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November 19, 2008

Christopher Meyer
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Subject: Data Response, Set 1
GWF Tracy Combined Cycle Power Plant Project (08-AFC-7)

On behalf of the GWF Energy LLC., please find attached 12 copies and one original of the Data Responses, Set 1, in response to Staff's Data Requests dated October 21, 2008.

Included in this submittal are 5 copies (each) of Attachments DR21-1, DR25-1, and DR25-2 per Data Request numbers 21 and 25.

Please call me if you have any questions.

Sincerely,

CH2M HILL

Jerry Salamy
Senior Project Manager

c: Proof of Service List

Application for Certification

Responses to Data Requests 1 though 37

GWF Tracy Combined Cycle Power Plant Project

Submitted by

GWF®

With Technical Assistance by

CH2MHILL

November 2008

ES032008008SAC

GWF Tracy Combined Cycle Power Plant Project

(08-AFC-7)

Data Responses

(Responses to Data Requests 1 though 37)

Submitted to

California Energy Commission

Submitted by

GWF Energy, LLC

November 2008

With Assistance from

CH2MHILL

2485 Natomas Park Drive
Suite 600
Sacramento, CA 95833

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Introduction

Attached are GWF Energy LLC's (GWF or Applicant) responses to the California Energy Commission (CEC) staff's Data Requests numbered 1 through 15 – Air Quality, 16 through 19 - Biological Resources, 20 through 28 -Cultural Resources, 29 - Geology and Paleontology, 30 through 31 - Land Use, and 32 through 37 – Soil & Water for the GWF Tracy Combined Cycle Power Plant Project (GWF Tracy). The CEC staff served these data requests on October 17, 2008, as part of the discovery process for GWF Tracy's Application for Certification (AFC) (08-AFC-7). The responses are presented in the same order as the CEC staff presented them and are keyed to the Data Request numbers (1 through 37). New or revised graphics or tables are numbered in reference to the Data Request number. For example, the first table used in response to Data Request 15 would be numbered Table DR15-1. The first figure used in response to Data Request 15 would be Figure DR15-1, and so on.

Additional documents submitted in response to a data request i.e., stand-alone documents) are found at the end of this Data Response submittal and are not sequentially page-numbered with the remainder of the document, though they may have their own internal page numbering system.

The Applicant looks forward to working cooperatively with CEC staff as GWF Tracy proceeds through the siting process. We trust that these responses address the staff's questions and remain available to have any additional dialogue the staff may require.

Air Quality (1-15)

BACKGROUND

Greenhouse Gas Emissions

Energy Commission staff seeks to quantify the emissions of greenhouse gases (GHG) caused during construction of the project. These include carbon dioxide, nitrous oxide, and methane (unburned natural gas). AFC Section 5.1.6.1 identifies the applicant proposed mitigation for construction, but staff needs to identify all feasible measures for increasing energy efficiency and reducing GHG emissions from construction. Staff also seeks to quantify emissions from worker commutes and material deliveries during operation of the proposed project.

Data Request

1. Please quantify the total and annual average GHG emissions for the construction phase of the proposed project. Staff considers the construction phase to include the activities at the construction site, any construction activities for linear facilities (gas and water pipelines and transmission lines), worker commutes, and material deliveries.

Response: Annual average and total GHG emissions from construction are presented in Table DR1-1. Construction equipment emissions were estimated using emission factors from the California Climate Action Registry (CCAR) General Reporting Protocol (GRP) (version 3.0) and fuel consumption rates from the OFFROAD model. Vehicle emissions (trucks and worker commutes) were estimated using emission factors from the CCAR GRP (version 3.0) and United States Environmental Protection Agency (EPA) fuel economy values. Detailed calculations are included in Attachment DR1-1.

TABLE DR1-1
GHG Emissions from Construction

	GHG Emissions (metric tons)			
	CO_2	CH_4	N_2O	CO_2 Equivalent
Annual Average (metric tons/year)	3,027	0.39	0.086	3,062
Total (metric tons)	4,078	0.53	0.108	4,123

Note: Calculations were based on monthly construction activity estimates for the 20 months of construction (see Attachment DR1-1, Table 5a and 5b).

Data Request

2. Please identify the measures and control strategies that would be implemented to minimize or reduce GHG emissions caused during the construction phase of the proposed project.

Response: GWF will implement the following measures to minimize GHG emissions during the construction phase of the project.

- Encourage construction workforce to carpool.
- Encourage through contract language with the Engineering, Procurement, and Construction (EPC) contractor to incorporate low carbon fuels and electrification of non-mobile construction equipment (welders, fork lifts, man-lifts, etc.).
- Encourage through contract language with the Engineering, Procurement, and Construction (EPC) contractor to incorporate low carbon fuels (biodiesel) for mobile construction equipment.
- Limit construction equipment idling time to no more than 5 minutes.

Data Request

3. Please quantify emissions of criteria pollutants and GHG from worker commutes and material deliveries during operation of the proposed project.

Response: Criteria pollutant emissions from worker commutes and material deliveries are presented in Table DR3-1. Emissions were estimated using emission factors from EMFAC2007 (version 2.3). Detailed calculations are included in Attachment DR3-1.

TABLE DR3-1
Criteria Pollutant Emissions from Worker Commute and Deliveries During Operation

Emission Source	Emissions (lbs/yr)*					
	ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
Worker Commute	28	1,138	113	1.9	19	9
Material Deliveries	3	75	20	0.1	1	1
Total	**31**	**1,212**	**133**	**2.0**	**20**	**10**

*The calculations assume 13 workers per day and 11 deliveries per month.

GHG emissions from worker commutes and material deliveries are presented in Table DR3-2. Emissions were estimated using emission factors from the CCAR GRP (version 3.0). Detailed calculations are included in Attachment DR3-2.

TABLE DR3-2
GHG Emissions from Worker Commute and Deliveries During Operation

Emission Source	GHG Emissions (metric tons/yr)*			
	CO_2	CH_4	N_2O	CO_2 Equivalent
Worker Commute	139	0.011	0.011	143
Material Deliveries	19	0.002	0.003	20
Total	**159**	**0.01**	**0.01**	**163**

*The calculations assume 13 workers per day and 11 deliveries per month.

BACKGROUND

Commissioning

The total number of hours necessary to complete the commissioning phase is not shown in AFC Section 5.1.4.1.2 or Appendix Table 5.1B-1. Without this information, it is not possible to confirm the total commissioning period emissions shown in AFC Table 5.1-5

Data Request

4. Please quantify the number of anticipated hours for each of the commissioning steps in AFC Appendix Table 5.1B-1.

Response: Attachment DR4-1 presents the number of anticipated firing hours for each of the commissioning steps.

It was determined during the preparation of Data Responses #4, #5 and #9 that the following corrections to the hourly NOx and CO emission rates for commissioning should also be noted in AFC Table 5.1-13 and AFC Appendix Table 5.1B-1:

- For commissioning activities which included a startup and shutdown (see Data Response #9), the hourly emission rates in AFC Table 5.1-13 and AFC Appendix Table 5.1B-1 were estimated assuming the startup and shutdown emission rates were per turbine. However, the emission rates should have been calculated assuming the startup and shutdown emission rates for NOx and CO were for both turbines combined. Therefore, the revised hourly emission rates in Attachment DR4-1 may be lower than the emission rates presented in AFC Table 5.1-13 and AFC Appendix Table 5.1B-1.
- Conversely, the emission rates for NOx and CO for the "CALISO Certification", "Performance Testing with Duct Burner", and "CALISO Certification with Duct Burner" were underestimated in AFC Table 5.1-13 and AFC Appendix Table 5.1B-1. The NOx and CO emission rates should have been multiplied by a factor of two. Therefore, the revised hourly emission rates for these three commissioning activities in Attachment DR4-1 will be higher than the emission rates presented in AFC Table 5.1-13 and AFC Appendix Table 5.1B-1. The increase in emission rates for these three activities would not increase the maximum predicted commissioning impact in AFC Table 5.1-16, however, because the maximum predicted impact was associated with the verification of STG on turning gear (Scenario #6 – See AFC Appendix Table 5.1C-2).

Data Request

5. Please quantify the total number of operational hours needed for the commissioning phase of the proposed project and confirm the emission totals shown in AFC Table 5.1-5.

Response: Attachment DR4-1 presents the total number of anticipated firing hours for turbine commissioning. However, it was also determined during the preparation of Data Response #4, #5, and #9 that the facility total should be 15.9 ton/year compared to 16.1 ton/year in AFC Table 5.1-5. The decrease was due to a minor correction made to the emission total for one of the "RATA/Pre-performance Testing/Source Testing" line items.

BACKGROUND

Startup Emissions

Staff aims to assess whether the proposed project would use the best available technology for minimizing emissions and durations in startup mode. According to public press releases from the manufacturer, the General Electric Rapid Response design and OpFlex turbine technology is available for new General Electric Frame 7F combustion turbines in combined-cycle systems. It is not clear from the AFC whether minimizing combined-cycle startup emissions from the existing Frame 7E turbines was a design consideration.

Data Request

6. Please describe what features were considered for minimizing startup mode emissions and durations caused by the existing Frame 7E combustion turbines in the proposed combined-cycle system. Include in this discussion whether aspects of the GE Rapid Response design systems could be incorporated in the existing Frame 7E turbine systems.

Response: Efforts to minimize startup emissions from GWF Tracy will be incorporated into the plant design through two main approaches: minimization of instantaneous combustion turbine generator (CTG) emissions during startup, and minimization of plant start times. The following response will address the efforts to minimize instantaneous CTG emissions. The minimization of plant start times will be discussed in response to Data Request #7.

During a startup event the CTG will be limited in how quickly it increases operational load by the exhaust temperature limitations of the heat recovery steam generator (HRSG) and the steam condition limitations of the air cooled condenser (ACC) and the steam turbine (ST). Combined cycle plant startup procedures normally require CTGs to hold at predetermined operational levels to allow the HRSG to heat with allowable thermal stress on equipment. The emission rates of the typical 7EA CTG through a startup event have been detailed by General Electric. The startup procedures and curves for the plant will be designed with the goal of ensuring that the CTG hold points are at the lowest emission rates available within an acceptable exhaust temperature range. GE Rapid Response design that is available for the 7F CTG models is not available for the 7EA, but many of the design aspects of the Rapid Response system are being incorporated into the design such as use of an auxiliary boiler and full steam bypass to the ACC. The use of auxiliary steam is discussed in response to Data Request #7.

Data Request

7. Please provide a discussion that demonstrates all feasible modifications have been considered and included in the proposed changes to the fuel system, turbine control system, steam control system, or other systems, including the proposed auxiliary boiler, to minimize combined-cycle startup emissions and durations.

Response: Another means of reducing GWF Tracy start emissions is through minimizing plant overall start times. The CTG start time, which is directly proportional to the total emissions per start event, is limited by the amount of time required for the HRSG, ST and ACC to achieve operation. The thermal stresses experienced by the HRSG hardware limits the exhaust temperature and thus the ramp rate of the CTG. Combined cycle plant start times are also lengthened by the amount of time required to prepare the ST and ACC to receive steam from the HRSG. GWF Tracy will have an auxiliary boiler on site to provide steam to the steam drums, steam turbine seals and ACC with the sole purpose of minimizing start times. Steam provided to the steam drums will allow the plant to maintain warm start capabilities longer than normal by maintaining steam drum metal temperatures and reducing potential thermal stress. Steam provided to the ST will establish steam seals prior to steam being available from the HRSG and will shorten the time required to prepare the ST to accept steam. Steam will also be provided to an ejector system to establish vacuum in the ACC and prepare it to receive steam. The incorporation of a full steam bypass to the ACC will allow the CTGs to ramp to full load while the ST may still be preparing to receive steam. The efforts will result in the ability of the CTG to ramp to its most efficient operating state sooner and an overall reduction in startup emissions.

BACKGROUND

Nitrogen Oxides (NOx) Emissions

Startup emissions of nitrogen oxides (NOx) are shown to be approximately 399 lb/hr for both turbines combined, during the worst hour of startup (AFC Table 5.1B-5). There is no explanation for why these emissions should be greater than those during commissioning, when numerous startups would occur, which are shown to be 161 lb/hr per turbine (AFC Table 5.1-5) or 322 lb/hr for both turbines combined.

Data Request

8. Please provide the emission calculations used to derive the 399 lb/hr emission rate and total emissions per event for NOx during startups.

Response: The maximum one hour start-up emission rate (399 lb/hr) is the sum of the maximum possible (worst) emissions in one hour during startup cycle. As per the assumed startup cycles, the worst NOx emission estimates occur between the 25th minute and 85th minute during cold startup cycle and between the 26th and 86th minute for warm startup cycle on a cold day with ambient temperature of 15F, 100% RH and 14.61 psia pressure. Commissioning emissions estimates were based on 59F, 60% RH conditions which represent the annual average for the site. The maximum one hour start-up emission estimate also assumes the SCR and CO catalyst are installed but not in service during the worst emissions period for NOx, CO, UHC, VOC and Particulates.

Attachment DR8-1 presents the Black & Veatch (B&V) engineering curve used to represent emissions during a start-up event. Per B&V, the flat curve below 50 percent represents a conservative estimate of the emissions provided by GE.

Data Request

9. Please confirm the 161 lb/hr per turbine maximum emission rate for commissioning shown in AFC Table 5.1-5.

Response: The values used to determine the 161 lb/hr per turbine maximum emission rate are presented in Attachment DR9-1. As discussed in the response to DR #4, the revised hourly emissions are lower than the emission rates presented in the AFC. The new maximum NOx emission rate during commissioning is 146.7 lb/hr.

BACKGROUND

Particulate Matter Emission Rate

AFC Table 5.1-14 shows that for air dispersion modeling input, a total particulate matter (PM10/PM2.5) rate of 5.8 lb/hr is used for each turbine over a 24-hour period, which indicates a combined hourly rate of 11.6 lb/hr and a combined daily rate of 278.4 lb/day. However, AFC Table 5.1-10 portrays the hourly maximum rate as 9.4 lb/hr during a startup and the daily maximum rate as 264 lb/day, or 11.0 lb/hr per turbine. The maximum rate is also shown as 11.0 lb/hr per turbine for a startup in AFC Appendix Table 5.1B-2.

Data Request

10. Please provide the emission calculations or assumptions used to derive the stated particulate matter emission rates.

Response: The maximum PM_{10} emission rate of 5.8 lb/hr/turbine, which is presented in AFC Table 5.1-14, is based on a conservative fuel sulfur content of 0.66 grains/100 dscf. The maximum PM10 emission rate using an average sulfur content of 0.25 grains/100 dscf would be 4.4 lb/hr/turbine. Therefore, the results of the dispersion modeling were based on the most conservative (i.e., high sulfur content) emission rate.

The 11 LBM value in AFC Appendix Table 5.1B-2 represents the total pounds of PM10 emitted per 180-minute startup event for the front or back half of the exhaust train for both turbines combined. Therefore, the total emission rate (front half plus back half) for both turbines during a 180-minute startup event is 22.0 lbs/event or an average PM10 emission rate of 3.67 lb/hr/turbine. However, based on the vendor data presented in AFC Appendix Table 5.1B-5, the PM10 emission rate over the 180-minute startup is non-linear. Therefore, the maximum PM10 emission rate of 9.4 lb/hr, which is presented in Table 5.1-10, represents the maximum 1-hour emission rate for both turbines calculated by the vendor (see AFC Appendix Table 5.1B-5).

The total daily PM10 emission rate of 264 lb/hr presented in Table 5.1-10 represents the combined daily PM10 emission rate assuming one cold start, one shutdown, 20.4 hours of steady state operation at 15F with duct burner firing, and a fuel sulfur content of 0.66 grains/100 dscf. Therefore, the hourly rate would be 264 lb/day/2 turbines/24 hours per day = 5.5 lb/hr/turbine, which would be less than the maximum one-hour emission rate of 5.8 lb/hr/turbine above.

Data Request

11. Please confirm the maximum PM10/PM2.5 emission rates during startups and routine operations and explain how the differences between the two modes of operation would affect emissions.

Response: Please see the response to Data Request #10.

BACKGROUND

Dispersion Modeling

AFC Table 5.1-17 shows the modeled impacts of nitrogen dioxide (NO2) during testing of one of the emergency diesel engines. Staff believes that concurrent operation of diesel engine testing with both turbines commencing startup is not a common operational scenario.

Data Request

12. Please summarize the results of modeling for 1-hour NO2 impacts during simultaneous startup of two combustion turbines, without operation of emergency diesel engines.

Response: A summary of the 1-hour NO2 impacts for each source group, individual source, and operating scenario are presented in Table 5.1C-6 of the AFC Appendix. The source groups include:

- EGENRUN – predicted impact for all sources with the exception of the fire pump.
- PUMPRUN – predicted impact for all sources with the exception of the emergency generator.
- HRSG – predicted impacts for the two HRSG only

BACKGROUND

Emission Reduction Credits

AFC Table 5.1-23 shows the currently permitted emissions for original project, and amounts of credits for reductions of carbon monoxide (CO) and sulfur dioxide (SO2) that would be surrendered voluntarily. This table also shows the quantity of reductions of NOx that would be applied to particulate matter increases, at a ratio of 2.38-to-1 that was derived from a Sierra Research study that was not included in the AFC. Staff needs additional information on the ERCs that will be surrendered as mitigation for the SO2 and CO increases and the inter-pollutant study that was used to determine the NOx to PM trading ratio.

Data Request

13. Please identify the emission reduction credits that GWF owns for CO and SO_2 that would be surrendered voluntarily, by certificate number, date of original reduction, and location of original reduction.

Response: AFC Appendix 5.1B contains copies of GWF's CO and SO2 ERC certificates being voluntarily surrendered.

Data Request

14. Please provide a copy of the reference for the inter-pollutant trading ratio of 2.38-to-1 for NOx-to-particulate matter, from Sierra Research, dated March 7, 2008.

Response: Attachment DR14-1 presents a copy of the requested memorandum.

BACKGROUND

Cumulative Modeling Analysis

AFC Section 5.1.7 describes a cumulative modeling impact assessment that has not yet been filed with the Energy Commission.

Data Request

15. Please provide the analysis of cumulative air quality impacts.

Response: The San Joaquin Valley Air Pollution Control District provided a list (on November 6, 2008) of 37 facilities that have requested or have received authority to construct permits within 6 miles of the GWF Tracy site. This list in provided in Attachment DR15-1. A preliminary review of this list shows that many of the sources are either VOC sources that are not included in cumulative air modeling impact analysis, equipment shutdowns, Permit-Exempt Equipment Registrations (PEER), rule compliance, permit renewals, or replacement/upgrading of existing systems. Based on this preliminary review, Table DR15-1 presents potential sources for which GWF will request additional information from the SJVAPCD to determine if these sources should be included in the cumulative impact assessment. GWF will submit the air quality cumulative impact assessment by the end of December 2008.

TABLE DR15-1
GWF Tracy Potential Cumulative Impact Sources

Facility ID	Facility Name	Date Received	Permit Type	Status	Description
1051	Basalite Concrete Products Llc	3/10/2006	ATC	Final	Addition of 40 Horsepower Dust Collectors to improve collection efficiency of a dry aggregate handling system.
1145	Musco Olive Products	9/15/08	ATC	PR-IN PR	A new bubbling fluidized bed boiler firing on olive pits.
1002	Lodi Metal Tech Inc	3/11/08	ATC	FINAL	Increased throughput.
1026	Thermal Energy Dev. Corp. Ltd.	8/21/07	ATC	FINAL	Modification of the biomass-fired boiler to establish an annual capacity factor of 10% for natural gas combustion.
692	RMC Pacific Materials	3/20/06	ATC	FINAL	Reconfigure Rock Plant with new and existing equipment.
692	RMC Pacific Materials	6/30/06	ATC	FINAL	New Aggregate Plant.
283	Deuel Vocational Institute	10/22/07	ATC	FINAL	Installation of a new 840 BHP diesel-fueled IC engine.
283	Deuel Vocational Institute	9/2/08	ATC	PR-INCO	398 HP Caterpillar Model C-9 diesel-fired emergency standby engine powering an electrical generator.
283	Deuel Vocational Institute	12/14/06	ATC	FINAL	Pyrolysis Cleaning Furnace.
472	Lawrence Livermore National Lab	10/10/06	ATC	FINAL	Explosives Detonation.
472	Lawrence Livermore National Lab	10/10/06	ATC	FINAL	The installation of a 315 BHP diesel-fired IC engine powering an electrical generator.

ATTACHMENT DR1-1

Construction Emission Calculations

Table 1a: Onsite Power Plant Construction Equipment CO_2 Emissions

Onsite Equipment	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Bulldozer	0	67.53	67.53	67.53	67.53	45.02	45.02	45.02	45.02	45.02	22.51	22.51	0	0	0	0	0	0	0	0
Air Compressor	0	0	0	0	0	0	0	0	0	0	35.37	35.37	35.37	41.27	47.16	53.06	58.95	70.74	70.74	64.85
Excavator	0	41.00	41.00	41.00	54.66	68.33	68.33	54.66	68.33	68.33	54.66	54.66	27.33	0	0	0	0	0	0	0
Grader	0	0	0	15.27	15.27	15.27	15.27	15.27	15.27	15.27	15.27	0	0	0	0	0	0	0	0	0
Cranes	0	0	0	0	0	0	0	13.67	27.33	54.66	95.66	95.66	95.66	95.66	95.66	95.66	95.66	109.33	109.33	109.33
Asphalt Paver	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34.30	34.30	17.15
Compactor	0	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33	0	0	0	0	0	0	0	0
Welding Machine	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (metric tons/month, E_m)	**0**	**120.85**	**120.85**	**136.12**	**149.79**	**140.95**	**140.95**	**140.95**	**168.28**	**195.61**	**235.80**	**220.53**	**158.36**	**136.93**	**142.82**	**148.72**	**154.61**	**214.37**	**214.37**	**191.32**
Annual Average (metric tons/year, E_a)	**2,182**																			
Total (metric tons/year, E_t)	**3,132**																			

Table 1b: Onsite Power Plant Construction Equipment CH_4 Emissions

Onsite Equipment	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Bulldozer	0	0.0093	0.0093	0.0093	0.0093	0.0062	0.0062	0.0062	0.0062	0.0062	0.0031	0.0031	0	0	0	0	0	0	0	0
Air Compressor	0	0	0	0	0	0	0	0	0	0	0.0049	0.0049	0.0049	0.0057	0.0065	0.0073	0.0081	0.0098	0.0098	0.0089
Excavator	0	0.0057	0.0057	0.0057	0.0075	0.0094	0.0094	0.0075	0.0094	0.0094	0.0075	0.0075	0.0038	0	0	0	0	0	0	0
Grader	0	0	0	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0	0	0	0	0	0	0	0	0
Cranes	0	0	0	0	0	0	0	0.0019	0.0038	0.0075	0.0132	0.0132	0.0132	0.0132	0.0132	0.0132	0.0132	0.0151	0.0151	0.0151
Asphalt Paver	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0047	0.0047	0.0024
Compactor	0	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0	0	0	0	0	0	0	0
Welding Machine	0	0	0	0	0	0	0	0.0003	0.0009	0.0012	0.0024	0.0030	0.0041	0.0041	0.0044	0.0059	0.0059	0.0059	0.0059	0.0059
Total (metric tons/month, E_m)	**0**	**0.0167**	**0.0167**	**0.0188**	**0.0207**	**0.0194**	**0.0194**	**0.0197**	**0.0241**	**0.0282**	**0.0349**	**0.0334**	**0.0260**	**0.0230**	**0.0241**	**0.0264**	**0.0272**	**0.0355**	**0.0355**	**0.0323**
Annual Average (metric tons/year, E_a)	**0.35**																			
Total (metric tons/year, E_t)	**0.48**																			

Table 1c: Onsite Power Plant Construction Equipment N_2O Emissions

Onsite Equipment	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Bulldozer	0	0.0007	0.0007	0.0007	0.0007	0.0004	0.0004	0.0004	0.0004	0.0004	0.0002	0.0002	0	0	0	0	0	0	0	0
Air Compressor	0	0	0	0	0	0	0	0	0	0	0.0003	0.0003	0.0003	0.0004	0.0005	0.0005	0.0006	0.0007	0.0007	0.0006
Excavator	0	0.0004	0.0004	0.0004	0.0005	0.0007	0.0007	0.0005	0.0007	0.0007	0.0005	0.0005	0.0003	0	0	0	0	0	0	0
Grader	0	0	0	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0	0	0	0	0	0	0	0	0
Cranes	0	0	0	0	0	0	0	0.0001	0.0003	0.0005	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0011	0.0011	0.0011
Asphalt Paver	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0003	0.0003	0.0002
Compactor	0	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0	0	0	0	0	0	0	0
Welding Machine	0	0	0	0	0	0	0	0	0.0001	0.0001	0.0002	0.0002	0.0003	0.0003	0.0003	0.0004	0.0004	0.0004	0.0004	0.0004
Total (metric tons/month, E_m)	**0**	**0.0012**	**0.0012**	**0.0013**	**0.0015**	**0.0014**	**0.0014**	**0.0014**	**0.0017**	**0.0020**	**0.0025**	**0.0024**	**0.0019**	**0.0016**	**0.0017**	**0.0019**	**0.0019**	**0.0025**	**0.0025**	**0.0023**
Annual Average (metric tons/year, E_a)	**0.025**																			
Total (metric tons/year, E_t)	**0.034**																			

Table 2a: Onsite Power Plant Construction Motor Vehicle CO_2 Emissions

Vehicle Type	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	19	17	18	19	20
Onsite Flatbed Truck	0	0	0	0	0	0	0	0	0.03	0.06	0.06	0.06	0.06	0.10	0.10	0.13	0.13	0.19	0.13	0.13
Onsite Fuel/Lube Truck	0	0	0	0	0	0	0.03	0.03	0.03	0.03	0.03	0.06	0.06	0.06	0.06	0.10	0.13	0.13	0.13	0.10
Onsite Water Truck	0	0.16	0.16	0.16	0.16	0	0	0	0	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0	0	0	0
Onsite Concrete Pump Truck	0	0	0	0	0	0.03	0.03	0.06	0.06	0.10	0.10	0.03	0.03	0.03	0.03	0	0	0	0	0
Total (metric tons/month)	**0**	**0.16**	**0.16**	**0.16**	**0.16**	**0.03**	**0.06**	**0.10**	**0.13**	**0.35**	**0.35**	**0.32**	**0.32**	**0.35**	**0.35**	**0.38**	**0.26**	**0.32**	**0.26**	**0.22**
Annual Average (metric tons/year, E_a)	**3.60**																			
Total (metric tons/year, E_t)	**4.43**																			

Table 2b: Onsite Power Plant Construction Motor Vehicle CH_4 Emissions

Vehicle Type	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	19	17	18	19	20
Onsite Flatbed Truck	0	0	0		0	0	0	0	0.000001	0.000003	0.000003	0.000003	0.000003	0.000004	0.000004	0.000005	0.000005	0.000008	0.000005	0.000005
Onsite Fuel/Lube Truck	0	0	0	0	0	0	0.000001	0.000001	0.000001	0.000001	0.000001	0.000003	0.000003	0.000003	0.000003	0.000004	0.000005	0.000005	0.000005	0.000004
Onsite Water Truck	0	0.000007	0.000007	0.000007	0.000007	0	0	0	0	0.000007	0.000007	0.000007	0.000007	0.000007	0.000007	0.000007	0	0	0	0
Onsite Concrete Pump Truck	0	0	0	0	0	0.000001	0.000001	0.000003	0.000003	0.000004	0.000004	0.000001	0.000001	0.000001	0.000001	0	0	0	0	0
Total (metric tons/month)	**0**	**0.000007**	**0.000007**	**0.000007**	**0.000007**	**0.000001**	**0.000003**	**0.000004**	**0.000005**	**0.000015**	**0.000015**	**0.000013**	**0.000013**	**0.000015**	**0.000015**	**0.000016**	**0.000011**	**0.000013**	**0.000011**	**0.000009**
Annual Average (metric tons/year, E_a)	**0.0001**																			
Total (metric tons/year, E_t)	**0.0002**																			

Table 2c: Onsite Power Plant Construction Motor Vehicle N_2O Emissions

Vehicle Type	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Onsite Flatbed Truck	0	0	0	0	0	0	0	0	0.000001	0.000002	0.000002	0.000002	0.000002	0.000003	0.000003	0.000004	0.000004	0.000007	0.000004	0.000004
Onsite Fuel/Lube Truck	0	0	0	0	0	0	0.000001	0.000001	0.000001	0.000001	0.000001	0.000002	0.000002	0.000002	0.000002	0.000003	0.000004	0.000004	0.000004	0.000003
Onsite Water Truck	0	0.000006	0.000006	0.000006	0.000006	0	0	0	0	0.000006	0.000006	0.000006	0.000006	0.000006	0.000006	0.000006	0	0	0	0
Onsite Concrete Pump Truck	0	0	0	0	0	0.000001	0.000001	0.000002	0.000002	0.000003	0.000003	0.000001	0.000001	0.000001	0.000001	0	0	0	0	0
Total (metric tons/month)	**0**	**0.000006**	**0.000006**	**0.000006**	**0.000006**	**0.000001**	**0.000002**	**0.000003**	**0.000004**	**0.000012**	**0.000012**	**0.000011**	**0.000011**	**0.000012**	**0.000012**	**0.000013**	**0.000009**	**0.000011**	**0.000009**	**0.000008**
Annual Average (metric tons/year, E_a)	**0.0001**																			
Total (metric tons/year, E_t)	**0.0002**																			

Table 3a: Offsite Motor Vehicle Usage During Construction

Vehicle Type	Number per Month																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Offsite Delivery Trucks[a, c]	8	8	6	9	14	65	184	230	420	301	240	195	199	179	171	208	224	226	184	144
Construction Worker Commute[b]	37	63	66	75	94	108	116	133	145	142	150	163	188	214	223	387	398	334	321	289

[a] Included Standard Deliveries and Heavy Haul Deliveries as Offsite Delivery Trucks, characterized as Medium-Duty Trucks (MDT).
[b] Assumed 1 commute per 1 worker.
[c] Assumed each offsite delivery truck makes 1 delivery.

Table 3b: Offsite Motor Vehicle CO_2 Emissions

Vehicle Type	Monthly Emissions																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Offsite Delivery Trucks	1.17	1.17	0.88	1.32	2.06	9.54	27.02	33.77	61.67	44.20	35.24	28.63	29.22	26.28	25.11	30.54	32.89	33.18	27.02	21.14
Construction Worker Commute	1.09	1.85	1.94	2.20	2.76	3.17	3.41	3.91	4.26	4.17	4.41	4.79	5.52	6.28	6.55	11.36	11.69	9.81	9.43	8.49
Total (metric tons/month)	**2.26**	**3.02**	**2.82**	**3.52**	**4.82**	**12.72**	**30.42**	**37.68**	**65.93**	**48.37**	**39.65**	**33.42**	**34.74**	**32.57**	**31.66**	**41.91**	**44.58**	**42.99**	**36.44**	**29.63**
Annual Average (metric tons/year, E_a)	**482**																			
Total (metric tons/year, E_t)	**579**																			

Table 3c: Offsite Motor Vehicle CH_4 Emissions

Vehicle Type	Monthly Emissions																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Offsite Delivery Trucks	0.0001	0.0001	0.0001	0.0001	0.0002	0.0008	0.0022	0.0028	0.0050	0.0036	0.0029	0.0023	0.0024	0.0021	0.0021	0.0025	0.0027	0.0027	0.0022	0.0017
Construction Worker Commute	0.0001	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0004	0.0004	0.0005	0.0005	0.0005	0.0009	0.0010	0.0008	0.0008	0.0007
Total (metric tons/month)	**0.0002**	**0.0002**	**0.0002**	**0.0003**	**0.0004**	**0.0010**	**0.0025**	**0.0031**	**0.0054**	**0.0040**	**0.0032**	**0.0027**	**0.0028**	**0.0027**	**0.0026**	**0.0034**	**0.0036**	**0.0035**	**0.0030**	**0.0024**
Annual Average (metric tons/year, E_a)	**0.039**																			
Total (metric tons/year, E_t)	**0.047**																			

Table 3d: Offsite Motor Vehicle N_2O Emissions

Vehicle Type	Monthly Emissions																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Offsite Delivery Trucks	0.0002	0.0002	0.0001	0.0002	0.0003	0.0013	0.0037	0.0046	0.0084	0.0060	0.0048	0.0039	0.0040	0.0036	0.0034	0.0042	0.0045	0.0045	0.0037	0.0029
Construction Worker Commute	0.0001	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0004	0.0004	0.0005	0.0005	0.0005	0.0009	0.0010	0.0008	0.0008	0.0007
Total (metric tons/month)	**0.0002**	**0.0003**	**0.0003**	**0.0004**	**0.0005**	**0.0016**	**0.0040**	**0.0049**	**0.0087**	**0.0064**	**0.0052**	**0.0043**	**0.0044**	**0.0041**	**0.0040**	**0.0051**	**0.0054**	**0.0053**	**0.0045**	**0.0036**
Annual Average (metric tons/year, E_a)	**0.061**																			
Total (metric tons/year, E_t)	**0.073**																			

Table 3e: Offsite Motor Vehicle Miles Traveled

Vehicle Type	Roundtrip Miles per Delivery
Offsite Delivery Trucks	100
Construction Worker Commute	60

Table 4: Equations Used to Calculate Emissions

Emission Source	Pollutant(s)	Equation	Variables
Construction Equipment	CO_2, CH_4, N_2O	$E_m = N * FC * EF * H * 22 * 0.001$	E_m = Emissions (Mton/month)
			N = Number of pieces of equipment
			FC = Fuel Consumption (gal/hr)
			EF = Emission factor (kg/gal)
			H = Daily hours of operation, assumed to be 12 hr/day
			22 = 22 construction days per month
			0.001 = Conversion from kg to Mton
		$E_t = \Sigma E_m$	E_t = Total Emissions (Mton/yr)
			E_m = Emissions (Mton/month)
		$E_a = \Sigma E_m$ for Worst-Case Months, 9 through 20	E_a = Annual Average Emissions (Mton/yr)
			E_m = Emissions (Mton/month)
Onsite and Offsite Motor Vehicle	CO_2	$E_m = N * VMT * 22 * EF * 0.001 / FE$	E_m = Emissions (Mton/month)
			VMT = Vehicle miles traveled per day (miles/day)
			FE = Fuel Economy (miles/hr)
			22 = 22 construction days per month
			0.001 = Conversion from kg to Mton
			EF = Emission Factor (kg/gal)
		$E_t = \Sigma E_m$	E_t = Total Emissions (Mton/yr)
			E_m = Emissions (Mton/month)
		$E_a = \Sigma E_m$ for Worst-Case Months, 9 through 20	E_a = Annual Average Emissions (Mton/yr)
			E_m = Emissions (Mton/month)
Onsite and Offsite Motor Vehicle	CH_4, N_2O	$E_m = N * VMT * 22 * EF * 0.000001$	E_m = Emissions (Mton/month)
			N = Number of vehicles or Number of deliveries
			VMT = Vehicle miles traveled per day (miles/day)
			22 = 22 construction days per month
			0.000001 = Conversion from g to Mton
			EF = Emission Factor (g/mile)
		$E_t = \Sigma E_m$	E_t = Total Emissions (Mton/yr)
			E_m = Emissions (Mton/month)
		$E_a = \Sigma E_m$ for Worst-Case Months, 9 through 20	E_a = Annual Average Emissions (Mton/yr)
			E_m = Emissions (Mton/month)

Reference: California Climate Action Registry General Reporting Protocol, Version 3.0, Chapter 7, April 2008.

Table 5a: Number of Onsite Power Plant Construction Equipment

	Month																			
Project Construction GHG Emissions	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Bulldozer	0	3	3	3	3	2	2	2	2	2	1	1	0	0	0	0	0	0	0	0
Air Compressor	0	0	0	0	0	0	0	0	0	0	6	6	6	7	8	9	10	12	12	11
Excavator	0	3	3	3	4	5	5	4	5	5	4	4	2	0	0	0	0	0	0	0
Grader	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Cranes	0	0	0	0	0	0	0	1	2	4	7	7	7	7	7	7	7	8	8	8
Asphalt Paver	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	2
Compactor	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Welding Machine	0	0	0	0	0	0	0	1	3	4	8	10	14	14	15	20	20	20	20	20

Table 5b: Number of Onsite Power Plant Construction Motor Vehicles

	Month																			
Vehicle Type	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Onsite Flatbed Truck	0	0	0	0	0	0	0	0	1	2	2	2	2	3	3	4	4	6	4	4
Onsite Fuel/Lube Truck	0	0	0	0	0	0	1	1	1	1	1	2	2	2	2	3	4	4	4	3
Onsite Water Truck	0	1	1	1	1	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0
Onsite Concrete Pump Truck	0	0	0	0	0	1	1	2	2	3	3	1	1	1	1	0	0	0	0	0

Table 6: Power Plant Construction Equipment Emission Factors

Project Construction GHG Emissions	Fuel Type	Hours per Month[a]	Fuel Consumption, EF (gal/hr)[b]		
			CO_2	CH_4	N_2O
Bulldozer	diesel	264	8.40	8.40	8.40
Air Compressor	diesel	264	2.20	2.20	2.20
Excavator	diesel	264	5.10	5.10	5.10
Grader	diesel	264	5.70	5.70	5.70
Cranes	diesel	264	5.10	5.10	5.10
Asphalt Paver	diesel	264	3.20	3.20	3.20
Compactor	diesel	264	4.60	4.60	4.60
Welding Machine	diesel	264		0.80	0.80

[a] Hours per month assumes 12 work hours per day and 22 days per month.

[b] Fuel Consumption based on consumption in the OFFROAD2007 model for San Joaquin APCD in the year 2011.

Table 7: Motor Vehicle Fuel Economy

Project Construction GHG Emissions	Fuel Type	Fuel economy (miles per gallon)[a]
Onsite Flatbed Truck	Diesel	7
Onsite Fuel/Lube Truck	Diesel	7
Onsite Water Truck	Diesel	7
Onsite Concrete Pump Truck	Diesel	7
Offsite Delivery Trucks	Gasoline	6
Construction Worker Commute	Gasoline	18

[a] Fuel economy for trucks based on assumptions from the California Climate Action Registry, General Reporting Protocol, April 2008. Construction worker commute vehicle fuel economy based on assuming workers would drive model year 2000 or newer passenger cars and fuel economy data from EPA (www.fueleconomy.gov).

Table 8: Greenhouse Gas Emission Factors

Project Construction GHG Emissions	Emission Factor	Emission Factor Units	Emission Factor Source
Mobile Combustion			
Gasoline	8.81	kg CO2/gallon	California Climate Action Registry General Reporting Protocol, Version 3.0, Table C.4, April 2008.
Diesel	10.15	kg CO2/gallon	California Climate Action Registry General Reporting Protocol, Version 3.0, Table C.4, April 2008.
Mobile Combustion			
Gasoline Passenger Car Model Year 2000-Present	0.04	g N2O/mile	California Climate Action Registry General Reporting Protocol, Version 3.0, Table C.5, April 2008.
Gasoline Delivery Truck Model Year 1990-Present	0.2	g N2O/mile	California Climate Action Registry General Reporting Protocol, Version 3.0, Table C.5, April 2008.
Diesel Heavy Duty Trucks Model Year 1996-Present	0.05	g N2O/mile	California Climate Action Registry General Reporting Protocol, Version 3.0, Table C.5, April 2008.
Diesel Off-road Vehicles	0.0001	kg N2O/ gallon	California Climate Action Registry General Reporting Protocol, Version 3.0, Table C.5, April 2008.
Mobile Combustion			
Gasoline Passenger Car Model Year 2000-Present	0.04	g CH4/mile	
Gasoline Delivery Truck Model Year 1990-Present	0.12	g CH4/mile	California Climate Action Registry General Reporting Protocol, Version 3.0, Table C.5, April 2008.
Diesel Heavy Duty Trucks Model Year 1996-Present	0.06	g CH4/mile	California Climate Action Registry General Reporting Protocol, Version 3.0, Table C.5, April 2008.
Diesel Off-road Vehicles	0.0014	kg CH4/ gallon	California Climate Action Registry General Reporting Protocol, Version 3.0, Table C.5, April 2008.

ATTACHMENT DR3-1

Operational Emission Calculations

Table 1. Criteria Pollutant Emissions - Operation Vehicles

Emission Source	Number [a]	Roundtrip Vehicle Miles Traveled	Emissions (lbs/yr) [b]					
			ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
Worker Commute	13	60	28	1,138	113	1.9	19	9
Deliveries	11	100	3	75	20	0.1	1	1
		TOTAL (lbs/yr)	**31**	**1,212**	**133**	**2.0**	**20**	**10**

[a] The number of workers is per day and the number of deliveries is per month. The number of worker commutes assume the following: (1) plant manager, (1) ops supervisor, (2) dayshift operators, (2) night shift operators, (1) maint. supervisor, (2) mechanics, (3) I&E, (1) admin/warehouse. The operations staff works in (4) rotating crews of 2 people each, so on a given day (4) operators work and (4) have the day off. The number of deliveries is based on the information presented in Section 5.12 of the AFC.

[b] Calculations assume that workers would be onsite 365 days per year.

Table 2. Criteria Pollutant Vehicle Emission Factors

Vehicle Type	Vehicle Emission Factors (lb/mile)					
	ROG	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
Passenger car	0.00010	0.00400	0.00040	0.000007	0.000066	0.000033
Delivery Truck	0.00019	0.00565	0.00152	0.00001	0.000086	0.000051

1. Emission factors are from the ARB EMFAC2007 v. 2.3 model for San Joaquin County for the year 2012 for vehicles traveling at a speed of 45 mph.

ATTACHMENT DR3-2

Operational Emission Calculations

Table 3. Greenhouse Gas Emissions - Operation Vehicles

Emission Source	Number [a]	Roundtrip Vehicle Miles Traveled	Fuel economy (miles per gallon) [b]	Emissions (metric tons/yr) [c]			
				CO_2	CH_4	N_2O	CO_2 equivalent
Worker Commute	13	60	18	139	0.011	0.011	143
Deliveries	11	100	6	19	0.002	0.003	20
			TOTAL (metric tons/yr)	**159**	**0.01**	**0.01**	**163**

[a] The number of workers is per day and the number of deliveries is per month. The number of worker commutes assume the following: (1) plant manager, (1) ops supervisor, (2) dayshift operators, (2) night shift operators, (1) maint. supervisor, (2) mechanics, (3) I&E, (1) admin/warehouse. The operations staff works in (4) rotating crews of 2 people each, so on a given day (4) operators work and (4) have the day off. The number of deliveries is based on the information presented in Section 5.12 of the AFC.

[b] Fuel economy for trucks based on assumptions from the California Climate Action Registry, General Reporting Protocol, April 2008. Worker commute vehicle fuel economy based on assuming workers would drive model year 2000 or newer passenger cars and fuel economy data from EPA (www.fueleconomy.gov).

[c] Calculations assume that workers would be onsite 365 days per year.

Table 4. Greenhouse Gas Emission Factors

Vehicle Type	Vehicle Emission Factors		
	CO_2 (kg/gallon)	CH_4 (g/mile)	N_2O (g/mile)
Passenger Car Model Year 2000-Present	8.81	0.04	0.04
Gasoline Delivery Truck Model Year 1990-Present	8.81	0.12	0.20

Emission factors are from the California Climate Action Registry General Reporting Protocol, Version 3.0, Tables C.4 and C.5, April 2008.

Table 5. Global Warming Potentials

CH_4	21
N_2O	310

Reference: Intergovernmental Panel on Climate Change, Second Assessment Report (SAR) (IPCC, 1996).

