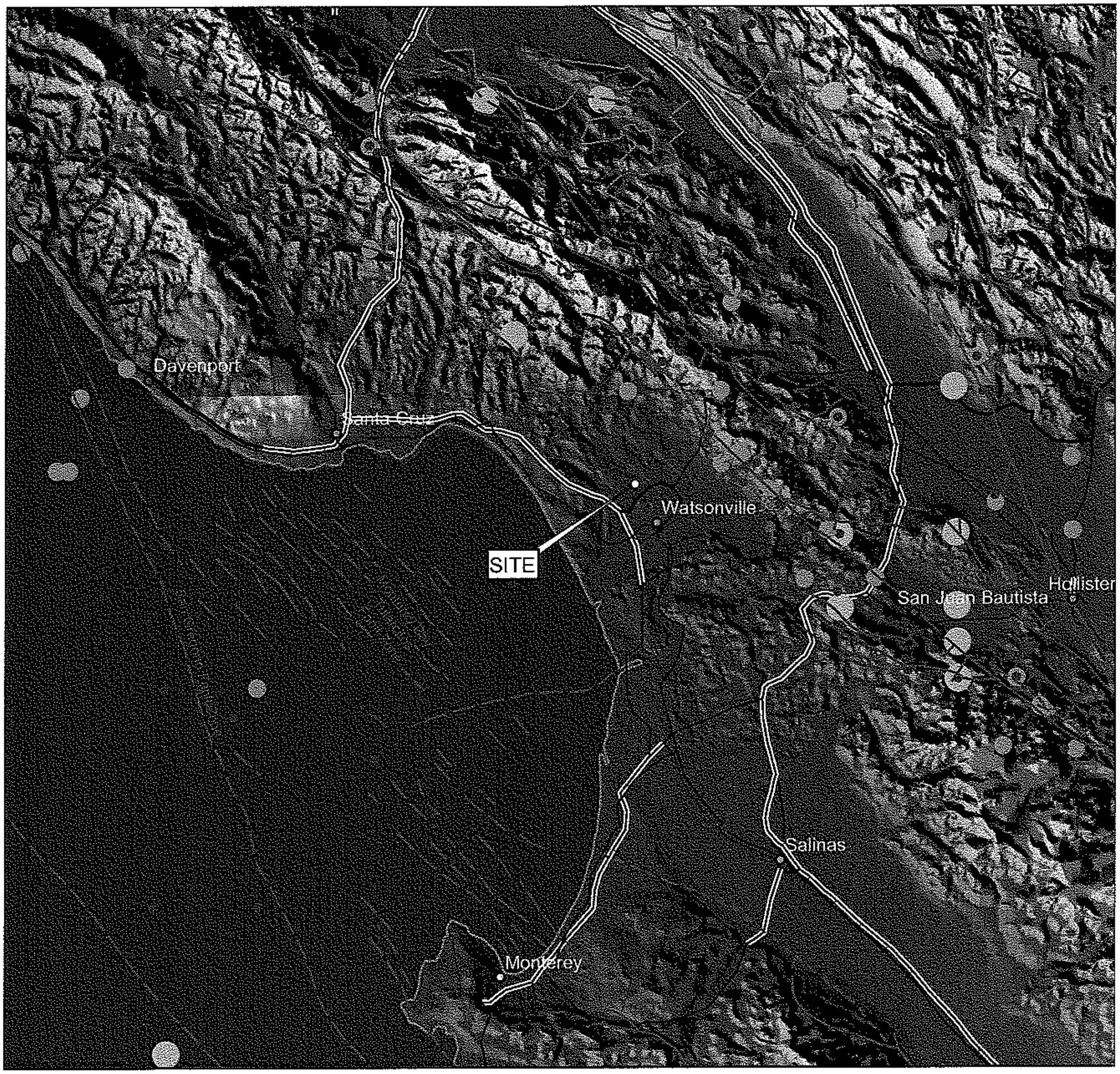
N W E S

SCALE 1:500,000
10 Miles 0



Regional Geologic Map
Atkinson Lane EIR
Atkinson Lane
Watsonville, California

FIGURE #
2
JOB #
2008010-G-SC



Seismicity Information: Magnitude 4 and greater earthquakes, compiled from various sources, 1769 to 2000; available at www.consrv.cagov/CGS/rghm/quakes/cgs2000_fnl.txt
Fault Information: Jennings, C.W., 1977, Geologic map of California: California Department of Conservation, Division of Mines and Geology, scale 1:750,000

EXPLANATION

Symbols

- fault, certain
- fault,approx. located
- fault, concealed or inferred

Earthquake Magnitude

- 4.0 to 4.99
- 5.0 to 5.99
- 6.0 to 6.99
- 7.0 +

N W E S

SCALE 1:500,000

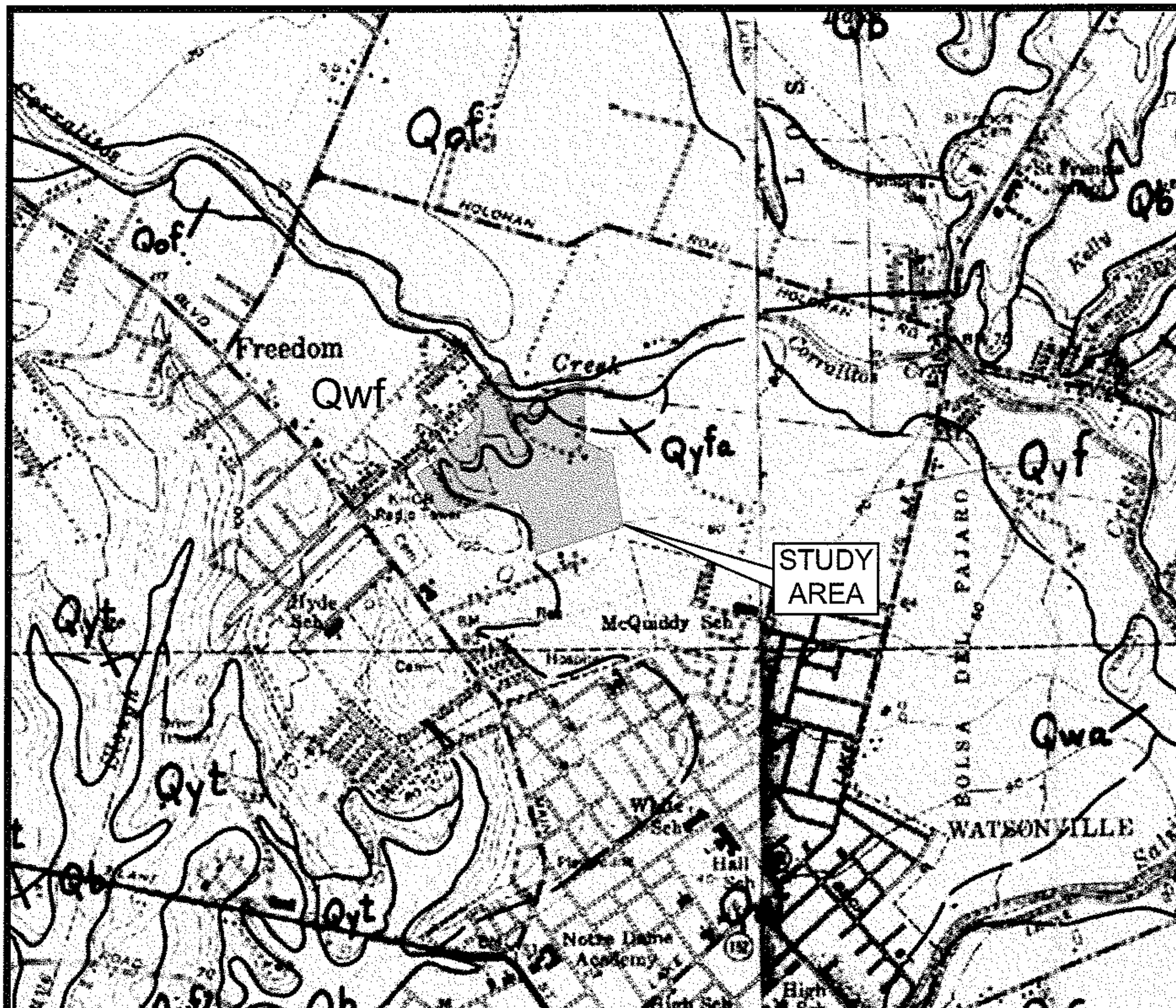
10 5 0 10

Miles

ZINN GEOLOGY

Regional Seismicity Map
Atkinson Lane EIR
Atkinson Lane
Watsonville, California

FIGURE #
3
JOB #
2008010-G-SC



BASE MAP: "MAPS SHOWING GEOLOGY AND LIQUEFACTION POTENTIAL OF NORTHERN MONTEREY AND SOUTHERN SANTA CRUZ COUNTIES, CALIFORNIA", Dupre and Tinsley, 1980, Sheet 1 of 2, Scale 1:62,500, U.S. Geological Survey Miscellaneous Field Studies Map MF-1199.

EXPLANATION

Qb	Basin deposits
Qyf	Younger flood-plain deposits
Qyfa	Veneer of younger flood-plain deposits
Qof	Older flood-plain deposits
Qyt	Younger terrace deposits
Qwf	Fluvial facies - Terrace deposits of Watsonville
Qwa	Alluvial fan facies - Terrace deposits of Watsonville