ATTACHMENT DR4-1

Anticipated Firing Hours for Commissioning Steps

GWF Tracy Combined Cycle Power Plant Project (08-AFC-7)

Data Response Set #1

Attachment DR4-1

CTG 1			CTG 2			Total Emissions Lb/Day		Total Emissions Lb/Hr	
Activity	Duration [hr](1)	Modeling Load (%)	Activity	Duration [hr](1)	Modeling Load (%)	Nox	CO	Nox	CO
CTG 1 Testing (Full Speed No Load, FSNL)	8	50	No Operation	0	0	416.6	592.9	52.1	74.1
No Operation	0	NA	CTG 2 Testing (Full Speed No Load, FSNL)	8	50	416.6	592.9	52.1	74.1
Steam Blows	12	50	No Operation	0		919.4	1918.4	76.6	159.9
Steam Blows	12	50	No Operation	0		852.9	1804.9	71.1	150.4
No Operation	0	NA	Steam Blows	12	50	919.4	1918.4	76.6	159.9
No Operation	0	NA	Steam Blows	12	50	852.9	1804.9	71.1	150.4
Steam Blows	12	50	Steam Blows	12	50	1705.8	3609.8	142.2	300.8
Restart CTGs and run HRSG in Bypass Mode Bypass Valve Tuning. HRSG Blow Down and Drum Tuning	12	50	No Operation	0	0	1760.7	2755.7	146.7	229.6
Restart CTGs and run HRSG in Bypass Mode Bypass Valve Tuning. HRSG Blow Down and Drum Tuning	12	50	No Operation	0	0	1648.7	1750.8	137.4	145.9
Restart CTGs and run HRSG in Bypass Mode Bypass Valve Tuning. HRSG Blow Down and Drum Tuning	12	100	No Operation	0	0	437.0	744.0	36.4	62.0
No Operation	0	0	Restart CTGs and run HRSG in Bypass Mode Bypass Valve Tuning. HRSG Blow Down and Drum Tuning	12	50	1760.7	2755.7	146.7	229.6
No Operation	0	0	Restart CTGs and run HRSG in Bypass Mode Bypass Valve Tuning. HRSG Blow Down and Drum Tuning	12	50	1648.7	1750.8	137.4	145.9
No Operation	0	0	Restart CTGs and run HRSG in Bypass Mode Bypass Valve Tuning. HRSG Blow Down and Drum Tuning	12	100	437.0	744.0	36.4	62.0
Verify STG on Turning Gear; Establish Vacuum in ACC Ext Bypass Blowdown to ACC (combined blows) commence tuning on ACC Controls; Finalize Bypass Valve Tuning	12	50	Verify STG on Turning Gear; Establish Vacuum in ACC Ext Bypass Blowdown to ACC (combined blows) commence tuning on ACC Controls; Finalize Bypass Valve Tuning	12	50	3297.4	3501.6	274.8	291.8
Verify STG on Turning Gear; Establish Vacuum in ACC Ext Bypass Blowdown to ACC (combined blows) commence tuning on ACC Controls; Finalize Bypass Valve Tuning	12	100	Verify STG on Turning Gear; Establish Vacuum in ACC Ext Bypass Blowdown to ACC (combined blows) commence tuning on ACC Controls; Finalize Bypass Valve Tuning	12	100	874.0	1488.0	72.8	124.0
CT Tuner After Liner Change	12	100	No Operation	0	0	549.0	270.3	45.8	22.5
CTG 1 Base Load / Commissioning of Ammonia system	12	100	No Operation	0	0	245.0	173.8	20.4	14.5
Pre-STG Roll Outage and Stack Emissions Test Equipment Installation	0	0	CT Tuner After Liner Change	12	100	549.0	270.3	45.8	22.5
Pre-STG Roll Outage and Stack Emissions Test Equipment Installation	0	0	CT 2 Base Load/Commissioning Ammonia	12	100	245.0	173.8	20.4	14.5
STG Load Test	24	50	No Operation	0	0	709.2	397.2	29.6	16.5
Load Test STG / Combine Cycle (2X1)	24	100	Load Test STG / Combine Cycle (2X1)	24	100	1748.4	1179.3	72.9	49.1
Load Test STG / Combine Cycle (2X1)	24	100	Load Test STG / Combine Cycle (2X1)	24	100	1418.4	794.3	59.1	33.1
Load Test STG / Combine Cycle (2X1)	24	100	Load Test STG / Combine Cycle (2X1)	24	100	345.6	259.2	14.4	10.8
Combine Cycle testing	24	100	Combine Cycle testing	24	100	345.6	259.2	14.4	10.8
No Operation	0	0	STG Load Test	24	100	709.2	397.2	29.6	16.5
Commissioning Duct Burners	24	100 + DB	Commissioning Duct Burners	24	100 + DB	460.8	417.6	19.2	17.4
Emissions Tuning	12	100	No Operation	0	0	251.4	257.3	21.0	21.4
Emissions Tuning	12	100 + DB	No Operation	0	0	168.2	200.4	14.0	16.7
RATA / Pre-performance Testing/Source Testing	12	100 + DB	No Operation	0	0	168.2	200.4	14.0	16.7

GWF Tracy Combined Cycle Power Plant Project (08-AFC-7)
Data Response Set #1
Attachment DR4-1

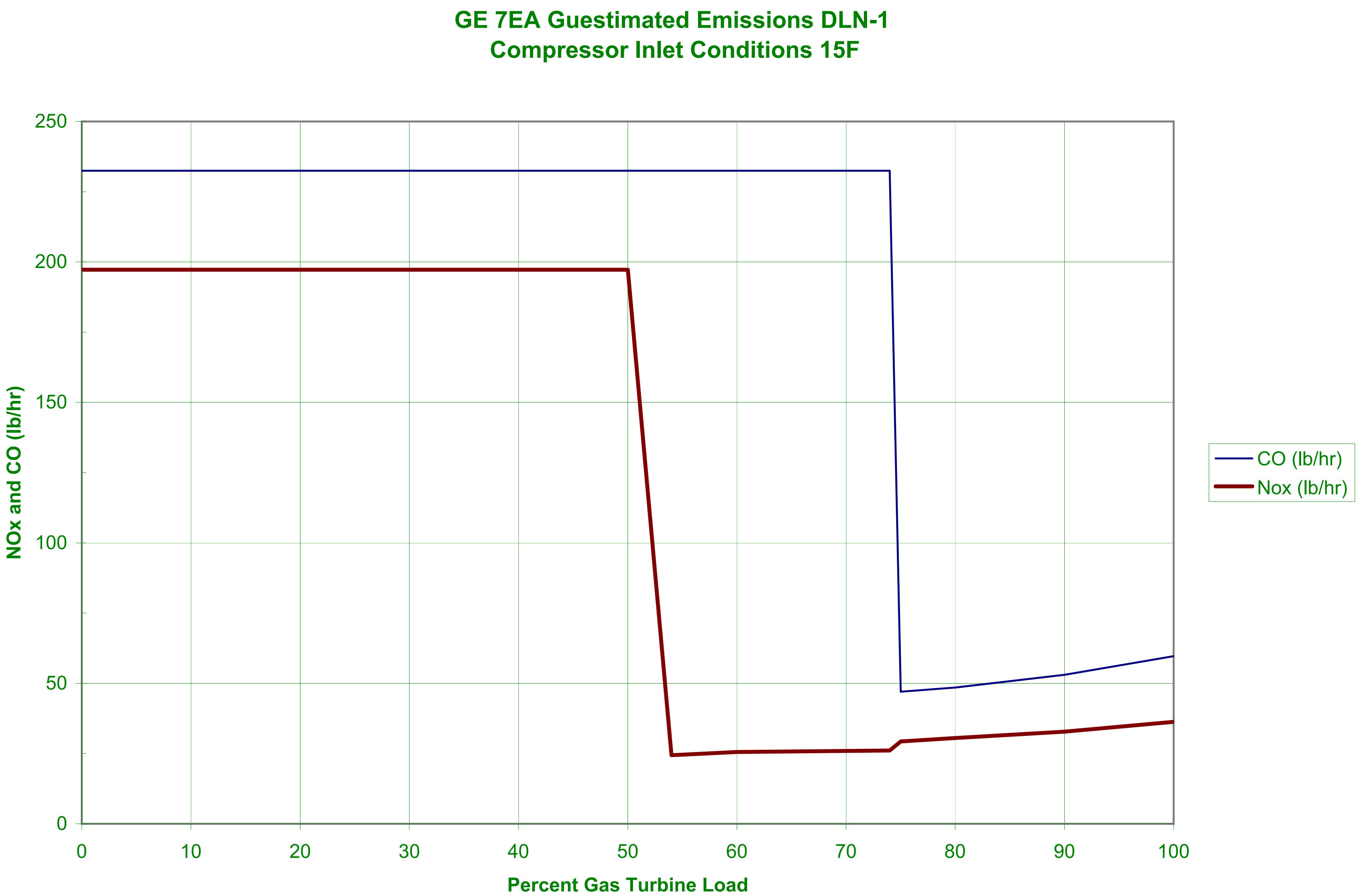
CTG 1			CTG 2			Total Emissions Lb/Day		Total Emissions Lb/Hr	
Activity	Duration [hr](1)	Modeling Load (%)	Activity	Duration [hr](1)	Modeling Load (%)	Nox	CO	Nox	CO
RATA / Pre-performance Testing/Source Testing	12	100 + DB	No Operation	0	0	168.2	200.4	14.0	16.7
RATA / Pre-performance Testing/Source Testing	12	100 + DB	No Operation	0	0	168.2	200.4	14.0	16.7
RATA / Pre-performance Testing/Source Testing	12	100 + DB	No Operation	0	0	168.2	200.4	14.0	16.7
RATA / Pre-performance Testing/Source Testing	12	100 + DB	No Operation	0	0	168.2	200.4	14.0	16.7
Source Testing & Drift Test Day 1	12	100 + DB	No Operation	0	0	168.2	200.4	14.0	16.7
Source Testing & Drift Test Day 2	12	100 + DB	No Operation	0	0	168.2	200.4	14.0	16.7
Source Testing & Drift Test Day 3	12	100 + DB	No Operation	0	0	168.2	200.4	14.0	16.7
Source Testing & Drift Test Day 4	12	100 + DB	No Operation	0	0	168.2	200.4	14.0	16.7
Source Testing & Drift Test Day 5	12	100 + DB	No Operation	0	0	168.2	200.4	14.0	16.7
Source Testing & Drift Test Day 6	12	100 + DB	No Operation	0	0	168.2	200.4	14.0	16.7
No Operation	0	0	Emissions Tuning	12	100	251.4	257.3	21.0	21.4
No Operation	0	0	Emissions Tuning	12	100 + DB	168.2	200.4	14.0	16.7
No Operation	0	0	RATA / Pre-performance Testing/Source Testing	12	100 + DB	168.2	200.4	14.0	16.7
No Operation	0	0	RATA / Pre-performance Testing/Source Testing	12	100 + DB	168.2	200.4	14.0	16.7
No Operation	0	0	RATA / Pre-performance Testing/Source Testing	12	100 + DB	168.2	200.4	14.0	16.7
No Operation	0	0	RATA / Pre-performance Testing/Source Testing	12	100 + DB	168.2	200.4	14.0	16.7
No Operation	0	0	RATA / Pre-performance Testing/Source Testing	12	100 + DB	168.2	200.4	14.0	16.7
No Operation	0	0	RATA/Pre-perform Testing/Source Testing/Drift Testing	12	100 + DB	168.2	200.4	14.0	16.7
No Operation & Performance Test Preparations	0	0	RATA/Pre-perform Testing/Source Testing/Drift Testing	12	100 + DB	168.2	200.4	14.0	16.7
No Operation & Performance Test Preparations	0	0	RATA/Pre-perform Testing/Source Testing/Drift Testing	12	100 + DB	168.2	200.4	14.0	16.7
No Operation & Performance Test Preparations	0	0	RATA/Pre-perform Testing/Source Testing/Drift Testing	12	100 + DB	168.2	200.4	14.0	16.7
No Operation & Performance Test Preparations	0	0	Source Testing & Drift Test Day 1	12	100 + DB	168.2	200.4	14.0	16.7
No Operation & Performance Test Preparations	0	0	Source Testing & Drift Test Day 2	12	100 + DB	168.2	200.4	14.0	16.7
Performance Testing	24	100	Performance Testing	24	100	451.6	451.2	18.8	18.8
Performance Testing	24	100 + DB	Performance Testing	24	100 + DB	460.8	417.6	19.2	17.4
CALISO Certification	12	100	CALISO Certification	12	100	709.2	397.2	59.1	33.1
CALISO Certification with duct burner	12	100+DB	CALISO Certification with duct burner	12	100 + DB	336.4	400.8	28.0	33.4
Total CTG operation hours	**500**			**500**					

NOTES
DB - Duct Burner "ON"
(1) CTG is assumed to ramp at 3 MW per minute during Commissioning Operations
(2) Steam Blows and restoration are based on a 7 day week
(3) Commissioning is based on a 6 day week

Lb/Day	NOx	CO
Facility Total (lbs)	31,771	39,316
Total/tons	15.9	19.7

ATTACHMENT DR8-1

Start-up Emissions Engineering Curve


GE 7EA Guestimated Emissions DLN-1
Compressor Inlet Conditions 15F
NOx and CO (lb/hr)
250
200
150
100
50
0
0
10
20
30
40
50
60
70
80
90
100
Percent Gas Turbine Load
CO (lb/hr)
Nox (lb/hr)

ATTACHMENT DR9-1

Values Used to Determine Turbine Maximum Emission Rate

GWF Tracy Combined Cycle Power Plant Project (08-AFC-7)

Data Response Set #1

Attachment DR9-1

CTG 2		LB/hr (per turbine)		Total lbs (per turbine)		Start up (facility total)		Shutdown (facility total)		Total Emssions Lb/Day (per turbine)		Total Emssions Lb/Hr (per turbine)	
Activity	**Duration [hr](1)**	**Nox**	**CO**	**Nox**	**CO**	**Nox**	**CO**	**Nox**	**CO**	**Nox**	**CO**	**Nox**	**CO**
CTG 2 Testing (Full Speed No Load, FSNL)	8	45.5	62.1	363.6	496.9	29	93	77	99	416.6	592.9	52.1	74.1
Steam Blows	12	66.7	142.4	799.9	1708.9	162	320	77	99	919.4	1918.4	76.6	159.9
Steam Blows	12	66.7	142.4	799.9	1708.9	29	93	77	99	852.9	1804.9	71.1	150.4
Steam Blows	12	66.7	142.4	799.9	1708.9	29	93	77	99	852.9	1804.9	71.1	150.4
Restart CTGs and run HRSG in Bypass Mode Bypass Valve Tuning. HRSG Blow Down and Drum Tuning	12	133.0	213.6	1595.7	2563.2	253	286	77	99	1760.7	2755.7	146.7	229.6
Restart CTGs and run HRSG in Bypass Mode Bypass Valve Tuning. HRSG Blow Down and Drum Tuning	12	133.0	137.9	1595.7	1654.8	29	93	77	99	1648.7	1750.8	137.4	145.9
Restart CTGs and run HRSG in Bypass Mode Bypass Valve Tuning. HRSG Blow Down and Drum Tuning	12	32.0	54.0	384.0	648.0	29	93	77	99	437.0	744.0	36.4	62.0
Verify STG on Turning Gear; Establish Vauum in ACC Ext Bypass Blowdown to ACC (combined blows) commence tuning on ACC Controls; Finalize Bypass Valve Tuning	12	133.0	137.9	1595.7	1654.8	29	93	77	99	1648.7	1750.8	137.4	145.9
Verify STG on Turning Gear; Establish Vauum in ACC Ext Bypass Blowdown to ACC (combined blows) commence tuning on ACC Controls; Finalize Bypass Valve Tuning	12	32.0	54.0	384.0	648.0	29	93	77	99	437.0	744.0	36.4	62.0
CT Tuning after liner change	12	32.0	6.5	384.0	77.8	253	286	77	99	549.0	270.3	45.8	22.5
CT 2 Base Load/Commissioning Ammonia	12	16.0	6.5	192.0	77.8	29	93	77	99	245.0	173.8	20.4	14.5
Load Test STG / Combine Cycle (2X1)	24	29.6	16.5	709.2	397.2	253	286	77	99	874.2	589.7	36.4	24.6
Load Test STG / Combine Cycle (2X1)	24	29.6	16.5	709.2	397.2					709.2	397.2	29.6	16.5
Load Test STG / Combine Cycle (2X1)	24	7.2	5.4	172.8	129.6					172.8	129.6	7.2	5.4
Combine Cycle testing	24	7.2	5.4	172.8	129.6					172.8	129.6	7.2	5.4
STG Load Test	24	29.6	16.5	709.2	397.2					709.2	397.2	29.6	16.5
Commissioning Duct Burners	24	9.6	8.7	230.4	208.8					230.4	208.8	9.6	8.7
Emissions Tuning	12	7.2	5.4	86.4	64.8	253	286	77	99	251.4	257.3	21.0	21.4
Emissions Tuning	12	9.6	8.7	115.2	104.4	29	93	77	99	168.2	200.4	14.0	16.7

GWF Tracy Combined Cycle Power Plant Project (08-AFC-7)

Data Response Set #1

Attachment DR9-1

CTG 2		LB/hr (per turbine)		Total lbs (per turbine)		Start up (facility total)		Shutdown (facility total)		Total Emssions Lb/Day (per turbine)		Total Emssions Lb/Hr (per turbine)	
Activity	Duration [hr](1)	Nox	CO	Nox	CO	Nox	CO	Nox	CO	Nox	CO	Nox	CO
RATA / Pre-performance Testing/Source Testing	12	9.6	8.7	115.2	104.4	29	93	77	99	168.2	200.4	14.0	16.7
RATA / Pre-performance Testing/Source Testing	12	9.6	8.7	115.2	104.4	29	93	77	99	168.2	200.4	14.0	16.7
RATA / Pre-performance Testing/Source Testing	12	9.6	8.7	115.2	104.4	29	93	77	99	168.2	200.4	14.0	16.7
RATA / Pre-performance Testing/Source Testing	12	9.6	8.7	115.2	104.4	29	93	77	99	168.2	200.4	14.0	16.7
~~Emissions Tuning/Drift Testing~~ RATA/Pre-performance Testing/Source Testing	12	9.6	8.7	115.2	104.4	29	93	77	99	168.2	200.4	14.0	16.7
RATA/Pre-perform Testing/Source Testing/Drift Testing	12	9.6	8.7	115.2	104.4	29	93	77	99	168.2	200.4	14.0	16.7
RATA/Pre-perform Testing/Source Testing/Drift Testing	12	9.6	8.7	115.2	104.4	29	93	77	99	168.2	200.4	14.0	16.7
RATA/Pre-perform Testing/Source Testing/Drift Testing	12	9.6	8.7	115.2	104.4	29	93	77	99	168.2	200.4	14.0	16.7
RATA/Pre-perform Testing/Source Testing/Drift Testing	12	9.6	8.7	115.2	104.4	29	93	77	99	168.2	200.4	14.0	16.7
Source Testing & Drift Test Day 1	12	9.6	8.7	115.2	104.4	29	93	77	99	168.2	200.4	14.0	16.7
Source Testing & Drift Test Day 2	12	9.6	8.7	115.2	104.4	29	93	77	99	168.2	200.4	14.0	16.7
Performance Testing	24	7.2	5.4	172.8	129.6	29	93	77	99	225.8	225.6	9.4	9.4
Performance Testing	24	9.6	8.7	230.4	208.8					230.4	208.8	9.6	8.7
CALISO Certification	12	29.6	16.5	354.6	198.6					354.6	198.6	29.6	16.5
CALISO Certification with duct burner	12	9.6	8.7	115.2	104.4	29	93	77	99	168.2	200.4	14.0	16.7
Totals	500			13,940	16,566	1,812	3,510	2,079	2,673				

ATTACHMENT DR14-1

Interpollutant Off-set Ratio (NO_X: PM_{10}) Memorandum, Sierra Research

sierra research

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March 7, 2008

Memo to: Doug Wheeler
GWF Power Systems

From: Gary Rubenstein

Subject: Interpollutant Offset Ratio ($NOx:PM_{10}$) for Tracy, CA

This is in response to your request for calculation of an appropriate interpollutant offset ratio (NOx for PM_{10}) for the proposed combined cycle upgrade of the Tracy Peaker Project. The San Joaquin Valley Air Pollution Control District (District) has used a methodology based on Chemical Mass Balance (CMB) and rollback modeling to determine appropriate interpollutant offset ratios in past permit reviews. Using the District's methodology, we have calculated an interpollutant offset ratio of 2.38:1. Under the District's rules, this offset ratio would be multiplied by the appropriate distance adjustment ratio to obtain an overall offset ratio.

The analysis that leads us to the conclusion is attached to this memorandum.

Calculation of Interpollutant Offset Ratio

The interpollutant offset ratio is the number of tons of nitrogen oxide (NOx) emission reductions that would result in the same reduction in ambient PM_{10} concentration as one ton of direct PM_{10} emissions.

The methodology used to develop an interpollutant offset ratio for NOx and PM_{10} uses Chemical Mass Balance (CMB) and rollback modeling from the San Joaquin Valley Air Pollution Control District (SJVAPCD) draft 2007 PM_{10} plan. This methodology was provided by Jim Sweet of the SJVAPCD's Planning Division for use in previous applications.

The data used in this analysis were taken from the District's modeling results for the Modesto 14th Street monitoring station and emission inventories for Stanislaus County. The Modesto station, located 30 miles from Tracy, is the closest station for which all necessary data are available.

The analysis calculates the contribution from subregional industrial combustion-related PM_{10} emissions to PM_{10} concentrations on a PM_{10} episode day, and compares that to the contribution from subregional NOx emissions to ammonium nitrate concentrations. The analysis determines the increase in episode PM_{10} concentration (in ug/cu m) that results from a ton of direct industrial combustion-related PM_{10} emissions, and the increase in episode PM_{10} concentration (in ug/cu m) that results from a ton of NOx emissions. The ratio of NOx impact to direct PM_{10} impact is the interpollutant offset ratio.

The analysis begins by calculating the ambient concentration of PM_{10} attributed to industrial combustion. The contribution from industrial combustion makes up part of the "vegetative burning" category in the CMB modeling. The industrial component of this category has been estimated to be 30% based on the literature, including the EPA Criteria Document for PM_{10}. Because we are trying to determine the relative benefits of local emission reductions, the contribution from natural sources and transport from outside the region is subtracted from this result. The SJVAPCD estimates that these sources contribute 20% of the measured concentration. According to the rollback modeling, local sources within the smallest area of influence contribute 50% of the measured PM_{10}, after excluding transport and natural sources. The balance is contributed by regional and subregional sources.

The emission inventory associated with the rollback analysis has been provided by the SJVAPCD in the PM_{10} plan. The inventory includes the local component (L1), a broader local component (L2), the subregional component (Sr = County), and the regional component (R = San Joaquin Valley). The concentration calculated by the methodology described in the previous paragraph corresponds to the local component (L1) of the emission inventory.

The local impact is obtained by dividing local concentration by local emissions.
The relative impact (NOx: PM_{10}) is obtained by dividing the local impact for direct PM_{10} by the local impact for NOx). This relative impact is the interpollutant offset ratio.

PM10 Interpollutant Offset Ratio Analysis
Tracy

PM10

	Notes	Units	Estimate
"Vegetative Burning" Total	1	$\mu g/m^3$	30.16
Industry Component (30%)	2	$\mu g/m^3$	9.05
Transport/Background (20%)	3	$\mu g/m^3$	1.81
Industry minus Background		$\mu g/m^3$	7.24
Local Contribution	4	$\mu g/m^3$	3.62
Organic Carbon PM10 Inventory - Modesto Local (L1)	5	ton/day	4.28
Local Impact		$\mu g/m^3$ per ton	0.85

Nitrate

	Notes	Units	Estimate
Ammonium Nitrate	6	$\mu g/m^3$	83.88
Transport/Background (20%)	7	$\mu g/m^3$	4.20
Ammonium Nitrate minus Background		$\mu g/m^3$	79.68
Local Contribution	8	$\mu g/m^3$	39.84
NOx Inventory - Modesto Local (L1)	9	ton/day	112.18
Local Impact		$\mu g/m^3$ per ton	0.36
Tons of NOx to Equal Effect of 1 ton PM10	10		2.38

1. Per SJVAPCD and CARB, PM10 emissions from stationary industrial combustion sources are included in the Vegetative Burning category from Chemical Mass Balance modeling performed for the SJVAPCD 2007 PM10 Attainment Plan (Modesto 14th Street station)
2. Per SJVAPCD, 30% of Vegetative Burning category is attributed to stationary industrial combustion sources.
3. Per SJVAPCD, contribution from transport and natural sources is estimated to be 20% of net concentration after previous adjustment
4. Per SJVAPCD, contribution from sources within the local area (L1) is 50% of net concentration after previous adjustments
5. Organic carbon PM10 inventory for portion of Stanislaus County that contributes to this monitoring location (L1); from 2007 PM10 Planning inventory
6. Ammonium nitrate category from Chemical Mass Balance modeling performed for the SJVAPCD; from 2007 PM10 Planning inventory
7. Per SJVAPCD, regional background of ammonium nitrate is estimated to be 4.2 mg/m3.
8. Per SJVAPCD, contribution from sources within the local area (L1) is 50% of net concentration after previous adjustments
9. NOx inventory for Stanislaus County that contributes to this monitoring location (L1); from 2007 PM10 Planning inventory
10. PM10 Local Impact divided by Ammonium Nitrate Local Impact.

ATTACHMENT DR15-1

ATC Permits within 6 Miles of the GWF Tracy Site

ATC Within 6 Miles

APPs Received Between 1/1/2006 and 12/31/2008

Region N

Facility ID 80

Facility Name ARCO #02093 - K & N VENTURES INC
Facility Type GASOLINE DISPENSING

Distance To Location 6507.422
Degrees 29.08197

Received	Type	Status	Description
5/13/2008	ATC	FINAL	upgrade the phase II vapor recovery system from Balance (G-70-52-AM) to Healy EVR ISD (VR-202-F)

Facility ID 190

Facility Name THE DOW CHEMICAL COMPANY
Facility Type MANUFACTURER OF INSULATION MATERIALS

Distance To Location 6503.053
Degrees 29.10338

Received	Type	Status	Description
6/12/2008	ERC	FR-IN PR	for the shutdown of a foam insulation material manufacturing facility

Facility ID 245

Facility Name CARL A. COX (TRACY SHELL)
Facility Type GASOLINE DISPENSING

Distance To Location 7643.413
Degrees 50.71503

Received	Type	Status	Description
6/23/2008	ATC	FINAL	the replacement of the phase II vapor recovery system with a Healy phase II vapor recovery system with in-station diagnostics

Facility ID 263

Facility Name DEFENSE DISTRIB DEPOT SAN JOAQ

Facility Type MILITARY INSTALLATION

Distance To Location 6503.053

Degrees 29.10338

Received	Type	Status	Description
3/5/2008	PEER	FINAL	PEER for one unit

Facility ID 283

Facility Name DEUEL VOCATIONAL INSTITUTE

Facility Type CORRECTIONAL INSTITUTION

Distance To Location 6503.053

Degrees 29.10338

Received	Type	Status	Description
10/22/2007	ATC	FINAL	installation of a new 840 bhp diesel-fueled IC engine
9/2/2008	ATC	PR-INCO	398 hp Caterpillar Model C-9 diesel-fired emergency standby engine powering an electrical generator
2/1/2007	ATC	FINAL	retrofit the 34.6 MMBtu/hr boiler #1 with a Coen Model ULN ultra-low NOx burner to comply with District Rule 4306
12/14/2006	ATC	FINAL	pyrolysis cleaning furnace
5/30/2006	ATC	FINAL	increasing the quantity of powder coating usage on the metal parts and products coating operation to 140 pounds per day, installing a metal parts and products coating operation for large parts, and installing a wood parts and products coating operation

Facility ID *367*

Facility Name GRANITE CONSTRUCTION CO

Facility Type AGGREGATE AND ASPHALTIC CONCRETE PRODUCTION

Distance To Location 6503.053

Degrees 29.10338

Received	*Type*	*Status*	*Description*
10/29/2008	PEER	NEW PR	
9/25/2008	PEER	FINAL	PEER: ONE (1) PROCESS HEATER

Facility ID *410*

Facility Name HOLLY SUGAR CORPORATION

Facility Type SUGAR REFINING AND PROCESSING FACILITY

Distance To Location 9049.69

Degrees 47.60195

Received	*Type*	*Status*	*Description*
2/28/2007	ATC	FINAL	modify GDF to replace the existing 1,000 gallon aboveground gasoline storage tank and dispenser with a 550 gallon aboveground storage tank and dispenser
10/16/2007	ERC T/O	FINAL	ERC T/O of certificate N-257-4 from Holly Sugar to CE2 Environmental Opportunities I LP and CE2 Environmental Markets LP
10/16/2007	ERC T/O	FINAL	ERC T/O of certificate N-409-4 from Holly Sugar to CE2 Environmental Opportunities I LP
1/3/2008	PEER	FINAL	PEER

Facility ID *421*

Facility Name INLAND PAPERBOARD & PACKAGING

Facility Type CORRUGATED PAPERBOARD CONTAINER MANUFACTURER

Distance To Location 5228.289

Degrees 0.4871246

Received	*Type*	*Status*	*Description*

9/18/2006	ATC	FINAL	the installation of a new flexographic printing press to replace an existing printing press
10/11/2007	ATC	FINAL	the installation of a new flexographic printing press to replace an existing printing press
5/2/2006	ATC	FINAL	installing a EVOL-84 flexographic printing press and modifying the cyclone product separator
12/5/2007	ATC	FINAL	the installation of two new 2-color flexographic printing presses with rotary die cutters to replace two existing printing presses

Facility ID *472*

Facility Name LAWRENCE LIVERMORE NATL. LAB

Facility Type RESEARCH FACILITY

Distance To Location 6503.053

Degrees 29.10338

Received	Type	Status	Description
10/10/2006	ATC	FINAL	explosives detonation
8/24/2007	ATC	FINAL	the installation of a 315 bhp diesel-fired IC engine powering an electrical generator
8/12/2008	ATC	FINAL	modify the gasoline dispensing operation

Facility ID *474*

Facility Name LEPRINO FOODS

Facility Type FOOD PROCESSOR

Distance To Location 6991.559

Degrees 103.3724

Received	Type	Status	Description
11/30/2007	ATC	FINAL	modify process dryer unit -6 NOx and CO emissions limits for Rule 4309 compliance

Facility ID 534

Facility Name CHEVRON USA PRODUCTS COMPANY

Facility Type GASOLINE DISPENSING

Distance To Location 7679.156

Degrees 50.95207

Received	Type	Status	Description
7/9/2008	ATC	FINAL	upgrade the phase II vapor recovery system from Phil-Tite (VR-101-D) to a Healy EVR ISD (VR-202-F)
9/5/2008	ATC	FINAL	replace the phase II vapor recovery system with a Healy phase II vapor recovery system with Incon in-station diagnostics

Facility ID 593

Facility Name OWENS-BROCKWAY GLASS CONTAINER

Facility Type GLASS CONTAINER MANUFACTURER

Distance To Location 467.4709

Degrees 354.1065

Received	Type	Status	Description
1/3/2006	ATC	FINAL	replace chemical in Hot End Surface Treatment lines, designate 2 IC engines as emergency engines (fire pumps), remove one gasoline-fired IC engine (fire pump), and update 3 diesel-fire IC engines for 4702 and ATCM requirements
7/24/2007	AMEND TV	FINAL	convert ATC -2-5, 11-5, 37-0, 38-0, 39-0, 40-0, 41-0
1/30/2007	TV RENEWAL	FINAL	TV Renewal DROP DEAD DATE: 7/30/08
1/13/2006	ERC WITHDRA	FINAL	surrender of PM10 Emission Reduction Credits in response to Short Term Variance N-05-16S
9/22/2006	MINOR MOD.	FINAL	Minor mod for 5 IC engines for Rule 4702 and ATCM compliance.

Facility ID *671*

Facility Name QUIK STOP MARKET #138

Facility Type GASOLINE DISPENSING

Distance To Location 5414.319

Degrees 37.64662

Received	*Type*	*Status*	*Description*
11/13/2007	ATC	FINAL	gdf - install Phase II EVR (Healy) w/ISD

Facility ID *692*

Facility Name RMC PACIFIC MATERIALS

Facility Type SAND AND GRAVEL PROCESSING

Distance To Location 6879.242

Degrees 111.467

Received	*Type*	*Status*	*Description*
3/20/2006	ATC	FINAL	Ronconfigure rock plant with new and existing equipment.
6/30/2006	ATC	FINAL	New aggregate plant

Facility ID *704*

Facility Name RO-LAB RUBBER COMPANY INC.

Facility Type MANUFACTURER OF RUBBER PLUGS

Distance To Location 6916.109

Degrees 103.032

Received	*Type*	*Status*	*Description*
8/21/2008	PEER	FR-IN PR	PEER: ONE (1) BOILER

Facility ID *842*

Facility Name TEICHERT AGGREGATES

Facility Type AGGREGATE PROCESSING OPERATION

Distance To Location 6997.19

Degrees 106.7386

Received	*Type*	*Status*	*Description*
3/26/2008	PEER	FINAL	PEER for one boiler

Facility ID *1002*

Facility Name LODI METAL TECH INC

Facility Type METAL PARTS AND PRODUCT COATING OPERATION

Distance To Location 6292.018

Degrees 127.3471

Received	*Type*	*Status*	*Description*
10/4/2006	TV RENEWAL	COMPLE	TV renewal application DROP DEAD DATE 4/18/08
3/11/2008	ATC	FINAL	Increase throughput
8/7/2007	MINOR MOD.	COMPL	Convert ATC -3-4 and -4-0

Facility ID *1026*

Facility Name THERMAL ENERGY DEV. CORP, LTD

Facility Type ELECTRICAL GENERATION FACILITY

Distance To Location 1296.493

Degrees 31.7899

Received	*Type*	*Status*	*Description*
2/22/2007	AMEND TV	NEW PR	Transfer of Ownership
8/21/2007	ATC	FINAL	modification of the biomass-fired boiler to establish an annual capacity factor of 10% for natural gas combustion
6/2/2008	AMEND TV	FINAL	convert ATC N-1026-1-9

Received	Type	Status	Description
10/3/2008	ATC	PR-INCO	permit to operate for 15,000 gpm cooling tower, modification to condition #32 (N-1026-1-8) to allow demonstration of emission offsets of previous year at the beginning of the following year

Facility ID *1051*

Facility Name BASALITE CONCRETE PRODUCTS LLC

Facility Type CONCRETE PRODUCTS

Distance To Location 3777.582

Degrees 115.3403

Received	Type	Status	Description
3/10/2006	ATC	FINAL	addition of 40 HP dust collector to improve dust collection efficiency of a dry aggregate handling system

Facility ID *1094*

Facility Name GRANT LINE SHELL

Facility Type GASOLINE DISPENSING

Distance To Location 5555.62

Degrees 60.54642

Received	Type	Status	Description
6/23/2008	ATC	FINAL	the replacement of the phase II vapor recovery system with a Healy phase II vapor recovery system with in-station diagnostics

Facility ID *1145*

Facility Name MUSCO OLIVE PRODUCTS

Facility Type AGRICULTURAL PRODUCTS PROCESSING - OLIVE

Distance To Location 3537.658

Degrees 273.7829

Received	Type	Status	Description
9/15/2008	ATC	PR-IN PR	a new bubbling fluidized bed boiler firing on olive pits
1/18/2006	INHOUSE PTO	FINAL	wastewater treatment operation

7/19/2007	ATC	FINAL	a boiler retrofit to install an ultra-low NOx burner for compliance with District Rule 4306

Facility ID *2515*

Facility Name CHEVRON USA INC
Facility Type GASOLINE DISPENSING

Distance To Location 4661.409
Degrees 43.32771

Received	*Type*	*Status*	*Description*
9/27/2007	ATC	FINAL	the modification of a gasoline dispensing facility to install and EVR phase II VRS with ISD
9/19/2008	ATC	FINAL	replace the phase II vapor recovery system with a Healy phase II vapor recovery system with Incon ISD

Facility ID *3187*

Facility Name TRACY MATERIAL RECOVERY
Facility Type MATERIAL RECOVERY, COMPOSTING AND TRANSFER

Distance To Location 7773.476
Degrees 120.7579

Received	*Type*	*Status*	*Description*
1/25/2007	ATC	FINAL	gdf - ast
1/25/2007	ATC	FINAL	the permitting of an existing 80 BHP diesel-fired emergency IC engine powering an electrical generator

Facility ID *3912*

Facility Name ARCO #06347-BP WEST COAST PRODUCTS LLC
Facility Type GASOLINE DISPENSING FACILITY

Distance To Location 6507.422
Degrees 29.08197

Received	*Type*	*Status*	*Description*
4/28/2008	ATC	FINAL	modification to an existing gasoline dispensing operation to install a Healy EVR Phase II vapor recovery system with a Veeder-Root ISD system

Facility ID *3940*

Facility Name 7-ELEVEN, INC

Facility Type GASOLINE DISPENSING

Distance To Location 5557.448

Degrees 60.51431

Received	Type	Status	Description
11/8/2007	ATC	FINAL	Install Healy phase 2 EVR

Facility ID *3970*

Facility Name TRACY TRUCK & AUTO STOP

Facility Type GASOLINE DISPENSING

Distance To Location 7814.576

Degrees 51.50682

Received	Type	Status	Description
2/13/2006	ATC	FINAL	modify GDF - install balance Phase II VRS for ORVR compliance.

Facility ID *4034*

Facility Name CHEVRON PRODUCTS CO

Facility Type GASOLINE DISPENSING

Distance To Location 5241.097

Degrees 19.82314

Received	Type	Status	Description
8/2/2007	ATC	FINAL	mod gdf - upgrade to Healy EVR w/ISD
9/19/2008	ATC	FINAL	upgrade Phase II to Healy EVR with Incon ISD

Facility ID 4065

Distance To Location 3325.051

Degrees 290.1158

Facility Name BARBOSA CABINETS, INC.

Facility Type MANUFACTURER OF WOODEN CABINETS

Received	Type	Status	Description
5/9/2006	ATC	FINAL	modification of the emission concentration and flow rate limits of the baghouses
11/5/2008	ATC	NEW PR	

Facility ID 4597

Distance To Location 1211.589

Degrees 347.5637

Facility Name GWF ENERGY, LLC - TRACY PEAKER PROJECT

Facility Type ELECTRIC POWER GENERATION

Received	Type	Status	Description
8/14/2008	TV RENEWAL	PR-ASSI	TV Renewal appl DROP DEAD DATE: 02/14/10
8/21/2006	ATC	FINAL	reinstate fuel sulfur content testing even when firing on PUC regulated natural gas
8/9/2007	AMEND TV	FINAL	convert ATC -1-4 and -2-4
7/21/2008	ATC	FR-ASSI	convert powerplant from simple cycle to combined cycle operation

Facility ID 4614

Distance To Location 4727.332

Degrees 45.73252

Facility Name SAFEWAY INC

Facility Type GROCERY STORE

Received	Type	Status	Description
8/1/2007	ATC	FINAL	mod gdf - upgrade to Healy EVR w/ISD

Facility ID *4669*

Facility Name COSTCO GASOLINE LOC NO 0135

Facility Type GASOLINE DISPENSING

Distance To Location 5113.659

Degrees 70.08838

Received	Type	Status	Description
2/4/2008	ATC	FINAL	replace the existing product spill containment and debris buckets, and upgrade the existing Healy Phase II Vapor Recovery System (G-70-191-AA) to a Healy EVR Phase II Vapor Recovery System including Veeder-Root ISD (VR-202-E)
11/14/2006	ATC	FINAL	gdf - replace spill bucket

Facility ID *4772*

Facility Name GIRARD MANAGEMENT GROUP, LLC

Facility Type SPECIALTY TRADE CONTRACTORS

Distance To Location 2996.492

Degrees 284.2471

Received	Type	Status	Description
2/14/2008	ATC	FINAL	modification to an existing wood coating operation to install a conveyorized feed system and to install a three-sided enclosure for the stenciling operation

Facility ID *4846*

Facility Name KNOX & ASSOC LLC/ DBA BURGER KING #3421

Facility Type RESTAURANT - FAST FOOD

Distance To Location 7398.909

Degrees 49.1652

Received	Type	Status	Description
8/8/2008	ATC	FINAL	replace the existing charbroiler with a Duke model FBBN1C120 charbroiler and increase daily meat processed throughput from 200 pounds to 300 pounds

Facility ID *4849*

Distance To Location 5157.599

Facility Name KNOX & ASSOC LLC/ DBA BURGER KING #11835

Facility Type RESTAURANT - FAST FOOD

Degrees 68.57802

Received	Type	Status	Description
8/21/2008	ATC	FINAL	replacement of NIECO chain-driven charbroiler served by a catalytic oxidizer with a Duke Model FBB-NIC-120 charbroiler served by Duke Model 175480 catalytic oxidizer

Facility ID *4852*

Distance To Location 5931.019

Facility Name KNOX & ASSOC LLC / DBA BURGER KING #9494

Facility Type RESTAURANT - FAST FOOD

Degrees 65.62196

Received	Type	Status	Description
4/1/2008	ATC	FINAL	the installation of a char broiler (replacement for the existing unit)

Facility ID *4875*

Distance To Location 8302.209

Facility Name SURTEC, INC

Facility Type CHEMICAL MANUFACTURING

Degrees 31.77729

Received	Type	Status	Description
6/27/2006	ATC	FINAL	to increase the maximum annual production quantity for a floor stripper and cleaner blending operation from 100,000 gallons per year to 200,000 gallons per year

Facility ID 5026

Facility Name ATLANTIC RICHFIELD OIL COMPANY (ARCO)

Facility Type SOIL REMEDIATION OPERATION

Distance To Location
4342.718

Degrees
271.8763

Received	Type	Status	Description
3/10/2008	ATC	FINAL	Soil remediation

Biological Resources (16-19)

BACKGROUND

In the Data Adequacy Supplement, the applicant provided some but not all records of conversation for agency staff contacts regarding the project and potential biological issues of concern. The applicant indicated the San Joaquin County and U.S. Fish and Wildlife Service (USFWS) contacts were forthcoming. In addition, the California Department of Fish and Game (CDFG) regional biologist record of conversation stated that the applicant needs to follow up with the new unit biologist who, effective mid-September, serves as the new CDFG contact for this project for concurrence on the previous project review and a final determination regarding the need for protocol-level surveys for burrowing owl.

Data Request

16. Please provide the remaining USFWS and San Joaquin County records of conversation.

Response: Records of conversation for contacts with the USFWS and San Joaquin County are included as Attachment DR16-1. The USFWS staff (Mary Hammer) was aware of the project but has not spent significant time reviewing project documentation.

The San Joaquin County staff (Steve Mayo) was very familiar with the project and indicated that no additional mitigation fees are required. Mr. Mayo indicated that compliance measures include the need to conduct preconstruction surveys for the particular species of concern (e.g., San Joaquin kit fox and burrowing owls) and report the results of the survey to the SJCOG, Inc., Habitat Conservation Plan Division.

Data Request

17. Please contact the new CDFG biologist and provide a record of conversation that includes a discussion on the need for burrowing owl surveys and other potential project-related biological resource impacts or issues of concern.

Response: Andrea Boertien, the CDFG biologist, was contacted to discuss the need for burrowing owl surveys and other potential project-related biological resource impacts or concerns. Ms. Boertien requested additional information, which was transmitted via email. After a brief review, Ms. Boertien indicated the information was sufficient for her to start the review and that she would provide a response by November 14, 2008. GWF will provide a copy of any response from the CDFG to the CEC when received. The record of conversation is included as Attachment DR17-1.

BACKGROUND

Section 5.2.2.3.1 discusses the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan (SJMSCP) and the Tracy Peaker Project's (TPP) land purchase SJMSCP fee payment, which were required by a habitat compensation condition of certification. Staff could not locate a detailed description of the SJMSCP's biological resource goals, policies, and programs in the AFC or the TPP licensing materials (Appendix 1A). Also, page 5.2-6 states that because the current project construction impacts would occur in the area covered by the SJMSCP fee for the TPP and reconductoring would occur in disturbed areas with best management practices, "…no additional SJMSCP fees or other mitigation are anticipated for GWF Tracy construction at this time." It is unclear how the previous land purchase and fee were calculated and which species are covered by this mitigation.

Data Request

18. Please discuss the project's compliance with the SJMSCP in general and specifically with respect to individual special-status species of concern to the project (e.g., burrowing owl, San Joaquin kit fox) and provide an analysis of how each is covered by the TPP's land purchase and fee.

Response: The SJMSCP Master Incidental Take Permit conditions require replacement of agricultural habitat land on a 1:1 basis. Therefore, GWF Energy LLC purchased 34.6 acres of San Joaquin kit fox and burrowing owl habitat credits purchased for the TPP project from the San Joaquin Council of Governments, consistent with TPP Condition of Certification (COC) BIO-9. The mitigation acreage was calculated based on the impact areas determined during licensing proceeding. Table DR18-1 presents the basis for the impacted acreage.

TABLE DR18-1
TPP Biological Resource Estimated Impacted Acreage

Project Features	Temporary Disturbance Acres	Permanent Disturbance Acres
Access Road	1.5	1.9
Temporary Access Road	1.9	0.0
Water Supply Line	0.6	0.0
Power Plant Fenced Area	0.0	9.0*
PG&E Switchyard Fenced Area	0.0	1.3
Construction Laydown/Parking	18.4	0.0
Total	22.4	12.2

Source: Biological Resources Table 2, TPP Final Staff Assessment, Page 163.

* Includes GWF Switchyard

The SJMSCP Permit Conditions applicable to the TPP are presented in Attachment DR18-1 (included as Appendix A of the TPP Biological Resources Mitigation Implementation and Monitoring Plan- BRMIMP). The requirements of these conditions include notifying SJCOG, Inc., of plans to commencement ground disturbing activities, performing pre-construction surveys between 14 and 30 days prior to ground disturbance for San Joaquin kit fox and burrowing owl and submit the results to SJCOG, Inc., meet with SJCOG, Inc., to discuss minimization measures designed to avoid impacts, and construction mitigation measures (biological monitoring). GWF Energy will implement the mitigation measures, including identifying a designated biologists, preparation of a BRMIMP, conducting environmental awareness training of construction workforce, and biological monitoring during construction (as directed by the designated biologist).

Data Request

19. Please contact county staff about whether any additional mitigation would be required for the GWF Tracy project and include the discussion and rationale in a record of conversation (can be included in the one requested above).

Response: As noted in the response to Data Request #16, no additional mitigation is required.

ATTACHMENT DR16-1

Records of Conversations with USFWS and San Joaquin County

CH2MHILL CONVERSATION RECORD

Contact with: Mary Hammer/USFWS

Phone No.: 916-414-6600 **Date:** November 10, 2008

From: John Cleckler **Time:**

Message Taken By: John Cleckler

Subject: GWF Tracy Biological Resources – permitting/survey recommendations

I discussed survey/permitting requirements for the GWF TPP expansion project with Mary Hammer in person at the Sacramento Field Office. Mary is aware of the project but has not had an opportunity to review past emails that she has received regarding the project.

I provided Mary with a copy of the biological resources section of the AFC.

I plan to follow-up with Mary on the week of November 17th.

CH2MHILL TELEPHONE CONVERSATION RECORD

Call To: Steve Mayo, Senior Regional Planner — San Joaquin Council of Governments, Habitat Conservation Plan Department

Phone No.: 209-468=3913 **Date:** November 14, 2008

Call From: **Time:** 10:55 AM

Message Taken By: Steve Long

Subject: SJMSCP permit for TPP and any potential need for additional mitigation for GWF Tracy

Project No.: **365887.GW.TR.05**

Got a call back from Mr. Mayo after leaving him a message at 9:05.

Mr. Mayo was familiar with the GWF Tracy Peaker Project (TPP) and the 2002 SJMSCP permit. I described the additional work for the GWF Tracy project that was occurring within the same footprint as was covered in the original TPP permit.

Mr. Mayo said that no additional mitigation fees are required. The permit simply requires that preconstruction surveys for the particular species of concern (e.g., San Joaquin kit fox and burrowing owls) be conducted and the results of the survey be communicated in a note to the SJCOG, Inc., Habitat Conservation Plan Division. That note will be kept on file and is used to document the GWF project's continuing fulfillment of the SJMSCP permit (i.e., need for species survey and notification prior to construction).

I said that it was already foreseen that the preconstruction surveys and SJCOG, Inc. notification would be taking place. He said a SJCOG biologist is not required for the preconstruction survey because he has confidence that CH2M HILL biologists are fully capable to get it done correctly.

In support of what is written in the SJCOG HCP brochure, namely that participation in the SJMSCP permits system "guarantees no further mitigation, except for incidental Take Minimization Measures required in limited cases", Mr. Mayo says the mitigation fee payment system is a one-time payment system that avoids the need for additional payments when work is done subsequently within a project area. He cited the example of O&M on pipeline facilities, where it makes no sense to require additional fees for later impacts on the same footprint. For that reason, the permit project has no provisions for temporary impacts.