Earth materials contact

N W E S

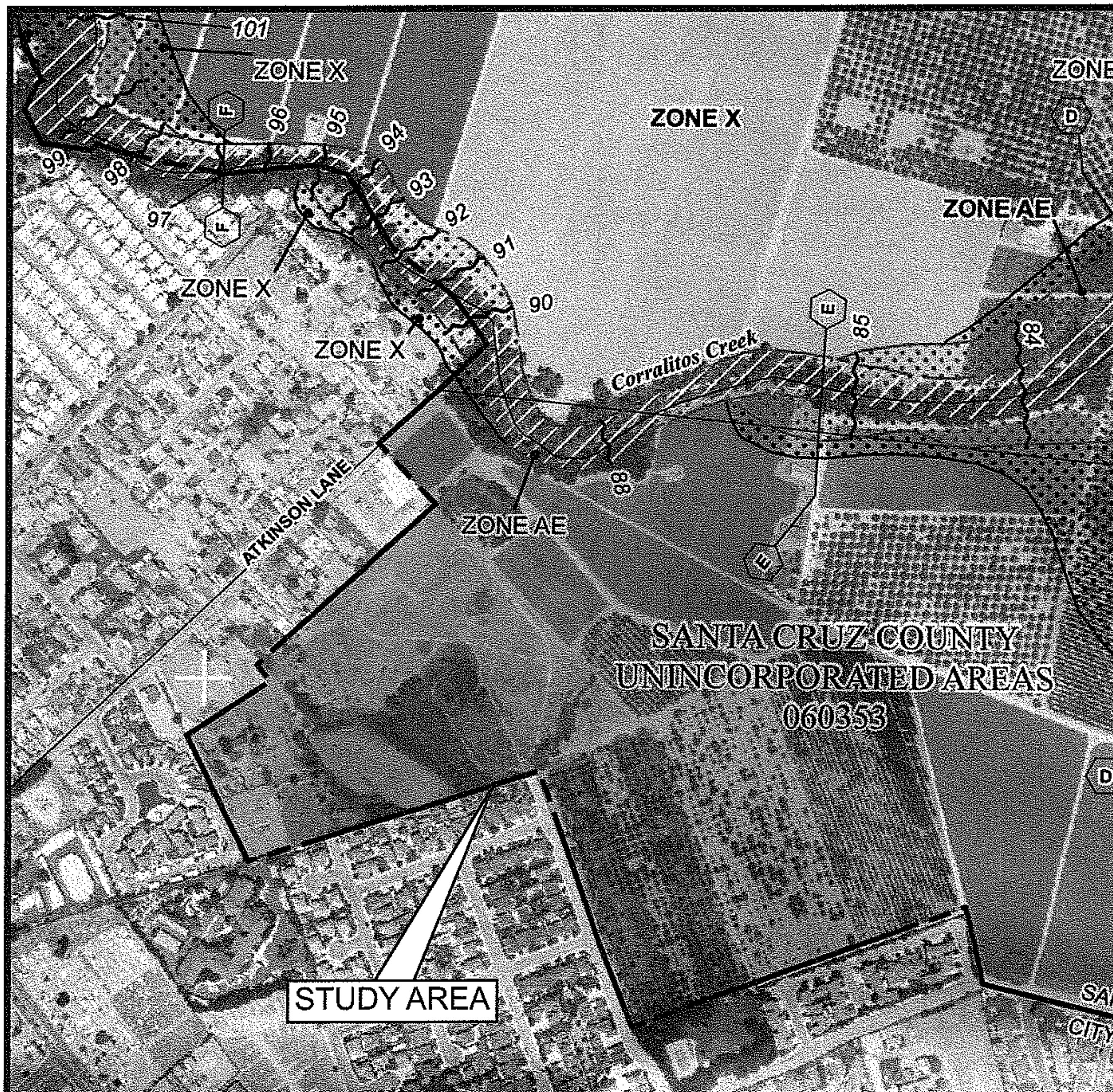
SCALE 1:24,000

1000 0 1000 2000 feet

ZINN GEOLOGY

Local Geologic Index Map
Atkinson Lane EIR
Atkinson Lane
Watsonville, California

FIGURE #
4
JOB #
2008010-G-SC



BASE MAP: Flood Insurance Rate Map, Santa Cruz County, California (unincorporated areas), community-panel # 0392D. Federal Emergency Management Agency, effective March 2, 2006.

Explanations of Zone Designations

ZONE X — Areas Deteremined to be outside the 0.2% annual chance floodplain.

ZONE X in — Areas of average 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less that 1 foot or with daringe areas less than 1 square mile; and areas protected b levees from 1% annual chance flood.

ZONE AE in — Special Flood Hazards Area Subject To Inundation By The 1% annual Chance Flood

Floodway Areas in ZONE AE

N W E S

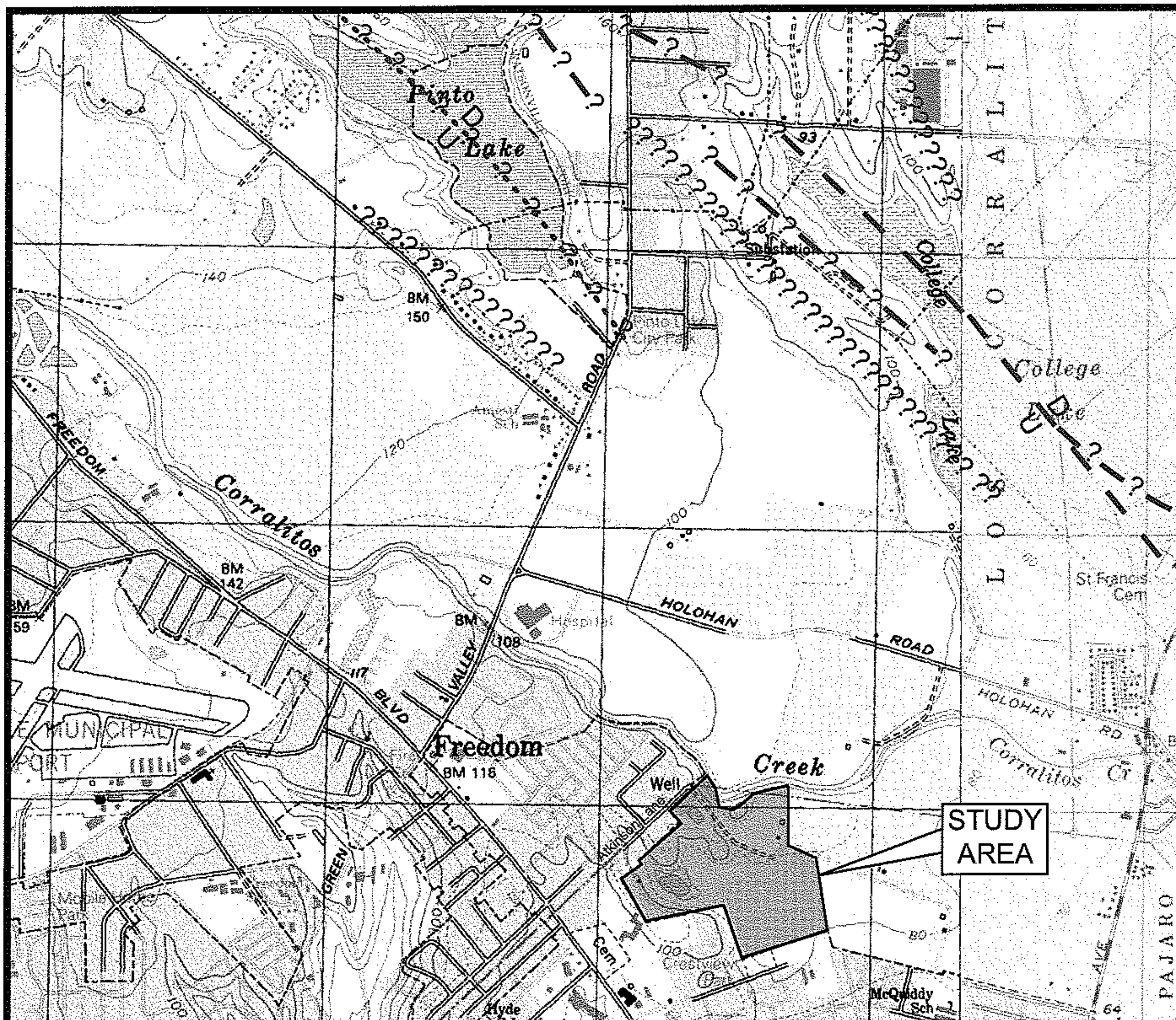
SCALE 1:12000

0 feet 1000

ZINN GEOLOGY

FLOOD INSURANCE RATE INDEX MAP
Atkinson Lane EIR
Atkinson Lane
Watsonville, California

FIGURE #
5
JOB #
2008010-G-SC



BASE MAP: U.S. Geological Survey, 1954 (photorevised 1995), Watsonville West Quadrangle, California, 7.5' topographic series, scale 1:24,000, U.S. Geological Survey, 1955 (photorevised 1995), Wastonville east Quadrangle, California 7.5' topographic series 1:24,000. Excerpts of fault traces taken from Hall et al. (1974), "Faults and their potential hazards in Santa Cruz County", U.S. Geological Survey Miscellaneous Field Studies Map MF-626, scale 1:62,500.COUNTY, CALIFORNIA, USGS.