Mr. Mayo did say that the project needed to be vigilant during the construction process to assure that no sensitive species, which may not have been identified in the preconstruction survey, are harmed. I indicate that these projects typically undergo a WEAT by a qualified biologist and that a biologist is generally available to help resolve biological issues that could arise.

ATTACHMENT DR17-1

Record of Conversation with CDFG

CH2MHILL TELEPHONE CONVERSATION RECORD

Call To: Andrea Boertien CDFG

Phone No.: 209-942-6070 **Date:** November 13, 2008

Call From: **Time:** 2:26 PM

Message Taken By: Steve Long

Subject: Burrowing Owl Surveys and Other Potential Biological Resource Impacts or Issues of Concern

Project No.: **365887.GW.TR.05**

Spoke briefly with Ms. Boertien, the new biologist at CDFG, about the upcoming GWF project and proposed mitigations for biological impacts such as pre-construction surveys and mitigation requirements for San Joaquin kit fox and burrowing owl. I inform her that the GWF project (3.3 acres) will occur within the same footprint as the permitted TPP project (34.6 acres) and that we are subject to the same survey and avoidance measures as detailed in the SJMSCP permit, which I briefly described.

She asked me to forward a copy of the TPP permit so she could review the proposed mitigations included in it and decide if more was required. I sent a copy of the permit as well as some background information on the GWF project survey findings and compliance requirements.

Ms. Boertien informed me that she is currently under deadline, but if the information sent was sufficient, she would try to give me an answer to the CEC Data Request by COB Friday (Nov 14).

ATTACHEMNT DR18-1

SJMSCP Permit Conditions

CWF Tracy Peaker Project
SJMSCP
REVISED Conditions of Project Approval for Biological Resources

Project Number: SJMSCP 2001-002
Date: January 14, 2002
Findings: Potential occupied habitat, San Joaquin kit fox
Potential occupied habitat, burrowing owls
Total Disturbed Acres Anticipated: 34.6
Habitat Types to be Disturbed: Agricultural Habitat Lands (C4)

Conditions

Within 30 days of filing a Notice of Completion with the State Clearinghouse, or prior to commencing ground disturbance, whichever occurs first:

1. Pay a fee of $58,474 to SJCOG, Inc. for the disturbance of 34.6 acres of Agricultural Habitat Lands at a cost of $1,690 per acre.

Between 14 and 30 calendar days before ground disturbance:

2. Notify SJCOG, Inc. of plans to commence ground disturbance to allow for preconstruction surveys for the San Joaquin kit fox.

   If surveys identify potential dens (potential dens are defined as burrows at least four inches in diameter which open up within two feet), potential den entrances shall be dusted for three calendar days to register track of any San Joaquin kit fox present. If no San Joaquin kit fox activity is identified, potential dens may be destroyed. If San Joaquin kit fox activity is identified, then dens shall be monitored to determine if occupation is by an adult fox only or is a natal den (natal dens usually have multiple openings). If the den is occupied by an adult only, the den may be destroyed when the adult fox has moved or is temporarily absent. If the den is a natal den, a buffer zone of 250 feet shall be maintained around the den until the biologist determines that the den has been vacated. Where San Joaquin kit fox are identified, the provisions of the U.S. Fish and Wildlife Service's published *Standardized Recommendations for Protection of the San Joaquin Kit Fox Prior to or During Ground Disturbance* shall apply. These standards are summarized in conditions 4, 5 and 6.

3. Notify SJCOG, Inc. of plans to commence ground disturbance to allow for preconstruction surveys for the burrowing owl. If burrowing owls are found,

   During the non-breeding season (September 1 through January 31) burrowing owls occupying the project site shall be evicted from the project site by passive relocation as described in the California Department of Fish and Game's Staff Report on Burrowing Owls (Oct., 1995)

During the breeding season (February 1 through August 31) occupied burrows shall not be disturbed and shall be provided with a 75 meter protective buffer until and unless the TAC, with the concurrence of the Permitting Agencies' representatives on the TAC; or unless a qualified biologist approved by the Permitting Agencies verifies through non-invasive means that either: 1) the birds have not begun egg laying, or 2) juveniles from the occupied burrows are foraging independently and are capable of independent survival. Once the fledglings are capable of independent survival, the burrow can be destroyed.

Prior to commencing ground disturbance:

4. The construction team shall meet with SJCOG, Inc. to discuss minimization measures designed to avoid impacts to the San Joaquin kit fox. SJCOG Inc.'s biologist shall be present at the meeting to conduct kit fox education.

During project construction:

5. All construction pipes, culverts, or similar structures with a diameter of 4-inches or greater that are stored at the construction site for one or more overnight periods shall be thoroughly inspected for kit foxes before using or moving the equipment or materials. If a kit fox is discovered, then the materials or equipment shall not be moved until consultation with the U.S. Fish and Wildlife Service. If necessary, under the direct supervision of SJCOG, Inc.'s biologist, the equipment may be moved once to remove it from the path of construction activity until the fox escapes.

6. All food-related trash items such as wrappers, cans, bottles, and food scraps shall be disposed of in closed containers and removed at least once a week from the construction site.

"In reliance on the Section 10(a)(1)(B) Permit issued by the United States Fish and Wildlife Service and the Section 2081(b) Incidental Take Permit issued by the California Department of Fish and Game, *San Joaquin County has consulted with and agreed to allow coverage pursuant to the SJMSCP for the CA State Energy Commission and GWF Energy LLC*, its successors, agents and assigns pursuant to the "Implementation Agreement for the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan" which will allow *the CA State Energy Commission and GWF Energy LLC*, its successors, agents and assigns to construct, operate and maintain the Project commonly known as *the GWF Energy LLC Tracy Peaker Project* and *located as indicated on the attached map* which may result in a legally permitted Incidental Take of the SJMSCP Covered Species in accordance with and subject to the terms and conditions of *the GWF Energy LLC Tracy Peaker Project plans approved by the California State Energy Commission (Attached)*. This Certification applies only to activities on the subject parcel(s) which are carried out in full compliance with *the approved plans for the GWF Energy LLC Tracy Peaker Project*, Section 10(a)(1)(B) Permit and Section 2081(b) Incidental Take Permit conditions."

I have read, acknowledge, and agree to the preceding conditions:

GWF Energy, LLC by__________________ Date

Attachment
Recommended Additional Measures to Minimize Potential Construction Delays Due to Burrowing Owls

Incidental take minimization measures to prevent occupation of the site by burrowing owls is not required because there is no confirmation of actual presence of burrowing owls on site. However, given the high likelihood that this species could be present during construction, May and Associates Inc., and Augustine Land Use Planning strongly urge the project proponent to implement the following SJMSCP minimization measures, as feasible, to reduce the likelihood of conflicts with this species during construction.

5.2.4.15 Burrowing Owls

The presence of ground squirrels and squirrel burrows are attractive to burrowing owls. Burrowing owls may therefore be discouraged from entering or occupying construction areas by discouraging the presence of ground squirrels. To accomplish this, the Project Proponent should prevent ground squirrels from occupying the project site early in the planning process by employing one of the following practices:

A. The Project Proponent may plant new vegetation or retain existing vegetation entirely covering the site at a height of approximately 36" above the ground. Vegetation should be retained until construction begins. Vegetation will discourage both ground squirrel and owl use of the site.

B. Alternatively, if burrowing owls are not known or suspected on a project site and the area is an unlikely occupation site for red-legged frogs, San Joaquin kit fox, or tiger salamanders:

The Project Proponent may disc or plow the entire project site to destroy any ground squirrel burrows. At the same time burrows are destroyed, ground squirrels should be removed through one of the following approved methods to prevent reoccupation of the project site. Detailed descriptions of these methods are included in Appendix A, *Protecting Endangered Species, Interim Measures for Use of Pesticides in San Joaquin County*, dated March, 2000:

1. **Anticoagulants.** Establish bait stations using the approved rodenticide anticoagulants Chlorophacinone or Diphacinone. Rodenticides shall be used in compliance with U.S. Environmental Protection Agency label standards and as directed by the San Joaquin County Agricultural Commissioner.

2. **Zinc Phosphide.** Establish bait stations with non-treated grain 5-7 calendar days in advance of rodenticide application, then apply Zinc Phosphide to bait stations. Rodenticides shall be used in compliance with U.S. Environmental Protection Agency label standards and as directed by the San Joaquin County Agricultural Commissioner.

3. **Fumigants.** Use below-ground gas cartridges or pellets and seal burrows. Approved fumigants include Aluminum Phosphide (Fumitoxin, Phostoxin) and gas cartridges sold by the local Agricultural Commissioner's office. NOTE: Crumpled newspaper covered with soil is often an effective seal for burrows when fumigants are used. Fumigants shall be used in compliance with U.S. Environmental Protection Agency label standards and as directed by the San Joaquin County Agricultural Commissioner.

4. **Traps.** For areas with minimal rodent populations, traps may be effective for eliminating rodents. If trapping activities are required, the use of , shall be consistent with all applicable laws and regulations.

Cultural Resources (20-28)

BACKGROUND

Staff's data adequacy review of the GWF Tracy Combined Cycle Power Plant (GWF Tracy) Application for Certification (AFC) identified a number of California Historical Resources Information System (CHRIS) Central California Information Center (CCIC) reports, copies of which the applicant needed to provide for the AFC to be approved as Data Adequate for cultural resources. Staff finds that two of those required reports (listed in AFC Table 5.3-4) were not received and so is asking for them now.

Additionally, in support of the present application, the applicant provided cultural resources data compiled for the AFC for the now-operating Tracy Peaker Project (TPP), including a project-sponsored cultural resources technical report by Rachael Egherman, dated August 2001. Attachment 3.3-2 of that report references a study of transmission lines in the vicinity of the TPP, conducted by JRP Historical Consulting. Staff needs to review this study to assess whether the Tesla-Manteca 115-kV transmission line, to which the GWF Tracy project proposes to interconnect, may be a historical resource under CEQA.

Data Request

20. Under confidential cover, please provide copies of CCIC technical reports #716 and #4216, whose survey coverage is within 0.25 mile of two of the three transmission line segments that the GWF Tracy project proposes to reconductor.

Response: Copies of these two reports were previously provided in the original filing package as part of the CHRIS CCIC data under confidential cover as Appendix 5.3C.

Data Request

21. Please provide a copy of this study: JRP Historical Consulting Services, "Historic Resources Inventory and Evaluation Report, Transmission Lines in the Stanislaus Corridor, Alameda County, California," October, 2000. This need not be provided under confidential cover.

Response: Five copies of the requested report are provided with this filing as Attachment DR21-1. Additional copies will be provided upon request.

BACKGROUND

The GWF Tracy AFC's project description (pp. 2-1–2-2) lists several equipment installations that appear to require foundations capable of considerable weight-bearing. Staff assumes that such foundations would have to extend to some depth in the ground and additionally that overexcavation of the holes for these foundations and filling with engineered fill could be required to ensure the stability of the foundations. To assess potential project impacts to possible buried archaeological resources, staff needs information on the greatest depths to which the excavations for the proposed equipment foundations would extend, and the locations of any excavations expected to exceed four feet below the surface.

The proposed new steam turbine generator (STG) and air-cooled condenser (ACC) are to be installed where a stormwater basin is currently located. Staff needs information on the depth of the stormwater basin, and how much deeper than the basin's greatest depth the foundations for the new equipment would extend into undisturbed ground.

Data Request

22. Please provide the depths of the excavations required for the following features and foundations for proposed equipment:

    a) HRSGs
    b) 150-foot-tall, 17-foot-diameter exhaust stacks
    c) auxiliary boiler
    d) 50-foot-tall, 4-foot-diameter boiler stack
    e) 400,000-gallon service water tank
    f) 125,000-gallon demineralized water tank
    g) modified water piping system, fire protection system, natural gas piping system, and stormwater drainage collection system
    h) stormwater retention basin
    i) new water treatment building
    j) pole or poles for the new on-site 115-kV overhead transmission line
    k) 45-foot-tall, 5.5-foot-diameter, tubular steel poles for interconnection to the 115-kV Tesla-Manteca transmission line

Response: In order to respond to the data requests in a timely manner, GWF with the assistance of B&V, is providing excavation depths for the largest proposed structures which would coincide with the deepest excavations required. The equipment, structures, and features not listed below are expected to require excavation depths less than 4 feet. Please see Table DR22-1.

TABLE DR22-1
Excavation depths for the largest proposed structures

Project Feature	Estimated Excavation Depth
HRSGs	3.5’ below grade
HRSG exhaust stacks	3.5’ below grade
400,000 gallon service water tank	2’ below grade
New storm water retention basin	10’ below grade
Air cooled condenser	8.5’ below grade
Steam turbine generator	4.5’ below grade
Generator step-up transformer	3.5’ below grade

Data Request

23. Please provide a project site plan showing the locations of equipment for whose foundations excavation would exceed four feet below the surface. A site plan such as AFC Figure 2.1-1 with the appropriate equipment indicated by shading or other such convention would be acceptable.

Response: Please refer to the attached Figure DR23-1 for a project site plan.

Data Request

24. Please provide the greatest depth of the existing stormwater retention basin and the greatest depths of the excavations below the bottom of the stormwater retention basin required for the foundations of the STG and ACC.

Response: The greatest depth of the existing storm water retention basin is 10 feet below grade. The bottom of the STG foundation will be 5.5′ feet above the lowest point of the existing storm water retention basin and the ACC foundation will be 1.5 feet above the lowest point.

BACKGROUND

Several AFC sections reference a previous geotechnical study for the TPP at the proposed project site, but no geotechnical report was included with the present AFC. If a later geotechnical study is planned, staff believes that could present an opportunity for the applicant to reduce the amount of archaeological monitoring that staff recommends in the conditions for certification that would accompany a decision from the Commission to permit the proposed project. While it has not yet been established that the proposed project would disturb previously undisturbed ground (which is the purpose of the previous three data requests), if the applicant were to provide factual field data on the archaeological potential of the undisturbed geological deposits that underlie the portions of the proposed project area that will be subject to ground disturbance, then staff would have a more objective basis for scaling back the standard archaeological monitoring requirements. If this possibility interests the applicant, staff recommends that a professional geoarchaeologist participate in any future geotechnical study and collect the data needed for an analysis of the potential for buried archaeological deposits at the proposed GWF Tracy plant site. ("Professional geoarchaeologist" means an archaeologist who is able to demonstrate the completion of graduate-level coursework in geoarchaeology, Quaternary science, or a related discipline.)

Involving a geoarchaeologist in a future geotechnical study is strictly voluntary. Staff offers two options below for this participation. The greater involvement the geoarchaeologist has in the geotechnical study, the more likely that the resulting cultural resources information would either reduce the project's archaeological monitoring requirements or focus them more efficiently and cost effectively than would otherwise be possible.

Data Request

25. Please choose one of the following options for the participation of a geoarchaeologist in the planned geotechnical study at the GWF Tracy project site.

    a. Please provide a professional geoarchaeologist the opportunity to observe, in the field, the removal of any sediment cores by the geotechnicians, to examine the cores, in the field or a laboratory, for physical and chemical indices of human activity, and, where feasible, to collect chronometric dating samples from the cores. At least one of the cores should be drilled to a depth that exceeds, by approximately one meter, the deepest construction excavations planned for the project. Prior to the field work, the geoarchaeologist should conduct background research on the geology and geomorphology of the project area to be able to place the stratigraphic units observed in the cores into a meaningful local sequence. The geoarchaeologist should write a brief letter report for staff that describes the fieldwork and the stratigraphic units observed, that estimates the probable age of those units, that interprets the depositional history of the units, and that assesses the likelihood that the units contain buried archaeological deposits.

    b. Or, please have a trench excavated to the specifications of a professional geoarchaeologist in the part of the proposed project site where project excavations are expected to extend to the greatest depth. Prior to the field work, the geoarchaeologist should conduct background research on the geology and geomorphology of the project area to be able to place the stratigraphic units observed in the trench into a meaningful local sequence. Have the geoarchaeologist record reasonably detailed written descriptions of the lithostratigraphic and pedostratigraphic units in one profile of the trench. The recordation of that profile should include a measured drawing of the profile, a profile photograph with a metric scale and north arrow, and the screening of a small sample (three 5-gallon buckets) of sediment from the major lithostratigraphic or pedostratigraphic units in the profile, or from two arbitrary levels in the profile, through ¼-inch hardware cloth. Soil humate samples for dating the profile's stratigraphic sequence should also be collected, as appropriate. Have the soil humate samples assayed at a professional radiocarbon laboratory, per the geoarchaeologist's instructions, and have the results provided to the geoarchaeologist. The geoarchaeologist should write a brief letter report for staff that describes the fieldwork and the stratigraphic units observed, estimates the probable age of those units, interprets the depositional history of the units, and assesses the likelihood that the units contain buried archaeological deposits.

Response: During the construction of the TPP, the power block of the TPP was excavated to the base of the CTG foundations. The foundations were constructed and the power block was backfilled to finished grade. The excavations for the construction of the TPP are shown on the attached Figure DR25-1 (drawing 069516-CSTF-S3030). The majority of the site was excavated and backfilled during the TPP construction with no archaeological finds. The modifications to the plant do not require any excavations deeper than those previously performed onsite. Based on these two facts it is reasonable to estimate that new excavations associated with the modification will not produce buried archaeological deposits. Therefore additional geotechnical studies should not be required to support scaling back the standard biological monitoring requirements, which GWF believes is appropriate. Five copies of the TPP 2001 Geotechnical and Soils Reports are included for reference as Attachments DR25-1 and DR25-2. Additional copies will be provided upon request.

BACKGROUND

The AFC indicates that accommodating the additional power output from the proposed project would require modifications to the PG&E Schulte Substation (pp. 3-1–3-2). Staff needs to know whether this structure is 45 years old or older, and so would have to be considered a potential cultural resource subject to impact by the proposed project. If the structure is 45 years old or older, staff additionally needs an assessment of its eligibility for the California Register of Historical Resources (CRHR) and of the impact of the proposed modifications to the structure's integrity.

Data Request

26. If the Schulte Substation is older than 45 years, please have a qualified architectural historian compile historical information on this structure, make a recommendation on its CRHR-eligibility, and evaluate the impact of the modifications (converting its three-position ring bus to a three-bay, breaker-and-a-half bus configuration) proposed to accommodate the interconnection loop through the 115-kV Tesla-Manteca transmission line.

Response: The PG&E Schulte Substation was constructed in 2002-2003 in concert with the GWF Tracy Peaker Plant. The PG&E Schulte Substation is not CRHR-eligible.

BACKGROUND

In describing the archaeological survey field methods employed at the locations of the transmission line segments that would be reconductored by the proposed project, the AFC includes inspection of exposed soils and cut banks (AFC, p. 5.3.10). Those field observations would provide staff with a necessary picture of the surface and subsurface soils of the reconductoring area. Consequently, staff requests more detailed information on the soil exposures and profiles that were documented.

Data Request

27. On a map, please show the locations of soil profiles observed and noted.

Response: Opportunistic examination of exposed soils, furrows, ditches, and cut banks were utilized throughout the survey area. Areas of particularly high soil visibility were found along the two western transmission segments as shown on Figure DR27-1. Both of these transmission line segments are located adjacent to, and the existing towers are located within, active agricultural fields. Freshly excavated irrigation ditches were also present in these agricultural areas aiding soil observation. Soils were found to be consistently rocky loam. These areas have been highly disturbed from mechanical equipment used in excavation, mixing, and spreading soils within the plow zone.

Data Request

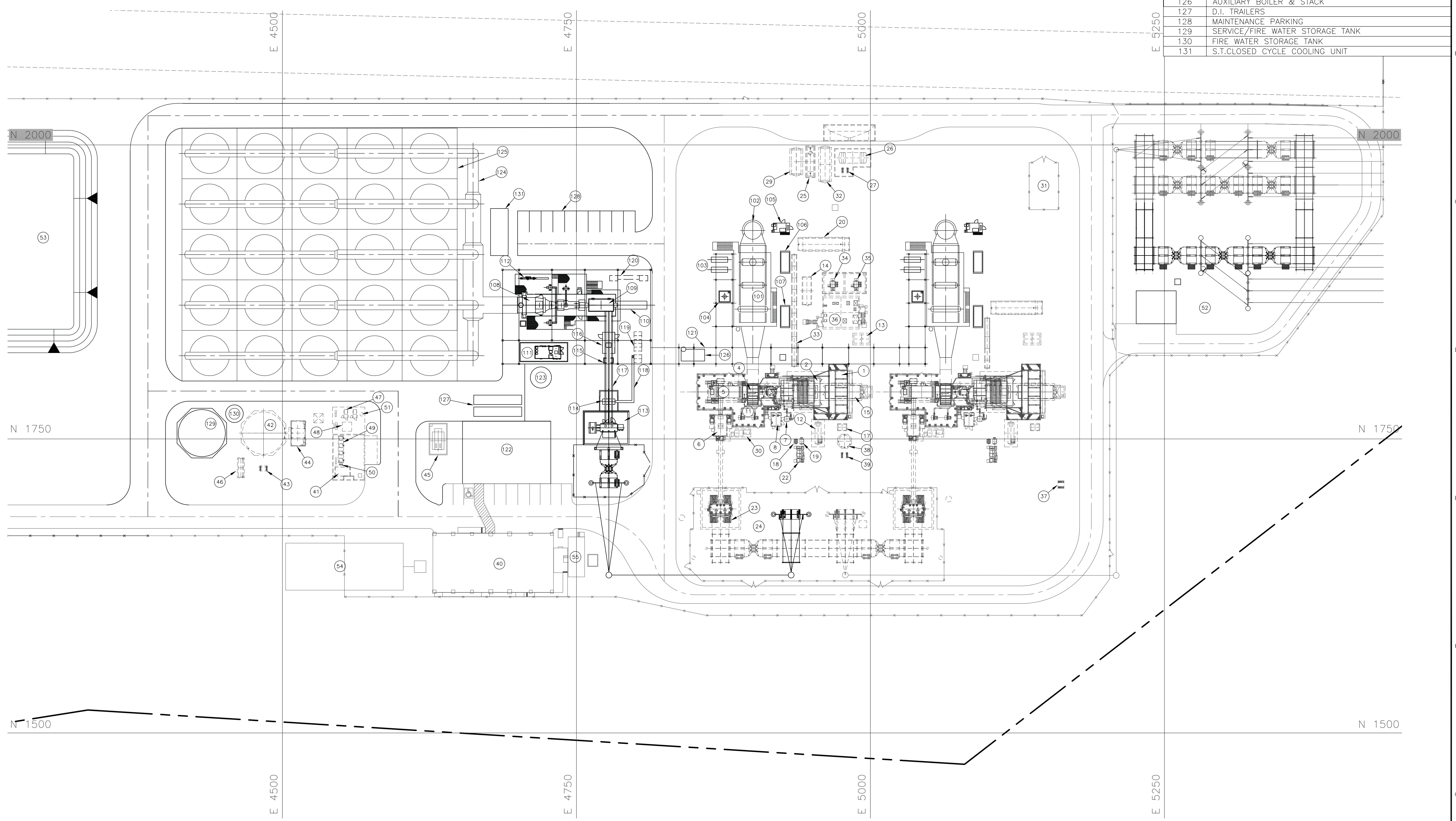
28. Please provide detailed information on the profiles, including section drawings and notes on soil changes and any disturbances.

Response: See response to #27 above.

Note: Highlighted items are expected to require an excavation deeper than 4'.

EQUIPMENT LIST

ITEM NO.	DESCRIPTION
1	INLET AIR FILTER EXISTING
2	ACCESSORY COMPARTMENT EXISTING
3	COMBUSTION TURBINE 7EA EXISTING
4	EXHAUST PLENUM EXISTING
5	GENERATOR EXISTING
6	SWITCHGEAR COMPARTMENT EXISTING
7	LUBE OIL DEMISTER EXISTING
8	GAS VALVE MODULE EXISTING
9	NOT USED
10	NOT USED
11	EXHAUST FRAME BLOWERS EXISTING
12	CO2 FIRE PROTECTION SKID EXISTING
13	WATER WASH DRAINS TANK (UNDERGROUND) EXISTING
14	WATER WASH SKID EXISTING
15	PEECC EXISTING
16	NOT USED
17	AIR PROCESSING UNIT EXISTING
18	FUEL GAS SCRUBBER EXISTING
19	FUEL GAS SCRUBBER DRAINS TANK EXISTING
20	COOLING WATER MODULE EXISTING
21	NOT USED
22	FUEL GAS HEATER SKID EXISTING
23	GSU TRANSFORMER EXISTING
24	GWF SWITCHYARD EXISTING
25	OIL/WATER SEPARATOR (UNDERGROUND) EXISTING
26	AQUEOUS AMMONIA STORAGE TANK EXISTING
27	AQUEOUS AMMONIA FORWARDING PUMPS EXISTING
28	NOT USED
29	WASTE WATER STORAGE TANK (UNDERGROUND) EXISTING
30	CRANKING MOTOR STARTER TRANSFORMER/SWITCHGEAR EXISTING
31	GAS METERING STATION (BY OWNER) EXISTING
32	SPILL CONTAINMENT STORAGE TANK (UNDERGROUND) EXISTING
33	PIPE TRENCH EXISTING
34	UNIT 1 AUXILIARY TRANSFORMER EXISTING
35	UNIT 2 AUXILIARY TRANSFORMER EXISTING
36	SWITCHGEAR EXISTING
37	RAW WATER FORWARDING PUMPS EXISTING
38	EVAPORATIVE COOLER BLOWDOWN TANK EXISTING
39	EVAPORATIVE COOLER BLOWDOWN FORWARDING PUMPS EXISTING
40	ADMIN/MAINTENANCE BUILDING EXISTING
41	POTABLE WATER TREATMENT SKID EXISTING
42	SERVICE/FIRE WATER STORAGE TANK EXISTING
43	SERVICE WATER FORWARDING PUMPS EXISTING
44	FIRE PROTECTION PUMPS REWORKED
45	EMERGENCY DIESEL GENERATOR EXISTING
46	RAW WATER TREATMENT SKID EXISTING
47	AIR COMPRESSORS EXISTING
48	AIR DRYERS EXISTING
49	LONG TERM MIXING BEDS EXISTING
50	DEMIN BOTTLE EXISTING
51	AIR RECEIVER EXISTING
52	SUBSTATION EXISTING
53	RETENTION BASIN RELOCATED
54	SEPTIC TANK FIELD EXISTING
55	GWF SWITCHYARD CONTROL BUILDING EXISTING
101	HRSG
102	HRSG STACK
103	BOILER FEED PUMPS
104	BOILER BLOWDOWN TANK
105	CEM EQUIPMENT/ENCLOSURE
106	SCR SKID
107	DUCT BURNER SKID
108	STEAM TURBINE
109	STEAM TURBINE GENERATOR
110	GENERATOR ROTOR REMOVAL
111	ST LUBE OIL RESERVOIR
112	GLAND CONDENSER
113	ST STEP-UP TRANSFORMER
114	ST AUXILIARY TRANSFORMER
115	ST GENERATOR BREAKER
116	ST GENERATOR EXCITATION COMPARTMENT
117	ST ISOLATED PHASE BUS DUCT
118	NON-SEGREGATED BUS DUCT
119	MEDIUM VOLTAGE SWITCHGEAR
120	SECONDARY UNIT SUBSTATION
121	PIPE RACK
122	WATER TREATMENT
123	DEMINERALIZED WATER TANK
124	STEAM DUCT
125	AIR COOLED CONDENSER
126	AUXILIARY BOILER & STACK
127	D.I. TRAILERS
128	MAINTENANCE PARKING
129	SERVICE/FIRE WATER STORAGE TANK
130	FIRE WATER STORAGE TANK
131	S.T.CLOSED CYCLE COOLING UNIT



NOT TO BE USED
FOR CONSTRUCTION

NO	DATE	REVISIONS AND RECORD OF ISSUE	DRN	DES	CHK	PDE	APP
E	04-23-08	REVISED TANK 123 NAME	MDB				
D	02-27-08	GENERAL REVISIONS	JSH				
C	01-09-08	GENERAL REVISIONS	BEZ				
B	11-27-07	GENERAL REVISIONS	MDB				
A	11-13-07	INITIAL REVIEW	MDB				

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF CALIFORNIA.
SIGNED ____
DATE ____ REG NO. ____

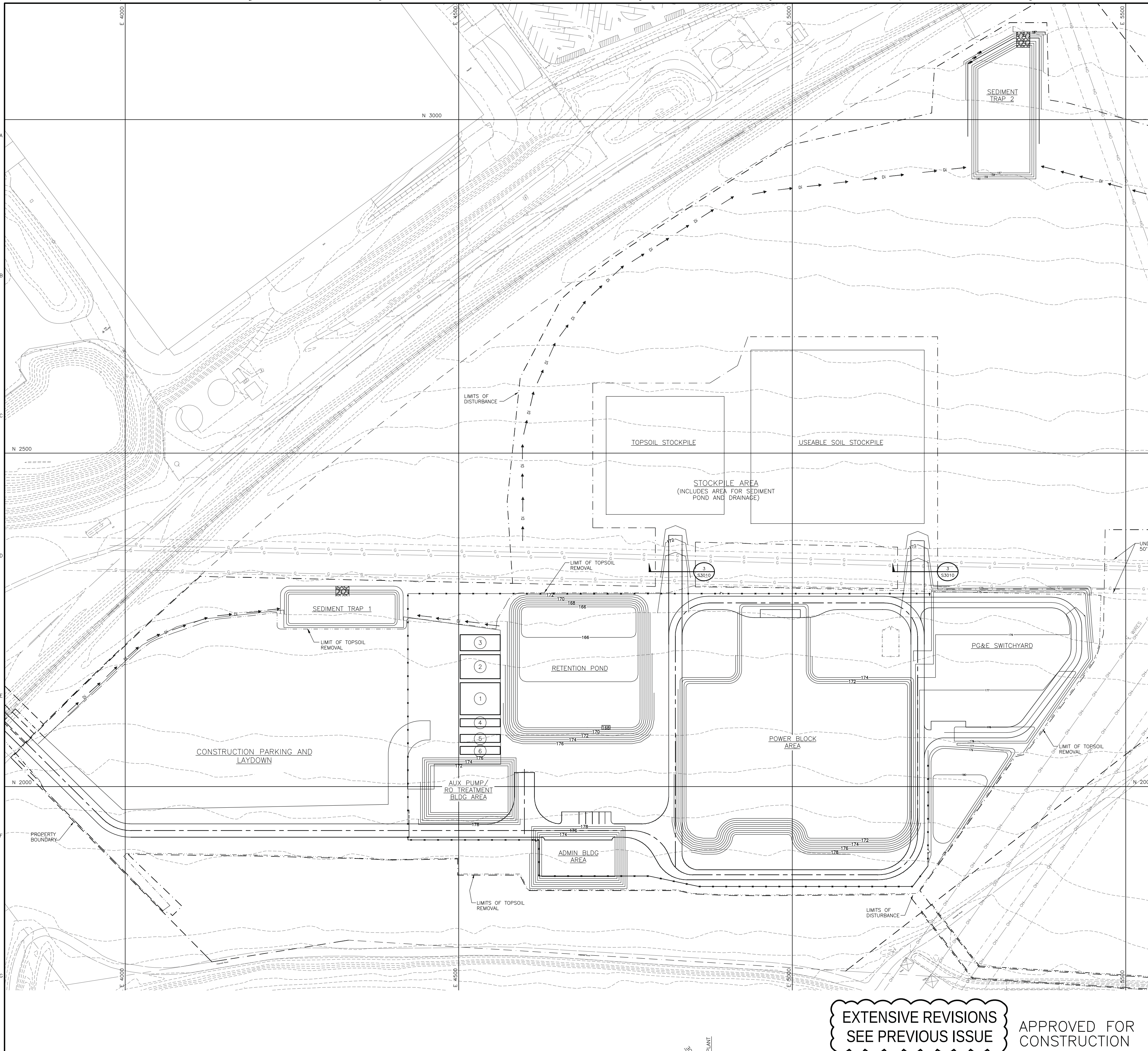
BLACK & VEATCH CORPORATION
ENGINEER | DRAWN MDB | CHECKED | DATE

GWF TRACY COMBINED CYCLE POWER PLANT
PLANT GENERAL ARRANGEMENT
PROJECT DRAWING NUMBER 160129-DM-M1001 REV E

FIGURE DR23-1
GENERAL ARRANGEMENT WITH DEPTHS

GWF TRACY COMBINED POWER PLANT PROJECT
DATA RESPONSES 1-37

CH2MHILL



FOUNDATION TABLE

FOUNDATION	FDN PLAN DIMENSIONS	T/BACKFILL ELEVATION	LOCATION	PLANT COORDINATES NORTH	PLANT COORDINATES EAST
ADMINISTRATION BUILDING	106'X56'	175.75'	NE CORNER	1919.85	4729.75
			SE CORNER	1869.65	4729.75
			SW CORNER	1869.65	4628.75
			NW CORNER	1919.85	4628.75
AUX PUMP/RO TREATMENT BUILDING	66'X31'	174.75'	NE CORNER	2026.00	4569.00
			SE CORNER	1966.00	4569.00
			SW CORNER	1966.00	4544.00
			NW CORNER	2026.00	4544.00
SERVICE WTR STORAGE TANK	37' DIA	171.50'	CENTER	2005.00	4484.00

SITE PREPARATION NOTES

1. FURNISH AND INSTALL SILT FENCES. EXCAVATE RETENTION POND, CONSTRUCT SEDIMENT TRAPS AND TEMPORARY DIVERSION DITCHES AS INDICATED ON THE DRAWINGS.
2. CONSTRUCT PERMANENT PAVED ACCESS ROAD FROM SCHULTE ROAD TO THE PROPERTY LINE INCLUDING THE RAILROAD CROSSING AS INDICATED ON THE DRAWINGS.
3. INSTALL TEMPORARY CONSTRUCTION FENCE ALONG THE ENTIRE PERIMETER OF THE DISTURBED AREA AND ALONG THE PERIMETER OF THE CONSTRUCTION LAYDOWN AREA AS INDICATED ON THE DRAWINGS.
4. PROVIDE TEMPORARY CROSSING PROTECTION, SUCH AS CRANE MATS, FOR THE EXISTING SHALLOW GAS AND OIL LINES LOCATED IN THE GAS EASEMENT. CONSTRUCT TWO CONSTRUCTION CROSSINGS AS INDICATED ON THE DRAWINGS.
5. CLEAR, GRUB AND REMOVE APPROXIMATELY 6 INCHES OF TOPSOIL ACROSS THE CONSTRUCTION SITE AS INDICATED ON THE DRAWINGS AND STOCKPILE TOPSOIL IN LOCATION SHOWN ON THE DRAWINGS.
6. FURNISH AND INSTALL 6" CLASS 2-3/4" AGGREGATE BASE (CALTRAN STD. 26-1.02 A) ON THE CONSTRUCTION PARKING AND LAYDOWN AREAS.
7. EXCAVATE POWER BLOCK AREA DOWN TO ELEVATION SHOWN ON PHASE I GRADING PLANS. FILL THE SWITCHYARDS WITH EXCAVATED MATERIAL. COMPACT IN ACCORDANCE WITH THE SPECIFICATIONS. REMAINING MATERIAL SHALL BE STOCKPILED IN LOCATION SHOWN ON DRAWINGS. SANDY MATERIAL SHALL BE SEGREGATED FROM CLAYEY MATERIAL. CLAYEY MATERIAL SHALL BE LIME TREATED WITH DQM QUICKLIME, 5% BY WEIGHT AND STOCKPILED WITH SANDY MATERIAL FOR LATER USE.
8. BACKFILL EXCAVATED POWER BLOCK AREA TO ELEVATION 172.0 WITH SANDY SOIL OR LIME CONDITIONED CLAY AND COMPACT IN ACCORDANCE WITH THE SPECIFICATIONS.
9. EXCAVATE FOR THE FOLLOWING FOUNDATIONS WITHIN THE POWER BLOCK AREA TO 3 INCHES BELOW BOTTOM OF CONCRETE AND 5 FEET BEYOND THE EDGE OF CONCRETE FOOTING, AS SHOWN ON THE FOLLOWING FOUNDATION DRAWINGS:

   GAS TURBINE GENERATOR AND PEECC
10. BACKFILL WITH SANDY SOIL OR LIME CONDITIONED CLAY FOR THE FOLLOWING FOUNDATIONS BACK UP TO 3 INCHES BELOW BOTTOM OF CONCRETE AND 5 FEET BEYOND THE EDGE OF CONCRETE FOOTING, AS SHOWN ON THE FOLLOWING FOUNDATION DRAWINGS AND COMPACT IN ACCORDANCE WITH THE SPECIFICATIONS:

    GSU TRANSFORMER
11. EXCAVATE FOR THE FOLLOWING FOUNDATIONS DOWN TO ELEVATION SHOWN ON PHASE I GRADING PLANS. BACKFILL WITH SANDY SOIL OR LIME CONDITIONED CLAY BACK UP TO 3 INCHES BELOW BOTTOM OF CONCRETE AND 5 FEET BEYOND THE EDGE OF CONCRETE FOOTING, AS INDICATED ON THE FOUNDATION TABLE ON THIS DRAWING AND COMPACT IN ACCORDANCE WITH THE SPECIFICATIONS:

    ADMINISTRATION BUILDING
    AUXILIARY PUMP/RO TREATMENT BUILDING
    FIRE/SERVICE WATER STORAGE TANK.
12. EXCAVATE A 3 FT WIDE, 3.5 FT DEEP TRENCH FOR THE 12 IN SERVICE WATER PIPELINE ALONG THE CANAL IN THE DESIGNATED EASEMENT SHOWN ON DRAWING S1002, FROM TIE-IN-POINT TO TIE-IN-POINT, AS INDICATED ON THE DRAWING.
13. FURNISH AND CONSTRUCT STORM DRAIN PIPING, CULVERTS, DROP INLETS, AND MANHOLES. (TRENCH DRAIN BY OTHERS)
14. CONSTRUCT ROAD SUBGRADE FROM STATION 0+00 TO RR CROSSING. LIME TREAT SUBGRADE WITH DQM QUICKLIME, 5% BY WEIGHT AND COMPACT PER SPECIFICATIONS. FURNISH AND INSTALL AGGREGATE BASE AS INDICATED ON DRAWINGS.
15. CONSTRUCT A 20 FOOT WIDE HEAVY HAUL ROAD JUST SOUTH OF THE CT'S (FIELD TO LOCATE) BETWEEN THE EASTERN AND WESTERN LOOP ROADS AT ELEVATION 176.0 USING LIME TREATED OR SANDY MATERIAL. FURNISH AND INSTALL 8" CLASS 2-3/4" AGGREGATE BASE (CALTRAN STD. 26-1.02 A).

NO	DATE	REVISIONS AND RECORD OF ISSUE	DRN	DES	CHK	PDE	APP
5	07-24-2002	GENERAL REVISIONS	CEL	KDM	MPT	WMS	TD
4	07-10-2002	GENERAL REVISIONS	CEL	KDM	MPT	WMS	TD
3	03-27-2002	GENERAL REVISIONS	RGH	KDM	JHL	WMS	TD
2	02-07-2002	GENERAL REVISIONS	RGH	KDM	JHL	WMS	TD
1	12-14-2001	ISSUED FOR CONSTRUCTION	RGH	KDM	JHL	WMS	TD
0	12-05-2001	ISSUED FOR BIDS	RGH	KDM		WMS	JER

HAS07252 A1ASL017 08/01/02 E1 09:00:00 ACAD 1=1 15.05

TRUE PLANT 37.25°

SCALE: 1"=50'

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF CALIFORNIA.
SIGNED JOHN B. NAGLE
DATE 12-14-2001 REG NO. C 040136

BLACK & VEATCH CONSTRUCTION, INC.
ENGINEER KDM DRAWN RGH
CHECKED JHL DATE 12-14-2001

GWF ENERGY LLC
TRACY PEAKER PROJECT

SITE – GRADING AND DRAINAGE
PHASE I – EXCAVATION PLAN

PROJECT DRAWING NUMBER 069516-CSTF-S3030 REV 5
CODE
AREA

FIGURE DR25-1
EVACUATION PLAN
GWF TRACY COMBINED POWER PLANT PROJECT
DATA RESPONSES 1-37

CH2MHILL

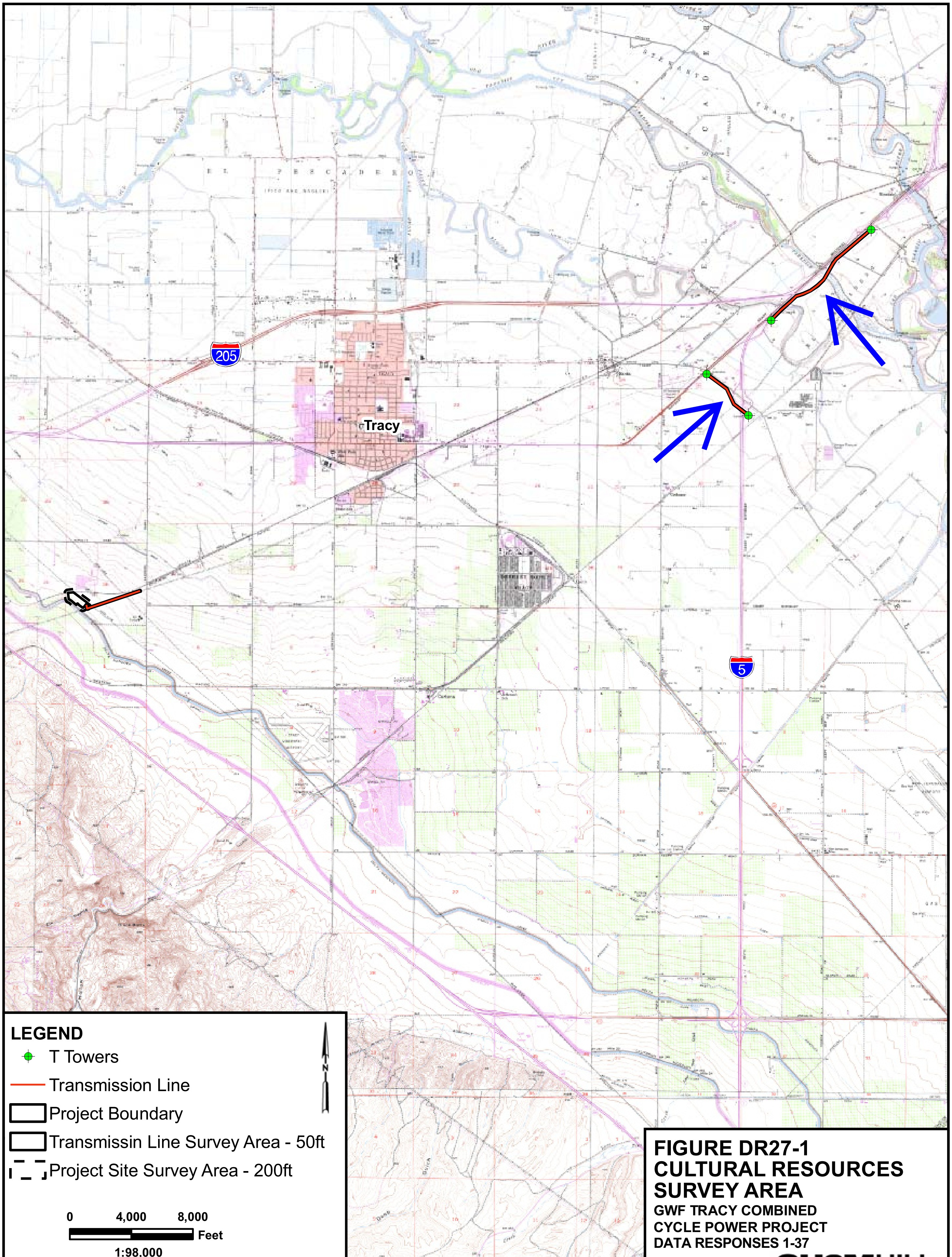


FIGURE DR27-1
CULTURAL RESOURCES SURVEY AREA

GWF TRACY COMBINED CYCLE POWER PROJECT
DATA RESPONSES 1-37

CH2MHILL

Geology and Paleontology (29)

BACKGROUND

Site-specific subsurface information is essential to completely evaluate a site with respect to potential geologic hazards and how the existing materials may impact design, construction, and operation of the facility. The information is also useful in establishing the geologic profile with respect to potential paleontological resources. The original AFC for the Tracy Peaker Project, referenced in the subject AFC, references an existing preliminary geotechnical report for the project site (Hultgrens-Tillis Engineers, 2001). In addition, the original AFC indicates that additional geotechnical studies may have been performed for the project (Page 8.15-21, GWF, 2001).

Data Request

29. Please provide copies of any geotechnical documents that have been completed subsequent to the referenced 2001 Hultgrens-Tillis report and are available for the project.

Response: Five copies of this report are being submitted as Attachment DR25-2 with this Data Response. Additional copies will be provided on request.

Land Use (30 & 31)

BACKGROUND

According to information provided in the AFC Sections 2.0 (Project Description) and 5.6 (Land Use), staff understands the following regarding project-related land disturbance and/or land conversion:

- 3.28 acres of permanent disturbance to currently undisturbed areas within the 40-acre, GWF-owned parcel where the TPP is currently located;
- 12.3 acres of temporary disturbance for construction laydown and parking on a previously disturbed portion of the 40-acre, GWF-owned parcel; and
- An additional conversion of 3.28 acres of Prime Farmland to non-agricultural uses associated with the relocation of the stormwater retention basin.

Staff also understands that there are other lands (in addition to those described in the list above) that would be affected by the following proposed project features:

- Two transmission termination structures;
- The equipment storage area that would be relocated; and
- The three existing transmission line segments that would be reconductored.

However, the existing land uses and status of lands that would be affected by these project features is unclear.

Data Request

30. Please provide information regarding the status of the lands where the project features listed above would be located (i.e., two transmission termination structures, the equipment storage area, and three existing transmission line segments). Specifically, provide information regarding land ownership or easement status of lands that would be affected by the proposed project, and that are not currently owned by GWF Tracy (i.e., outside of the 40-acre TPP parcel).