EXPLANATION

— — ... Probable Fault - Dashed where exposed; dotted where concealed

—? —? ...? Possible Fault - Dashed where exposed; dotted where concealed

????????? Photolineament of unknown origin

N W E S

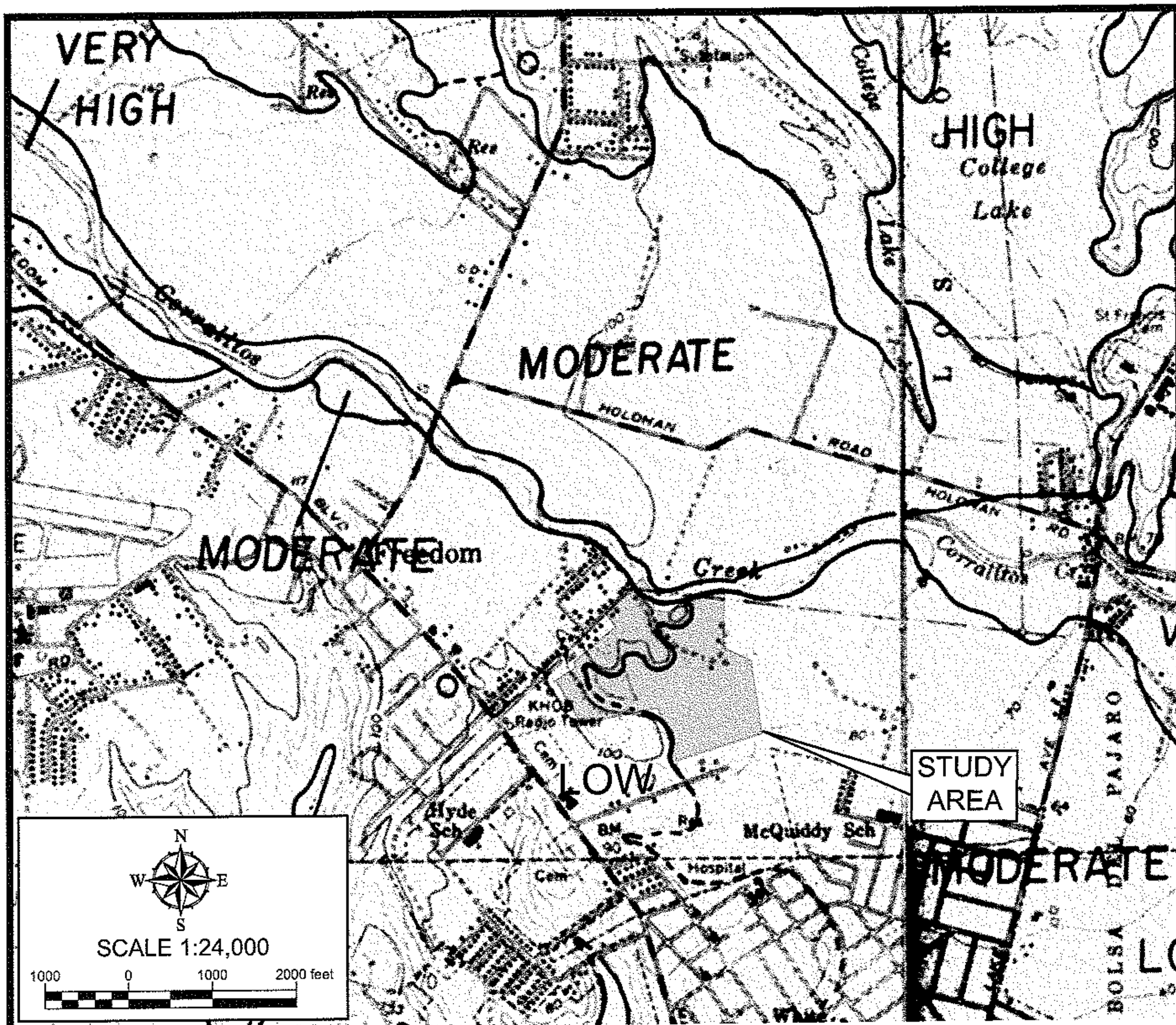
SCALE 1:24,000

1000 0 1000 2000 feet

ZINN GEOLOGY

Fault Index Map
Atkinson Lane EIR
Atkinson Lane
Watsonville, California

FIGURE #
6
JOB #
2008010-G-SC



BASE MAP: "MAPS SHOWING GEOLOGY AND LIQUEFACTION POTENTIAL OF NORTHERN MONTEREY AND SOUTHERN SANTA CRUZ COUNTIES, CALIFORNIA", Dupre and Tinsley, 1980, Sheet 2 of 2, Scale 1:62,500, U.S. Geological Survey Miscellaneous Field Studies Map MF-1199.

ZONES OF LIQUEFACTION SUSCEPTIBILITY

VERY HIGH SUSCEPTIBILITY FOR LIQUEFACTION: Sediments that are characterized by high susceptibilities for liquefaction (based on engineering tests) and for which there is historical evidence of extensive liquefaction-induced ground failure in the 1906 earthquake are classified as having very high susceptibility for liquefaction. Sediments in this zone are very likely to liquefy (and fail) in the event of even a moderate earthquake. The zone is mainly restricted to younger flood-plain deposits, as well as some basin deposits, beach sand, and dune sand in the vicinity of Moss Landing.

HIGH SUSCEPTIBILITY FOR LIQUEFACTION: Sediments for which engineering tests, the presence of shallow water tables, and the local presence of free faces indicate high susceptibility for liquefaction, but for which no historical evidence for liquefaction has been reported, are classed as having high susceptibility. Sediments in this zone are likely to liquefy in the even of a nearby major earthquake. Includes some basin deposits and younger flood-plain deposits, as well as most undifferentiated alluvial deposits and abandoned channel-fill deposits. Most dune sand and some beach sand are also included.

MODERATE SUSCEPTIBILITY FOR LIQUEFACTION: Sediments classed as having moderate susceptibility may liquefy in the event of a nearby major earthquake; they include sediments for which high susceptibilities were calculated but historical evidence for liquefaction is absent. Includes older flood-plain deposits, most basin and colluvium deposits, most undifferentiated alluvial deposits, and some late Pleistocene to Holocene eolian deposits.

ZINN GEOLOGY

Liquefaction Susceptibility Index Map
Atkinson Lane EIR
Atkinson Lane
Watsonville, California

FIGURE #
7
JOB #
2008010-G-SC

APPENDIX B

SCALE OF ACCEPTABLE RISKS FROM GEOLOGIC HAZARDS

SCALE OF ACCEPTABLE RISKS FROM SEISMIC GEOLOGIC HAZARDS

Risk Level	Structure Types	Extra Project Cost Probably Required to Reduce Risk to an Acceptable Level
Extremely low[1]	Structures whose continued functioning is critical, or whose failure might be catastrophic: nuclear reactors, large dams, power intake systems, plants manufacturing or storing explosives or toxic materials.	No set percentage (whatever is required for maximum attainable safety).
Slightly higher than under "Extremely low" level.[1]	Structures whose use is critically needed after a disaster: important utility centers; hospitals; fire, police and emergency communication facilities; fire station; and critical transportation elements such as bridges and overpasses; also dams.	5 to 25 percent of project cost.[2]
Lowest possible risk to occupants of the structure.[3]	Structures of high occupancy, or whose use after a disaster would be particularly convenient: schools, churches, theaters, large hotels, and other high rise buildings housing large numbers of people, other places normally attracting large concentrations of people, civic buildings such as fire stations, secondary utility structures, extremely large commercial enterprises, most roads, alternative or non-critical bridges and overpasses.	5 to 15 percent of project cost.[4]
An "ordinary" level of risk to occupants of the structure.[3,5]	The vast majority of structures: most commercial and industrial buildings, small hotels and apartment buildings, and single family residences.	1 to 2 percent of project cost, in most cases (2 to 10 percent of project cost in a minority of cases).[4]

1 Failure of a single structure may affect substantial populations.

2 These additional percentages are based on the assumptions that the base cost is the total cost of the building or other facility when ready for occupancy. In addition, it is assumed that the structure would have been designed and built in accordance with current California practice. Moreover, the estimated additional cost presumes that structures in this acceptable risk category are to embody sufficient safety to remain functional following an earthquake.

3 Failure of a single structure would affect primarily only the occupants.

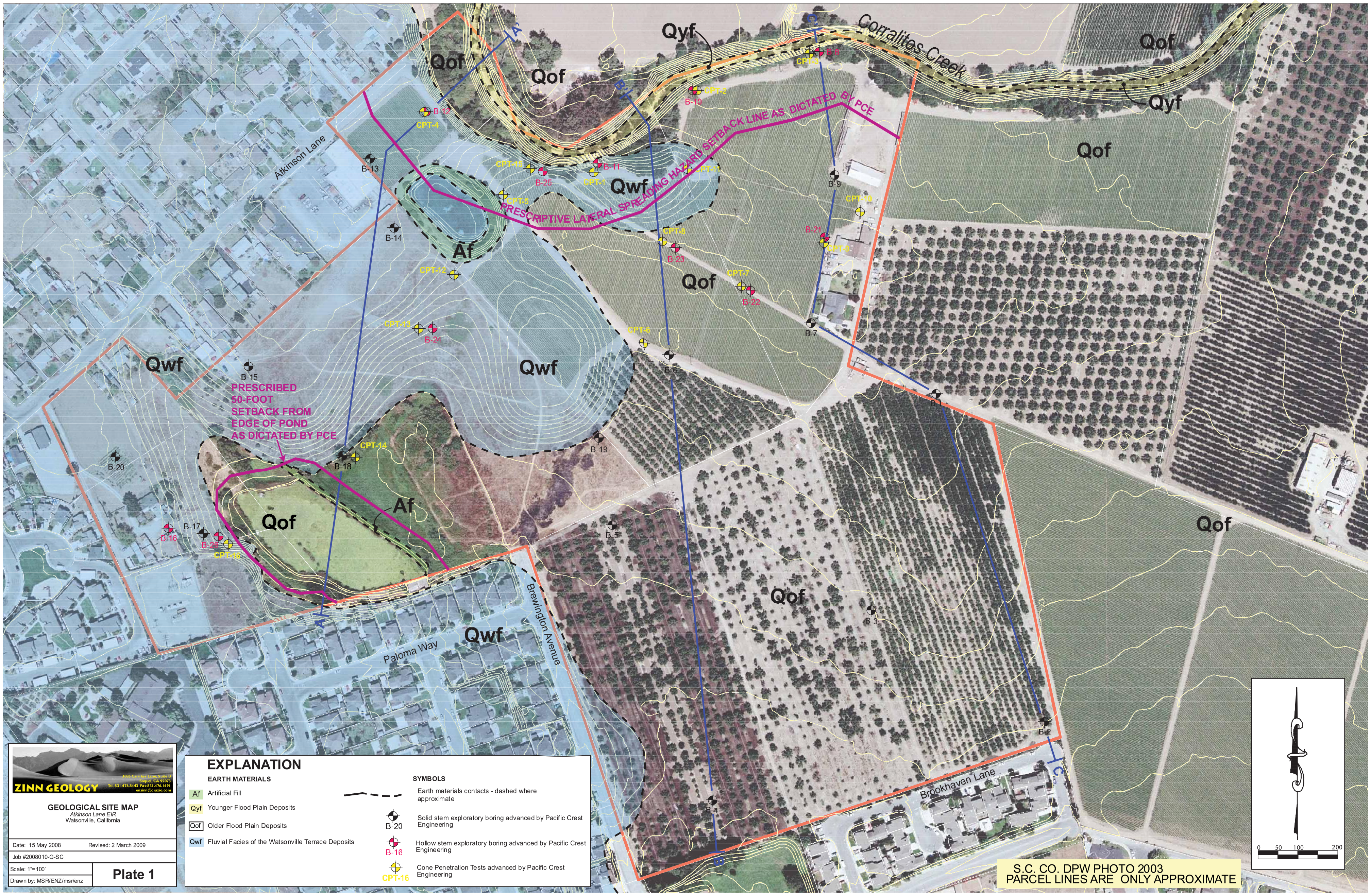
4 These additional percentages are based on the assumption that the base cost is the total cost of the building or facility when ready for occupancy. In addition, it is assumed that the structures would have been designed and built in accordance with current California practice. Moreover the estimated additional cost presumes that structures in this acceptable-risk category are to be sufficiently safe to give reasonable assurance of preventing injury or loss of life during and following an earthquake, but otherwise not necessarily to remain functional.