Response: As described in Section 2.1, GWF Tracy will occupy a 16.38-acre site within the larger 40-acre GWF owned parcel. GWF Tracy will be approximately 3.28 acres larger than the existing 13.1-acre TPP fenced site. This increase in total area of permanent disturbance is due to the relocation of the storm water retention basin to the west of the existing TPP fence line. Of the project features noted above (i.e., two transmission termination structures, the equipment storage area, and three existing transmission line segments), only Segments 2 and 3, of the transmission line to be reconductored, occur entirely outside of the 40-acre GWF owned parcel. Segment 1 occurs partially within and partially outside of the 40-acre GWF owned parcel.

The two transmission structures shown on Figure 3.1-1 (each new structure aggregates the three points in the northern and southern halves of the dashed ellipse) occur within an existing PG&E Right-of-Way (ROW) on land owned by GWF.

The equipment storage area refers to the temporary construction laydown areas shown on Figure 1.1-4. These areas encompass a total of 12.3 acres located in the southwest corner and northern portion of the larger GWF owned 40 acre parcel.

Property owners within 500 ft of the three segments of transmission line to be reconductored are shown and listed in Appendix 1B, Property Owner Info. These transmission line segments are part of existing PG&E transmission lines and therefore fall within existing easements and utility ROWs.

Data Request

31. Please describe the activities or existing land uses that currently occur on the lands listed above. In some agricultural zones, agricultural production and activities are allowed within transmission line rights-of-way if the utility operating those lines does not own the lands traversed, but has an easement across them.

Response: The areas proposed for development of GWF Tracy include: the 3.28 acres of new permanent disturbance l west of the existing TPP fence line (within the GWF-owned 40 acre parcel); the land on which the two new transmission termination structures will be located; and, 12.3 acres proposed for equipment storage and construction laydown, were all previously zoned for agriculture. These areas are no longer under Williamson Act contract (as described in AFC Section 5.6.3.2.2), and are currently vacant land (no existing dedicated land use).

Existing land uses along the three segments of transmission line to be reconductored are shown in Figures 5.6-1a and 5.6-1b. As shown on Figure 5.6-5a, the project site and Segment 1 are surrounded by agricultural lands in active production, including irrigated crops, orchards, and grazing lands. As discussed in AFC Section 5.6.7.3, since the development of the TPP, the undeveloped portion of the GWF-owned parcel has been made available for agricultural use, consistent with TPP COC LAND-2. However, no agricultural activities are presently occurring on this portion of the GWF-owned property. Similar to the project site, Segments 2 and 3 are surrounded by agricultural lands (refer to Figure 5.6-5b). These lands are primarily in row crop production.

As discussed in AFC Section 5.2.3.1, the reconductoring work includes replacement of conductors only. No new towers are proposed, and all existing towers will remain in place. Ground-disturbing activities will be limited to temporary staging areas and conductor pull sites. To the extent practicable, previously disturbed areas located along each segment will be used during reconductoring, minimizing potential impacts. Each segment passes through agricultural areas that are interspersed by a variety of mature ornamental tree species. In addition, Segment 3 crosses Tom Paine Slough and Paradise Cut, two perennial creeks that support native riparian habitat and reconductoring activities would occur outside of sensitive areas. Much of Segments 2 and 3, however, are physically located in or along existing transportation corridors.

Soil & Water Resources (32-37)

BACKGROUND

Section 5.15.4.2 discusses the surface water hydrology and drainage. The AFC states that the "natural drainage outside of the plant fence line will not be altered." Based on the limited off-site area viewable on Figure 5.15-3a, (and after review of the USGS Tracy, San Joaquin County Quadrangle Map) the area to the south will drain north toward the GWF site. All overland non-contact flow at the GWF site is expected to drain to a permanent stormwater retention facility sized for the 25-year 24-hour rainfall. Staff could not determine why this rainfall intensity and duration was selected.

Data Request

32. Please provide a description, including current land use, area, and expected runoff contribution during the 25-year 24-hour rainfall, of all off-site land that currently slopes toward the project's proposed trench drains, shallow ditches, culverts, storm piping system, or onsite stormwater retention facility.

Response: The land on which TPP is constructed naturally slopes toward the northeast. No major surface water drainages are present on the site. Storm water runoff outside of the fenced area currently runs by sheet flow toward the northeast, but it is prevented from continuing in that direction by the Union (Southern) Pacific railroad tracks. The project site also has embankment that runs diagonally across the acreage that has been used for tree planting. This embankment acts as a barrier for sheet flow storm water runoff. Annually the entire acreage that is not used for the existing plant site is tilled which also impedes the storm water runoff. The nearest drainage ditch to the east is along the west side of Lammers Road, though it is doubtful that sheet flow from the site continues that far. The gradual slope and intervening features (pipeline, farm fields) likely encourage infiltration by slowing flow velocities in all but the most extreme storm events.

The presence of the Delta-Mendota Canal along the upslope (western) boundary of the site means that offsite runoff from upslope areas is prevented from flowing onto the TPP site. Thus, the majority of the storm water crossing the GWF Tracy site is runoff generated by rain falling on the site itself, as opposed to surrounding properties.

The runoff generated from all storms up to and including the 25-year, 24-hour event will be captured by the GWF Tracy drainage system and either routed to the on-site stormwater retention basin or to an on-site holding tank for eventual offsite disposal via truck, depending on the portion of the site it comes from. Since 2003 GWF has not detected runoff from off-site land in the project's drainage system or storm water retention basin, and expects the same results with the modified drainage system.

Data Request

33. Please provide data that describes the percolation rate and typical (winter) evaporation rate expected for the stormwater retention facility.

Response: Attachment DR25-2 (5 copies provided with this filing) contains a soils evaluation of the GWF site. This evaluation includes double ring infiltrometer data for the GWF Tracy site. The results of the infiltration (percolation) tests indicated infiltration rates of 1.12 centimeters per hour (cm/hr) to 8.99 cm/hr.

Table DR33-1 presents expected monthly pan evaporation rates in the project area. These evaporation rates are from the California Department of Water Resource's Agroclimatic Monitoring in the San Joaquin Valley 1958-1991 and are for Stockton, California. They represent the expected evaporation rates for GWF Tracy site.

TABLE DR33-1
Expected Pan Evaporation Rates for the GWF Tracy Site

Month	Normalized Monthly Evaporation Rates (Stockton, CA) (inches/month)
January	1.35
February	2.29
March	4.29
April	5.81
May	8.53
June	9.84
July	10.29
August	8.59
September	6.76
October	5.69
November	2.43
December	1.21

Source: Table 10 of California Department of Water Resource's Agroclimatic Monitoring in the San Joaquin Valley 1958-1991

BACKGROUND

The applicant proposes to use high quality surface water (fresh water) from the Delta-Mendota Canal (DMC) for operation (Section 5.15.4.3). The use of fresh water for GWF Tracy cooling purposes may not be consistent with the Energy Commission's 2003 water conservation policy. The applicant acknowledges the Energy Commission's water conservation policy and considers the use of fresh water to be consistent with this policy because, as stated in the AFC,

> "… it would be economically infeasible for the project to construct a pipeline to utilize wastewater from the Tracy Wastewater Treatment Plant. In addition, the construction of such a pipeline and related water supply infrastructure could significantly increase environmental impacts related to water quality, air quality, soils, traffic, and biological resources."

The applicant's contention that the infrastructure required to deliver recycled water to GWF Tracy is "environmentally undesirable and economically unsound" has not been substantiated through the presentation of, or reference to, environmental and economic studies that are required by the Energy Commission's water conservation policy.

Data Request

34. Please substantiate the position state in the AFC that recycled water from the Tracy Wastewater Treatment Plant is environmentally undesirable or economically unsound.

Response: Process and other water requirements for GWF Tracy will be met through an existing water allocation and infrastructure. As the owner of the 40-acre site, GWF has the rights to 136 acre feet per year of water, which is significantly more than the incremental increase of 25.5 acre feet per year associated with GWF Tracy. Since the incremental demand for water can be met through existing entitlements, and with existing infrastructure, GWF's proposal will result in no environmental or economic impacts.

By contrast, the Tracy Wastewater Treatment Plant is located in the northeastern corner of the City of Tracy, while GWF Tracy is located southwest of the city as shown on Figure DR34-1. The distance between the two facilities is approximately 7 miles. If GWF Tracy was to utilize recycled water from the Tracy Wastewater Treatment Plant it would require installation of a pipe approximately 12" in diameter through a large portion of City of Tracy. The installation of the pipe would require trenching city streets, installation of the pipe, and reinstallation of pavement over the trench. The estimated cost for this work is approximately $1 million per mile or $7 million total. The estimated construction duration is approximately 1.5 weeks per mile or 10.5 weeks total. Based on the estimated cost and potential environmental impacts to traffic, air quality, biological, cultural, paleontological, and geologic resources, and noise the utilization of recycled water is not environmentally or economically sound relative to the water supply plan set forth in the AFC.

BACKGROUND

Section 5.15.6 Cumulative Effects, describes the stormwater's "gradual release into the storm drain system." According to Section 5.15.3.3.2 the stormwater will percolate or evaporate from the proposed retention pond.

Data Request

35. Please clarify what the potential cumulative effects are for stormwater that drains into the proposed retention pond

Response: AFC Section 5.15.6 incorrectly states that there will be a "gradual release into the storm drain system." There would be no offsite stormwater runoff. All stormwater would be directed to the onsite stormwater retention basin, which will be expanded to accommodate the project modifications as described in Sections 5.15.3.3.2, 5.15.4.2, and 5.15.4.4 of the AFC. Because runoff would be contained entirely onsite, there would be no cumulative impacts to any municipal storm drain systems. For additional information about potential runoff from offsite sources, see the response to Data Request 32 above.

Water Supply

In the Data Adequacy Supplement, Page 32, states the current annual allocation of water from the Byron Bethany Irrigation District is 136 acre-feet associated with the 40-acre GWF parcel. This allocation is subject to the U.S. Bureau of Reclamation (Bureau) declaring a 100 percent availability of water. During droughts or other years in which the Bureau is unable to provide the full contract amount the allocation may be less than 136 acre-feet and possibly less than the average annual water consumption of 54.4 acre-feet.

Data Request

36. Please provide data showing annual water usage since the start of TPP operations. Identify any years where the Bureau apportioned less than the 100 percent availability and identify whether this impacted plant operations.

Response: The annual water usage for TPP is shown below in Table DR36-1. The allocation history for the parcel of land is shown in Table DR36-2. To date, plant operations have not been impacted by the Byron Bethany Irrigation District (BBID) water allocation. The estimated maximum water usage for GWF Tracy is 54.4 AFY, which is 40% of the entitlement. For the given allocation history, GWF Tracy operations would not have been impacted by water supply allocation for the past 10 years.

TABLE DR36-1
TPP Historical Water Usage

Year	Total Water gallons	Total Water acre-ft	Percent of Entitlement
2003	103,746	0.32	0.2%
2004	346,139	1.06	0.8%
2005	260,750	0.80	0.6%
2006	379,464	1.16	0.9%
2007	705,138	2.16	1.6%
2008	477,590	1.47	1.1%

Notes: Entitlement is 136 AFY

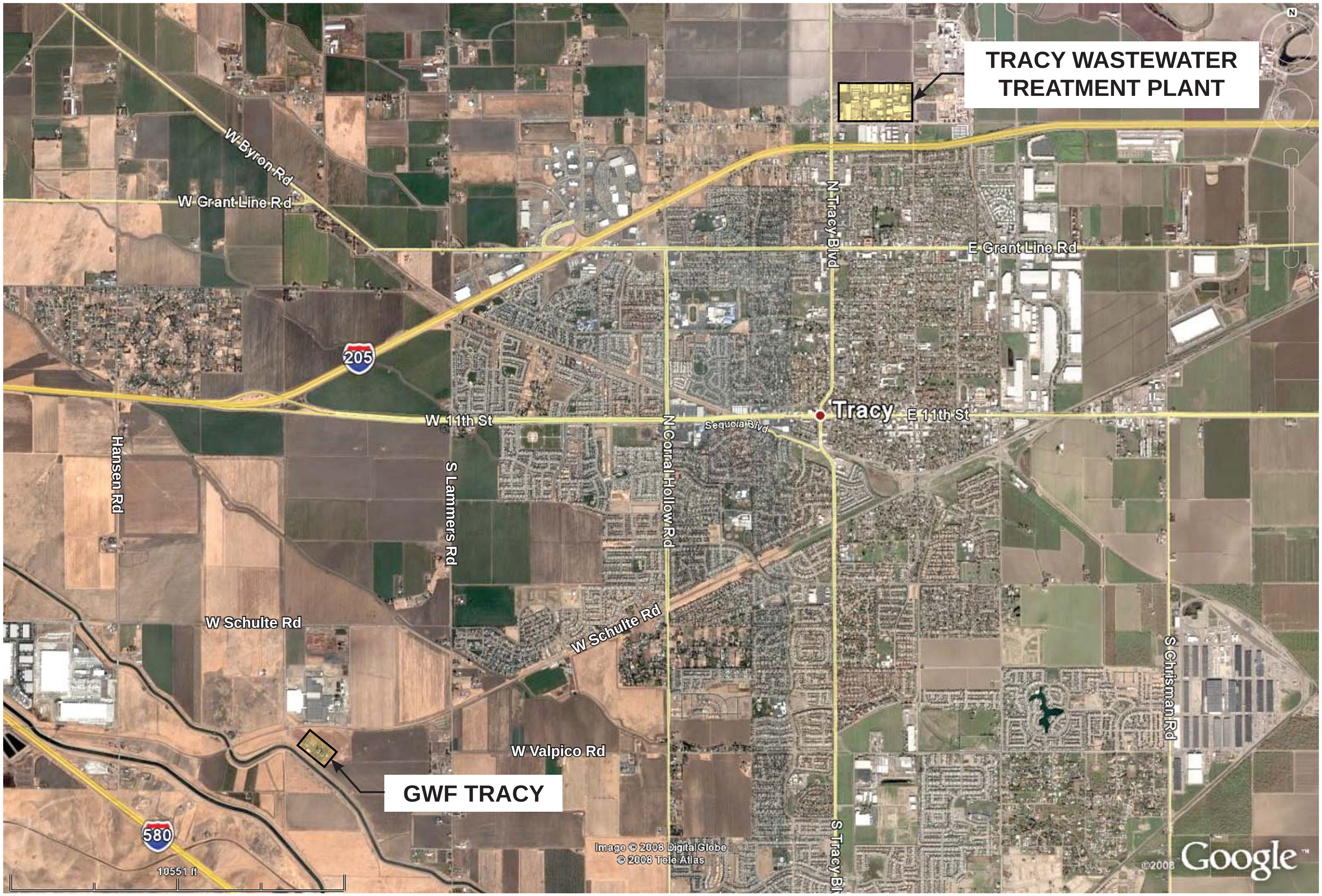
TABLE DR36-2
Allocation History

Year	Percent of Entitlement
1998	100
1999	70
2000	70
2001	65
2002	85
2003	75
2004	70
2005	85
2006	100
2007	50
2008	40

Data Request

37. Please identify how operations would change with an annual allocation less than the anticipated average annual water consumption.

Response: If GWF Tracy were allocated a supply of water less than the anticipated average annual water consumption, the plant would be required to modify equipment operations which would include reducing water consumption to the WSAC and the CTG evaporative coolers. Water supply reductions to the WSAC during times of high ambient temperature would cause the ST lube oil temperature to increase and would force ST load to be reduced, resulting in lower ST output. Water supply reductions to the CTG evaporative coolers would reduce CTG efficiency and output.



AERIAL MAP FROM GOOGLE EARTH PRO © 2008. ADDITIONAL INFORMATION ADDED BY CH2M HILL.

FIGURE DR34-1
MAP OF TRACY, CALIFORNIA
GWF TRACY COMBINED POWER PLANT PROJECT
DATA RESPONSES 1-37

CH2MHILL

EY012008001BAO_GWF_Tracy_SiteLocMap.indd_111408_lho

GWF Tracy Combined Cycle Power Plant Project

(08-AFC-7)

Five Copies of Attachment DR21-1

Historic Resources Inventory and Evaluation Report, Transmission Lines in the Stanislaus Corridor, Alameda County, California
October 2000

Submitted to

California Energy Commission

Submitted by

GWF Energy, LLC

November 2008

With Assistance from

CH2MHILL
2485 Natomas Park Drive
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Sacramento, CA 95833

Historic Resources Inventory and Evaluation Report, Transmission Lines in the Stanislaus Corridor, Alameda County, California

Submitted to:

Aspen Environmental Group
235 Montgomery Street, Ste. 800
San Francisco, California 94104

On behalf of:

California Public Utilities Commission

Prepared by:

JRP Historical Consulting Services
1490 Drew Avenue, Suite 110
Davis, California 95616

October 2000

SUMMARY OF FINDINGS

JRP Historical Consulting Services has prepared this Historic Resources Inventory and Evaluation Report to evaluate a segment of Pacific Gas & Electric (PG&E) transmission lines in Alameda County. The purpose of the evaluation is to determine whether these resources appear meet the criteria for listing on the National Register of Historic Places or the California Register of Historical Resources. This document is prepared to comply with applicable sections of the National Historic Preservation Act and the implementing regulations of the Advisory Council on Historic Preservation as these pertain to federally-funded undertakings and their impacts on historic properties.

This report includes a segment of PG&E's Stanislaus-Newark line, and a connector line from the Stanislaus-Newark line to the Tesla Substation near Midway. All of the resources are located within Alameda County. Attached as **Appendix A** are the maps of the project location (**Figure 1**), project vicinity (**Figure 2**), and alignment of the transmission lines in the project area (**Figure 3**). These properties were recorded on two DPR523 forms attached as **Appendix B**.

This report concludes that none of the properties appear to meet the criteria for listing in the National Register of Historic Places. JRP Historical Consulting has also evaluated these properties in accordance with Section 15064.5(a)(2)-(3) of CEQA Guidelines, using the criteria outlined in Section 5024.1 of the California Public Resources Code, and determined the transmission lines are not historical resources for the purposes of CEQA.

TABLE OF CONTENTS

ATTACHMENTS

1. PROJECT DESCRIPTION

In this alternative to Pacific Gas & Electric's (PG&E) proposed Phase 2, a new 230 kV double circuit line would be constructed from Tesla Substation to the tap point of the selected alternative (either at about Milepost V17 for the proposed route or S4 alternative or near Milepost V14 for the S1 or S2 alternatives). This route would be about 14 miles long (if combined with the S1 or S2 alternatives) or 17 miles long (if combined with the proposed route or the S4 alternative).

This alternative would require more miles of new construction than PG&E's Phase 2 (which is ten miles long, in the proposed Northern Corridor between the Contra Costa-Newark line in North Livermore to the Tesla Substation at the Alameda-San Joaquin county line). However, the new construction would be entirely within an established transmission corridor. The Stanislaus Corridor is currently occupied by two parallel lattice tower lines that were constructed in the early 1900's. These two sets of towers (in which the towers are spaced much closer together than the larger towers of the 230 kV alternative would be) would be removed if this alternative were selected. Therefore, the landowners whose land is currently crossed by this route would have taller, but more widely-spaced, towers crossing their land, and there would be only one set of towers where there are currently two.

Starting at the Tesla-Newark tap at the western end of the Stanislaus Corridor that would be utilized, tubular steel towers would be installed and the old lattice towers would be removed. The new line would be installed at the center of the existing ROW. At Tesla Junction, where the Stanislaus towers continue east across the Valley, the new line would turn northerly, for 2.1 miles into the Tesla Substation, paralleling an existing 115kV lattice line.

2. RESEARCH AND FIELD METHODS

JRP Historical Consulting Services conducted background research to arrive at a general understanding of the history of the transmission lines, focusing upon their construction history, as well as general developments in California's early hydroelectric industry. JRP conducted the background research for this project at the California State Library, Sacramento, and at the Water Resources Center Archives, U.C. Berkeley. JRP personnel also conducted interviews with various PG&E personnel. This research included review of area maps, historic maps, plans, reports, and photographs.

The properties were inspected in the field, photographed, and are described in detail on DPR523 forms as established by the standards of the California Department of Parks and Recreation, Office of Historic Preservation. The DPR523 forms are included as **Appendix B** in this document. JRP attempted to inventory each transmission tower within the project area; however, access to the properties on which the towers are located were restricted by property owners. JRP personnel, with the aid of binoculars, viewed and documented the resources from available vantage points along county roads and State Highway 84. Approximately one-third of the towers, most of which are located in the eastern portion of the project area, were not visible and could not be recorded. The transmission lines within the project area are part of a much larger line that extends from the Stanislaus Power House in Tuolumne County to the Newark Substation in southwest Alameda County. JRP only inventoried and evaluated those properties within the project area, but also inspected towers between the east end of the project area and the City of Tracy for purposes of comparison.

2.1. Project Personnel

This project was conducted under the direction of Rand Herbert (MAT in History, University of California, Davis), a principal at JRP with more than twenty years of experience conducting such studies; Mr. Herbert also served as an editor of the context statement. Bryan Larson assisted in the fieldwork, research, and prepared the context statement. Mr. Larson is a graduate of the University of California, Los Angeles, with B.A. in history, and is currently writing his thesis for the Masters Program in Public History at California State University, Sacramento. Paul Ferrell assisted in the fieldwork and research, and contributed to the context statement. Mr. Ferrell is a graduate of the California State University, Humboldt with a B.A. in history, and is currently writing his thesis for the Masters Program in Public History at California State University, Sacramento.

3. HISTORICAL OVERVIEW

3.1. Introduction

There are three discrete lines of transmission towers in the project area, which lies entirely within Alameda County. The first, built in 1908 by the Stanislaus Electric Power Company (SEP), travels through the project area in a roughly southwesterly direction, stretching a distance of approximately 17 miles. For the purposes of this report this first line will be referred to as the "SEP Line." In 1909-1910 the Sierra & San Francisco Power Company (S&SFP) constructed the second line, hereafter referred to as the "S&SFP Line." This 17 mile long segment parallels the SEP Line on its south side throughout the project area, separated by a distance of approximately 50 feet. The third and most recent line, called hereafter the "PG&E Tesla Substation Line" after the Pacific Gas & Electric Company who built it in 1965, runs roughly north from the SEP and S&SFP lines to the Tesla Substation near Midway, a distance of one and a half miles. **Figures 1, 2, and 3** in **Appendix A** show the location and alignments of the lines. PG&E currently owns and operates all three of the transmission lines; a detailed discussion of the construction history and ownership of each of the lines follows in **Section 3.3**, **Section 3.4**, and **Section 3.5**.

3.2. The Hydroelectric Industry in California, 1879-1910

The SEP and S&SFP long-distance transmission lines were built between 1908 and 1910, a very active period of growth for the hydroelectric industry in California. During these years demand for electric energy, especially in the larger urban areas, was on the rise. This trend in growth stemmed from several factors: the state's population was rapidly increasing; mining, agricultural, railroad, and manufacturing industries needed a steady and inexpensive supply of fuel; and the passage of laws allowing the U.S. Forest Service to provide power companies with lands on which to build their hydroelectric plants. However, it was only through several decades of technological and engineering developments that power companies were able to deliver electricity from the hydroelectric plants, usually located high in the Sierra Nevada, to prospective markets often over 100 miles away.

The development of the long distance transmission lines in California was an evolutionary process that dates to 1879, the year in which California Electric Light Company began operation. This San Francisco-based company generated electricity, and distributed it to local subscribers from a central station.[1] During the 1880s the use of electricity in California became increasingly widespread, and local electric companies began to spring up in cities throughout the state. These early power plants, which used low-voltage direct current (D.C.) dynamos, could only transmit electricity about three miles. Only urban areas with concentrated populations could be economically served with a local electrical generating plant. The first important technological advancement that would allow the transmission of electricity over greater distances was the development of alternating current (A.C.) system, which could produce higher voltages than the D.C. system. By 1890, the pioneering technology invented by Nikolas Tesla was put to use in a limited capacity in power plants in four California cities: Santa Barbara, Highgrove, Visalia, and Pasadena.[2]

Although the A.C. system was a promising development, it did not catch on immediately, primarily because the D.C. system was already in place in most of the existing power stations. Pioneering developments at the Pomona Plant of the San Antonio Light & Power Company, however, greatly helped to advance the electric industry in California. In 1892, this was the first hydroelectric facility in California to use "step-up" A.C. transformers, in which the generator potential of 1,000 volts was increased to 10,000 volts for transmission. The voltage was then "stepped down" at the receiving stations. The concept of boosting voltage for transmission was a major innovation that soon became standard practice throughout the industry. This plant was also important in a nationwide context: only Oregon and Colorado had step-up hydroelectric plants and distribution systems that pre-date the Pomona Plant. On November 28, 1892, San Antonio Light & Power began delivery of 10,000 volts of electricity from its plant at San Antonio Canyon to Pomona, a distance of 14 miles. A month later service was extended to San Bernardino, roughly doubling the length of the line.[3]

Over the next decade, technological and engineering advancements made it possible for power companies to transport electricity in increasing amounts over ever-longer distances. In 1893, the Redlands Electric Light & Power Company Mill Creek Plant Number 1 became the first three-phase A.C. plant in California, a technology that increased efficiency and reliability of power transmission.[4] In 1899, the Edison Electric Company built an 83-mile transmission line between its power plant on the upper Santa Ana River and Los Angeles. By far the longest in the world at the time, this engineering feat was made possible by the development of glazed porcelain

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[1] William A. Myers, *Iron Men and Copper Wires: A Centennial History of the Southern California Edison Company* (Glendale, California: Trans-Anglo Books, 1983), 11.

[2] Myers, *Iron Men and Copper Wires*, 23.

[3] Fredrick Hall Fowler, *Hydroelectric Power Systems of California and Their Extensions into Oregon and Nevada* (Washington DC: Government Printing Office, 1923), 1; Myers, *Iron Men and Copper Wires*, 24-31.

[4] Fowler, *Hydroelectric Power Systems of California*, 1-2.

insulators capable of handling 40,000 volts.[5] In 1901, Bay Counties Power Company completed a transmission line 142 miles in length that brought hydroelectric power from the Colgate Powerhouse in the Sierra Nevada near Grass Valley to Oakland. The line consisted of two parallel rows of cedar poles carrying copper and aluminum wires. In addition to its length, the line was impressive because of its 4,427-foot crossing of the Carquinez Straits. John Debo Galloway was the construction engineer for the project and is credited with directing the design and construction of the cable span, the longest in the world at that time. The Colgate-Oakland line also marked the first time electrical power produced in the Sierra crossed the rugged mountain terrain and the wide Sacramento Valley to be utilized by residents of the Bay Area.[6]

The first decade of the 20th century marked a period of marked growth in the hydroelectric industry. Between 1900 and 1910 the population of California increased by 60 per cent, and with it came an increased demand for electric power.[7] Dozens of hydroelectric companies formed throughout California, each building networks of long-distance transmission lines to service new and growing markets. By 1902 the Bay Counties Power Company and the Standard Electric Company had a network of transmission lines in place that provided coverage to much of the Bay Area, as well as communities such as Marysville, Stockton, and Amador City. In 1907, California Gas & Electric (CG&E) purchased the lines of these two companies, as well as other smaller Northern California operations. The transmission lines of this consolidated system spanned from Chico in the north to San Jose in the south, serving dozens of communities in between.[8] In 1907, Edison Electric completed its Kern River No. 1 hydroelectric plant in Kern Canyon. This 118-mile long transmission line delivered power to Los Angeles, carrying a 75,000-volt line, and was the first line entirely to use steel towers. The Wind Engine Company, a windmill manufacturer, supplied the towers.[9] In 1908, the Great Western Power Company completed its hydroelectric plant at Big Bend on the Feather River, and by January 1909 began sending electrical power to the Bay Area via its 165-mile stretch of transmission lines.[10] It was at this time, in late 1908, that SEP built its power plant on the Stanislaus River. The Stanislaus-Mission San Jose line, later coupled with the S&SFP Stanislaus-San Francisco line, served communities in Calaveras, San Joaquin, Alameda, Santa Clara, and San Mateo counties. By the spring of 1909, the major hydroelectric companies of Northern California, including CG&E,

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[5] Myers, *Iron Men and Copper Wires*, 39.

[6] Charles M. Coleman, *PG&E of California: The Centennial Story of Pacific Gas and Electric Company 1952-1952* (New York: McGraw-Hill Book Company Inc., 1953), 146-148.

[7] Coleman, *PG&E of California*, 257.

[8] Galloway and Markwart Consulting Engineers, "Map of Central California Showing Principal Power Plants and Transmission Lines." In: J.D. Galloway, "Report on the Stanislaus Electric Power Company on the Stanislaus River, California," March 1909; Fowler, *Hydroelectric Power Systems of California*, 273-274.

[9] Myers, *Iron Men and Copper Wires*, 44-47.

[10] Jackson Research Projects, "Great Western Power Company: Hydroelectric Power Development on the North Fork of the Feather River, 1902-1930," prepared for PG&E, 1986, 96, 102; Fowler, *Hydroelectric Power Systems of California*, 275.

SEP, Great Western, and the American River Power Company, had a network of long-distance transmission lines in place that criss-crossed the state.

3.3. Stanislaus Electric Power Company Line

The oldest line of transmission towers within the project area is the SEP Line, built in 1908. SEP was a subsidiary of the Stanislaus Water Power Company (SWP), organized in 1905 for the purpose of exploiting hydroelectric power potential of the Stanislaus River in Tuolumne County. Between 1905 and 1908 SWP began construction of its hydroelectric system that eventually included several power houses, dams and reservoirs, substations, transmission lines, and distribution lines. The central and most important resource in the SWP system was the Stanislaus Power House, built by the Union Construction Company and completed in 1908.

Just prior to the completion of its Stanislaus Power House, SWP formed SEP, a subsidiary company created for the purpose of distributing the electrical power throughout several Northern California counties. In early 1908, SEP began construction of its main transmission line. The company's original plan was to extend the line from the Stanislaus Power House to lucrative electric markets in San Francisco, a distance of 137 miles. However, when the power house became operational in 1908, the line only reached 96 miles, terminating at the CG&E-owned Mission San Jose Substation near Newark in southwest Alameda County. SEP sold its electricity to CG&E, so that the latter could distribute the energy to its East Bay and San Francisco markets. The SEP Stanislaus-Mission San Jose Line also served SEP customers along its route in communities in Calaveras, San Joaquin, and Alameda counties.[11]

The entire length of the SEP Line, including that segment within the project area, consisted of galvanized steel towers that carried a single circuit (three lines) of 60 kilovolt transmission lines (conductors) on strain or suspension insulators. The towers were spaced an average of 750 feet apart, although this distance varied because of differences in the terrain. The engineering firm of Sanderson & Porter, New York, oversaw the installation of the transmission towers and component parts. Interestingly, a windmill company, the Aermotor Company of Chicago, provided the towers, which were sent to the site broken down and bundled. Each of the steel members were numbered so that they could be quickly and easily assembled at the site. Two teams of workers installed the towers and electrical components. The first team, traveling in groups of 35, was responsible for setting the anchors into the ground, assembling the tower, and

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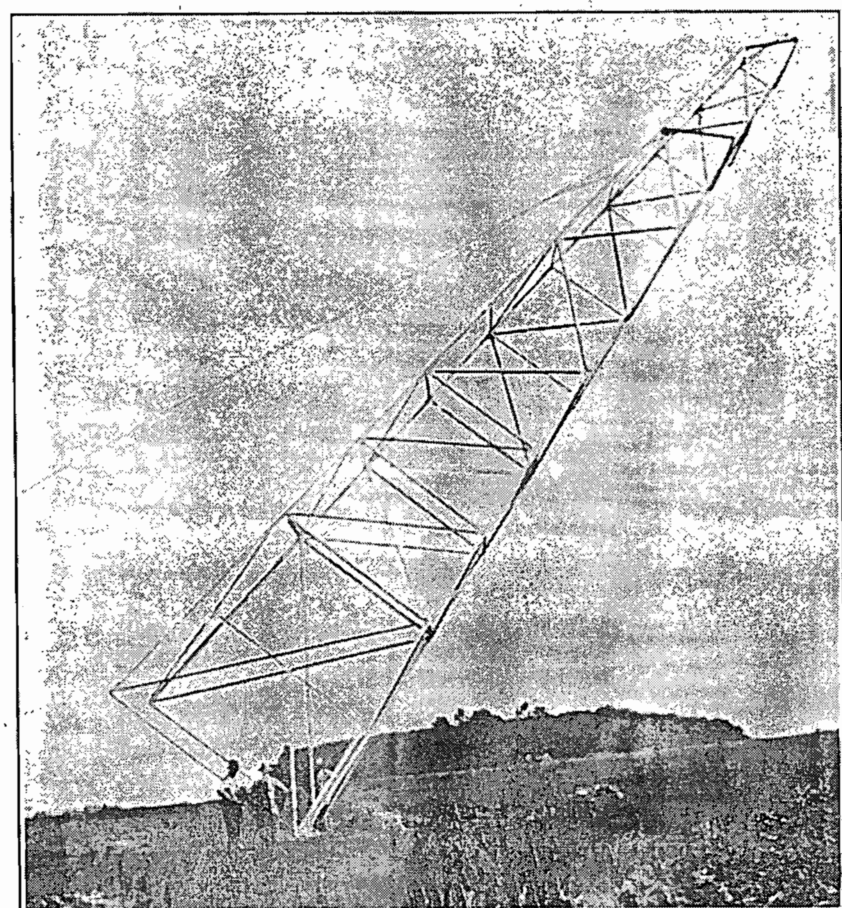
[11] Pacific Gas and Electric Company, *Annual Report of the Department of Electrical Operation and Maintenance* (1930), 93; Sierra and San Francisco Power Company (S&SFP), *The Stanislaus Power Development* (New York: Sanderson & Porter, 1909), 19; Fowler, *Hydroelectric Power Systems of California*, 286-288.

hoisting it into its upright position. This crew could erect an average of five towers each day. The second crew was responsible for installing the insulators and conductors, and did so at an average rate of one and three quarter miles of three-circuit line each day. The towers followed a standard design for the length of the line, although the heights sometimes varied. Some were taller than others in order to provide adequate clearance across waterways, and others were shorter, especially along steep grades.[12]



Erection of Typical SEP Tower, ca. 1908

(Source: Sierra & San Francisco Power Company. *The Stanislaus Power Development*. New York: Sanderson & Porter, 1909.)

The original conductors, furnished by the American Wire and Steel Company, consisted of six strands of medium hard drawn copper around a hemp center. The hemp core, a non-conductive material, was selected in favor of a steel core because of better durability when used to carry higher voltages. However, in his 1909 report on the SEP Stanislaus-Mission San Jose line,

[12] S&SFP, *The Stanislaus Power Development*, 15-20.

consulting engineer J.D. Galloway noted his disapproval with using a hemp core, stating that it will decay over time and will tend to lengthen and sag. PG&E records indicate that 202 miles of the line's original conductors were replaced in the San Joaquin and East Bay Divisions in 1936. It is likely that most or all of the conductors within the project area were replaced at that time.[13]

The original insulators used on the SEP Line were a departure from the insulators typically used at the turn of the century. Although the line originally carried 60 kilovolts of electricity, the SEP intended to increase this number to 110 kilovolts within a few year's time. The usual pin type insulator then in wide use was incapable of carrying such a pressure. The SEP decided to employ suspension-type insulators, consisting of five separate porcelain units. Each unit was made of two ½ inch thick shells fastened together with Portland cement. Designed jointly by the Locke Insulator Manufacturing Company of Victor, New York, and the consulting engineers on the project, Sanderson & Porter, this configuration worked well under heavy mechanical and electrical strain because of its strength and flexibility.[14] It appears, however, that in later years both the Sierra & San Francisco Power Company and Pacific Gas & Electric systematically replaced the original insulators on the line. PG&E records indicate that in 1931 the S&SFP replaced 1,500 insulators between the Stanislaus Power House and the City of Tracy, just east of the project area. In 1936, PG&E replaced 500 more in the San Joaquin Division. An additional 2,000 insulators in the Stockton Division were replaced in 1940 and 1944.[15] Although these records do not make it clear whether or not the insulators within the project area were replaced, observations in the field seem to indicate that they were. As described above, the original insulator groups utilized five porcelain elements. The towers presently use nine-element insulators. It is likely that they replaced the out-of-date insulators with entirely new sets that reflected advances in insulator technology.

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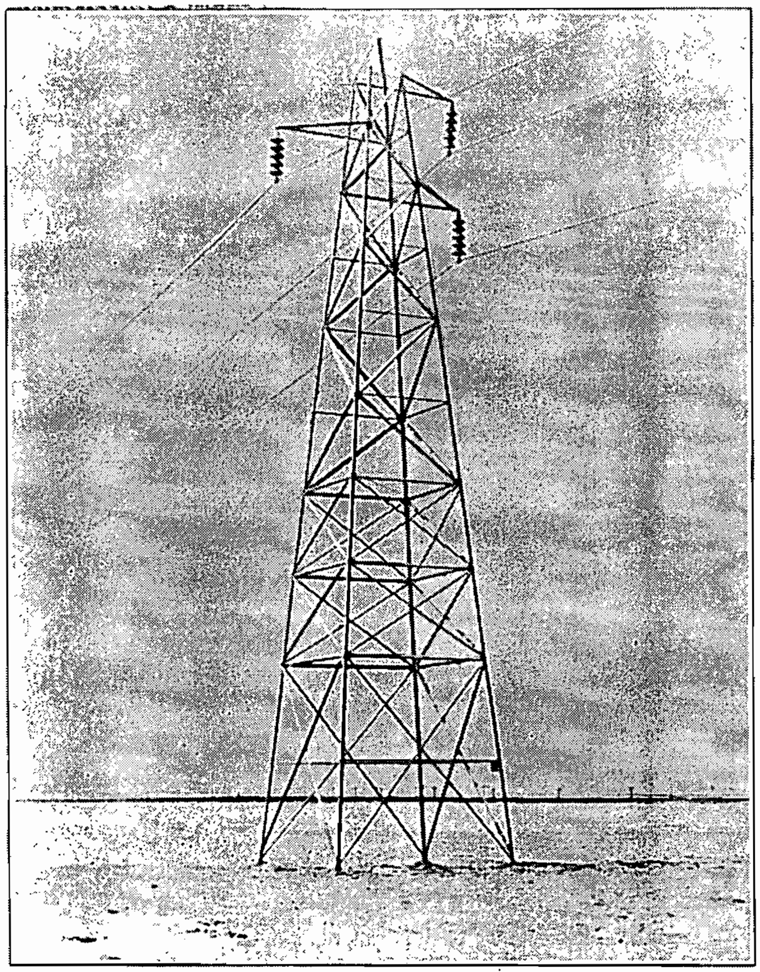
[13] Stephen Dunn, "The System of the Sierra & San Francisco Power Company," 1917. Bachelor of Science Thesis, University of California, Berkeley.; J.D. Galloway, "Report on the Stanislaus Electric Power Company on the Stanislaus River, California," March 1909, 18-19; Pacific Gas & Electric, "Index to the General Maintenance Authority Jobs," provided by PG&E on October 17, 2000.

[14] S&SFP, *The Stanislaus Power Development*, 19-20; Dunn, "The System of the Sierra & San Francisco," 79-80.

[15] PG&E Index to the General Maintenance Authority Jobs.



Typical SEP Single Circuit Transmission Tower, ca. 1908

(Source: Sierra & San Francisco Power Company. *The Stanislaus Power Development.* New York: Sanderson & Porter, 1909.)

3.4. Sierra & San Francisco Power Company Line

Although SEP was successful in establishing its hydroelectric plant with the construction of the Stanislaus Power House and the Stanislaus-Mission San Jose transmission line, the company nonetheless fell on financial hard times. In 1908 the Knickerbocker Trust Company of New York, financial backers of SEP, suffered a financial failure and were forced to temporarily close. The SEP was subsequently placed in receivership. The United Railways Investment Company, a corporation seeking to develop electric railroad systems in San Francisco, saw the opportunity to refinance the struggling company and acquire its newly established system for its own uses. In May 1909 United Railways created the S&SFP. The goal of S&SFP was to acquire the SEP power system and extend the SEP Stanislaus-Mission San Jose Line to San Francisco, where it would provide power to its electric rail system and other local customers. In August 1909 the

S&SFP achieved its first goal, acquiring at auction the Stanislaus Power House, the Stanislaus-Mission San Jose transmission line, and all other holdings of the then defunct SEP.[16]

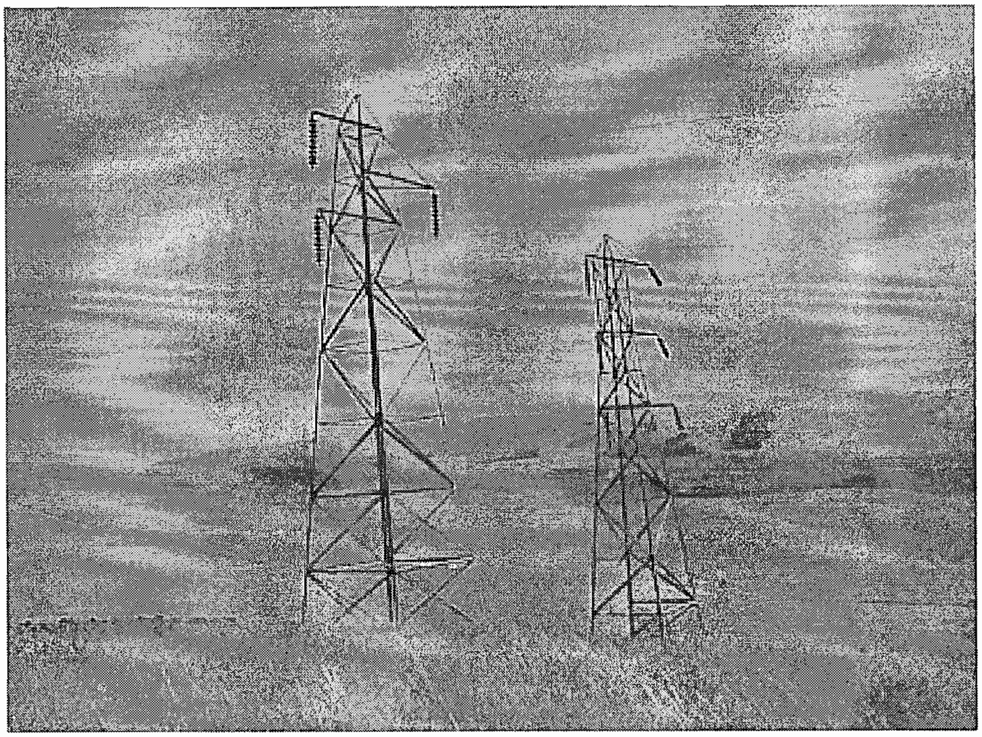
Almost immediately following S&SFP's acquisition of the SEP system, the new company began expanding its main transmission line from Mission San Jose to San Francisco. At the same time, the company also began construction on a second line that would ultimately extend from Stanislaus Power House to San Francisco, closely paralleling the 1908 SEP line for its entire length. Construction of the two new lines began in September 1909 and continued into the spring of 1910. On April 13, 1910, the lines reached San Francisco and began supplying power to the United Railroads system.[17]

The 1909-1910 S&SFP transmission line, although built by a different company, closely followed the basic design and engineering standards of the 1908 SEP line. The conductors were 60 kilovolt lines with the capability of carrying 114 kilovolts, and the same insulator configurations were used. The main difference between the older SEP and newer S&SFP lines was in the design of the transmission towers. Although the towers were supplied by the same manufacturer, the Aermotor Company, and consisted of similar galvanized steel components, the newer towers were slightly larger and had a different configuration at the peak. This difference in design was required by the fact that the new towers were double circuit towers, capable of holding six conductors rather than three.[18]

[16] Fowler, *Hydroelectric Power Systems of California,* 287-288.

[17] Fowler, *Hydroelectric Power Systems of California,* 288-289; S&SFP, *The Stanislaus Power Development*, 18.

[18] S&SFP, *The Stanislaus Power Development*, 14-20; Dunn, "The System of the Sierra & San Francisco," 77-80.



Single Circuit Tower (Left) and Double Circuit Tower (Right)

(Source: JRP Historical Consulting Services, October 2000)

The S&SFP line, when completed, stretched 137 miles from the Stanislaus Power House to the Bay Shore Substation in San Francisco, on its way passing through Calaveras, San Joaquin, Alameda, Santa Clara, and San Mateo counties. In 1910, the voltage of the lines was increased from 60 kilovolts to 114 kilovolts, and has remained at that level ever since.

The S&SFP continued to own and operate the Stanislaus-San Francisco Line until 1936, although PG&E began leasing the line in January 1920.[19] In 1936 the Sierra & San Francisco Power Company dissolved, and PG&E subsequently assumed ownership of all S&SFP assets.[20] PG&E has continuously owned and operated the parallel Stanislaus-San Francisco lines since that time. In the company's 1930 annual operations and maintenance report, PG&E refers to the two lines as both the "Stanislaus-San Francisco Line" and "Line 200."[21] Currently it is referred to as the "Stanislaus-Newark Line." It appears that PG&E has not made any substantial alterations to the alignment of the Stanislaus-Newark line, and the majority of the original towers

[19] Fowler, *Hydroelectric Power Systems of California,* 286.

[20] Sierra & San Francisco Power Company, "Certificate of Winding Up and Dissolution," July 30, 1936. On file at the California State Archives, Sacramento.

[21] Pacific Gas and Electric Company, *Annual Report of the Department of Electrical Operation and Maintenance* (1930).

appear to be intact. PG&E maintenance records do show that a small number of individual sets of towers were added or replaced as necessary along the line, but there have been no large-scale replacement projects anywhere along its length.[22]

3.5. Pacific Gas & Electric Tesla Substation Line

PG&E began planning in the early 1960s to build the third transmission line in the project area, connecting the Stanislaus-Newark lines to the Tesla Substation near Midway. The new line was to carry 230/115 kilovolt lines a distance of 2.2 miles to the north. In December 1964 PG&E purchased the right-of-way rights for the line of towers, and in July 1965 completed the construction of the new line. The project, which cost $1,332,000 to complete, included the installation of a new transformer bank at the Tesla Substation, as well as the construction of the double circuit towers. PG&E records do not indicate that there have been any substantial modifications to these towers since their construction.[23]

[22] PG&E Index to the General Maintenance Authority Jobs.

[23] PG&E Index to the General Maintenance Authority Jobs.