5 "Ordinary risk": Resist minor earthquakes without damage: resist moderate earthquakes without structural damage, but with some non-structural damage; resist major earthquakes of the intensity or severity of the strongest experienced in California, without collapse, but with some structural damage as well as non-structural damage. In most structures it is expected that structural damage, even in a major earthquake, could be limited to repairable damage. (Structural Engineers Association of California)

Source: *Meeting the Earthquake,* Joint Committee on Seismic Safety of the California Legislature, Jan. 1974, p.9.

SCALE OF ACCEPTABLE RISKS FROM NON-SEISMIC GEOLOGIC HAZARDS[6]		
Risk Level	Structure Type	Risk Characteristics
Extremely low risk	Structures whose continued functioning is critical, or whose failure might be catastrophic: nuclear reactors, large dams, power intake systems, plants manufacturing or storing explosives or toxic materials.	1. Failure affects substantial populations, risk nearly equals nearly zero.
Very low risk	Structures whose use is critically needed after a disaster: important utility centers; hospitals; fire, police and emergency communication facilities; fire station; and critical transportation elements such as bridges and overpasses; also dams.	1. Failure affects substantial populations. Risk slightly higher than 1 above.
Low risk	Structures of high occupancy, or whose use after a disaster would be particularly convenient: schools, churches, theaters, large hotels, and other high rise buildings housing large numbers of people, other places normally attracting large concentrations of people, civic buildings such as fire stations, secondary utility structures, extremely large commercial enterprises, most roads, alternative or non-critical bridges and overpasses.	1. Failure of a single structure would affect primarily only the occupants.
"Ordinary" risk	The vast majority of structures: most commercial and industrial buildings, small hotels and apartment buildings, and single family residences.	1. Failure only affects owners /occupants of a structure rather than a substantial population. 2. No significant potential for loss of life or serious physical injury. 3. Risk level is similar or comparable to other ordinary risks (including seismic risks) to citizens of coastal California. 4. No collapse of structures; structural damage limited to repairable damage in most cases. This degree of damage is unlikely as a result of storms with a repeat time of 50 years or less.
Moderate risk	Fences, driveways, non-habitable structures, detached retaining walls, sanitary landfills, recreation areas and open space.	1. Structure is not occupied or occupied infrequently. 2. Low probability of physical injury. 3. Moderate probability of collapse.

[6] Non-seismic geologic hazards include flooding, landslides, erosion, wave runup and sinkhole collapse



EXPLANATION

EARTH MATERIALS

- Af — Artificial Fill
- Qyf — Younger Flood Plain Deposits
- Qof — Older Flood Plain Deposits
- Qwf — Fluvial Facies of the Watsonville Terrace Deposits

SYMBOLS

- Earth materials contacts - dashed where approximate
- B-20 — Solid stem exploratory boring advanced by Pacific Crest Engineering
- B-16 — Hollow stem exploratory boring advanced by Pacific Crest Engineering
- CPT-16 — Cone Penetration Tests advanced by Pacific Crest Engineering

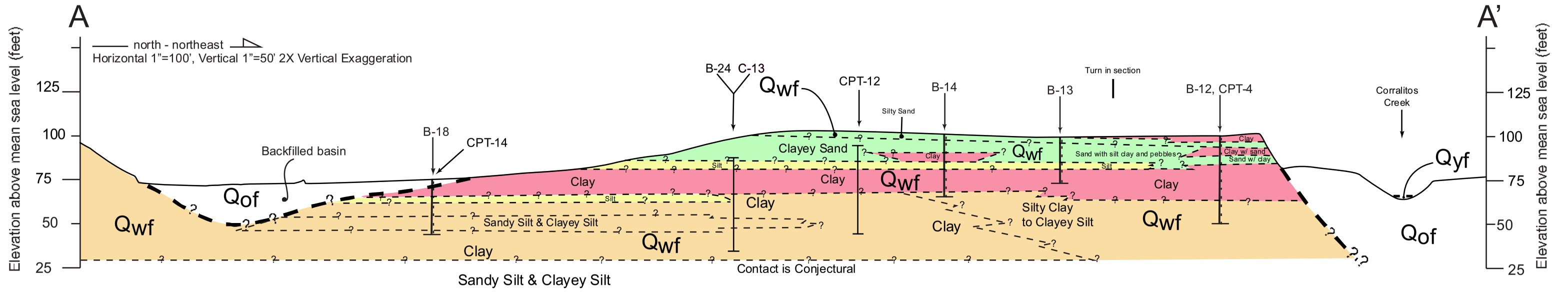
ZINN GEOLOGY

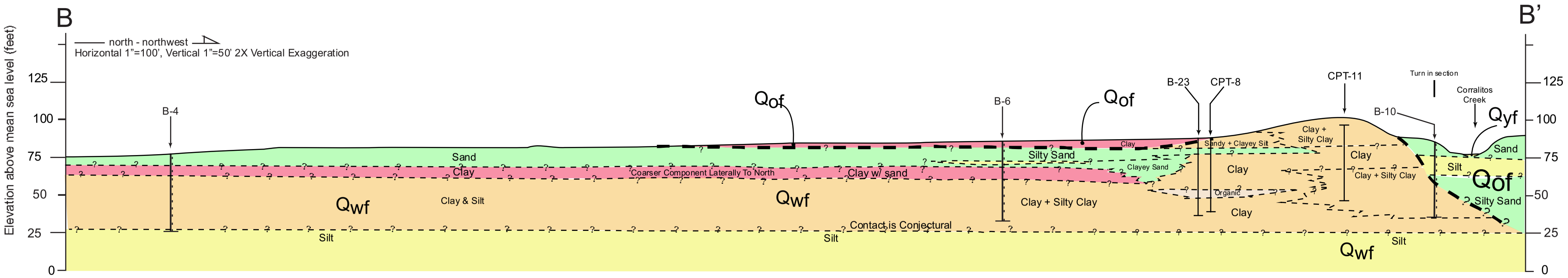
GEOLOGICAL SITE MAP

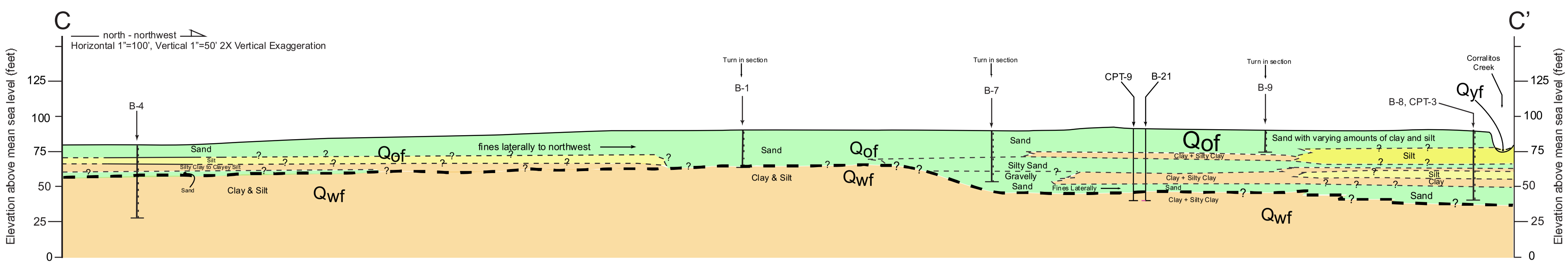
Atkinson Lane EIR

Watsonville, California

Date: 15 May 2008	Revised: 2 March 2009
Job #2008010-G-SC	
Scale: 1"=100'	Plate 1
Drawn by: MSR/ENZ/msr/enz	







EXPLANATION

EARTH MATERIALS

- Silty Clay to Clayey Silt
- Clay
- Sand
- Silt

SYMBOLS

- Geologic unit contact - dashed where approximate, queried where uncertain
- Intra-geologic unit earth materials contact - dashed where approximate, queried where uncertain
- B-18: Exploratory boring advanced by Pacific Crest Engineering small filled rectangles indicate where samples were taken.
- CPT-4: Cone penetration test soundings advanced by Pacific Crest Engineering.

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GEOLOGICAL CROSS SECTIONS

Atkinson Lane EIR
Watsonville, California

Date: 20 May 2008 | Revised: 2 March 2009

Job #: 2008010-G-SC

Scale: Horizontal 1"=100', Vertical 1"=50' 2X Vertical Exaggeration

Drawn by: MSR/ENZ/msr/enz

Plate 2