4. DESCRIPTION OF RESOURCES

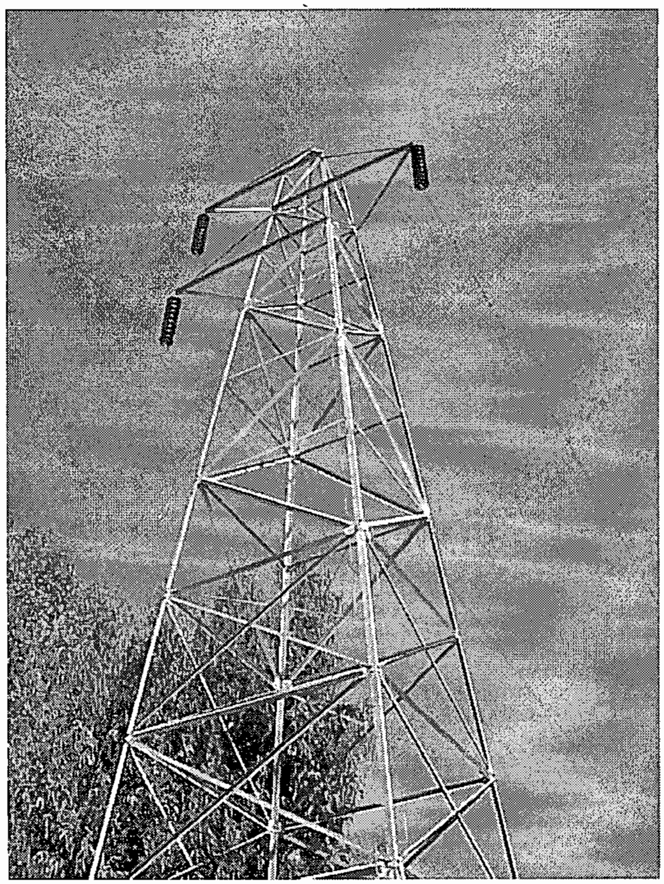
4.1. General Description

The purpose of this report is to inventory and evaluate a system of electrical power transmission towers now owned and operated by PG&E. The segment of lines that comprises the project area is approximately 17 miles long and is located entirely within Alameda County. The segment begins at the Tesla Substation near Midway and proceeds roughly south for two miles. At this point the line turns to the southwest; the segment within the project area ends a short distance southeast of the Vallecitos Atomic Laboratory, near Highway 84. It should be noted that this segment is just one part of a much longer line that travels 137 miles from the Stanislaus Power House to the City of San Francisco.

Within the project area there are three types of electric power transmission towers. The first, built in 1908, comprised part of the SEP's Stanislaus-Mission San Jose Line. The second, built by S&SFP in 1909-1910, was part of that company's Stanislaus-San Francisco Line. The third, built by PG&E in 1965, connects the two earlier lines to the Tesla Substation, located 2.2 miles to the north. Each of the transmission lines and towers will be discussed separately below.

4.2. Stanislaus Electric Power Company Line

SEP built this line of single circuit towers in 1908. The line is now part of the PG&E Stanislaus-Newark Line, carrying the designation "Circuit #1." ["Circuit #2" refers to the parallel line of towers built the following year, described in Section 4.3 below.] The Circuit #1 towers all appear to be the original structures; however, owing to access restrictions most of the towers had to be viewed at a distance, and many could not be seen at all. The observed towers are uniform throughout the entire project area, following a standard design. They are entirely constructed of galvanized steel members, standing on four straight legs that are set at an angle and meet at the apex. The legs are connected with evenly spaced horizontal members, and diagonal braces further stabilize the tower from the ground to the peak. All pieces of the tower are bolted together. The towers are anchored with inverted V-shaped steel legs, approximately eight feet in length, which are sunk into the ground. At the base of each leg is a square metal plate that provides stability. The tower is bolted to the apex of the "V" at ground level. Each of the transmission towers carry three 114 kilovolt power lines, or conductors, one on each of the three cross arms at the top of the structure. Two of the cross arms hang two the north, the other to the south. Each of the cross arms supports a set of nine suspended insulators. The insulators suspend the wires between the towers, which on average are set approximately 500 feet apart.

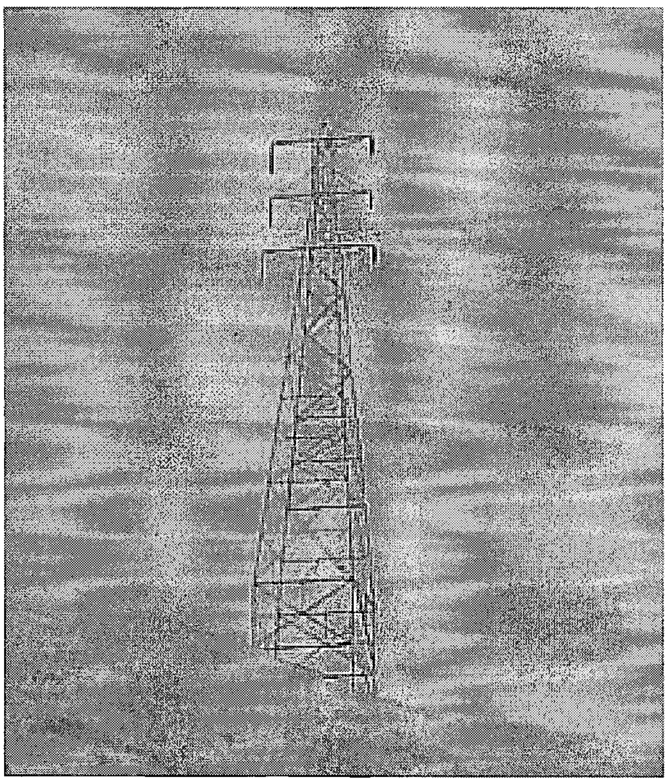


Typical SEP Tower in Project Area

(Source: JRP Historical Consulting Services, October 2000)

4.3. Sierra & San Francisco Power Company Line

S&SFP built this line of double circuit towers in 1909-1910. It is now part of the PG&E Stanislaus-Newark Line, carrying the designation "Circuit #2." The Circuit #2 towers all appear to be the original structures; however, due to access restrictions most of the towers had to be viewed at a distance, and many could not be seen at all. The observed towers are uniform throughout the entire project area, following a standard design very similar to those that comprise Circuit #1. They are entirely constructed of galvanized steel members, standing on four legs connected with evenly spaced horizontal members, with diagonal braces for stabilization. Also like the Circuit #1 towers, the Circuit #2 towers are anchored with inverted V-shaped steel legs that are sunk into the ground. While the Circuit #1 towers have straight legs from top to bottom, the legs of the Circuit #2 towers have a break near the top, so that at their peak the members run perpendicular to the ground. These towers are also slightly taller. The reason for this difference is that the Circuit #2 towers are designed to carry six 114 kilovolt power lines – or conductors – rather than three. Mounted to the top portion of the towers are three horizontal cross arms, each designed to carry two insulators. However, only the towers in the western half of the project area carry six conductors. The towers in the eastern half only carry three, all on the north side of the tower. The conductors are suspended with nine-unit porcelain insulators.



Typical S&SFP Tower in Project Area

(Source: JRP Historical Consulting Services, October 2000)

4.4. Pacific Gas & Electric Tesla Substation Line

This line is a relatively short segment (approximately two miles) of newer towers, running from the Tesla Substation to the Stanislaus-Newark lines. PG&E built these towers in 1965, and they are much larger than the older generation of towers along the Stanislaus-Newark Line. They are also configured much differently. The steel structures have two separate sets of supports, each consisting of two legs resting on above-ground concrete footings. The legs are braced with diagonal and horizontal members from top to bottom. A steel lattice element, oriented horizontally, joins the two supports and carries the insulators. The towers that comprise this segment appear uniform; however, many of the towers on the southern end of this line were inaccessible and could not be observed.

Typical Tower on PG&E Tesla Substation Line

(Source: JRP Historical Consulting Services, October 2000)

5. FINDINGS AND CONCLUSIONS

JRP Historical Consulting Services has prepared this report to evaluate whether the PG&E transmission towers appear to be eligible for listing on the National Register of Historic Places or the California Register of Historical Resources. The purpose of this document is to comply with applicable sections of the National Historic Preservation Act and the implementing regulations of the Advisory Council on Historic Preservation as these pertain to federally-funded undertakings and their impacts on historic properties. The report also seeks to comply with CEQA guidelines by evaluating properties in accordance with Section 15064.5(a)(z)-(3), using the criteria outlined in Section 5024.1 of the California Public Resources Code. Under CEQA Guidelines, the report determines that the properties evaluated for this project are historical resources for the purposes of CEQA.

Eligibility to the National Register of Historic Places rests on twin factors: *significance* and *integrity*. A property must have both significance and integrity to be considered eligible for listing on the National Register. Loss of integrity, if sufficiently great, will overwhelm the historical significance of a resource and render it ineligible. Likewise, a resource can have complete integrity, but if it lacks significance it will also be considered ineligible.

Historical significance is judged by application of four criteria, denominated A through D.

> Criterion A: association with "events that have made a significant contribution to the broad patterns of our history"
>
> Criterion B: association with "the lives of persons significant in our past"
>
> Criterion C: resources "that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction"
>
> Criterion D: resources "that have yielded, or may be likely to yield, information important to history or prehistory"

Integrity is determined through application of seven factors: location, design, setting, workmanship, materials, feeling, and association. In addition, a resource must be at least 50 years old in order to be eligible to the National Register, unless it meets specific and exacting criteria for special significance.[24] The procedures for evaluating historic resources are explained in bulletins issued by the National Park Service, including Bulletin 15, *Guidelines for Applying the National Register Criteria for Evaluation.*

5.1. Discussion

5.1.1. SEP and S&SFP Lines

Although the SEP and S&SFP transmission lines appear to be intact examples of early long-distance transmission lines, they do not appear to meet the criteria for listing in the National Register of Historic Places. The transmission lines retain a high degree of integrity. Available documentation indicates that its physical features, including design, materials and workmanship, are essentially unaltered. While PG&E maintenance records indicate it is likely the original conductors and insulators have been replaced, the towers appear to be original. Also the location, setting, feeling, and association of the towers remain intact, although it is somewhat diminished as a result of encroachment of modern Highway 84 and recent residential developments along some of its length. Although the transmission lines retain integrity, they do not appear to meet any of the National Register's significance criteria. They do not appear eligible under Criterion A because they have not "made a significant contribution to the broad patterns of our history." Furthermore, they do not appear to qualify for listing under Criterion B because they have no known associations with persons important to our history. Under Criterion C the transmission lines do not appear to be eligible because they are not distinctive or pioneering engineering features, nor are they the work of a master designer. In rare instances, buildings and structures themselves can serve as sources of important information about historic construction materials or technologies under Criterion D; however, these properties are otherwise documented and do not appear to be a principal source of important information in this regard.

The potential of the SEP and S&SFP transmission lines to qualify for listing under Criterion A lies with their associations with the growth of the hydroelectric industry in California, and the development of long-distance high voltage electrical transmission systems. As discussed in Section 3.1 above, the SEP and S&SFP transmission lines were built between 1908 and 1910. This was an active period of hydroelectric development in California, with several companies, including Great Western Power, CG&E, and the American River Power Company, greatly expanding their transmission systems. Although the SEP and S&SFP transmission lines are properties that represent this period of growth, they do not appear to be important or pioneering examples. Transmission lines that would meet the requirements of Criterion A would need to

[24] CFR Title 36, Part 60.

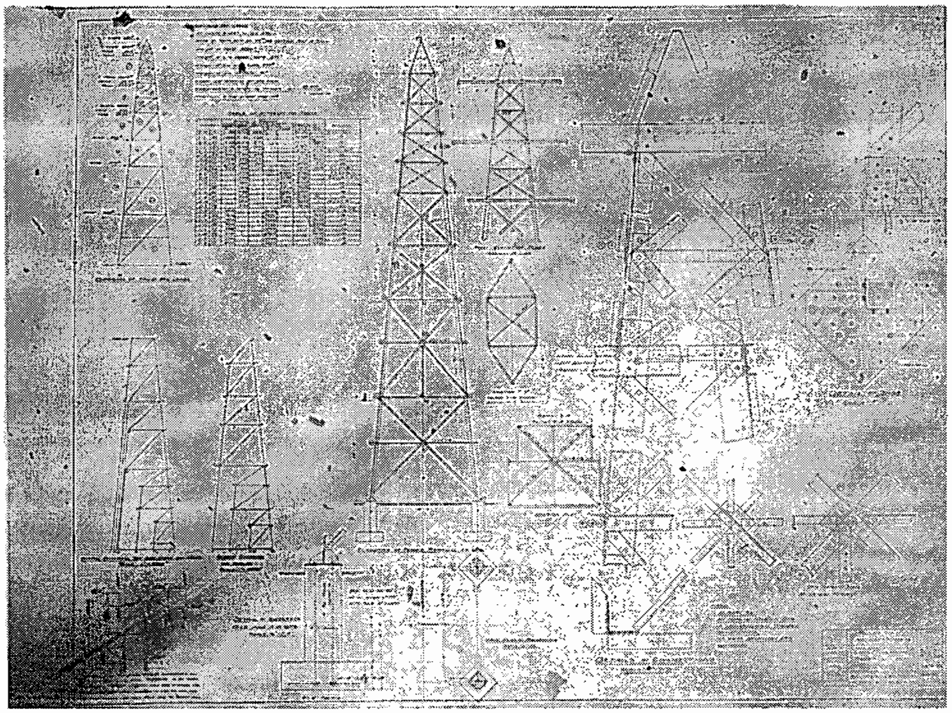
represent pioneering events or trends in long-distance, high-voltage electric transmission. The SEP and S&SFP lines were not the first to carry high-voltage electricity over a great distance, nor were they the first to use steel towers rather than wooden ones. On the contrary, they are typical examples of transmission lines for their period, utilizing commonly accepted technology and engineering principles that were the result of nearly three decades of development.

Under Criterion B, the potential for eligibility lies with the transmission lines' associations with John Debo Galloway, a prominent figure in early hydroelectric developments in California. Galloway (1869-1943) was educated at the Rose Polytechnic Institute in Terre Haute, Indiana. He began his engineering career in the 1890s, first for a railroad in the Pacific Northwest, then for two San Francisco firms. His early work involved the design and construction of bridges, harbors, sewers, and the foundations and steel frames for buildings. Beginning in 1900, Galloway became an independent contractor and shifted his focus to hydroelectric engineering. He designed and supervised the construction of several hydroelectric plants, including the first two plants for the California Electric Power Company that later became a part of the PG&E system. He also directed the design and construction of the PG&E cable span across the Straits of Carquinez, near Benicia, at the time the world's longest.[25] His association with the Stanislaus Electric Power Company came in March 1909 when, acting in the role of consulting engineer, he authored a report summarizing the design and construction progress of the Stanislaus Electric Power Company system. The intent of the document was to inform investors in the company about the state of the physical plant, as well as the performance of the management.[26]

Galloway also drew plans for the Great Western Power Company illustrating the design of transmission towers that are nearly identical to those used along the SEP line. It is unclear whether or not the plans, dated February 1909, were also used by SEP. As discussed further below, a windmill manufacturing company based in Chicago provided the towers for the SEP line; it is likely that the towers were based on a standard or modified company plan.

[25] Walter L. Huber, Henry D. Dewell, and A. Kempkey, "Memoir of John Debo Galloway," *Transactions of the ASCE,* Volume 109 (1943): 1451-56.

[26] Galloway, "Report on the Stanislaus Electric Power Company," March 1909.



Plans for Great Western Power Company Towers, 1909

(Source: J.D. Galloway, "Plans for Anchor Towers, Great Western Power Company," February 1909. Located in the Huber Photograph Collection, WRCA, University of California, Berkeley)

Although J.D. Galloway was an important member of the engineering community during the early 1900s, and was involved in the design and engineering of several large-scale hydroelectric systems in California, he does not appear to have strong associations with the development of the SEP transmission lines. Acting as consulting engineer for the company in 1909, his role was limited to summarizing and evaluating the existing system. It is also possible that he designed the towers that the SEP, and later the S&SFP, used in their transmission lines. This association, however, is not well documented and is speculative, at best. Therefore, the SEP and S&SFP lines do not appear to meet the eligibility requirements of Criterion B.

The transmission towers that comprise the PG&E Stanislaus-Newark Line do not appear to meet the requirements of Criterion C. Towers that would be eligible for listing under this criterion would represent distinctive or pioneering engineering features in the field of long distance power transmission. This does not appear to be the case. The transmission towers that comprise both the SEP and S&SFP lines were commonplace prefabricated structures. Each of the approximately 1,800 towers was manufactured by the Aermotor Company of Chicago, shipped broken down and bundled, and assembled at the construction site. The Aermotor Company, founded in 1888, was chiefly in the field of manufacturing easy-to-assemble windmills and towers. The design of the transmission towers closely resembles that of the windmill towers, both of them featuring galvanized steel components with horizontal and diagonal cross bracing. Although it is unknown whether or not the Aermotor Company also supplied transmission towers to other hydroelectric companies in the early 1900s, it does appear that the general design was in wide use throughout California. In 1908, the Great Western Power Company used nearly identical towers along its long distance transmission line from Big Bend to Oakland.[27] In the following years such companies as the Southern Sierras Power Company, CG&E, and Southern California Edison Company were all using towers similar to those along S&SFP's Stanislaus-San Francisco line.[28] Because the towers are commonplace, prefabricated structures of a standard design, the transmission lines do not appear to be eligible for listing for the National Register under Criterion C.

Additionally, the SEP and S&SFP transmission lines have been evaluated in accordance with Section 15064.5(a)(2)-(3) of the CEQA Guidelines, using criteria outlined in Section 5024.1 of the California Public Resources Code. It is determined that they are not historical resources for the purposes of CEQA.

5.1.2. PG&E Tesla Substation Line

The PG&E Tesla Substation Line does not appear to meet the criteria for listing in the National Register of Historic Places. The connecting line today still functions and retains a high degree of integrity. The structure meets the National Register's guidelines regarding aspects of integrity. Available documentation indicates that its physical features, including design, materials and workmanship, are essentially unaltered. Also its location, setting, feeling, and association remain intact. Although it retains integrity, the structure fails to meet any of the National Register's significance criteria. The line does not appear eligible under Criterion A because it has not "made a significant contribution to the broad patterns of our history." There is nothing to indicate that the construction of this line was linked to any pioneering advancements in the field of electrical transmission. Furthermore, research did not indicate that it was associated with any persons known to have made important advancements in the engineering or construction of high-voltage transmission lines. The line, therefore, does not appear to meet the requirements of Criterion B. Also, the PG&E Tesla Substation line does not appear to qualify under Criterion C. The towers are modern examples of a standard design, do not appear to be the first of their kind, and represent a type of junction line common to the area. Finally, the line was constructed

27 Jackson Research Projects, "Great Western Power Company," 116.

28 Walter Leroy Huber, "Photographs of Hydro-electric Power Plants and Canal Companies in California, 1911-1916," (Folder 641); and Walter Leroy Huber, "Photographs of Pacific Gas and Electric Company and Other Electric Power Plants, 1913-1932," (Folder 642). On file at the Water Resources Center & Archives, University of California, Berkeley; Meyers, *Iron Men and Copper Wires*, 79.

within the past fifty years and would need to be of "exceptional importance" under Consideration G to be listed in the National Register. It is not. Therefore, the 2.2-mile connecting transmission line at the Tesla Substation does not appear to meet the criteria for listing in the National Register of Historic Places. Additionally, this property has been evaluated in accordance with Section 15064.5(a)(2)-(3) of the CEQA Guidelines, using criteria outlined in Section 5024.1 of the California Public Resources Code, and determined that it is not a historical resource for the purposes of CEQA.

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________. "Report on the Stanislaus Electric Power Company on the Stanislaus River, California." March 1909.

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Maps

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USGS. *Altamont, Calif.* 7.5 Minute Series Topographic, Washington, D.C.: GPO, 1953; Photorevised 1968; Photorevised 1981.

________. *La Costa Valley, Calif.* 7.5 Minute Series Topographic, Washington, D.C.: GPO, 1953; 1960 Photorevised 1968.

________. *Livermore, Calif.* 7.5 Minute Series Topographic, Washington, D.C.: GPO, 1953; 1961; 1961 Photorevised 1968; Photorevised 1968 and 1973; Photorevised 1980.

________. *Midway, Calif.* 7.5 Minute Series Topographic, Washington, D.C.: GPO, 1953; Photorevised 1968.

________. *Tracy, Calif.* 7.5 Minute Series Topographic, Washington, D.C.: GPO, 1954; Photorevised 1968; Photorevised 1981.

APPENDIX A:
Figures

Figure 1. Project Location

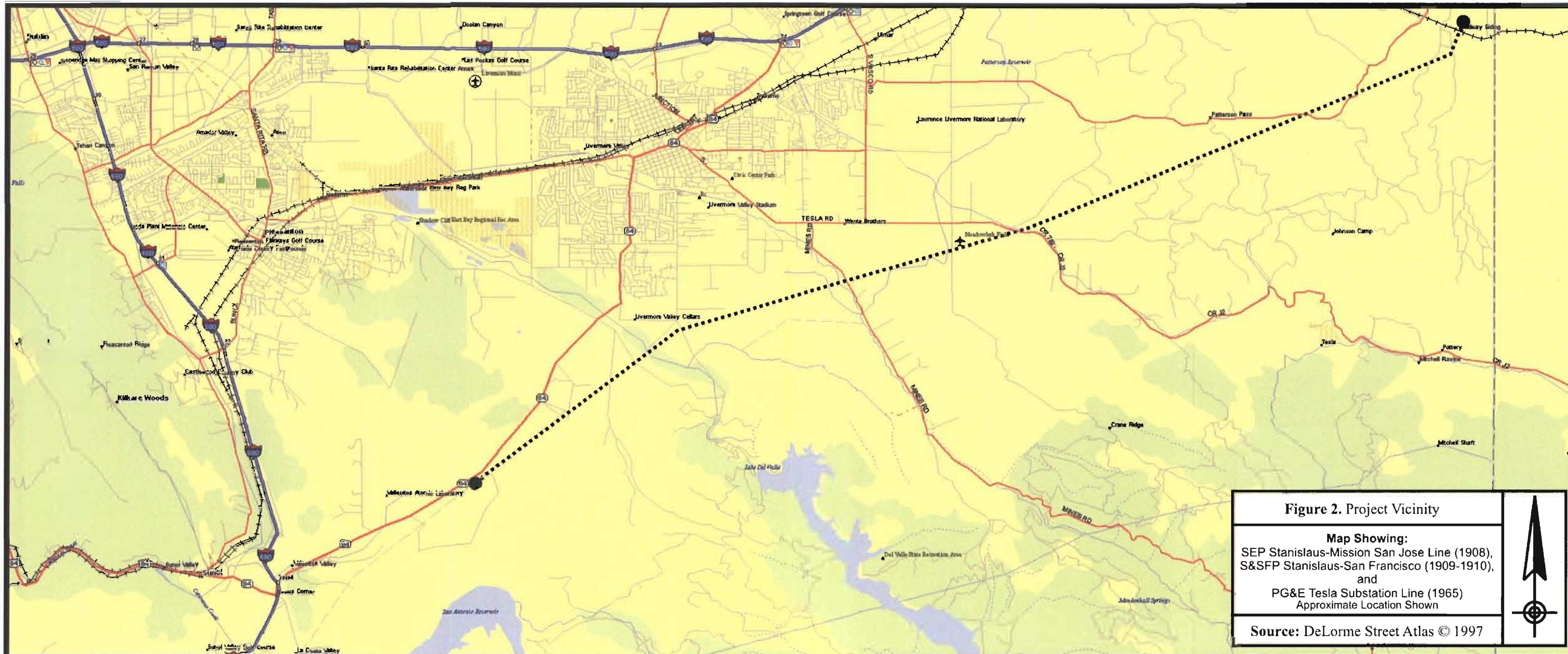


Figure 2. Project Vicinity

Map Showing:
SEP Stanislaus-Mission San Jose Line (1908),
S&SFP Stanislaus-San Francisco (1909-1910),
and
PG&E Tesla Substation Line (1965)
Approximate Location Shown

Source: DeLorme Street Atlas © 1997

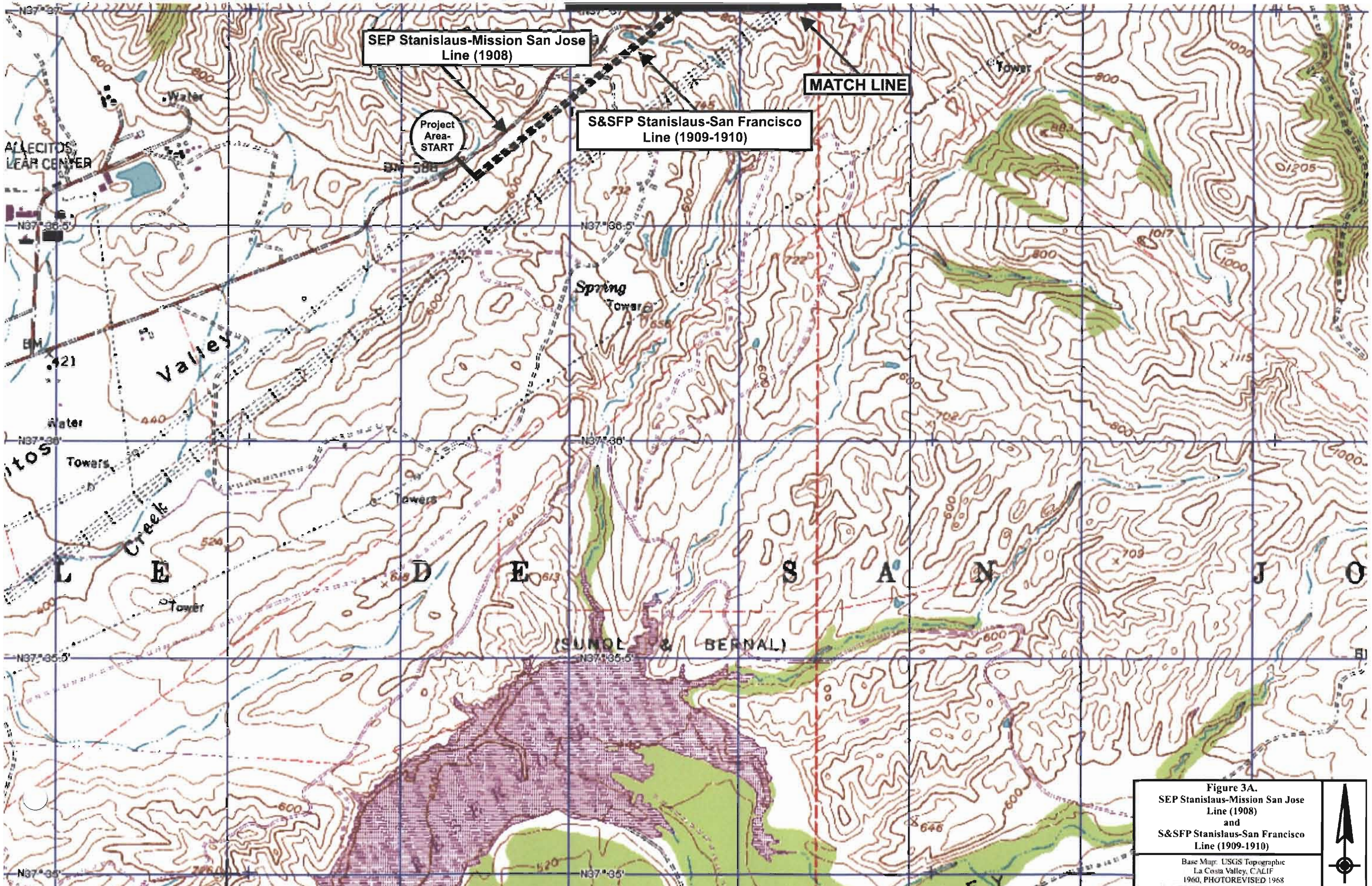


Figure 3A.
SEP Stanislaus-Mission San Jose Line (1908)
and
S&SFP Stanislaus-San Francisco Line (1909-1910)

Base Map: USGS Topographic
La Costa Valley, CALIF
1960, PHOTOREVISED 1968

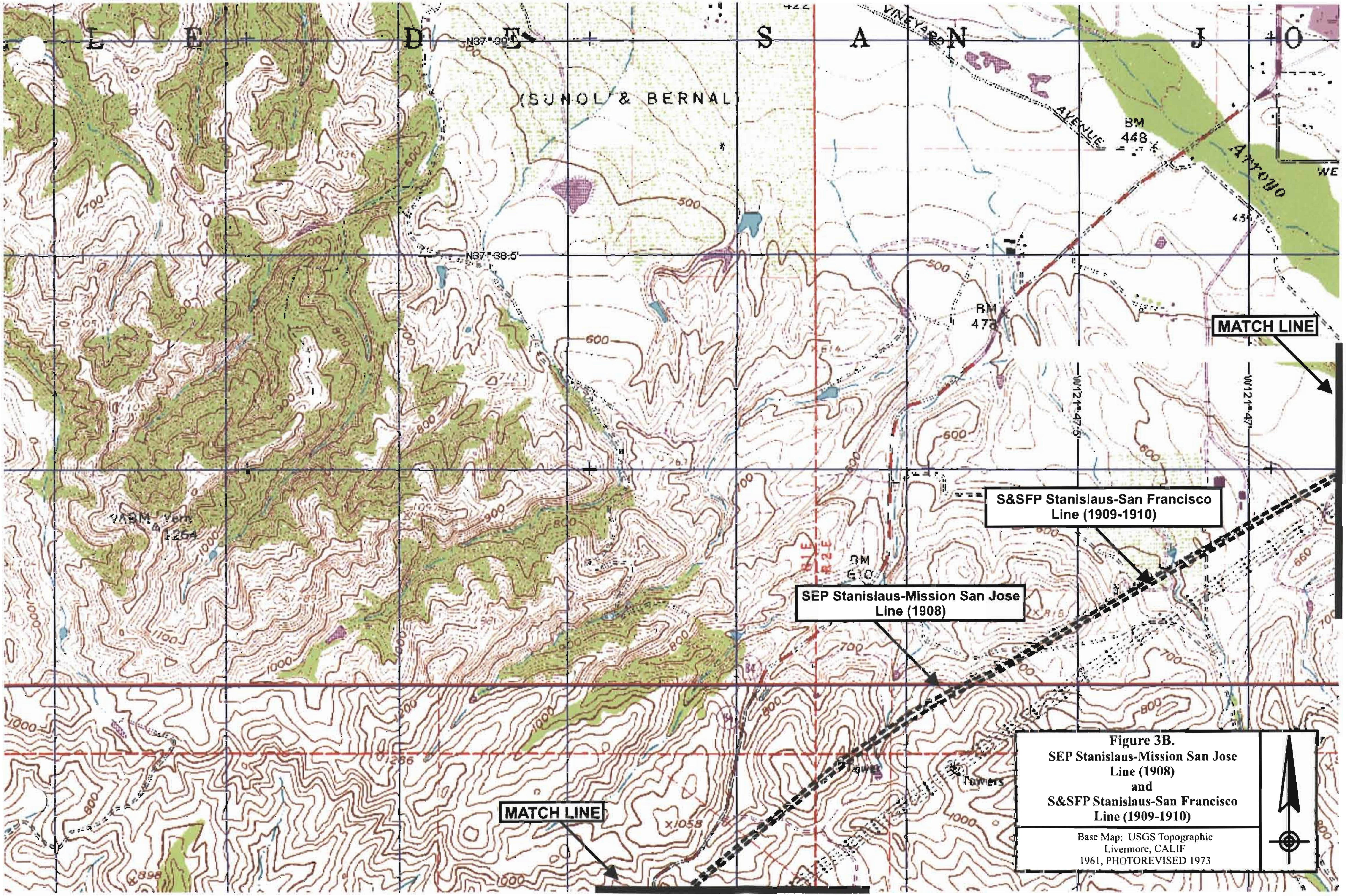


Figure 3B.
SEP Stanislaus-Mission San Jose Line (1908) and S&SFP Stanislaus-San Francisco Line (1909-1910)

Base Map: USGS Topographic Livermore, CALIF 1961, PHOTOREVISED 1973

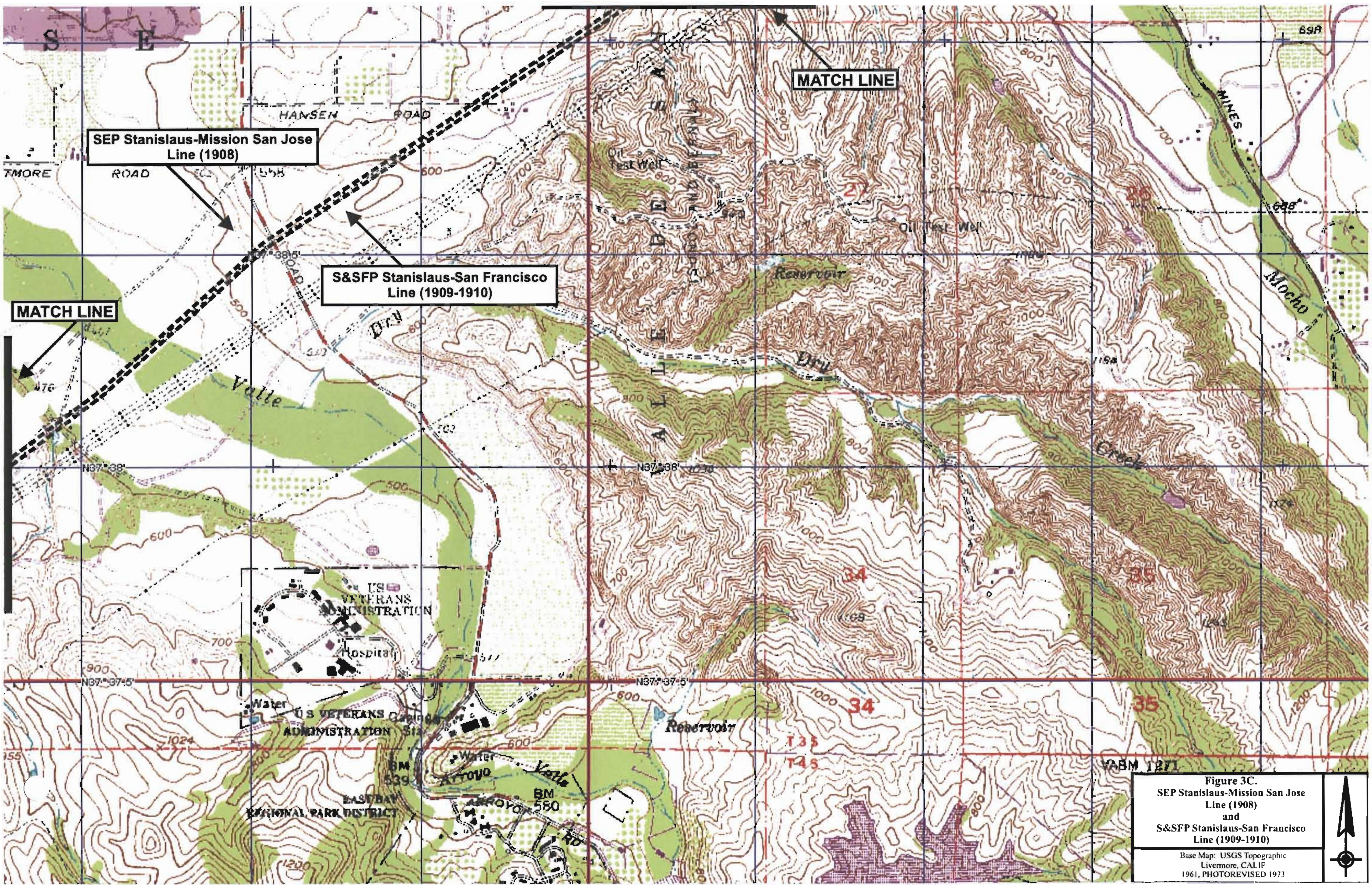


Figure 3C.
SEP Stanislaus-Mission San Jose Line (1908)
and
S&SFP Stanislaus-San Francisco Line (1909-1910)

Base Map: USGS Topographic
Livermore, CALIF
1961, PHOTOREVISED 1973

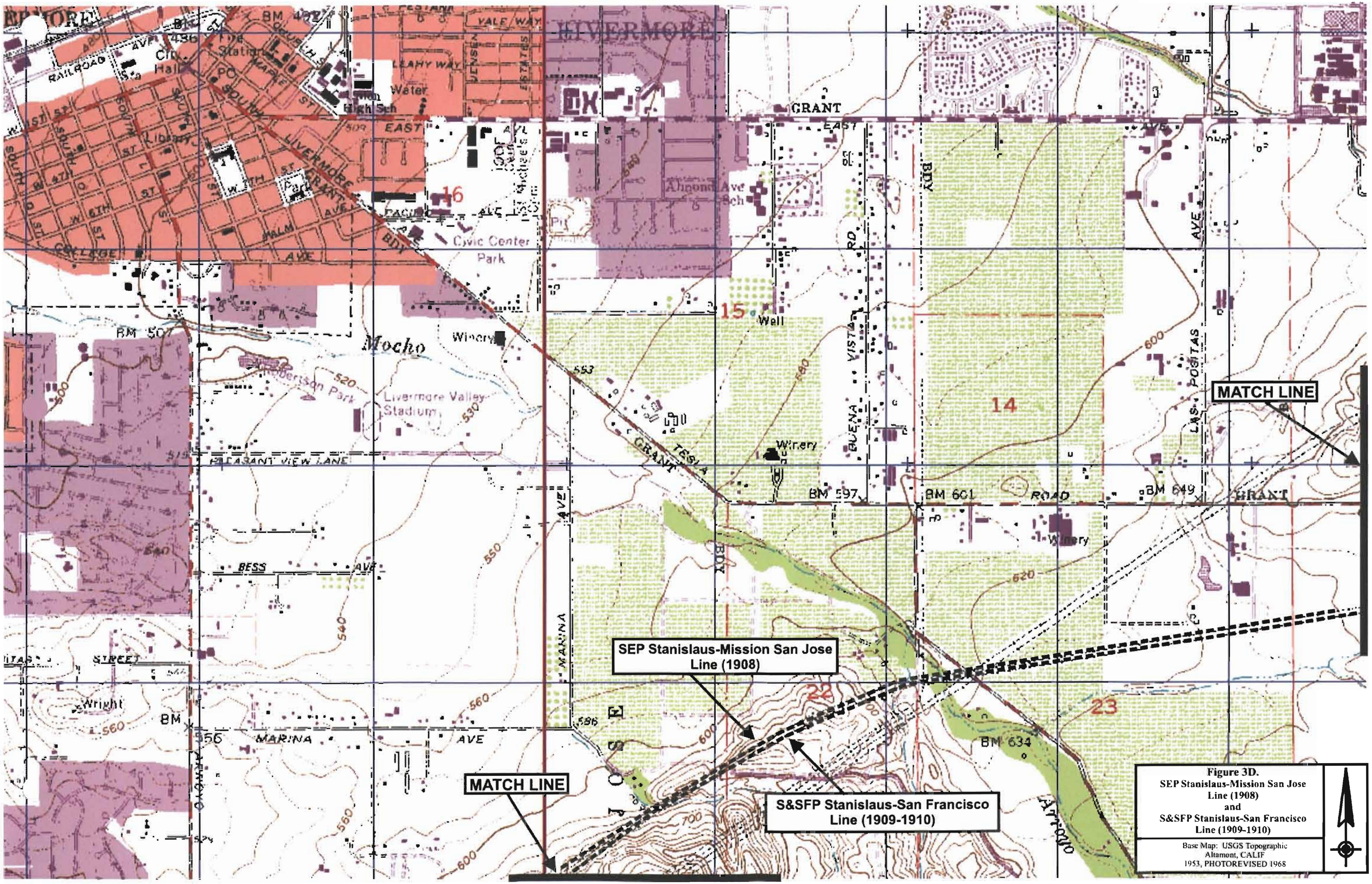


Figure 3D.
SEP Stanislaus-Mission San Jose Line (1908)
and
S&SFP Stanislaus-San Francisco Line (1909-1910)

Base Map: USGS Topographic
Altamont, CALIF
1953, PHOTOREVISED 1968

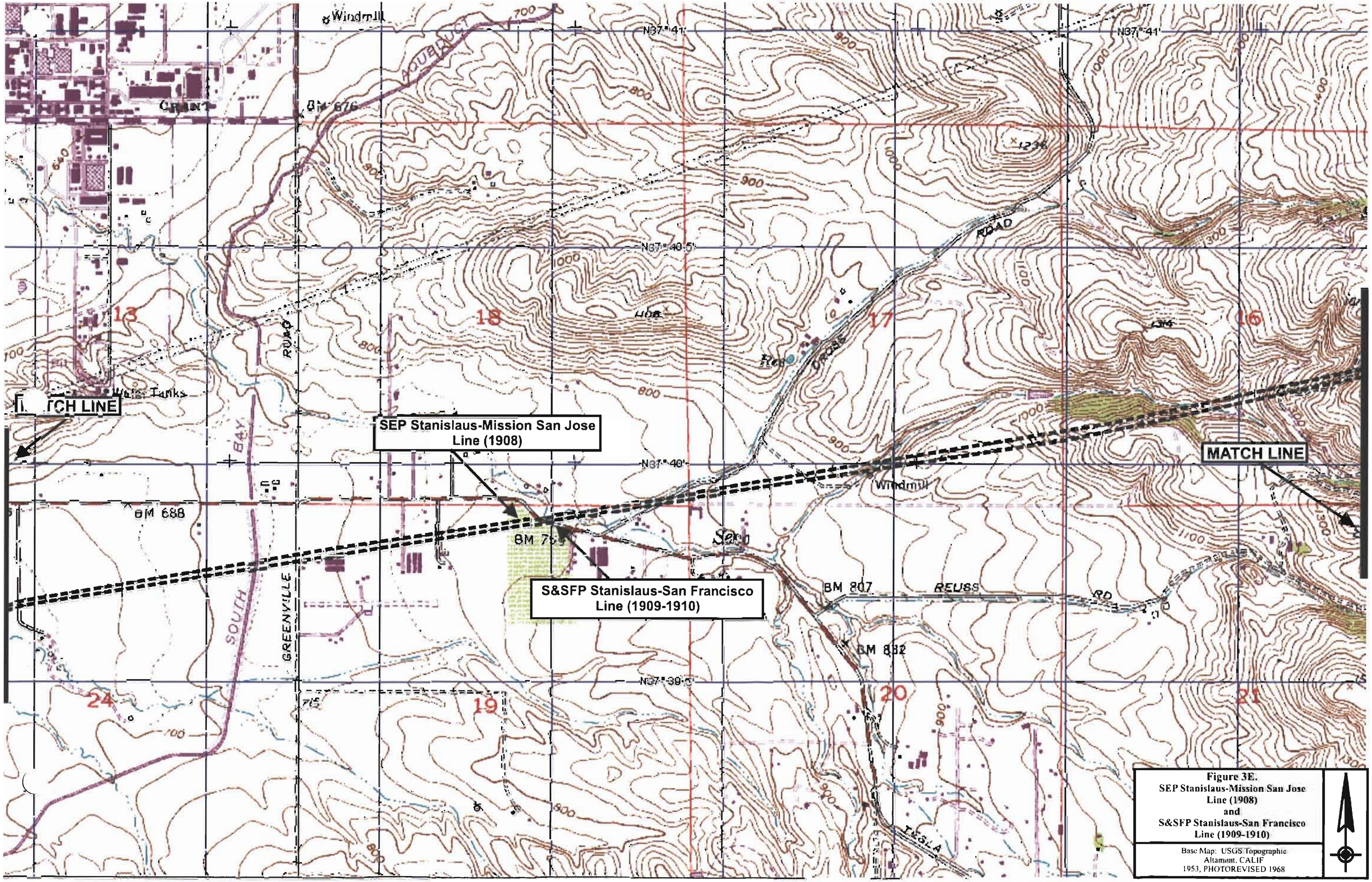


Figure 3E.
SEP Stanislaus-Mission San Jose Line (1908) and S&SFP Stanislaus-San Francisco Line (1909-1910)

Base Map: USGS Topographic
Altamont, CALIF
1953, PHOTOREVISED 1968

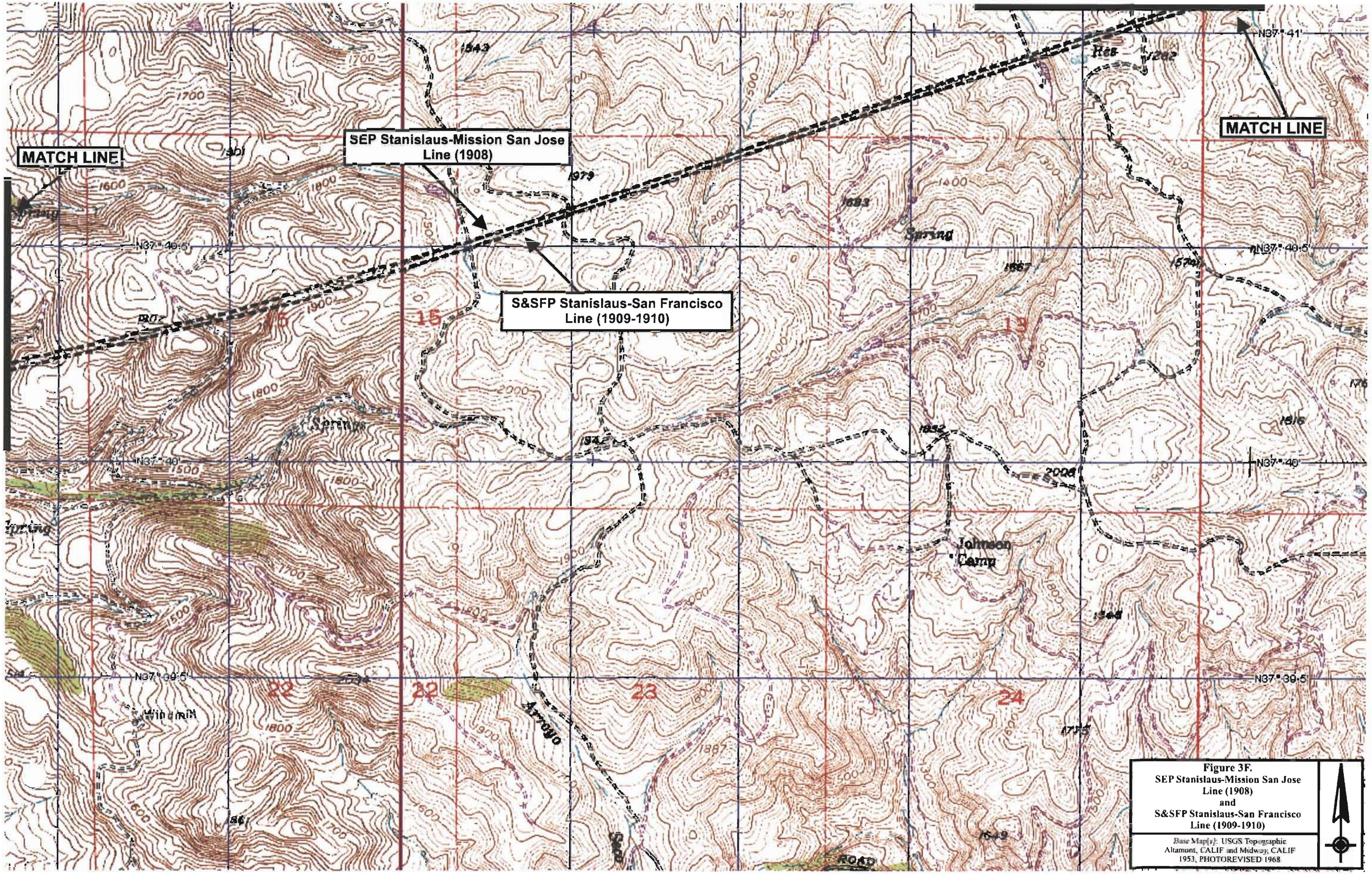


Figure 3F.
SEP Stanislaus-Mission San Jose Line (1908) and S&SFP Stanislaus-San Francisco Line (1909-1910)

Base Map(s): USGS Topographic Altamont, CALIF and Midway, CALIF 1953, PHOTOREVISED 1968

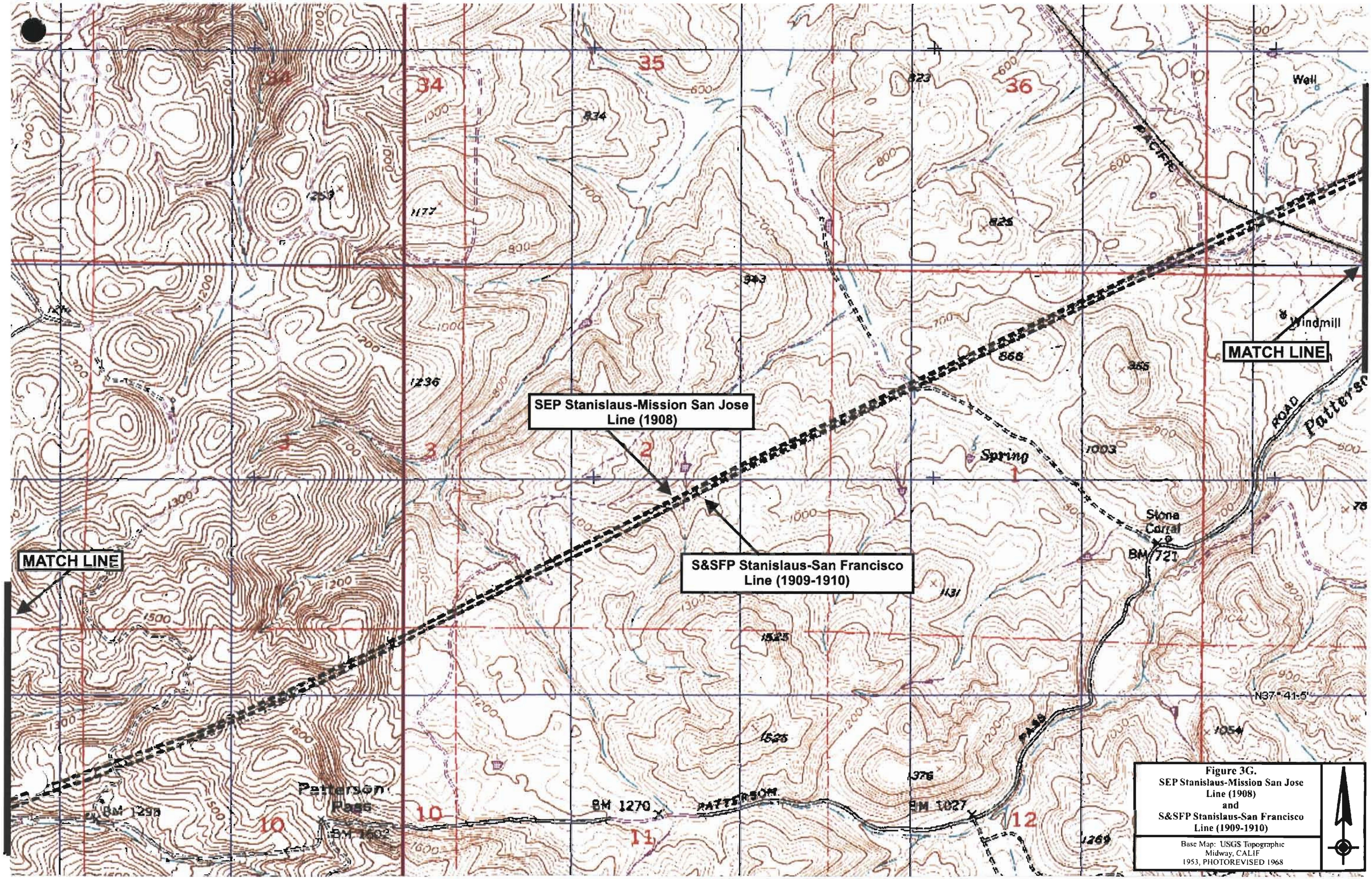


Figure 3G.
SEP Stanislaus-Mission San Jose
Line (1908)
and
S&SFP Stanislaus-San Francisco
Line (1909-1910)

Base Map: USGS Topographic
Midway, CALIF
1953, PHOTOREVISED 1968

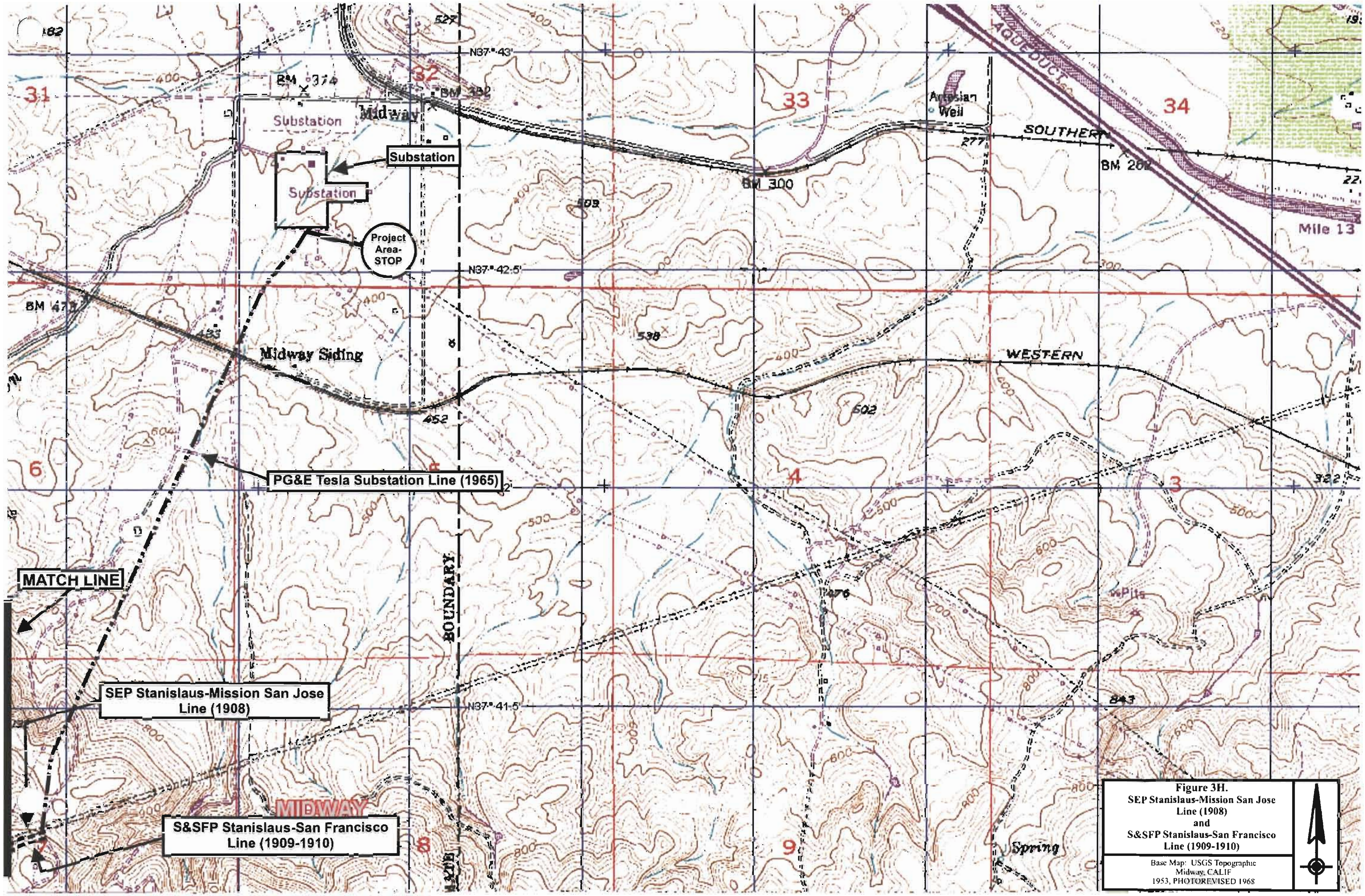


Figure 3H.
SEP Stanislaus-Mission San Jose Line (1908)
and
S&SFP Stanislaus-San Francisco Line (1909-1910)

Base Map: USGS Topographic
Midway, CALIF
1953, PHOTOREVISED 1968

APPENDIX B:

DPR 523 Forms

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD

Primary # ___
HRI # ___
Trinomial ___
NRHP Status Code 6
Other Listings ___
Review Code ___ Reviewer ___ Date ___

 ***Resource Name or #** (Assigned by recorder) Stanislaus-Newark Circuits #1 & #2

P1. Other Identifier: SEP Stanislaus-Mission San Jose Line; S&SFP Stanislaus-San Francisco Line

***P2. Location:** ☐ **Not for Publication** ☒ **Unrestricted** ***a. County** Alameda

and (P2b and P2c or P2d. Attach a Location Map as necessary.)

***b. USGS 7.5' Quad** Midway, Altamont, Livermore & La Costa **Date:**___ **T**__; **R** __; __ ¼ **of Sec** __; __ **B.M.**

c. Address ___ City ___ Zip ___

d. UTM: (give more than one for large and/or linear resources) See Continuation Sheet

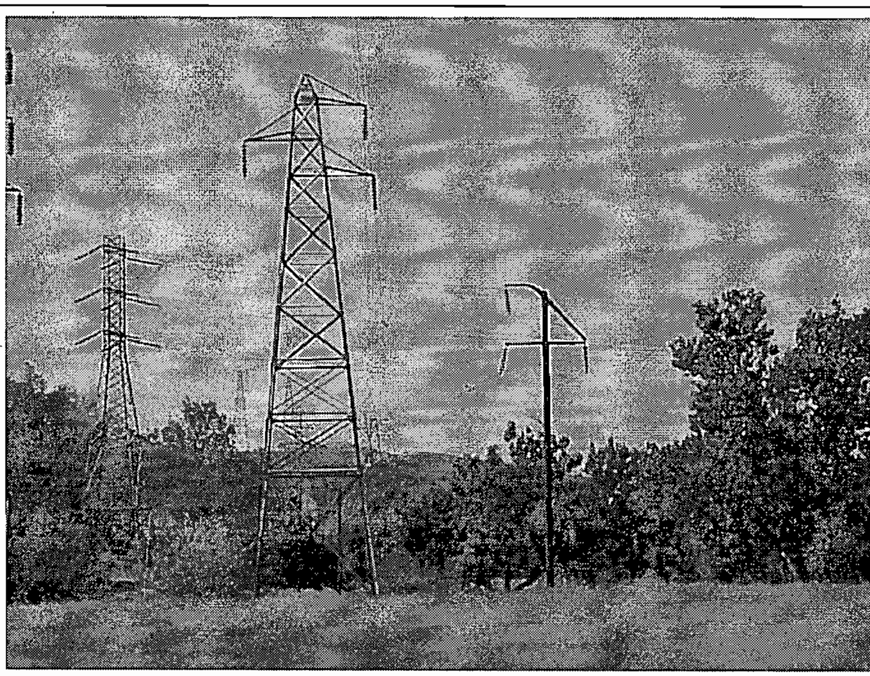
e. Other Locational Data: (e.g., parcel #, directions to resource, elevation, etc., as appropriate)

***P3a. Description:** (Describe resource and its major elements. Include design, materials, condition, alterations, size, setting, and boundaries)

This form evaluates a segment of the PG&E Stanislaus-Newark transmission line, located in Alameda County. purpose of this report is to inventory and evaluate a system of electrical power transmission towers now owned and operated by PG&E. The segment in the project area begins approximately two miles south Tesla Substation near Midway, and proceeds in a roughly southwesterly direction for approximately 17 miles. The project area ends a short distance southeast of the Vallecitos Atomic Laboratory, near Highway 84. It should be noted that this segment is just one part of a much longer line that travels 137 miles from the Stanislaus Power House to the City of San Francisco. (See Continuation Sheet)

***P3b. Resource Attributes:** (List attributes and codes) HP11 (Engineering Structure)

***P4. Resources Present:** ☐ Building ☒ Structure ☐ Object ☐ Site ☐ District ☐ Element of District ☐ Other (Isolates, etc.)



P5b. Description of Photo: (View, date, accession #) October 2, 2000; Circuit #1 tower, at intersection with Mines Road (facing west).

***P6. Date Constructed/Age and Sources:** ☒ Historic ☐ Prehistoric ☐ Both
1908

***P7. Owner and Address:**
Pacific Gas & Electric
77 Beale Street
San Francisco, California 94105

***P8. Recorded by:** (Name, affiliation, address)
Paul Ferrell & Bryan Larson
JRP Historical Consulting Services 1490 Drew Ave, Suite 110
Davis, CA 95616

***P9. Date Recorded:** October 6, 2000

***P10. Survey Type:** (Describe)
Intensive

***P11. Report Citation:** (Cite survey report and other sources, or enter "none.") "Historic Resources Inventory and Evaluation Report, Transmission Lines in the Stanislaus Corridor, Alameda County, California," October 2000.

***Attachments:** NONE ☐ Location Map ☒ Sketch Map ☒ Continuation Sheet ☒ Building, Structure, and Object Record ☐ Archaeological Record ☐ District Record ☐ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record ☐ Artifact Record ☐ Photograph Record ☐ Other (list) ___

DPR 523A (1/95) ***Required Information**

***NRHP Status Code** 6

***Resource Name or #** (Assigned by recorder) Stanislaus-Newark Circuits #1 & # 2

B1. Historic Name: See Significance Statement

B2. Common Name: PG&E Stanislaus–Newark Circuits # 1 & #2

B3. Original Use: 110 kV Transmission Line B4. Present Use: 114 kV Transmission Line

***B5. Architectural Style:** n/a

***B6. Construction History:** (Construction date, alteration, and date of alterations) Circuit #1: 1908; Circuit #2: 1909-10

***B7. Moved?** ☒ **No** ☐ **Yes** ☐ **Unknown** **Date:** ______ **Original Location:** ______

***B8. Related Features:** None

B9. Architect: n/a b. Builder: Sanderson & Porter, Consulting Engineers

***B10. Significance: Theme** n/a **Area** n/a

Period of Significance n/a **Property Type** n/a **Applicable Criteria** n/a

(Discuss importance in terms of historical or architectural context as defined by theme, period, and geographic scope. Also address integrity.)

Although the PG&E Stanislaus-Newark transmission lines appear to be intact examples of early long-distance transmission lines, they do not appear to meet the criteria for listing in the National Register of Historic Places. They do not appear eligible under Criterion A because they have not "made a significant contribution to the broad patterns of our history." Furthermore, they do not appear to qualify for listing under Criterion B because they have no known associations with persons important to our history. Under Criterion C the transmission lines do not appear to be eligible because they are not distinctive or pioneering engineering features, nor are they the work of a master designer. In rare instances, buildings and structures themselves can serve as sources of import—t information about historic construction materials or technologies under Criterion D; however, these properties otherwise documented and do not appear to be a principal source of important information in this regard. (See Continuation Sheet)

B11. Additional Resource Attributes: (List attributes and codes) ____

***B12. References:** JRP Historical Consulting Services, "Historic Resources Inventory and Evaluation Report, Transmission Lines in the Stanislaus Corridor, Alameda County, California," October 2000.

B13. Remarks:

***B14. Evaluator:** R. Herbert / B. Larson

***Date of Evaluation:** October 2000

(This space reserved for official comments.)

See Continuation Sheet

P2d. Location:

The segment of PG&E Stanislaus-Newark the transmission lines in the project area begins at the junction point of the Tesla Substation Line, 2.2 miles south of the Tesla Substation near Midway. The UTM coordinates for this junction is: Zone 10 / 625350mE / 4171771mN. Running southwesterly the line crosses Grant Road at UTM coordinates: Zone 10 / 613135mE / 4169229mN. Further west it crosses Mines Road at UTM coordinates: Zone 10 / 612083mE / 4168499mN. The endpoint is in Vallecitos Valley, about one-half mile southeast of the Vallecitos Atomic Laboratory, near Highway 84, at UTM coordinates: Zone 10 / 603609mE / 4162669mN.

P3a. Description (continued):

The PG&E Stanislaus-Newark Line consists of two distinct sets of lines, running parallel to one another and separated by a distance of approximately 50 feet. The line on the north, built in 1908, was originally part of the Stanislaus Electric Power Company (SEP) Stanislaus-Mission San Jose Line. It is currently designated "Circuit #1" of the Stanislaus-Newark Line. The southern line, built by Sierra & San Francisco Power (S&SFP) in 1909-1910, was part of that company's Stanislaus-San Francisco Line. It is now designated "Circuit #2."

The towers of both Circuit #1 and Circuit #2 appear to be the original structures; however, owing to access restrictions most of the towers had to be viewed at a distance, and many could not be seen at all. The observed towers are uniform throughout the entire project area, following a standard design.

Circuit #1 is a line of single circuit lattice towers, each supporting three 114-kilovolt transmission lines (conductors). They are entirely constructed of galvanized steel members, standing on four straight legs that are set at an angle and meet at the apex. The legs are connected with evenly spaced horizontal members, and diagonal braces further stabilize the tower from the ground to the peak. All pieces of the tower are bolted together. The towers are anchored with inverted V-shaped steel legs, approximately eight feet in length, which are sunk into the ground. At the base of each leg is a square metal plate that provides stability. The tower is bolted to the apex of the "V" at ground level. Three horizontal cross arms carry the conductors near the top of the structure; two of the cross arms hang to the north, the other to the south. Each of the cross arms supports a set of nine suspended insulators. The insulators suspend the conductors between the towers, which on average are set approximately 500 feet apart. A typical example of this type of tower is shown in **Photograph 1**.

The line now designated as Circuit #2 is a line of double circuit lattice towers, designed to carry six 114-volt conductors. The observed Circuit #2 towers are uniform throughout the entire project area, following a standard design very similar to those in Circuit #1. They are entirely constructed of galvanized steel members, standing on four legs connected with evenly spaced horizontal members, with diagonal braces for stabilization. Also like the Circuit #1 towers, the Circuit #2 towers are anchored with inverted V-shaped steel legs that are sunk into the ground. While the Circuit #1 towers have straight legs from top to bottom, the legs of the Circuit #2 towers have a break near the top, so that at their peak they run perpendicular to the ground. These towers are also slightly taller. The reason for this difference is that the Circuit #2 towers are designed to carry six or conductors, rather than three. Mounted to the top portion of the towers are three horizontal cross arms, each designed to carry two insulators. However, only the towers in the western half of the project area carry six conductors. The towers in the eastern half only carry three, all on the north side of the tower. The conductors are suspended with nine-unit porcelain insulators. **Photograph 2** shows a typical example of a double circuit power line, located south of State Highway 84, approximately two miles east of the Vallecitos Atomic Laboratory. The view is to the southeast.

B10. Significance (Continued)

Historic Context

The SEP and S&SFP long-distance transmission lines were built between 1908 and 1910, a very active period of growth for the hydroelectric industry in California. During these years demand for electric energy, especially in the larger urban areas, was on the rise. This trend in growth stemmed from several factors: the state's population was rapidly increasing; mining, agricultural, railroad, and manufacturing industries needed a steady and inexpensive supply of fuel; and the passage of laws allowing the U.S. Forest Service to provide power companies with lands on which to build their hydroelectric plants. However, it was only through several decades of technological and engineering developments that power companies were able to deliver electricity from hydroelectric plants, usually located high in the Sierra Nevada, to prospective markets often over 100 miles away.

The development of the long distance transmission lines in California was an evolutionary process that dates to 1879, the year in which California Electric Light Company began operation. This San Francisco-based company generated electricity, and distributed it to local subscribers from a central station.[1] During the 1880s the use of electricity in California became increasingly widespread, and local electric companies began to spring up in cities throughout the state. These early power plants, which used low-voltage direct current (D.C.) dynamos, could only transmit electricity about three miles. Only urban areas with concentrated populations could be economically served with a local electrical generating plant. The first important technological advancement that would allow the transmission of electricity over greater distances was the development of alternating current (A.C.) system, which could produce higher voltages than the D.C. system. By 1890, the pioneering technology invented by Nikolas Tesla was put to use in a limited capacity in power plants in four California cities: Santa Barbara, Highgrove, Visalia, and Pasadena.[2]

Although the A.C. system was a promising development, it did not catch on immediately, primarily because the D.C. system was already in place in most of the existing power stations. Pioneering developments at the Pomona Plant of the San Antonio Light & Power Company, however, greatly helped to advance the electric industry in

[1] William A. Myers, *Iron Men and Copper Wires: A Centennial History of the Southern California Edison Company* (Glen , California: Trans-Anglo Books, 1983), 11.

[2] Myers, *Iron Men and Copper Wires*, 23.

California. In 1892, this was the first hydroelectric facility in California to use "step-up" A.C. transformers, in which the generator potential of 1,000 volts was increased to 10,000 volts for transmission. The voltage was then "stepped down" at the receiving stations. The concept of boosting voltage for transmission was a major innovation that soon became standard practice throughout the industry. This plant was also important in a nationwide context: only Oregon and Colorado had step-up hydroelectric plants and distribution systems that pre-date the Pomona Plant. On November 28, 1892, San Antonio Light & Power began delivery of 10,000 volts of electricity from its plant at San Antonio Canyon to Pomona, a distance of 14 miles. A month later service was extended to San Bernardino, roughly doubling the length of the line.[3]

Over the next decade, technological and engineering advancements made it possible for power companies to transport electricity in increasing amounts over ever-longer distances. In 1893, the Redlands Electric Light & Power Company Mill Creek Plant Number 1 became the first three-phase A.C. plant in California, a technology that increased efficiency and reliability of power transmission.[4] In 1899, the Edison Electric Company built an 83-mile transmission line between its power plant on the upper Santa Ana River and Los Angeles. By far the longest in the world at the time, this engineering feat was made possible by the development of glazed porcelain insulators capable of handling 40,000 volts.[5] In 1901, Bay Counties Power Company completed a transmission line 142 miles in length that brought hydroelectric power from the Colgate Powerhouse in the Sierra Nevada near Grass Valley to Oakland. The line consisted of two parallel rows of cedar poles carrying copper and aluminum wires. In addition to its length, the line was impressive because of its 4,427-foot crossing of the Carquinez Straits. John Debo Galloway was the construction engineer for the project and is credited with directing the design and construction of the cable span, the longest in the world at that time. The Colgate-Oakland line also marked the first time electrical power produced in the Sierra crossed the rugged mountain terrain and the wide Sacramento Valley to be utilized by residents of the Bay Area.[6]

The first decade of the 20th century marked a period of marked growth in the hydroelectric industry.. Between 1900 and 1910 the population of California increased by 60 per cent, and with it came an increased demand for electric power.[7] Dozens of hydroelectric companies formed throughout California, each building networks of long-distance transmission lines to service new and growing markets. By 1902 the Bay Counties Power Company and the Standard Electric Company had a network of transmission lines in place that provided coverage to much of the Bay Area, as well as communities such as Marysville, Stockton, and Amador City. In 1907, California Gas & Electric (CG&E) purchased the lines of these two companies, as well as other smaller Northern California operations. The transmission lines of this consolidated system spanned from Chico in the north to San Jose in the

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[3] Fredrick Hall Fowler, *Hydroelectric Power Systems of California and Their Extensions into Oregon and Nevada* (Washington DC: Government Printing Office, 1923), 1; Myers, *Iron Men and Copper Wires*, 24-31.

[4] Fowler, *Hydroelectric Power Systems of California*, 1-2.

[5] Myers, *Iron Men and Copper Wires*, 39.

Charles M. Coleman, *PG&E of California: The Centennial Story of Pacific Gas and Electric Company 1952-1952* (New York: McGraw-Hill Book Company Inc., 1953), 146-148.

[7] Coleman, *PG&E of California*, 257.

south, serving dozens of communities in between.[8] In 1907, Edison Electric completed its Kern River No. 1 hydroelectric plant in Kern Canyon. This 118-mile long transmission line delivered power to Los Angeles, carrying a 75,000-volt line, and was the first line entirely to use steel towers. The Wind Engine Company, a windmill manufacturer, supplied the towers.[9] In 1908, the Great Western Power Company completed its hydroelectric plant at Big Bend on the Feather River, and by January 1909 began sending electrical power to the Bay Area via its 165-mile stretch of transmission lines.[10] It was at this time, in late 1908, that SEP built its power plant on the Stanislaus River. The Stanislaus-Mission San Jose line, later coupled with the S&SFP Stanislaus-San Francisco line, served communities in Calaveras, San Joaquin, Alameda, Santa Clara, and San Mateo counties. By the spring of 1909, the major hydroelectric companies of Northern California, including CG&E, SEP, Great Western, and the American River Power Company, had a network of long-distance transmission lines in place that criss-crossed the state.

The oldest line of transmission towers within the project area is the SEP Line, built in 1908. SEP was a subsidiary of the Stanislaus Water Power Company (SWP), organized in 1905 for the purpose of exploiting hydroelectric power potential of the Stanislaus River in Tuolumne County. Between 1905 and 1908 SWP began construction of its hydroelectric system that eventually included several power houses, dams and reservoirs, substations, transmission lines, and distribution lines. The central and most important resource in the SWP system was the Stanislaus Power House, built by the Union Construction Company and completed in 1908.

Just prior to the completion of its Stanislaus Power House, SWP formed SEP, a subsidiary company created for the purpose of distributing the electrical power throughout several Northern California counties. In early 1908, SEP began construction of its main transmission line. The company's original plan was to extend the line from the Stanislaus Power House to lucrative electric markets in San Francisco, a distance of 137 miles. However, when the power house became operational in 1908, the line only reached 96 miles, terminating at the CG&E-owned Mission San Jose Substation near Newark in southwest Alameda County. SEP sold its electricity to CG&E, so that the latter could distribute the energy to its East Bay and San Francisco markets. The SEP Stanislaus-Mission San Jose Line also served SEP customers along its route in communities in Calaveras, San Joaquin, and Alameda counties.[11]

The entire length of the SEP Line, including that segment within the project area, consisted of galvanized steel towers that carried a single circuit (three lines) of 60 kilovolt transmission lines (conductors) on strain or

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[8] Galloway and Markwart Consulting Engineers, "Map of Central California Showing Principal Power Plants and Transmission Lines." In: J.D. Galloway, "Report on the Stanislaus Electric Power Company on the Stanislaus River, California," March 1909; Fowler, *Hydroelectric Power Systems of California*, 273-274.

[9] Myers, *Iron Men and Copper Wires*, 44-47.

[10] Jackson Research Projects, "Great Western Power Company: Hydroelectric Power Development on the North Fork of the Feather River, 1902-1930," prepared for PG&E, 1986, 96, 102; Fowler, *Hydroelectric Power Systems of California*, 275.

[11] Pacific Gas and Electric Company, *Annual Report of the Department of Electrical Operation and Maintenance* (1930), 93; Sierra San Francisco Power Company (S&SFP), *The Stanislaus Power Development* (New York: Sanderson & Porter, 1909), 19; Fowler, *Hydroelectric Power Systems of California*, 286-288.

suspension insulators. The towers were spaced an average of 750 feet apart, although this distance varied because of differences in the terrain. The engineering firm of Sanderson & Porter, New York, oversaw the installation of the transmission towers and component parts. Interestingly, a windmill company, the Aermotor Company of Chicago, provided the towers, which were sent to the site broken down and bundled. Each of the steel members were numbered so that they could be quickly and easily assembled at the site. Two teams of workers installed the towers and electrical components. The first team, traveling in groups of 35, was responsible for setting the anchors into the ground, assembling the tower, and hoisting it into its upright position. This crew could erect an average of five towers each day. The second crew was responsible for installing the insulators and conductors, and did so at an average rate of one and three quarter miles of three-circuit line each day. The towers followed a standard design for the length of the line, although the heights sometimes varied. Some were taller than others in order to provide adequate clearance across waterways, and others were shorter, especially along steep grades.[12]

The original conductors, furnished by the American Wire and Steel Company, consisted of six strands of medium hard drawn copper around a hemp center. The hemp core, a non-conductive material, was selected in favor of a steel core because of better durability when used to carry higher voltages. However, in his 1909 report on the SEP Stanislaus-Mission San Jose line, consulting engineer J.D. Galloway noted his disapproval with using a hemp core, stating that it will decay over time and will tend to lengthen and sag. PG&E records indicate that 202 miles of the line's original conductors were replaced in the San Joaquin and East Bay Divisions in 1936. It is likely that most or all of the conductors within the project area were replaced at that time.[13]

The original insulators used on the SEP Line were a departure from the insulators typically used at the turn of the century. Although the line originally carried 60 kilovolts of electricity, the SEP intended to increase this number to 110 kilovolts within a few year's time. The usual pin type insulator then in wide use was incapable of carrying such a pressure. The SEP decided to employ suspension-type insulators, consisting of five separate porcelain units. Each unit was made of two ½ inch thick shells fastened together with Portland cement. Designed jointly by the Locke Insulator Manufacturing Company of Victor, New York, and the consulting engineers on the project, Sanderson & Porter, this configuration worked well under heavy mechanical and electrical strain because of its strength and flexibility.[14] It appears, however, that in later years both the Sierra & San Francisco Power Company and Pacific Gas & Electric systematically replaced the original insulators on the line. PG&E records indicate that in 1931 the S&SFP replaced 1,500 insulators between the Stanislaus Power House and the City of Tracy, just east of the project area. In 1936, PG&E replaced 500 more in the San Joaquin Division. An additional 2,000 insulators in the Stockton Division were replaced in 1940 and 1944.[15] Although these records do not make it clear whether or not the insulators within the project area were replaced, observations in the field seem to indicate that

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[12] S&SFP, *The Stanislaus Power Development*, 15-20.

[13] Stephen Dunn, "The System of the Sierra & San Francisco Power Company," 1917. Bachelor of Science Thesis, University of California, Berkeley.; J.D. Galloway, "Report on the Stanislaus Electric Power Company on the Stanislaus River, California," March 1909, 18-19; Pacific Gas & Electric, "Index to the General Maintenance Authority Jobs," provided by PG&E on October 17, 2000.

[14] S&SFP, *The Stanislaus Power Development*, 19-20; Dunn, "The System of the Sierra & San Francisco," 79-80.

[15] PG&E Index to the General Maintenance Authority Jobs.

they were. As described above, the original insulator groups utilized five porcelain elements. The towers presently use nine-element insulators. It is likely that they replaced the out-of-date insulators with entirely new sets that reflected advances in insulator technology.

Although SEP was successful in establishing its hydroelectric plant with the construction of the Stanislaus Power House and the Stanislaus-Mission San Jose transmission line, the company nonetheless fell on financial hard times. In 1908 the Knickerbocker Trust Company of New York, financial backers of SEP, suffered a financial failure and were forced to temporarily close. The SEP was subsequently placed in receivership. The United Railways Investment Company, a corporation seeking to develop electric railroad systems in San Francisco, saw the opportunity to refinance the struggling company and acquire its newly established system for its own uses. In May 1909 United Railways created the S&SFP. The goal of S&SFP was to acquire the SEP power system and extend the SEP Stanislaus-Mission San Jose Line to San Francisco, where it would provide power to its electric rail system and other local customers. In August 1909 the S&SFP achieved its first goal, acquiring at auction the Stanislaus Power House, the Stanislaus-Mission San Jose transmission line, and all other holdings of the then defunct SEP.[16]

Almost immediately following S&SFP's acquisition of the SEP system, the new company began expanding main transmission line from Mission San Jose to San Francisco. At the same time, the company also began construction on a second line that would ultimately extend from Stanislaus Power House to San Francisco, closely paralleling the 1908 SEP line for its entire length. Construction of the two new lines began in September 1909 and continued into the spring of 1910. On April 13, 1910, the lines reached San Francisco and began supplying power to the United Railroads system.[17]

The 1909-1910 S&SFP transmission line, although built by a different company, closely followed the basic design and engineering standards of the 1908 SEP line. The conductors were 60 kilovolt lines with the capability of carrying 114 kilovolts, and the same insulator configurations were used. The main difference between the older SEP and newer S&SFP lines was in the design of the transmission towers. Although the towers were supplied by the same manufacturer, the Aermotor Company, and consisted of similar galvanized steel components, the newer towers were slightly larger and had a different configuration at the peak. This difference in design was required by the fact that the new towers were double circuit towers, capable of holding six conductors rather than three.[18]

The S&SFP line, when completed, stretched 137 miles from the Stanislaus Power House to the Bay Shore Substation in San Francisco, on its way passing through Calaveras, San Joaquin, Alameda, Santa Clara, and San

[16] Fowler, *Hydroelectric Power Systems of California*, 287-288.
[17] Fowler, *Hydroelectric Power Systems of California*, 288-289; S&SFP, *The Stanislaus Power Development*, 18.
[18] S&SFP, *The Stanislaus Power Development*, 14-20; Dunn, "The System of the Sierra & San Francisco," 77-80.

Mateo counties. In 1910, the voltage of the lines was increased from 60 kilovolts to 114 kilovolts, and has remained at that level ever since.

The S&SFP continued to own and operate the Stanislaus-San Francisco Line until 1936, although PG&E began leasing the line in January 1920.[19] In 1936 the Sierra & San Francisco Power Company dissolved, and PG&E subsequently assumed ownership of all S&SFP assets.[20] PG&E has continuously owned and operated the parallel Stanislaus-San Francisco lines since that time. In the company's 1930 annual operations and maintenance report, PG&E refers to the two lines as both the "Stanislaus-San Francisco Line" and "Line 200."[21] Currently it is referred to as the "Stanislaus-Newark Line." It appears that PG&E has not made any substantial alterations to the alignment of the Stanislaus-Newark line, and the majority of the original towers appear to be intact. PG&E maintenance records do show that a small number of individual sets of towers were added or replaced as necessary along the line, but there have been no large-scale replacement projects anywhere along its length.[22]

Discussion of Significance

The transmission lines appear to retain a high degree of integrity. Available documentation indicates that its physical features, including design, materials and workmanship, are essentially unaltered. While PG&E maintenance records indicate it is likely the original conductors and insulators have been replaced, the towers appear to be original. Also the location, setting, feeling, and association of the towers remain intact, although it is somewhat diminished as a result of encroachment of modern Highway 84 and recent residential developments along some of its length.

Although the transmission lines retain integrity, they do not appear to meet any of the National Register's significance criteria. The potential of the SEP and S&SFP transmission lines to qualify for listing under Criterion A lies with their associations with the growth of the hydroelectric industry in California, and the development of long-distance high voltage electrical transmission systems. As discussed in Section 3.1 above, the SEP and S&SFP transmission lines were built between 1908 and 1910. This was an active period of hydroelectric development in California, with several companies, including Great Western Power, CG&E, and the American River Power Company, greatly expanding their transmission systems. Although the SEP and S&SFP transmission lines are properties that represent this period of growth, they do not appear to be important or pioneering examples. Transmission lines that would meet the requirements of Criterion A would need to represent pioneering events or trends in long-distance, high-voltage electric transmission. The SEP and S&SFP lines were not the first to carry high-voltage electricity over a great distance, nor were they the first to use steel towers rather than wooden ones. On the contrary, they are typical examples of transmission lines for their period, utilizing

[19] Fowler, *Hydroelectric Power Systems of California,* 286.

[20] Sierra & San Francisco Power Company, "Certificate of Winding Up and Dissolution," July 30, 1936. On file at the California State Archives, Sacramento.

[21] Pacific Gas and Electric Company, *Annual Report of the Department of Electrical Operation and Maintenance* (1930).

[22] PG&E Index to the General Maintenance Authority Jobs.

commonly accepted technology and engineering principles that were the result of nearly three decades of development.

Under Criterion B, the potential for eligibility lies with the transmission lines' associations with John Debo Galloway, a prominent figure in early hydroelectric developments in California. Galloway (1869-1943) was educated at the Rose Polytechnic Institute in Terre Haute, Indiana. He began his engineering career in the 1890s, first for a railroad in the Pacific Northwest, then for two San Francisco firms. His early work involved the design and construction of bridges, harbors, sewers, and the foundations and steel frames for buildings. Beginning in 1900, Galloway became an independent contractor and shifted his focus to hydroelectric engineering. He designed and supervised the construction of several hydroelectric plants, including the first two plants for the California Electric Power Company that later became a part of the PG&E system. He also directed the design and construction of the PG&E cable span across the Straits of Carquinez, near Benicia, at the time the world's longest.[23] His association with the Stanislaus Electric Power Company came in March 1909 when, acting in the role of consulting engineer, he authored a report summarizing the design and construction progress of the Stanislaus Electric Power Company system. The intent of the document was to inform investors in the company about the state of the physical plant, as well as the performance of the management.[24]

Galloway also drew plans for the Great Western Power Company illustrating the design of transmission towers that are nearly identical to those used along the SEP line. It is unclear whether or not the plans, dated February 1909, were also used by SEP. As discussed further below, a windmill manufacturing company based in Chicago provided the towers for the SEP line; it is likely that the towers were based on a standard or modified company plan.

Although J.D. Galloway was an important member of the engineering community during the early 1900s, and was involved in the design and engineering of several large-scale hydroelectric systems in California, he does not appear to have strong associations with the development of the SEP transmission lines. Acting as consulting engineer for the company in 1909, his role was limited to summarizing and evaluating the existing system. It is also possible that he designed the towers that the SEP, and later the S&SFP, used in their transmission lines. This association, however, is not well documented and is speculative, at best. Therefore, the SEP and S&SFP lines do not appear to meet the eligibility requirements of Criterion B.

The transmission towers that comprise the PG&E Stanislaus-Newark Line do not appear to meet the requirements of Criterion C. Towers that would be eligible for listing under this criterion would represent distinctive or pioneering engineering features in the field of long distance power transmission. This does not appear to be the

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23 Walter L. Huber, Henry D. Dewell, and A. Kempkey, "Memoir of John Debo Galloway," *Transactions of the ASCE,* Volume (1943): 1451-56.

24 Galloway, "Report on the Stanislaus Electric Power Company," March 1909.

*Resource Name or # (Assigned by recorder) Stanislaus-Newark Circuits # 1 & #2

*Recorded by B. Larson / P. Ferrell *Date October 6, 2000 ☒ Continuation ☐ Update

case. The transmission towers that comprise both the SEP and S&SFP lines were commonplace prefabricated structures. Each of the approximately 1,800 towers was manufactured by the Aermotor Company of Chicago, shipped broken down and bundled, and assembled at the construction site. The Aermotor Company, founded in 1888, was chiefly in the field of manufacturing easy-to-assemble windmills and towers. The design of the transmission towers closely resembles that of the windmill towers, both of them featuring galvanized steel components with horizontal and diagonal cross bracing. Although it is unknown whether or not the Aermotor Company also supplied transmission towers to other hydroelectric companies in the early 1900s, it does appear that the general design was in wide use throughout California. In 1908, the Great Western Power Company used nearly identical towers along its long distance transmission line from Big Bend to Oakland.[25] In the following years such companies as the Southern Sierras Power Company, CG&E, and Southern California Edison Company were all using towers similar to those along S&SFP's Stanislaus-San Francisco line.[26] Because the towers are commonplace, prefabricated structures of a standard design, the transmission lines do not appear to be eligible for listing for the National Register under Criterion C.

Additionally, the SEP and S&SFP transmission lines have been evaluated in accordance with Section 15064.5(a)(2)-(3) of the CEQA Guidelines, using criteria outlined in Section 5024.1 of the California Public Resources Code. It is determined that they are not historical resources for the purposes of CEQA.

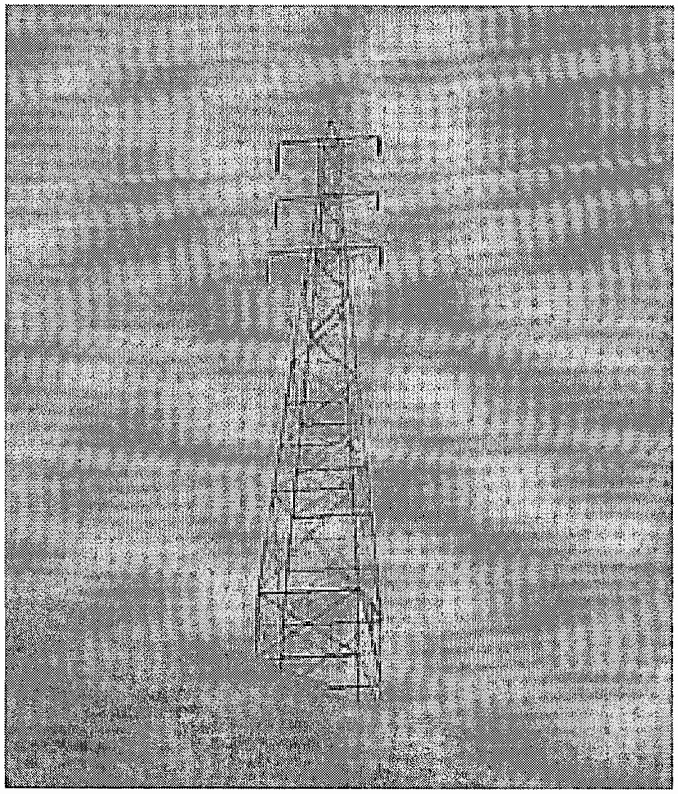
[25] Jackson Research Projects, "Great Western Power Company," 116.

[26] Walter Leroy Huber, "Photographs of Hydro-electric Power Plants and Canal Companies in California, 1911-1916," (Folder 641); and Walter Leroy Huber, "Photographs of Pacific Gas and Electric Company and Other Electric Power Plants, 1913-1932," (Folder 642). On file at the Water Resources Center & Archives, University of California, Berkeley; Meyers, *Iron Men and Copper Wires*, 79.

 *Resource Name or # (Assigned by recorder) Stanislaus-Newark Circuits # 1 & #2

*Recorded by B. Larson / P. Ferrell *Date October 6, 2000 ☒ Continuation ☐ Update

P5b. Photographs (Continued)

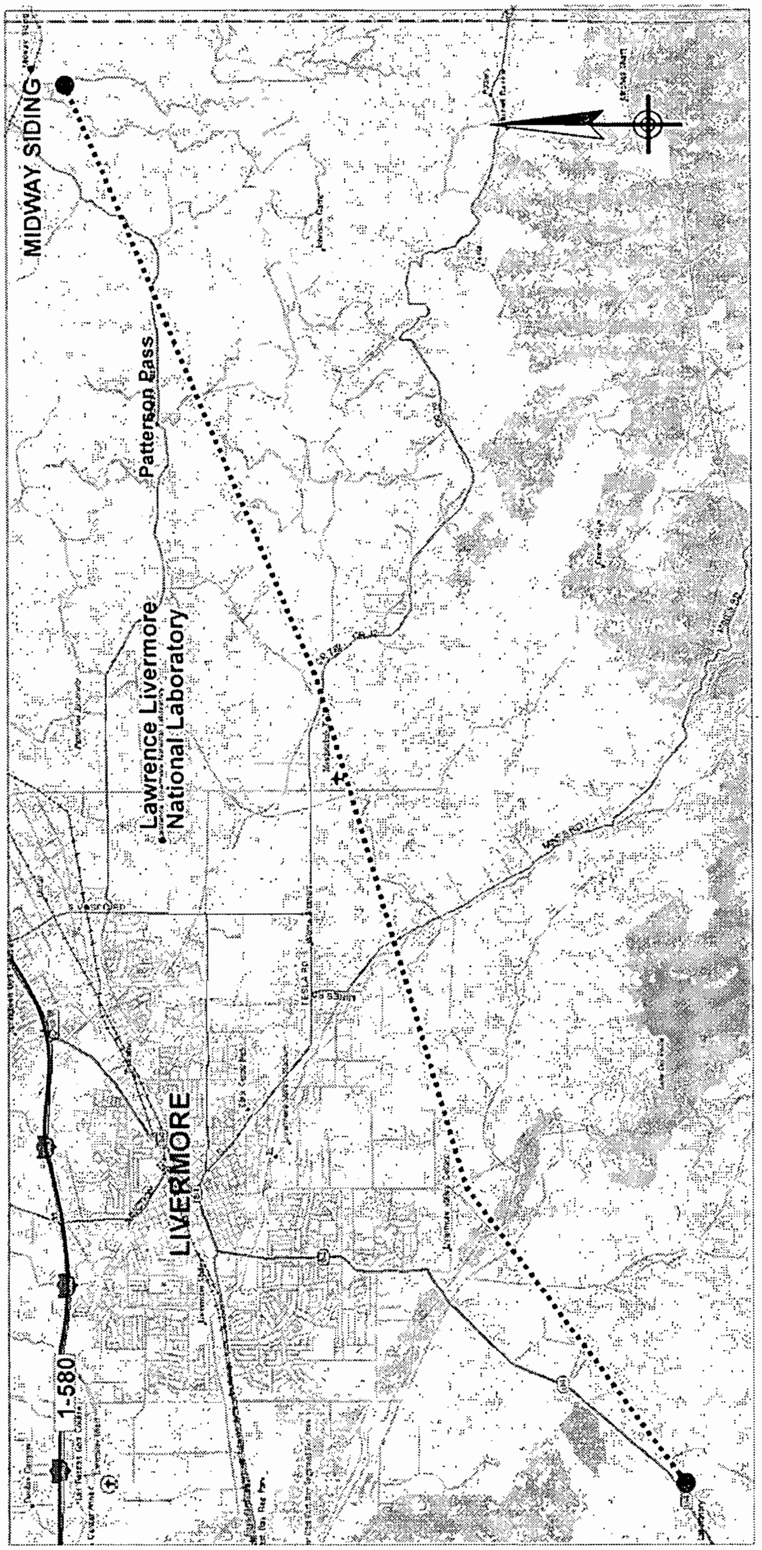


Photograph 2. Typical Double Circuit Tower (built 1909-1910)

Page 13 of 13 *Resource Name or # (Assigned by recorder) Stanislaus-Newark Circuits # 1 & #2

*Recorded by B. Larson / P. Ferrell *Date October 6, 2000 ☒ Continuation ☐ Update

Sketch Map (Continued)



State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD

Primary # ________
HRI # ________
Trinomial ________
NRHP Status Code 6

Other Listings ________
Review Code ________ Reviewer ________ Date ________

 ***Resource Name or #** (Assigned by recorder) Tesla Substation Transmission Line

P1. Other Identifier: 1965 PG&E Line

***P2. Location:** ☐ **Not for Publication** ☒ **Unrestricted** ***a. County** Alameda

and (P2b and P2c or P2d. Attach a Location Map as necessary.)

***b. USGS 7.5' Quad** Midway **Date** 1953, photorevised 1968 **T** ___; **R** ___; ___ ¼ **of Sec** ___; ___ **B.M.**

c. Address ________ City ________ Zip ________

d. UTM: (give more than one for large and/or linear resources) See Continuation Sheet

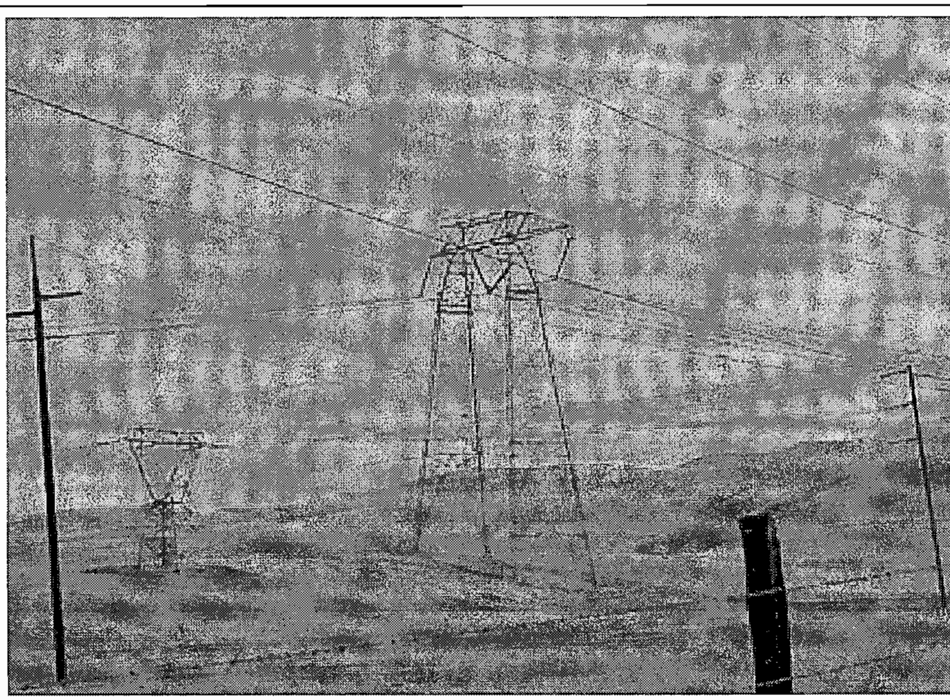
e. Other Locational Data: (e.g., parcel #, directions to resource, elevation, etc., as appropriate)

***P3a. Description:** (Describe resource and its major elements. Include design, materials, condition, alterations, size, setting, and boundaries)

This line is a relatively short segment (approximately two miles) of newer towers, running north from its junction with the Stanislaus-Newark Line to the Tesla Substation near Midway. PG&E built these towers in 1965, and they are substantially larger than the older generation of towers along the Stanislaus-Newark Line. They are also configured much differently. The steel structures have two separate sets of supports, each consisting of two legs resting on above-ground concrete footings. The legs are braced with diagonal and horizontal members from top to bottom. (See Continuation Sheet)

***P3b. Resource Attributes:** (List attributes and codes) HP11 (Engineering Structure)

***P4. Resources Present:** ☐ Building ☒ Structure ☐ Object ☐ Site ☐ District ☐ Element of District ☐ Other (Isolates, etc.)



P5b. Description of Photo: (View, date, accession #) October 6, 2000; typ tower south of Tesla Substation

***P6. Date Constructed/Age and Sources:** ☒ Historic ☐ Prehistoric ☐ Both
1965

***P7. Owner and Address:**
Pacific Gas & Electric
77 Beale Street
San Francisco, California 94105

***P8. Recorded by:** (Name, affiliation, address)
Paul Ferrell & Bryan Larson
JRP Historical Consulting Services
1490 Drew Ave, Suite 110
Davis, CA 95616

***P9. Date Recorded:** October 6, 2000

***P10. Survey Type:** (Describe)
Intensive

***P11. Report Citation:** (Cite survey report and other sources, or enter "none.") "Historic Resources Inventory and Evaluation Report, Transmission Lines in the Stanislaus Corridor, Alameda County, California," October 2000.

***Attachments:** NONE ☐ Location Map ☒ Sketch Map ☒ Continuation Sheet ☒ Building, Structure, and Object Record ☐ Archaeological Record ☐ District Record ☐ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record ☐ Artifact Record ☐ Photograph Record ☐ Other (list) ________

BUILDING, STRUCTURE, AND OBJECT RECORD

***NRHP Status Code** 6

***Resource Name or #** (Assigned by recorder) Tesla Substation Transmission Lines

B1. Historic Name: Tesla Substation Transmission Lines

B2. Common Name: Tesla Substation Transmission Lines

B3. Original Use: 230/115 kV Transmission Line B4. Present Use: 230/115 kV Transmission Line

***B5. Architectural Style:** n/a

***B6. Construction History:** (Construction date, alteration, and date of alterations) 1965

***B7. Moved?** ☒ **No** ☐ **Yes** ☐ **Unknown** **Date:** _____ **Original Location:** _____

***B8. Related Features:** None

B9. Architect: Unknown b. Builder: PG&E

***B10. Significance: Theme** n/a **Area** n/a

Period of Significance n/a **Property Type** n/a **Applicable Criteria** n/a

(Discuss importance in terms of historical or architectural context as defined by theme, period, and geographic scope. Also address integrity.)

In December 1964 PG&E purchased the right-of-way rights to connect the Stanislaus-Newark transmission line to the Tesla Substation near Midway. In July 1965 the construction of the Tesla Substation connecting line was completed. The 2.2-mile line of double circuit towers was built to carry 230/115 kilovolts north to the substation. The project, which included a transformer bank at the substation, cost $1,332,000 to build. (See Continuation Sheet)

B11. Additional Resource Attributes: (List attributes and codes) ___

***B12. References:** JRP Historical Consulting Services, "Historic Resources Inventory and Evaluation Report, Transmission Lines in the Stanislaus Corridor, Alameda County, California," October 2000.

B13. Remarks:

***B14. Evaluator:** R. Herbert / P. Ferrell

***Date of Evaluation:** October 2000

(This space reserved for official comments.)

See Continuation Sheet

P2d. Location:

The 2.2 mile long transmission line runs northward from the Stanislaus–Newark transmission line at UTM coordinates: Zone 10 / 625350mE / 4171771mN; through the approximate midpoint at Zone 10 / 625894mE / 4173597mN; and on to connect with the Tesla Substation at: Zone 10 / 626162mE / 4174947mN.

P3a. Description (continued):

A steel lattice element, oriented horizontally, joins the two supports and carries the insulators. The towers that comprise this segment appear uniform; however, many of the towers on the southern end of this line were inaccessible and could not be observed.

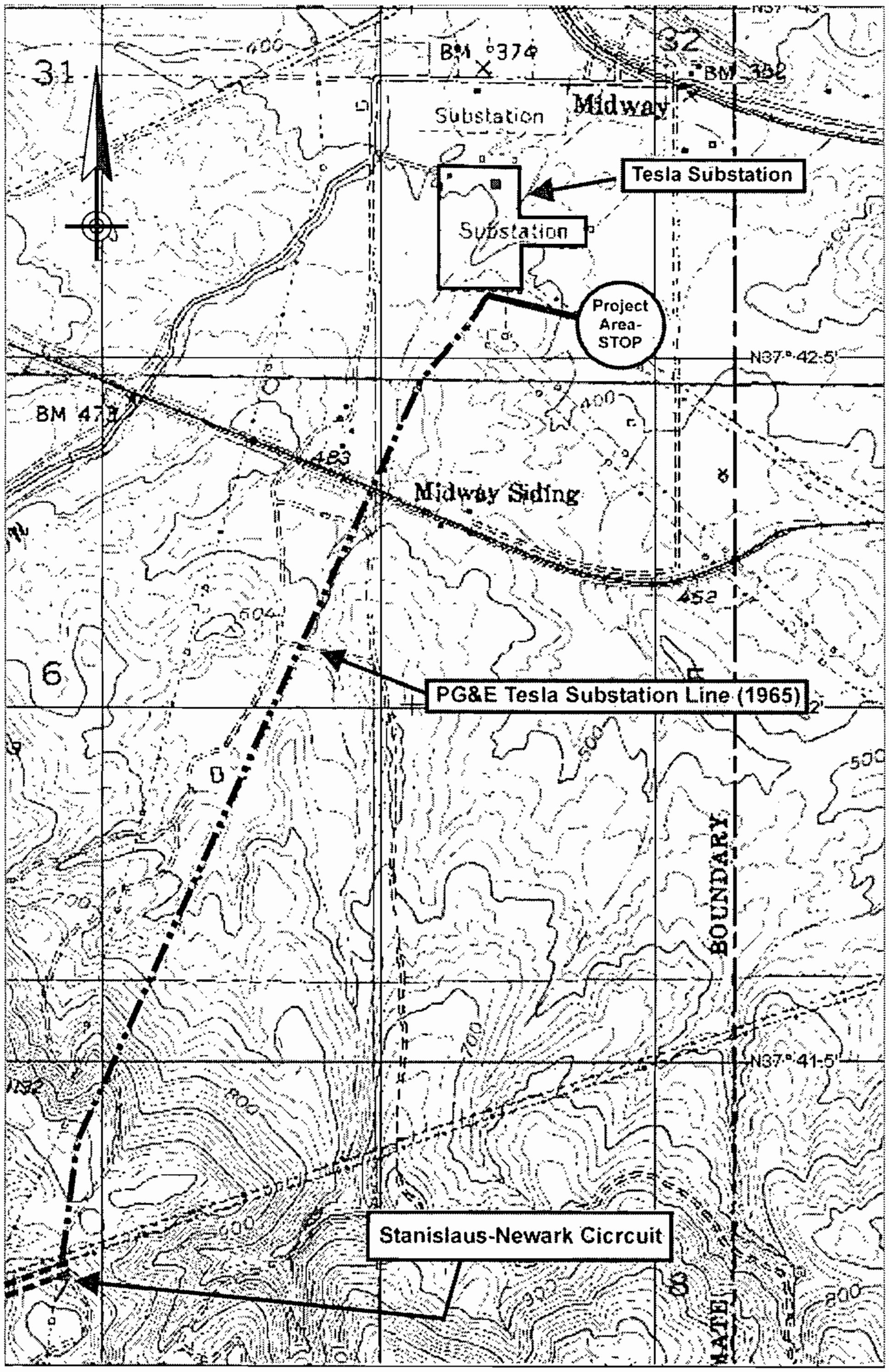
B10. Significance (continued):

The PG&E Tesla Substation Line does not appear to meet the criteria for listing in the National Register of Historic Places. The connecting line today still functions and retains a high degree of integrity. The structure meets the National Register's guidelines regarding aspects of integrity. Available documentation indicates tha physical features, including design, materials and workmanship, are essentially unaltered. Also its location, setting, feeling, and association remain intact. Although it retains integrity, the structure fails to meet any of the National Register's significance criteria. The line does not appear eligible under Criterion A because it has not "made a significant contribution to the broad patterns of our history." There is nothing to indicate that the construction of this line was linked to any pioneering advancements in the field of electrical transmission. Furthermore, research did not indicate that it was associated with any persons known to have made important advancements in the engineering or construction of high-voltage transmission lines. The line, therefore, does not appear to meet the requirements of Criterion B. Also, the PG&E Tesla Substation line does not appear to qualify under Criterion C. The towers are modern examples of a standard design, do not appear to be the first of their kind, and represent a type of junction line common to the area. Finally, the line was constructed within the past fifty years and would need to be of "exceptional importance" under Consideration G to be listed in the National Register. It is not. Therefore, the 2.2-mile connecting transmission line at the Tesla Substation does not appear to meet the criteria for listing in the National Register of Historic Places. Additionally, this property has been evaluated in accordance with Section 15064.5(a)(2)-(3) of the CEQA Guidelines, using criteria outlined in Section 5024.1 of the California Public Resources Code, and determined that it is not a historical resource for the purposes of CEQA.

*Resource Name or # (Assigned by recorder) Tesla Substation Transmission Line

*Recorded by B. Larson / P. Ferrell *Date October 6, 2000 ☒ Continuation ☐ Update

Sketch Map (Continued)



GWF Tracy Combined Cycle Power Plant Project

(08-AFC-7)

Five Copies of Attachment DR25-1

GWF Power LLC, Tracy Peaker Plant, Engineering Geology Report, B&V Project No. 69516 December 2001

Submitted to

California Energy Commission

Submitted by

GWF Energy, LLC

November 2008

With Assistance from

CH2MHILL

2485 Natomas Park Drive
Suite 600
Sacramento, CA 95833

GWF Power, LLC
Tracy Peaker Plant

Engineering Geology Report
B&V Project No. 69516

December 2001

Black & Veatch Corporation

GWF Power, LLC
Tracy Peaker Power Plant

Engineering Geology Report
B&V File 69518.41.0607
December 2001

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED CERTIFIED ENGINEERING GEOLOGIST UNDER THE LAWS OF THE STATE OF CALIFORNIA

Signed Norman B Holtt

Date 12-14-01 Registration No. EG 1991

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1.0 Introduction

1.1 Purpose and Scope

The purpose of this report is to provide an evaluation of the geology, geologic hazards, and adequacy of intended land use at the Tracy Peaker Project site. The report was prepared using available geologic maps, literature, and observations from two phases of site investigations.

This report was prepared in conjunction with geotechnical investigations performed at the site and summarized in the report entitled "GFW Tracy, Geotechnical Design Report" (Black & Veatch Corporation, November 2001). The investigations included soil borings, cone penetrometer soundings, test pits, infiltrometer tests, soil resistivity tests, and associated laboratory testing. The results of the investigations are presented in this report only to the extent necessary to document its findings. The complete data, including boring logs, test pit logs, penetrometer logs, and laboratory testing results are found in the Geotechnical Design Report.

The analysis and the following conclusions in this report were based on available literature at the time of the report, the site conditions existing at the time of the subsurface investigations, and the assumption that the information obtained from the investigation borings is representative of the subsurface conditions throughout the site. This report was prepared solely for the benefit of GWF Energy, LCC ("Client") by Black & Veatch Corporation under the terms and conditions of the written agreement dated July 6, 2001 between Client and B&V ("the Agreement"), and is based on information not within the control of Client or B&V. Neither Client nor B&V have made an analysis, verified, or rendered an independent judgment of the validity of the information provided by others. WHILE IT IS BELIEVED THAT THE INFORMATION, DATA AND OPINIONS CONTAINED HEREIN WILL BE RELIABLE UNDER THE CONDITIONS AND SUBJECT TO THE LIMITATIONS SET FORTH HEREIN, CLIENT AND B&V DO NOT GUARANTEE THE ACCURACY THEREOF. EXCEPT AS OTHERWISE ALLOWED BY THE AGREEMENT, THIS REPORT MAY NOT BE RELIED ON OR USED BY ANYONE WITHOUT THE EXPRESS WRITTEN AUTHORIZATION OF B&V, AND SUCH USE SHALL CONSTITUTE AGREEMENT BY THE USER THAT IT'S RIGHTS, IF ANY, ARISING FROM THIS REPORT SHALL BE SUBJECT TO THE TERMS OF THE B&V AUTHORIZATION, AND IN NO EVENT SHALL USER'S RIGHTS, IF ANY, EXCEED THOSE OF CLIENT UNDER THE AGREEMENT.

1.2 Project Description

The Tracy Peaker Project will be an electrical generating facility providing 168 megawatts of peaking power. The peaker plant will consist of two simple-cycle, natural gas combustion turbines with selective catalytic reduction (SCR) systems and discharge stacks, two transformers, and associated power generation equipment. A 115-kV substation will be located to the south of the units. Transmission lines will run to the east to a dead end structure and then to the north to a takeoff area that will connect the distribution lines with the existing power lines that run across the east side of the site. A detention pond will be constructed to the west of the power block for surface runoff water and an administration/control building and tank area will be constructed to the southwest of the power block.

2.0 Site Location and Conditions

The Tracy Project site is located on a 9-acre fenced area of a 40-acre parcel of a former fallow field. The 40-acre parcel is within an unincorporated portion of San Joaquin County. The site area is located between Lammers Road and Mountain House Parkway in Tracy, California, approximately 20 miles southwest of Stockton, California. The site is bounded by the Delta Mendota Canal to the southwest, a Southern Pacific Railroad spur to the north, and fallow fields to the east and west. Transmission lines run across the 40-acre parcel on the southeast and northeast corners of the site area. A site location map is shown in Figure 2-1.

The site slopes gently and uniformly to the northeast, at less than 2% grade, away from the Delta Mendota Canal. The site is a rural, presently fallow, agricultural field with no streams on the parcel. A buried 42-inch diameter gas pipeline passing along the northeast side of the future plant will provide fuel to the facility.

3.0 Regional Geology

The Tracy Project site is situated in the Great Valley geomorphic province of California. The Great Valley is a structural trough, over 400 miles long and averaging 50 miles in width, filled with late Jurassic to Recent sediments (Oakeshott, 1978). This broad, flat plain, lying mostly between a few feet below and about 1,000 feet above sea level with few topographic prominences, is surrounded by mountains: the Coastal Ranges on the west, the Sierra Nevada on the east, the Tehachapi Mountains on the south and the Klamath Mountains on the north (Figure 3.1). The flat plain is broken only by the Sutter Buttes, a volcanic plug north of Sacramento near Marysville, and a series of northwest trending, anticlinal ridges along the western valley margin, the most prominent of which is the Kettleman Hills. Figure 3.2 is a geologic map of the region around the project site.

3.1 Structure

The Great Valley synclinal basin plunges generally to the south. It is geographically and structurally divided into two valley segments by the fault-uplifted Stockton Arch: the Sacramento Valley to the north and the San Joaquin Valley to the south, named after the principal river in each segment. The San Joaquin Valley is further divided by another fault-controlled arch near Bakersfield. The Great Valley sedimentary basin is deepest south of the Bakersfield Arch. The Tracy Project is located just south of the Stockton Fault in the extreme northwest corner of the San Joaquin Valley.

The Great Valley is an asymmetric synclinal basin (Figure 3.3). On the east, the sedimentary valley fill dips gently to the west and feathers out eastward onto the Paleozoic through late Jurassic, metamorphic and Triassic through Cretaceous, igneous rocks of the Sierra Nevada foothills. On the west, the sediments are faulted and turned up against the late Jurassic through Paleogene, Franciscan assemblage of the Coastal Ranges that include deep ocean sediments, volcanics, and metamorphic rocks.

Basement rock under most of the valley is metamorphic and igneous rock of the Sierra Nevada (Sierra block), extending westward below the valley sediment to near the deepest part of the basin (Norris and Webb, 1976). On the west, basement consists of Franciscan rocks of the Coastal Range block, possibly underlain by ultra basic rock typical of ocean basins. The two basement blocks are thought to be in fault contact.

The basin originally developed as a forearc basin along an Andean type continental margin (the Sierra block), the Farallon plate subducted beneath the North American plate during late Jurassic through Paleogene time (Dickinson, 1981). The Franciscan assemblage rocks of the Coastal Range block formed in the coeval subduction zone and were welded to the continental margin during this time. By the end of the Cretaceous Period the forearc basin began to fill and sedimentation became more restricted. At the opening of the Miocene Epoch, as cessation of subduction followed collision of the Pacific spreading center with the North American plate, the style of deformation along the California coast progressively altered to the present transform tectonics. Sedimentation in the Great Valley continued through the Neogene but in more restricted, linear and episodic basins that were probably fault controlled.

3.2 Stratigraphy

The Great Valley has been filled with a great thickness of late Jurassic to Recent sediments (Hackel, 1966). The Jurassic, Cretaceous, and Tertiary rocks are primarily of marine origin and are clastic, siltstone, claystone, and sandstone in order of dominance. Limestone is present in only minor quantities. The proportion of continental sediments increases through the Tertiary Period. During the Pliocene Epoch, marine sedimentation was restricted to only the southwest part of the San Joaquin Valley and is composed of claystone, sandstone, and conglomerate. The continental deposits are of quite variable lithology but are primarily claystone, sandstone, and conglomerate. The Pleistocene to Recent deposits are all continental and generally grade downward into Pliocene beds of similar lithology.

Rocks of late Jurassic through Cretaceous age comprise the Great Valley Sequence that is exposed along the western margin of the Great Valley and into the Coastal Ranges. These are assigned to the late Jurassic Knoxville Formation, the lower Cretaceous Shasta Series, and the Upper Cretaceous Chico Group. They are derived from erosion of the Sierra block to the west and generally consist of relatively continuous units that can be recognized over large areas. The Great Valley sequence forms the thickest part of the sedimentary fill over the Stockton Arch and in the Tracy Project area.

The Stockton arch began to rise in the late Cretaceous or Paleocene and the rise is probably responsible for a relatively thin Tertiary cover over the arch (Bartow, 1991). Paleocene and lower Eocene rock were not deposited on the arch and upper Cretaceous rocks were truncated. The Ione Formation was deposited over part of the arch during an Eocene transgression, but is absent in the Tracy area. Sedimentation during the Oligocene Epoch was restricted to the southern part of the San Joaquin Valley. During the Miocene and Pliocene Epochs, the alluvial Valley Springs Formation was deposited over the northern San Joaquin Valley with the volcanics of the Mehrtan Formation. This was followed by fanglomerates shed off the rising Diablo Range onto the western side of the valley continuing into the Pliocene.

Pleistocene sedimentation consists of episodic fan, terrace, and channel alluvium deposits along the valley margins, grading to some lake deposits in the center. In the northern San Joaquin Valley, the Pleistocene sediments have been assigned to the Modesto, Riverbank, and Turlock Lake Formations on the east and the Tulare Formation on the west (Bartow, 1991). Alluvial sedimentation continues in the Holocene.

3.3 Tectonics and Faulting

Figure 3.4 is a map showing the major sources of earthquake activity in the project area. Present day seismicity in California south of the Mendocino triple junction is due to transform tectonics (Hill and others, 1991). The Pacific plate is sliding past the North American plate in a north-northwest direction, moving N35° to 38°W with respect to North America. The majority of this motion is accommodated by right lateral motion along the major strike slip faults of the San Andreas system. However, the average trend of the San Andreas fault in central California (about N41°W) is oblique to the plate motion, so that a small, residual component produces contractional deformation in the continental margin perpendicular to the San Andreas.

Table 3.1 is a listing of the major, active strike slip faults within 62 miles (100 kilometers) of the project site, arranged by distance to the trace (closest point). The seismic parameters and segmentation are taken from the Working Group on Northern California Earthquake Potential (WGNCEP, 1996) and the Working Group on California Earthquake Probabilities, (WGCEP, 1999). Distances to the project site were scaled on the Fault Activity Map of California and Adjacent Areas (Jennings, 1994).

Table 3.1 Major Holocene Strike-Slip Faults Within 100 Km of the Project Site

Faults	Length (miles/kilometers)	Characteristic Magnitude	Distance to Site (miles/kilometers)
Greenville	45 m/73 km	7.2	9 m/14.5 km
North Calaveras	32 m/52 km	6.8	23 m/37 km
Hayward (entire length)	53 m/86 km	7.1	27 m/43.5 km
Concord-Green Valley System	41 m/66 km	6.9	31 m/50 km
Ortigalita	41 m/66 km	6.9	32 m/52 km
South Calaveras	66 m/106 km	6.2	41 m/66 km
San Andreas (1906 rupture)	291 m/470 km	7.9	46 m/74 km
Sargent	33 m/53 km	6.8	46 m/74 km
Zayante-Vergeles	36 m/ 58 km	6.8	51 m/82 km
West Napa	19 m/30 km	6.5	53 m/85.5 km
Quien Sabe	14 m/23 km	6.4	54 m/87 km
North San Gregorio	80 m/129 km	7.3	57 m/92 km
Rodgers Creek	39 m/63 km	7.0	61 m/98 km

Most of the compressive deformation perpendicular to the San Andreas fault appears to be expressed in a system of blind thrust faulting and folding along the Coastal Range-Central Valley geomorphic boundary zone (Wong and others, 1988 and Wakabayashi and Smith, 1994), the Great Valley thrust fault system. The Great Valley thrust fault system may be due to thrusting of the more ductile Franciscan rocks of the Coastal Ranges block over the more rigid Sierran block rocks underlying the sediments of the Great Valley. It is conceived as a low angle detachment fault stepping up from the Franciscan rocks over the edge of the Sierran block into the base of the overlying Great Valley sequence sediments, producing east directed thrust/reverse faults and easterly dipping backthrusts that are responsible for uplift along the eastern margin of the Coastal Ranges. Most of the associated thrust faults do not rupture the surfaces, but terminate below northwest trending, anticlinal fault-bend ridges common along the western margin of the Great Valley. A series of three earthquakes south of the project area are attributed to blind-thrust faults associated with the Great Valley system: the M_L 5.5 New Idria event of 1982; the M_L 6.7 Coalinga event of May 2, 1983; and the M_L 6.1 Kettleman Hills event of 1985.

The Tracy segment of the Great Valley system, closest to the project site at about 1 kilometer distance, is capable of generating an M_w 6.7 earthquake (WGNCEP, 1996). Reverse faults, possibly associated with the Great Valley system and mapped near the project site, include the Midway, Black Butte and San Joaquin faults, but they do not offset Holocene deposits (Sowers and others, 1992)

The eastern San Francisco Bay region, east of the Hayward fault, is a geomorphic gap in the string of northwest trending fault-bend ridges that are the surface expression of the Great Valley thrust fault system (Unruh and Lettis, 1998). The contractional folds in the East Bay region trend more westward and about 40° oblique to the major strike slip faults (the Calaveras, the Greenville, and the Concord-Green Valley faults) that trend about 15° to 30° more northward than the San Andreas and Hayward faults to the west. The more northward trend of the strike slip faults may accommodate most of the contractional deformation that is associated with thrust faulting and folding of the Great Valley thrust fault system north and south of the East Bay region, leading to a lower rate of activity on the Great Valley system in the East Bay region.

The contractional folds in the East Bay region appear to be due to the transfer of dextral slip across a restraining, left stepover between the Greenville and Concord-Green Valley faults (Unruh and Sawyer, 1997 and Unruh and Hector, 1999). This left stepover creates a contractional belt of mostly blind, thrust faults and anticlinal fault ridges, the Mount Diablo fold and thrust belt. The major structures from south to north are the Williams/Verona thrust faults, Tassajara anticline, Mount Diablo anticline, Los Medanos Hills anticline, Roe/Ryer Island anticlines, Honker-Van Sickle anticline, Suisun-Grizzly Island anticline, and the Protrero Hills anticline. The belt is bounded on the northeast by the Pittsburg-Kirby Hills fault that appears to accommodate both right lateral and reverse motion. The Pittsburg-Kirby Hills fault, located about 31 miles (50 kilometers) from the project site, has a relatively short trace of about 12 miles (20 kilometers). The largest fault associated with this belt, the Mount Diablo thrust fault is estimated to be capable of producing an M_w 6.25 to 6.75 earthquake (Sawyer, 1999).

3.4 Historical Seismicity

The San Francisco Bay region is one of the most seismically active in the United States. Figure 3.5 shows 66 historical earthquakes of magnitude M_w 5.0 and greater with epicenters within 62 miles (100 kilometers) of the Tracy Project site. The earliest recorded earthquakes were a swarm of 18 events occurring between June 21 and July 17 of 1808 (Toppozada and others, 1881). These were felt at the Presidio in San Francisco, where they cracked houses and damaged the barracks. The most recent large earthquake is the M_w 7.1 Loma Prieta event of October 17, 1989.

Most of the historical seismicity appears to be generated by the region's strike slip faults including the great April 18, 1906 earthquake on the San Andreas. However, six historical earthquakes and one sequence do not appear to have been centered on one of the strike-slip faults and were probably generated by either the Great Valley thrust fault system or the Mount Diablo fold and thrust fault system (Wong and others, 1988 and estimated magnitudes from Toppozada and others, 1981):

- M_L 5.8 earthquake of July 15, 1866, with possible location in the Diablo Range or the western San Joaquin Valley.
- M_L 6.0 earthquake of April 10, 1881, centered near Modesto.
- M_L 6.0 earthquake of May 19, 1889, near Antioch.
- Two M_L 6.0+ events and an M_L 5.8 aftershock near Vacaville and Winters on April 30, 1892.
- MM VII to VIII earthquake east of Vacaville, near Elmira on May 18, 1902.
- MM VII earthquake on July 24, 1903, near Willows.
- MM VI earthquake on July 30, 1904, near Winters.

4.0 Site Geology

The Tracy Project site is located near the eastern margin of the Great Valley less than 1 mile from the foothills of the Diablo Range. The site is in essentially horizontal, undifferentiated, Pleistocene, alluvial fan and terrace deposits (Figure 4.1, from Sowers and others, 1993). Soil borings at the site encountered interlayered clay, silty clay, sandy silt and clay, silty and clayey sand, sand, sandy gravel, gravelly sand, and gravel to 80-feet depth. The depth to groundwater ranges from 40 to 50 feet (Black & Veatch, 2001).

The closest mapped Quaternary faults to the site are located at the eastern margin of the Great Valley and in the foothills of the Diablo Range to the east and south, the Black Butte (1.5 miles), Midway (2.1 miles), and San Joaquin faults (3.9 miles). None of these show evidence of Holocene displacement (Jennings, 1994). Sowers and others (2000) used U-series and radiocarbon dating to determine the ages of deformed and undeformed stream terraces over the San Joaquin fault at Lone Tree Creek, south of the Tracy Project site. The underformed terrace has an age between 16,000 and 32,000 years, indicating that the latest movement on the fault is prior to that age. The Vernalis and Stockton faults intersect about 7 miles to the northeast in the Great Valley. The Vernalis and Stockton faults show no movement later than Miocene and Pliocene, respectively (Sterling, 1992).

The west Tracy fault is a steeply dipping reverse fault identified seismically in the subsurface (Sterling, 1992). This northwest trending, reverse fault dips steeply to the southwest and passes by the site on the southwest side of Tracy in areas mapped as Holocene alluvium, fan, terrace, and levee deposits (Sowers and others, 1993). The exact location is difficult to determine because it does not break the surface, but it appears to be about 3 miles from the site. Sterling (1992), however, states that it can be traced on seismic profiles into the Holocene alluvium.

Many landslides are mapped in the Diablo Range to the west of the site (Sowers, and others, 1993). The closest is about 1.5 miles to the southwest. There are no indications of instability or subsidence at the project site.

5.0 Geologic Hazards

5.1 Ground Shaking

Ground shaking during earthquakes is the primary hazard to facilities at the Tracy Project site which is in Seismic Zone 4 of the California Building Code (1998). The site is not located in any identified known active fault near-source zones (Petersen and others, 1998). The closest fault is a blind thrust (the Great Valley thrust fault system), and these are not assigned near-source zones. The closest, class B strike-slip fault, the Greenville fault, is over 10 kilometers from the site.

The National Earthquake Hazard Reduction Program of the U.S. Geologic Survey has developed seismic hazard maps for the United States. The probabilistic ground motion data can be accessed on the USGS Geohazards website by latitude and longitude. The data for the nearest available grid point to the Tracy Project site are tabulated below in Table 5-1.

Table 5.1 Tracy Project Probabilistic Ground Motion Values

PE = Exceedance Probability	% gravity, 10% PE in 50 years	% gravity, 5% PE in 50 years	% gravity, 2% PE in 50 years
PGA	45.4	61.0	80.8
0.2 sec. Spectral Acc.	110.7	134.4	186.6
0.3 sec. Spectral Acc.	105.0	128.1	181.9
1.0 sec. Spectral Acc.	37.0	49.7	72.0

The closest large seismic source to the Tracy Project site is the Great Valley thrust fault system. An earthquake on the Great Valley thrust fault system has the potential for producing the largest ground motions at the site. The Tracy segment, with a vertical projection about 0.6 miles (1 kilometer) from the site, has an M_w 6.7 characteristic earthquake (WGNCEP, 1996).

The several known reverse faults in the project area the Black Butte, Midway, San Joaquin, and West Tracy faults are ancillary structures related to the larger, deep-seated Great Valley thrust fault system. There is no historical seismicity connected to any of them. Only the West Tracy fault has any evidence of displacement in Holocene deposits, and this is indirect evidence (seismic profiling). The latest demonstrable movement on all the others is pre-Holocene. The traces of the Black Butte and Midway faults are short. The length of the Tracy fault is unknown, as is the segmentation on the San Joaquin fault.

Faulting on the Great Valley thrust fault system Tracy segment should be modeled as a blind thrust similar to that producing the Coalinga earthquake to determine potential ground motions at the project site, a deep-seated seismogenic thrust fault with ancillary, steeply dipping thrust faults splaying off toward the surface. The Coalinga thrust fault is at 8 to 10 kilometers depth (Yeats and others, 1997). On these assumptions, the seismogenic and rupture distances from the site to the Great Valley thrust are about 8 kilometers. The fault segmentation (Tracy segment) and characteristic earthquake (M_w 6.7) by the WGNCEP (1996) are be used for the estimates of ground motion.

Four sets of ground motion attenuation relationships are appropriate for determining the site ground motion, Abrahamson and Silva (1997), Boore and others (1997), Campbell (1997), and Sadigh and others (1997). The results from the four sets of attenuation relations (horizontal peak ground acceleration) and the average are presented in Table 5-2 below.

Table 5.2 Mean Ground Motions from a Great Valley Thrust Fault System Earthquake

50th Percentile	Abrahamson and Silva	Campbell	Boore and Others	Sadigh and Others	Average
Hor. PGA	0.399	0.4699	0.552	0.421	0.47

5.2 Surface Rupture

No faults have been traced to the Tracy Project site. The closest fault zoned under the Alquist-Priolo Earthquake Fault Zoning Act (Hart, 1994) is the Greenville fault at a distance of 9 miles. There is no known hazard of earthquake ground rupture at the site.

5.3 Liquefaction and Lateral Spreading

Liquefaction typically occurs when, under strong ground shaking, loose, saturated, granular soils undergo an essentially complete loss of shear strength because of pore pressure buildup. Lateral spreading can occur in ground with even very low slope when a soil stratum below the surface liquefies. Liquefaction rarely occurs in soils with standard penetration test N values of 30 or greater or at depths greater than 50 feet. Geotechnical investigations at the site (Black and Veatch Corporation, 2001) indicate relatively deep groundwater (40 to 50 feet) and high N values for the site soils. The depth of groundwater and the high density of the granular materials indicate a low potential for liquefaction or lateral spreading.

5.4 Landslides

The Preliminary Maps Showing Quaternary Geology of the Tracy and Midway 7.5-Minute Quadrangles, California (Sowers, and others, 1993) delimit landslide deposits in the project area. They are common in the Diablo Range to the west of the Tracy Project site. The nearest mapped slide is 1.5 miles to the southwest.

The land surface in the Great Valley around the project site slopes gently at less than 2 percent grade to the northeast. No landslides have been mapped in the area. There are no topographic indications of slope instability. There is very little potential for landslide or slope instability to threaten the project during its lifetime.

5.5 Subsidence

Land subsidence can be induced both by natural phenomena and human activity. Natural phenomena include tectonic deformations and seismic induced settlements; soil subsidence resulting from consolidation, hydrocompaction, or rapid sedimentation; and subsidence related to subsurface cavities. Subsidence related to human activity includes that resulting from fluid or sediment withdrawal

The San Joaquin Valley has been subsiding relative to the Sierra Nevada and the Coast Ranges because of ongoing tectonic activity. Tectonic subsidence occurs over a long period of time and will not present a hazard to the facilities at the Tracy Project site. The potential for subsidence due to seismic settlement is considered unlikely because of the dense, consolidated nature of the ground.

Land subsidence in the Great Valley resulting from human agricultural activities has been recorded north and south of the Tracy Project site (Poland and Evenson, 1966). North of the project site, in the lowlands of the San Francisco Bay Delta, the subsidence has been due to drainage and concomitant oxidation of peat deposits. To the south of the project site, the subsidence has been due to the withdrawal of groundwater for irrigation. Neither of these phenomena has been recorded at the Tracy Project site.

Hydrocompaction or collapsible soil is a type of shallow subsidence characterized by low unit weight and high porosity debris flow sediments in which soil collapse results from dissolution of water soluble cement or clay binding agents. This is a common phenomena in the arid and semiarid areas of the western United States. It was widely recognized in the San Jaoquin Valley during construction of the California Aqueduct.

Three samples of clayey sand, near surface soil (1 to 3.5-foot depth) taken from the site during geotechnical investigations were tested for collapse potential. They showed moderate collapse potential ranging from about 3.2 to 5.4 percent. These tests are detailed in GWF Tracy, Geotechnical Design Report (Black & Veatch Corporation, 2001). They demonstrate a potential for settlement and damage to site facilities resulting from hydrocompaction.

5.6 Expansive Soils

Some clay soils, primarily those containing a component of expansive montmorillinite clay minerals, have a shrink-swell potential during changes in moisture content. These are not uncommon in the western United States. Three samples of near surface (<5 feet depth) clay soil, taken from the Tracy Project site and tested, exhibited about 6% expansion upon wetting. These are detailed in the GWF Tracy Geotechnical Design Report (Black & Veatch Corporation, 2001). They demonstrate a potential for damage to project facilities because of clay shrink-swell.

5.7 Flooding

The ground surface at the Tracy Project site slopes gently but consistently to the northeast for miles. The site is not in any active stream channels or within any 500-year floodplain. The site lies in flood insurance risk zone C. It is located off the nearest, large, actively aggrading alluvial fan, Corral Hollow to the south. The potential for flooding at the project site is very low.

6.0 Conclusions

The analysis and the following conclusions in this report were based on available literature at the time of the report, the site conditions existing at the time of the subsurface investigations, and the assumption that the information obtained from the investigation borings is representative of the subsurface conditions throughout the site. There were no geologic hazards identified or observed that would preclude development of the Tracy Peaker Project plant. The proposed site is adequate for its intended use with proper design:

- No known faults cross the site; there is no hazard of fault surface rupture.
- The project site is within Seismic Zone 4 of the 1998 edition of the California Building Code. The Tracy segment of the Great Valley thrust fault system contributes the greatest hazard to the site from earthquake-induced ground shaking. The estimated peak horizontal ground acceleration at the site is 0.47g for an M_w 6.7 earthquake on the Tracy segment. The site is not located in any identified known active fault near-source zones (Petersen and others, 1998).
- The potential for soil liquefaction at the site resulting from seismic shaking is low.
- The only known subsidence hazard to the site is that from moderately collapsible soils identified at the site during the geotechnical investigations.
- Clay soils at the site have been identified as possessing shrink-swell potential.
- The potential hazard at the site from landslides or other forms of slope instability is negligible.
- Flood hazard at the site is low.

7.0 Recommendations

The Tracy Peaker Project facilities should be designed for a peak horizontal ground acceleration of 0.47g. Since this acceleration was developed from a deterministic analysis of the hazard from the seismic source, and since the site is not located in any identified known active fault near-source zones (Petersen and others, 1998), no near-source factor need be applied.

The project facility foundations should be designed to preclude damage due to soil collapse and shrink-swell. Since both of these phenomena are associated with moisture, the site should be graded to intercept and deflect surface waters away from the facilities.

8.0 References

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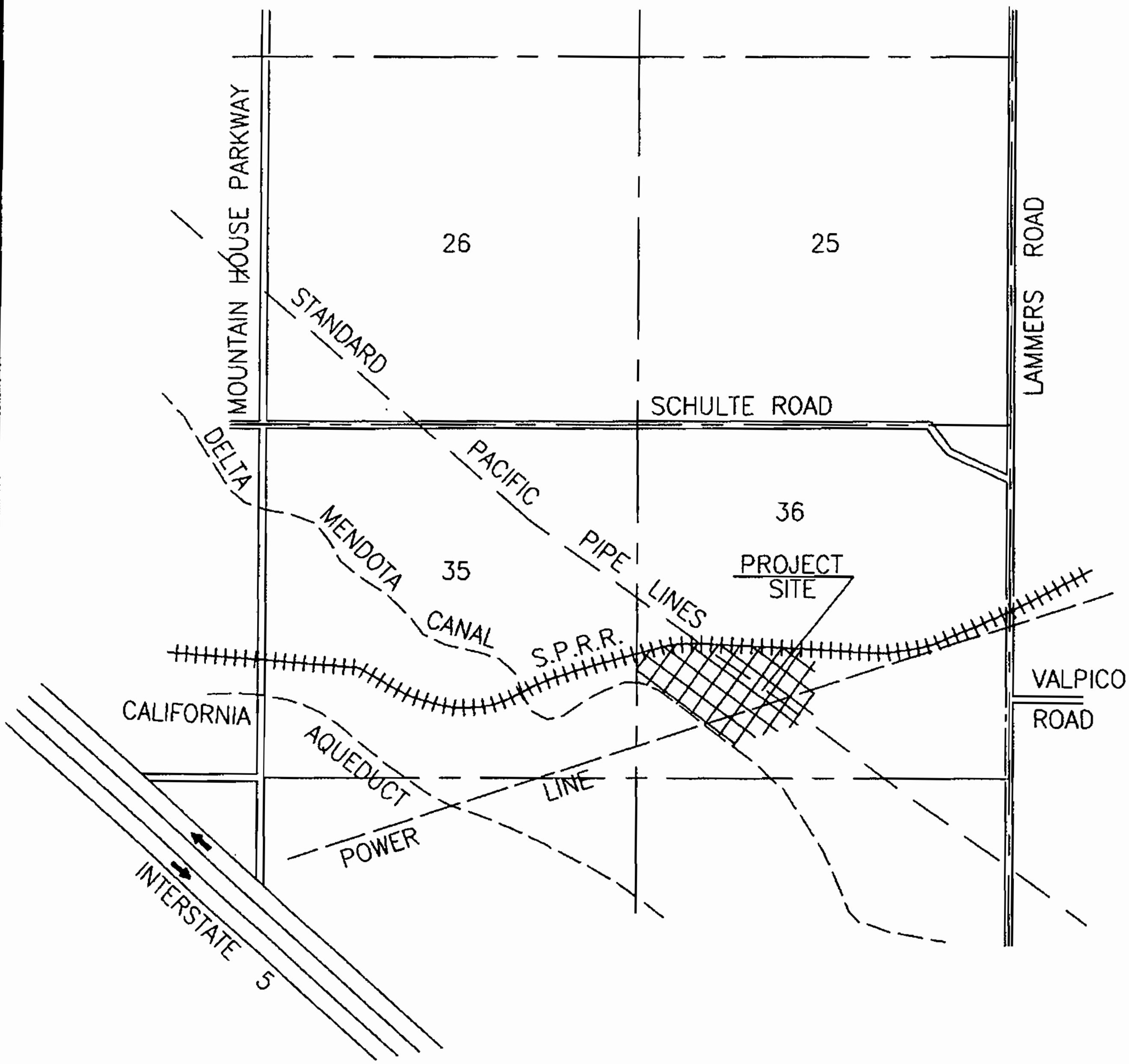
List of Figures



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B	12/14/01	ISSUE FOR ENGR. GEOLOGY REPORT	WG	BLC			
A	11/30/01	ISSUE FOR GEOTECHNICAL REPORT	DAT	BLC			

GWF ENERGY LLC
TRACY PEAKER PROJECT

PROJECT DRAWING NUMBER 069516-SS-0010 | REV B

SITE LOCATION MAP

CODE

AREA

FIGURE 2.1

GRA0773: A1ASL011 12/04/01
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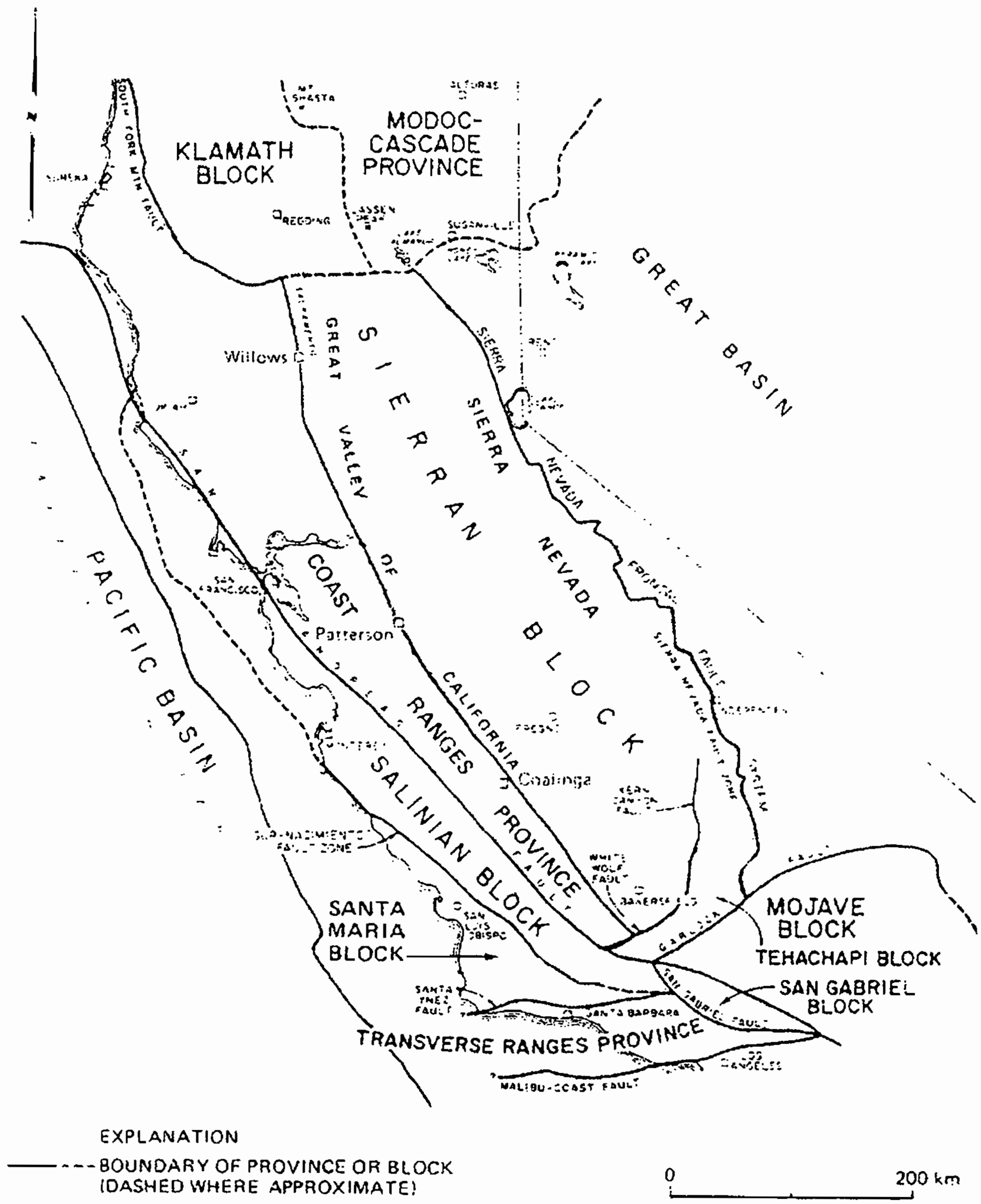

REFERENCE: MODIFIED FROM WONG AND OTHERS, 1988

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GWF ENERGY LLC
TRACY PEAKER PROJECT

PROJECT DRAWING NUMBER: 069516-SS-0014
REV: A

CALIFORNIA GEOMORPHIC AND TECTONIC PROVINCES

CODE
AREA

FIGURE 3.1

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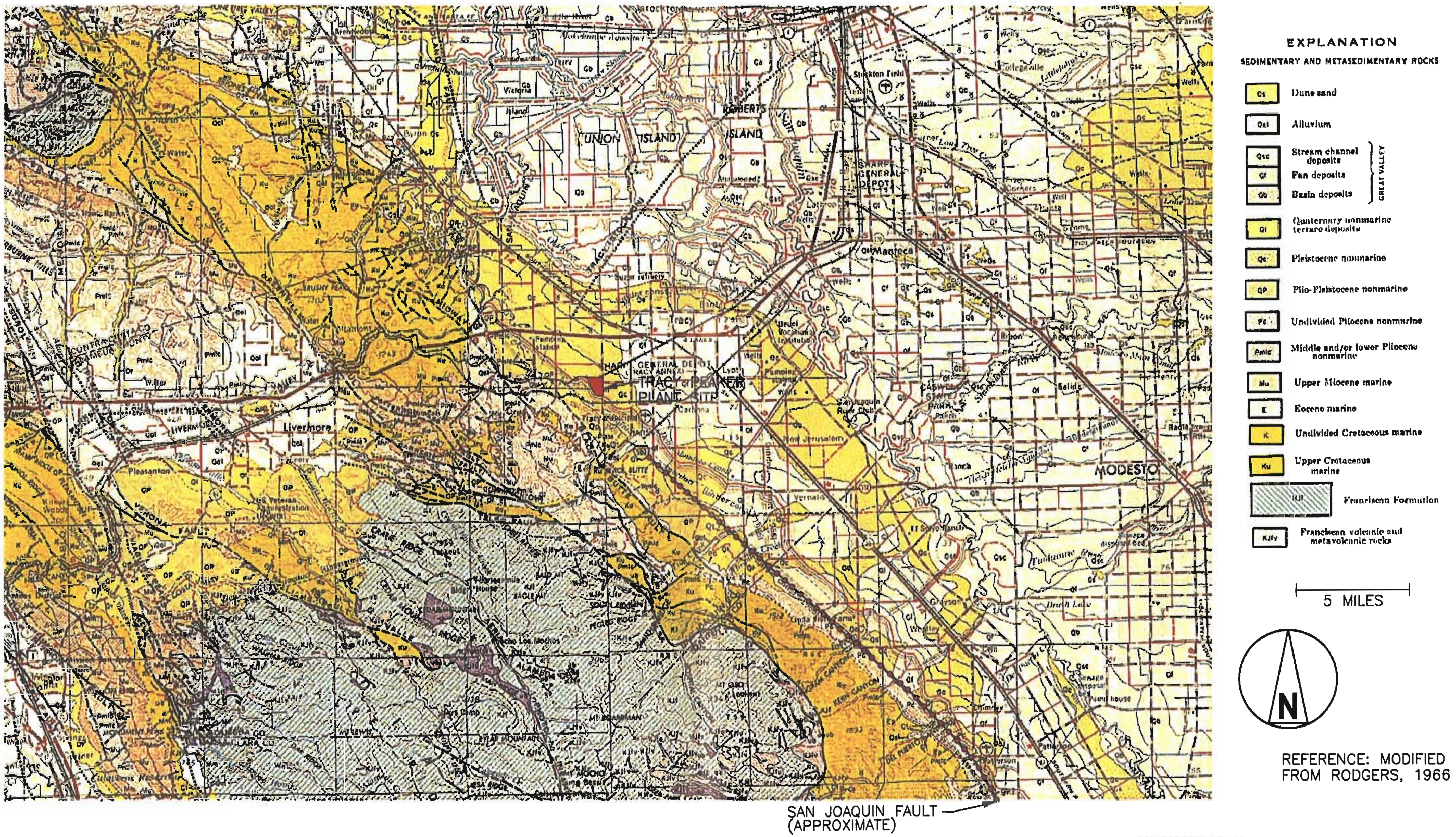

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A	12/14/01	ISSUE FOR ENGR. GEOLOGY REPORT	WG	BLC			

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TRACY PEAKER PROJECT

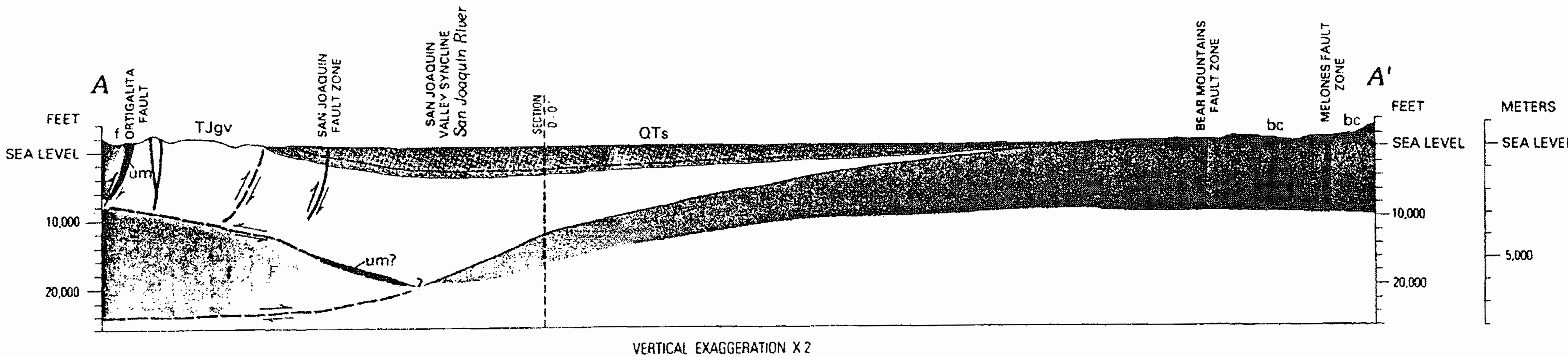
REGIONAL GEOLOGIC MAP

PROJECT | DRAWING NUMBER: 069516-SS-0015 | REV: A

CODE | AREA

FIGURE 3.2

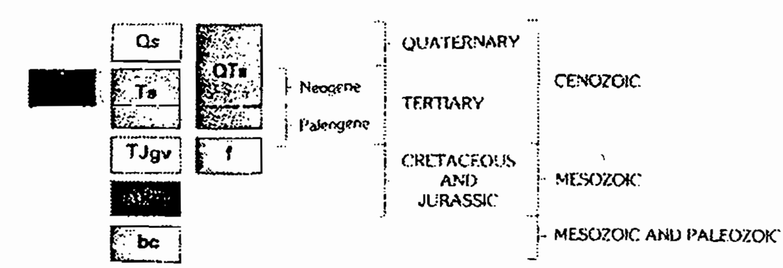
GRA07739 A1ASL012 12/05/01 07:32:26 B1 1=1 ACAD 15.05



DESCRIPTION OF MAP UNITS

- **Qs** — **Alluvial and lacustrine sediments (Quaternary)**
- **QTs** — **Alluvial deposits, sedimentary rocks, and minor volcanic rocks, undivided (Quaternary and Tertiary)**—Used on cross sections only and consists of units Qs and Ts. Dashed line shows approximate boundary between Paleogene and Neogene
- **Volcanic rocks (Tertiary)**
- **Ts** — **Sedimentary rocks (Tertiary)**—Marine and nonmarine rocks Dashed line shows approximate boundary between Paleogene and Neogene
- **TJgv** — **Great Valley sequence (Tertiary to Jurassic)**—Melanges of sedimentary rocks
- **f** — **Franciscan Complex (Tertiary to Jurassic)**—Melanges of sedimentary rocks, serpentinite, and blueschist in a sheared matrix and coherent sedimentary rocks
- **Ultramafic rocks (Cretaceous and Jurassic)**
- **bc** — **Crystalline rocks of the basement complex (Mesozoic and Paleozoic)**
- **Approximate area of structural arch**
- **Contact**—Queried where uncertain in cross sections only

CORRELATION OF MAP UNITS



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TRACY PEAKER PROJECT

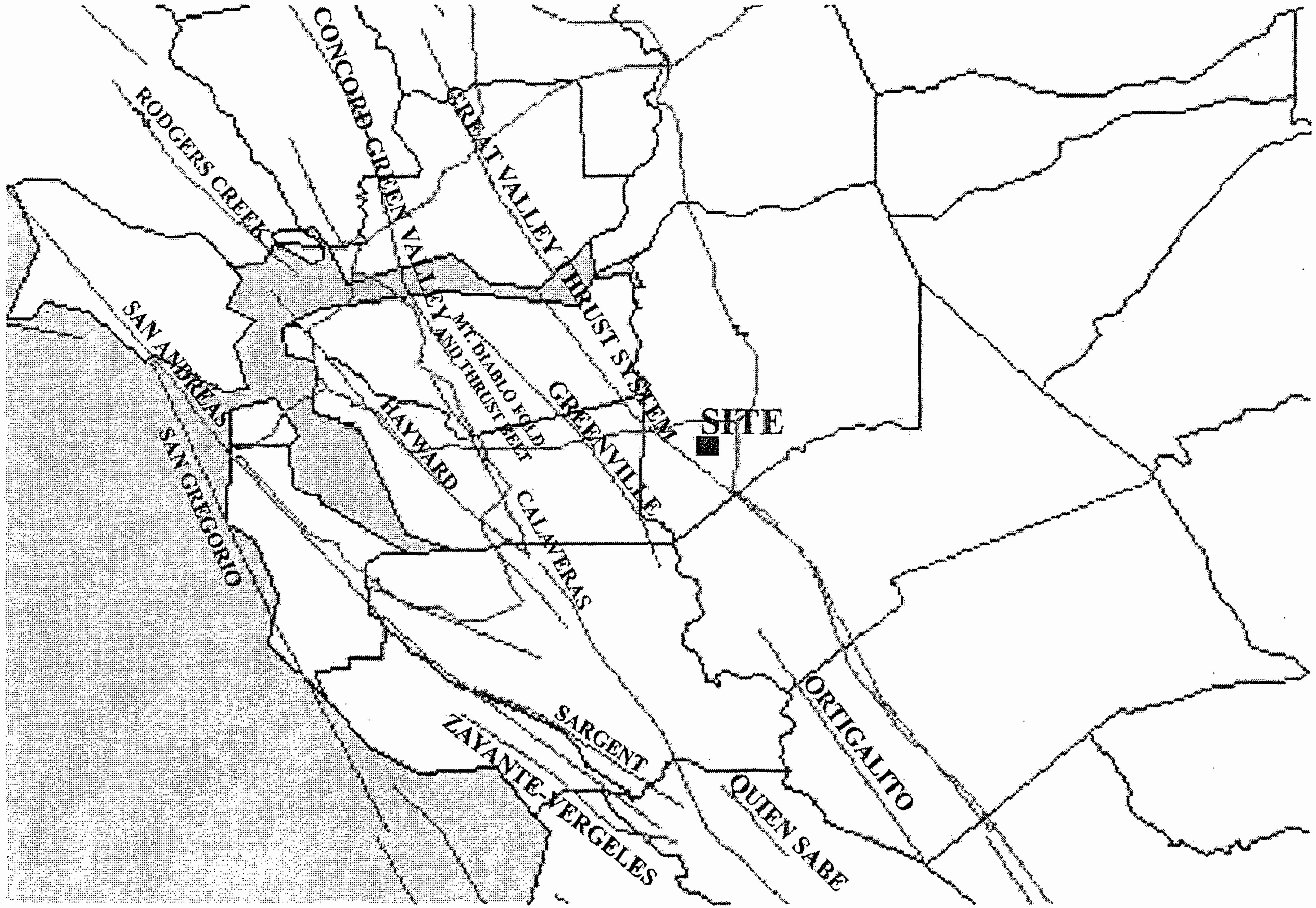
GEOLOGIC SECTION ACROSS THE NORTHERN SAN JOAQUIN VALLEY

PROJECT 069516-SS-0016 (DRAWING NUMBER) — REV A

CODE — AREA

FIGURE 3.3

ACAD 15.05



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TRACY PEAKER PROJECT

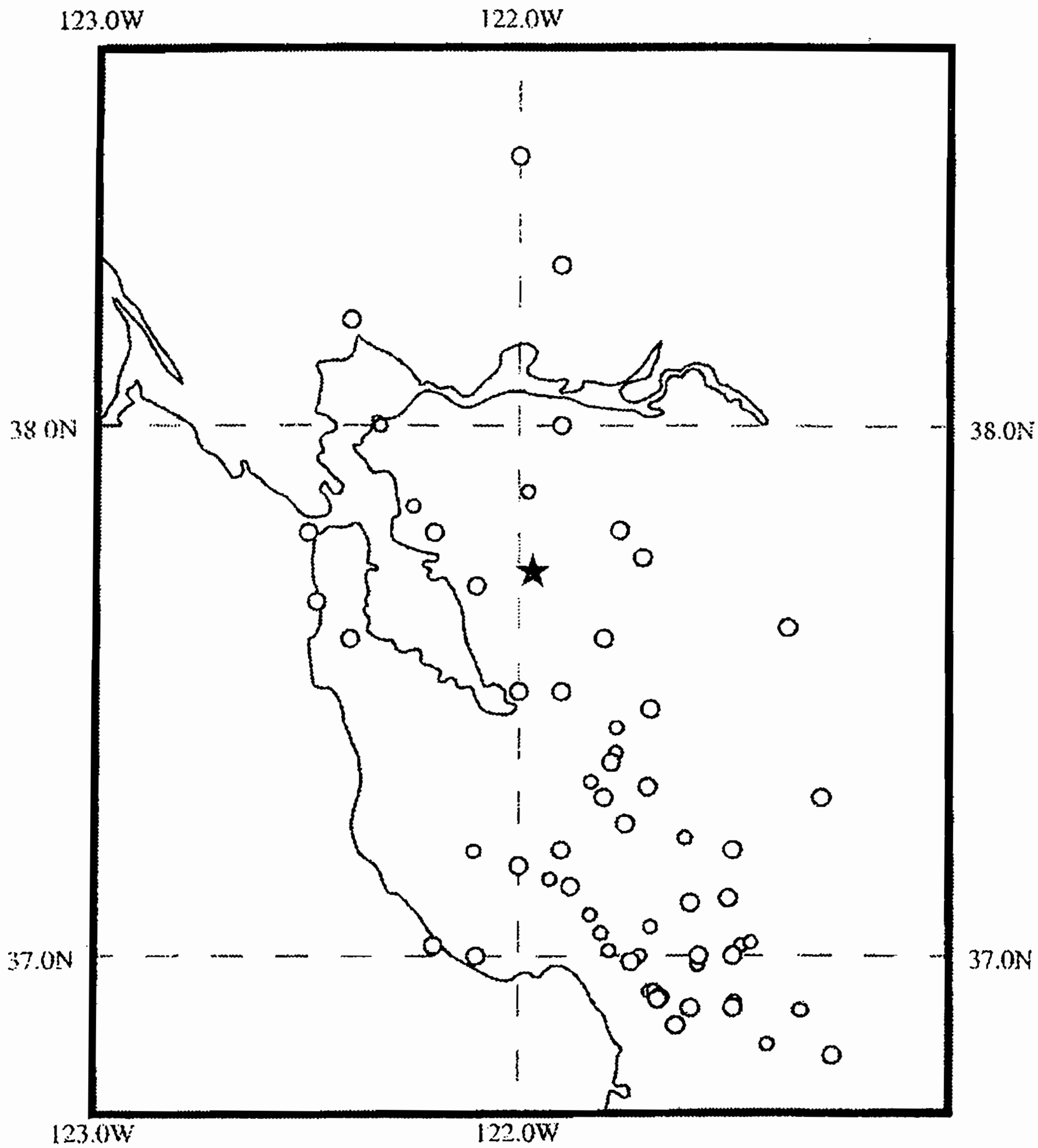
SOURCES OF SEISMIC ACTIVITY IN THE TRACY PROJECT REGION

PROJECT: 069516-SS-0017 (DRAWING NUMBER) | REV: A

CODE: | AREA:

FIGURE 3.4

GRA07739 A1ASL012 12/05/01 07:55:25 B1 1=1 ACAD 15.05



MAGNITUDES

0.1 - 1.9	·	4.0 - 4.4	∘
2.0 - 2.9	·	4.5 - 4.9	∘
3.0 - 3.4	·	5.0 - 5.4	○
3.5 - 3.9	·	> 5.4	○

66 Earthquakes Plotted

50 km   31 mi

REFERENCE: NOAA

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GWF ENERGY LLC
TRACY PEAKER PROJECT

PROJECT DRAWING NUMBER 069516-SS-0018 REV A

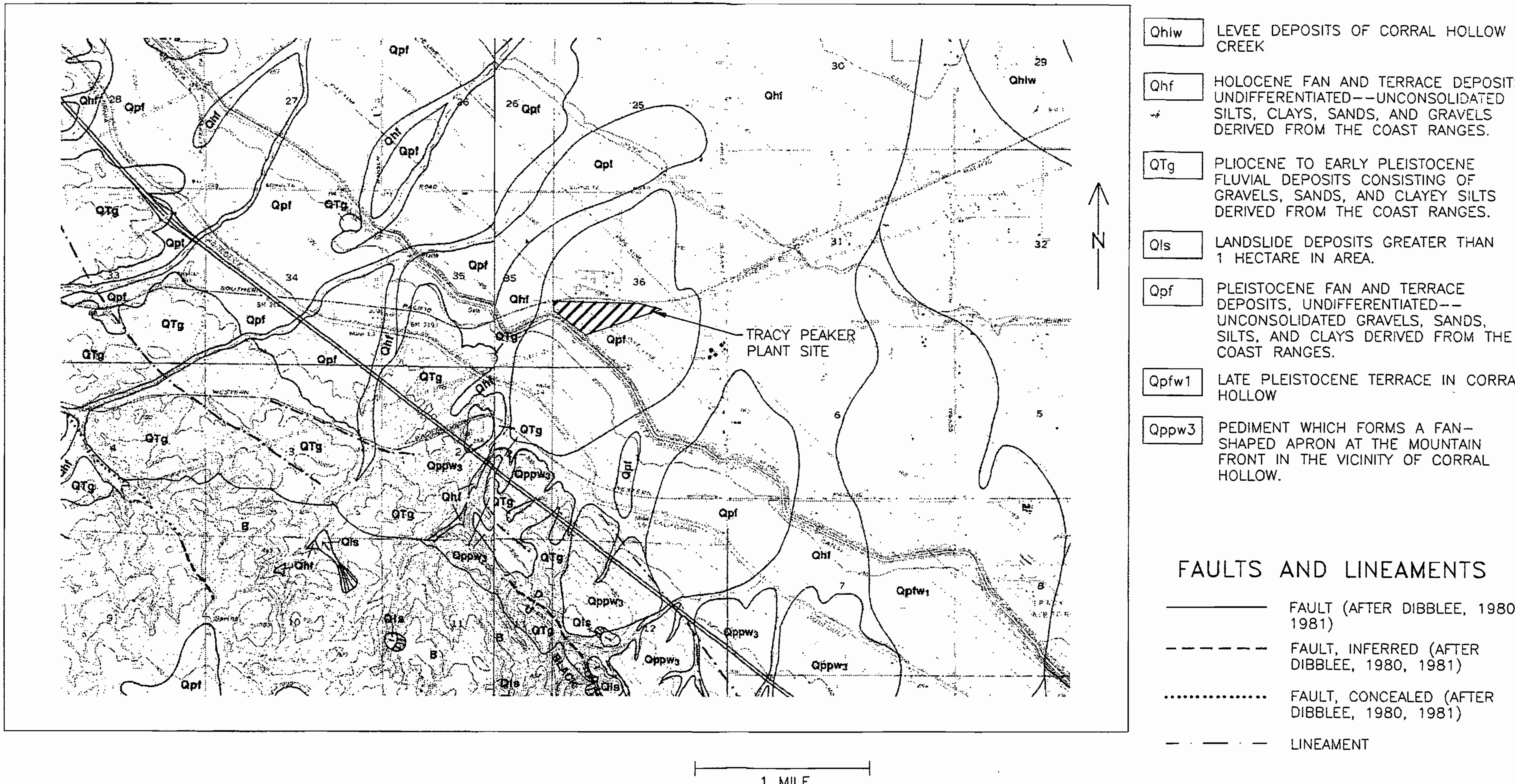
SEISMICITY ($M \geq 5$) WITHIN 100 km OF THE TRACY PEAKER SITE

CODE

AREA

FIGURE 3.5

GRA077 A1ASL011 12/05/01 A2 1=1 07:47:45 ACAD 15.05



REFERENCE: MODIFIED FROM SOWERS AND OTHERS, 1993

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ENGINEER: BLC
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DATE:

GWF ENERGY LLC
TRACY PEAKER PROJECT

GEOLOGIC MAP OF THE TRACY PEAKER PROJECT SITE

PROJECT: 069516-SS-0019 (DRAWING NUMBER)
REV: A
CODE:
AREA:

FIGURE 4.1

GRA07739 A1ASL012 12/05/01 08:00:27 B1 1=1 ACAD 15.05

GWF Tracy Combined Cycle Power Plant Project

(08-AFC-7)

Five Copies of Attachment DR25-2

GWF Tracy Peaker Plant, Laboratory Test Data, Hultgren-Tillis Engineers December 3, 2001

Submitted to

California Energy Commission

Submitted by

GWF Energy, LLC

November 2008

With Assistance from

CH2MHILL
2485 Natomas Park Drive
Suite 600
Sacramento, CA 95833

A California Corporation
Specializing in Geotechnical Engineering

Hultgren-Tillis Engineers

December 3, 2001
File 474.02

GWF Power Systems
4300 Railroad Avenue
Pittsburg, California 94565

Attention: Mr. Dan Monk

Laboratory Test Data
GWF Tracy Peaker Plant
Tracy, California

Dear Mr. Monk:

This report presents the laboratory test data, field resistivity and double ring infiltrometer tests performed through us. We performed the testing for the GWF Tracy Peaker Plant in accordance with the Contract Agreement No. 01-0638 dated September 24, 2001.

The laboratory testing and field data collection presented in this report include the following:

- Moisture-Density
- Liquid and Plastic Limits
- Resistance (R) Value
- Compaction Curves
- Sieve Analysis
- Swell
- Triaxial Shear Strength
- Consolidation
- Corrosion and Resistivity
- Thermal Resistivity
- Double Ring Infiltrometer

The cone penetration testing data has been previously submitted to Black and Veatch and is not included in this submittal.

The data is separated by test type with a colored page separating the various test results. If you have any questions, please call.

Sincerely,

Hultgren-Tillis Engineers

R. Kevin Tillis
R. Kevin Tillis
Geotechnical Engineer

REGISTERED PROFESSIONAL ENGINEER
R. KEVIN TILLIS
No. GE 2160
EXP. 3/31/03
GEOTECHNICAL
STATE OF CALIFORNIA

RKT:la

1 copy enclosed

cc: Black & Veatch (3 copies)
Attention: Mr. Brian Christensen

File No. 47402L01

2520 Stanwell Drive, Suite 100 • Concord, California 94520
Phone (925) 685-6300 • Fax (925) 685-6768

MOISTURE - DENSITY

COOPER TESTING LABS

MOISTURE DENSITY - POROSITY DATA SHEET

Job #	212-041
Client	Hultgren-Tillis
Project/Location	GWF Power
Date	10/09/01

Boring #	BV2/16	BV3/2	BV3/5	BV4/5	BV4/15
Depth (ft)	68.5-70	3.5-4.5	13.5-15	13.5-15	63.5-66
Soil Type	brown CLAY	brown sandy CLAY/ clayey sand	brown CLAY with sand (silty)	brown sandy CLAY	brown CLAY with sand
Specific Gravity		2.70 ASSUMED			
Volume Total cc		315.823			
Volume of Solids		195.542			
Volume of Voids		120.281			
Void Ratio		0.615			
Porosity %		38.1%			
Saturation %		46.1%			
Moisture %	23.8%	10.5%	29.1%	17.9%	25.7%
Dry Density (pcf)		104.4			

Remarks

Moisture Density Measurements

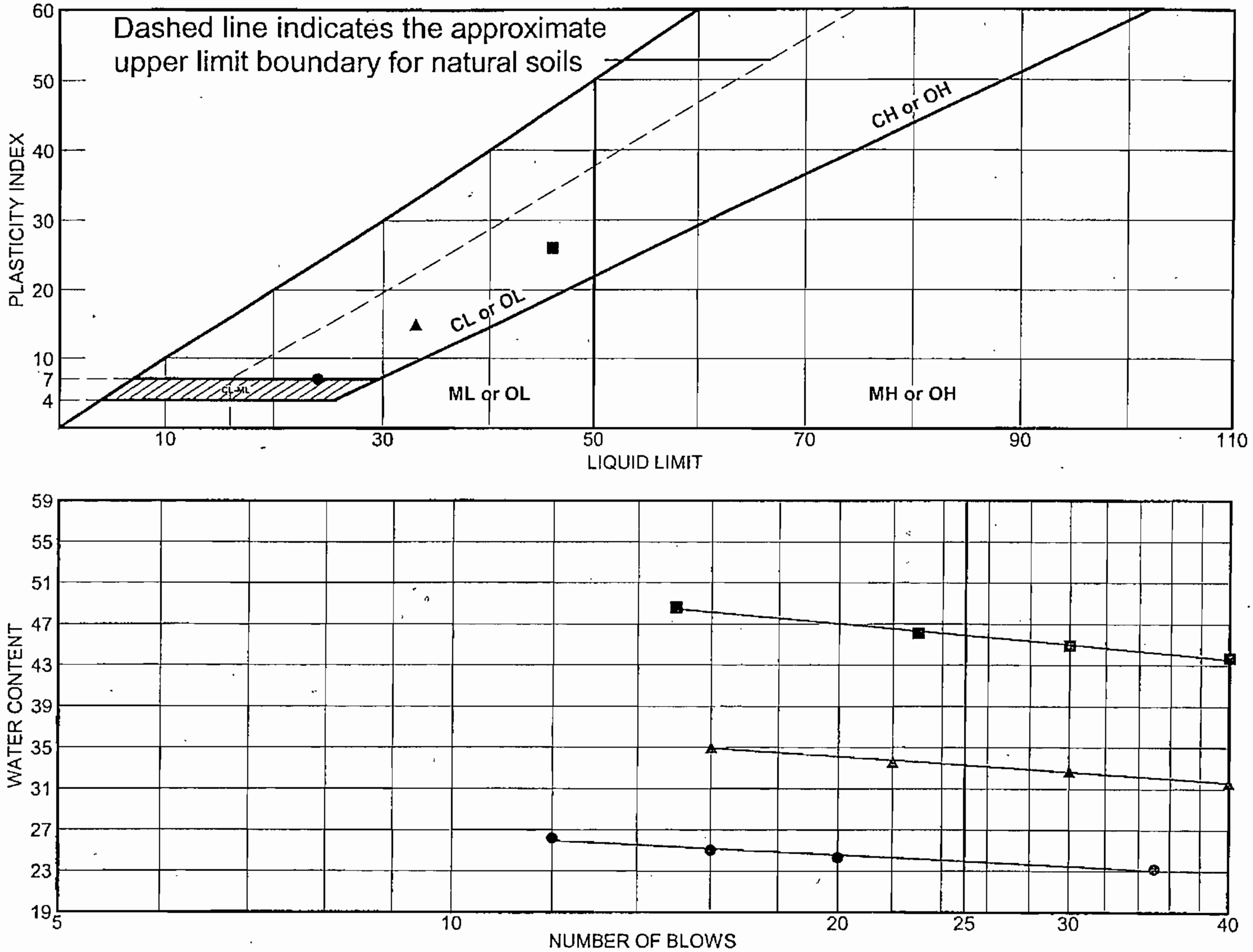
GWF Tracy Peaker Plar

File 474.02

Boring / Test Pit No.	Depth	Wet Density	Moisture Content	Dry Density
	ft	PCF	%	PCF
1	1-2.5		14.3%	
1	9-9.5		13.8%	
1	39-39.5		27.8%	
1	43.5-45		33.4%	
2	8.5-10		11.2%	
2	24.5-25		20.3%	
2	38.5-40		29.5%	
2	48.5-50		14.0%	
3	19-19.5		19.7%	
3	23.5-25		17.2%	
3	43.5-45		25.2%	
3	69.5-70		15.0%	
4	6-7.5		10.4%	
4	8.5-10		25.1%	
4	44.5-45	130.9	20.7%	108.2
4	48.5-50		27.5%	
4	68.5-70		19.5%	
5	23.5-25		21.9%	
TP-1	2		14.7%	
TP-2	3		13.8%	
TP-5	3		18.7%	
TP-5	6.5		14.8%	

LIQUID AND PLASTIC LIMITS

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	brown silty clayey SAND	24	17	7	67.7	33.7	SC-SM
■	brown sandy lean CLAY	46	20	26	77.2	53.0	CL
▲	brown lean CLAY	33	18	15	99.4	91.4	CL

Project No. 212-041 **Client:** Hultgren-Tillis

Project: GWF Power

● **Source:** BV-2 **Sample No.:** 1 **Elev./Depth:** 1-3.5'

■ **Source:** BV-2 **Sample No.:** 11 **Elev./Depth:** 43.5 (Tip)

▲ **Source:** BV-2 **Sample No.:** 16 **Elev./Depth:** 68.5-70'

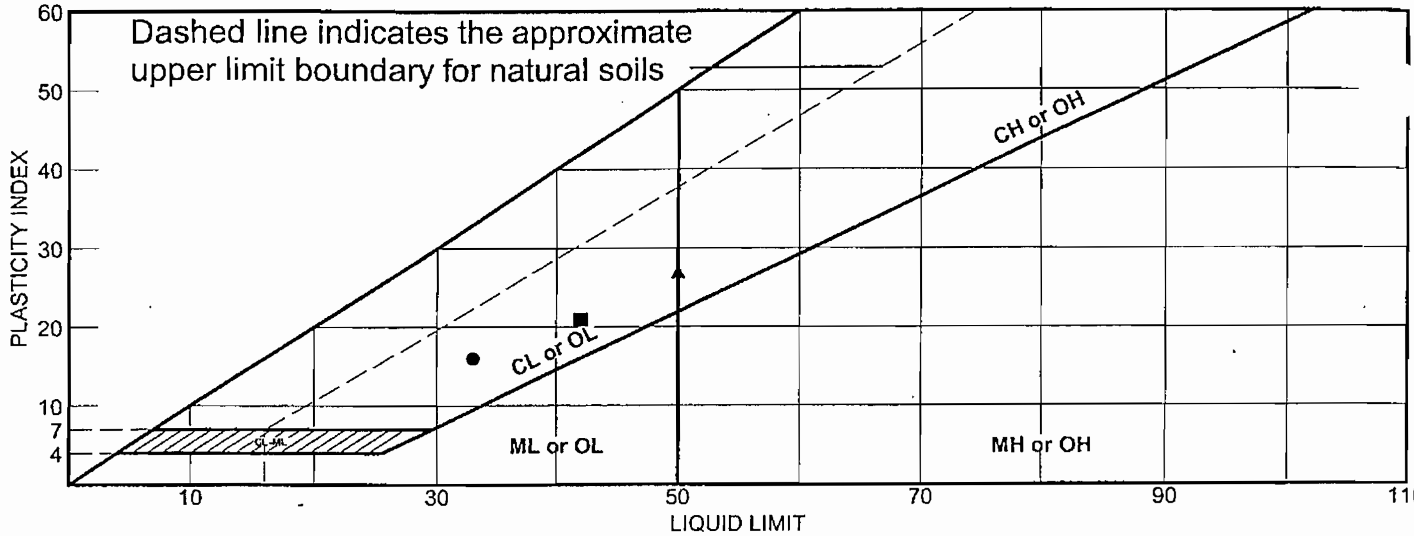
Remarks:
●
■
▲

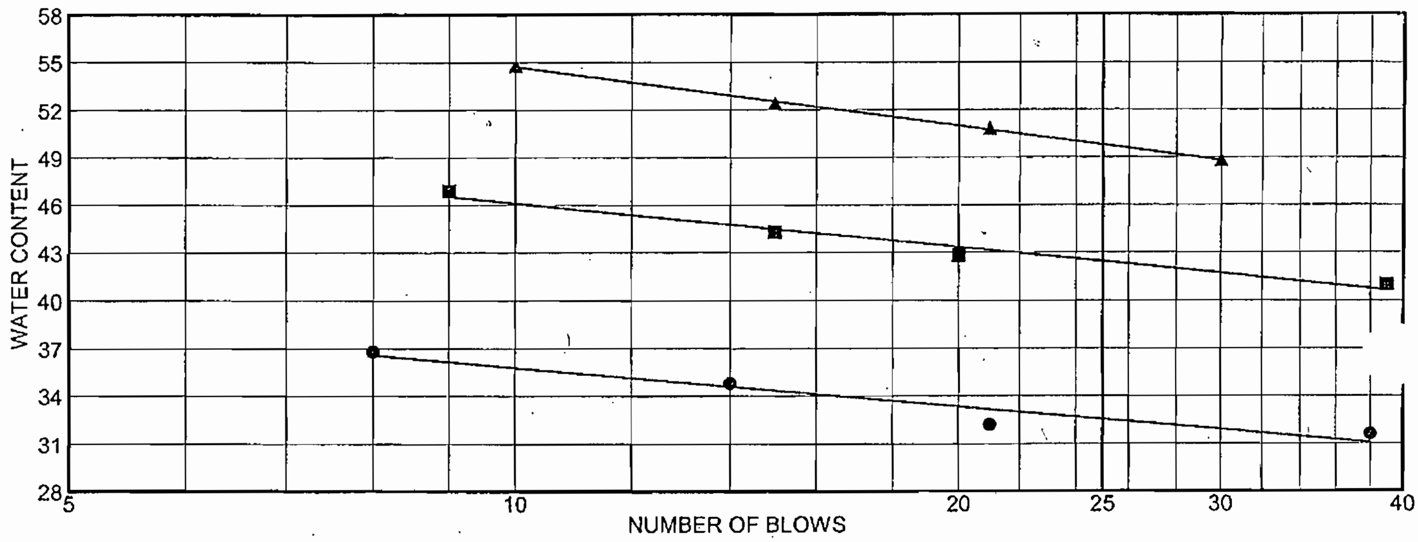
LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Plate

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	brown sandy CLAY / clayey sand (silty)	33	17	16			
■	brown CLAY with sand (silty)	42	21	21			
▲	brown CLAY with sand	50	23	27			

Project No. 212-041 **Client:** Hultgren-Tillis

Project: GWF Power

● **Source:** BV-3 **Sample No.:** 2 **Elev./Depth:** 3.5-4.5

■ **Source:** BV-3 **Sample No.:** 5 **Elev./Depth:** 13.5-15

▲ **Source:** BV-3 **Sample No.:** 8 **Elev./Depth:** 28.5-30

Remarks:

●

■

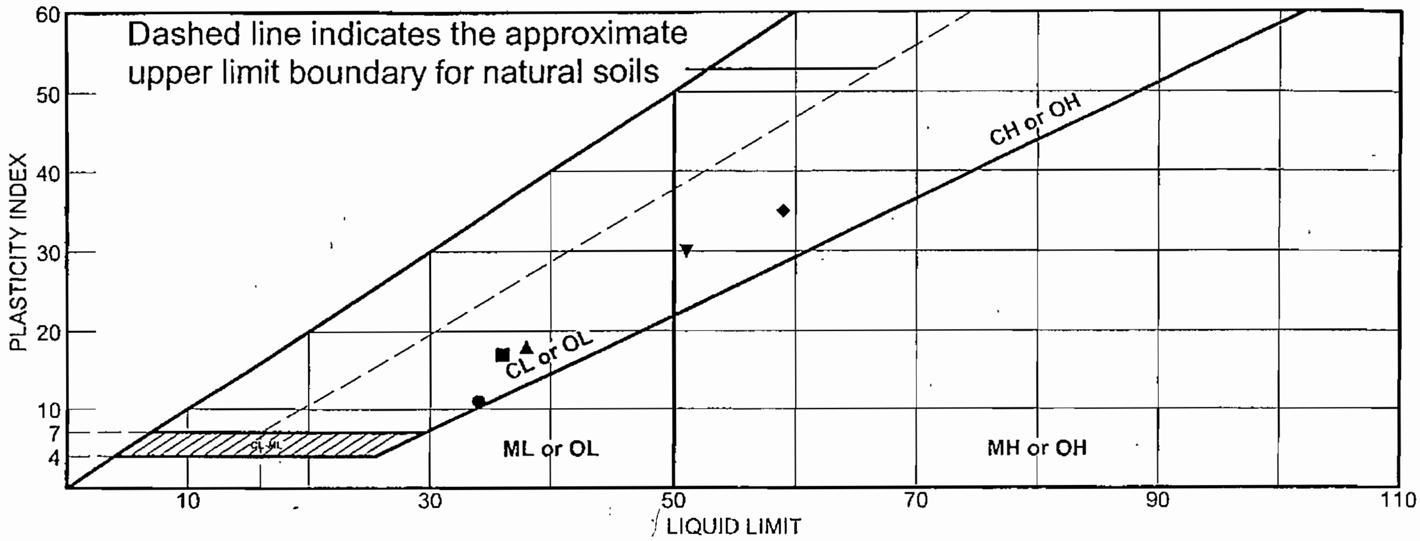
▲

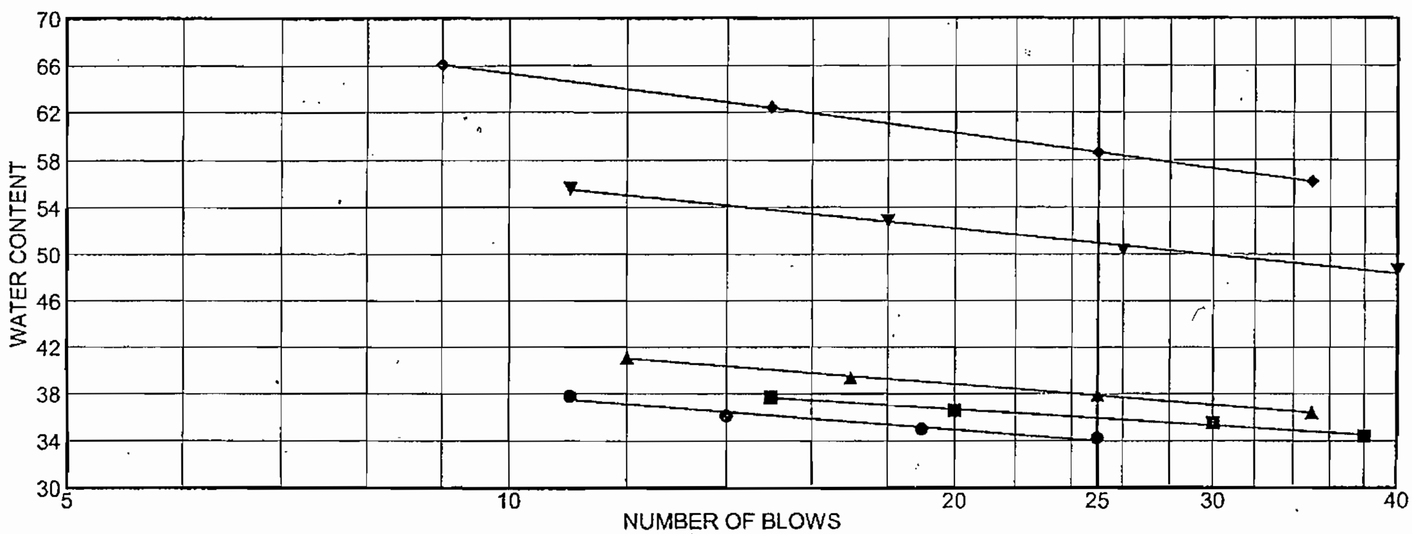
LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Plate

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	brown mottled gray clayey SAND	34	23	11	93.0	46.8	SC
■	brown lean CLAY with sand	36	19	17	98.0	70.8	CL
▲	brown lean CLAY	38	20	18	97.2	86.0	CL
◆	light brown mottled orange CLAY	59	24	35			
▼	dark brown sandy CLAY / clayey sand	51	21	30			

Project No. 212-041 **Client:** Hultgren-Tillis

Project: GWF Power

● **Source:** BV-4 **Sample No.:** 1 **Elev./Depth:** 1-3.5'

■ **Source:** BV-4 **Sample No.:** 5 **Elev./Depth:** 13.5-15'

▲ **Source:** BV-4 **Sample No.:** 15 **Elev./Depth:** 63.5-66'

◆ **Source:** BV-4 **Sample No.:** 16 **Elev./Depth:** 78.5-81

▼ **Source:** BV-5 **Sample No.:** 2 **Elev./Depth:** 3.5-5'

Remarks:

●

■

▲

◆

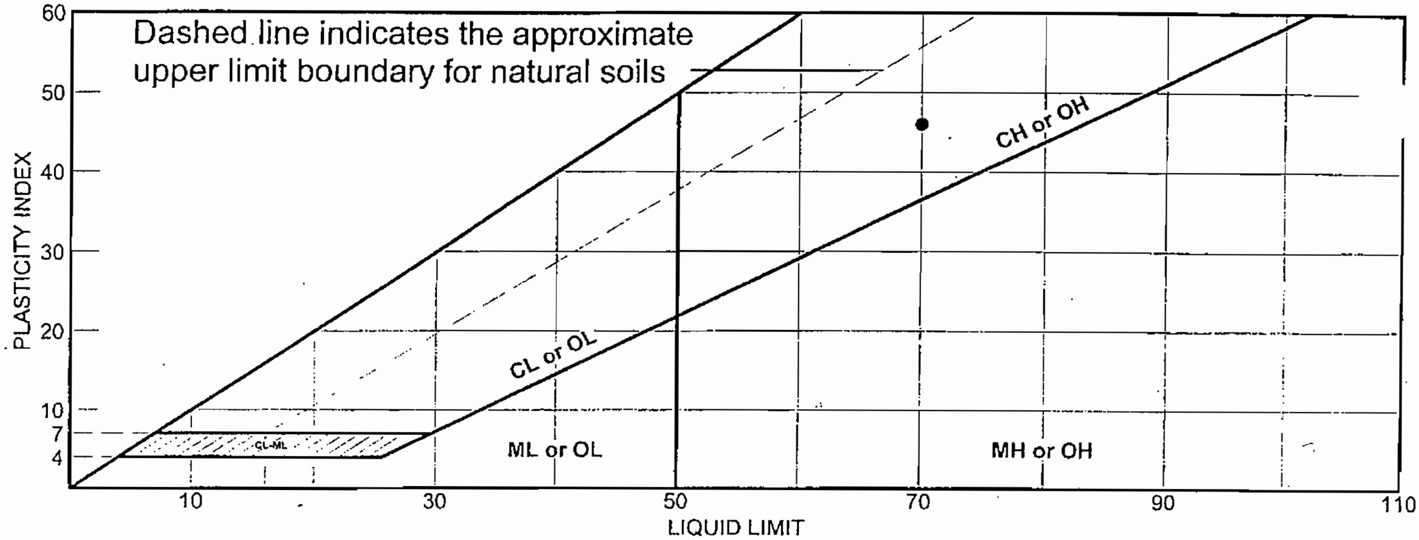
▼

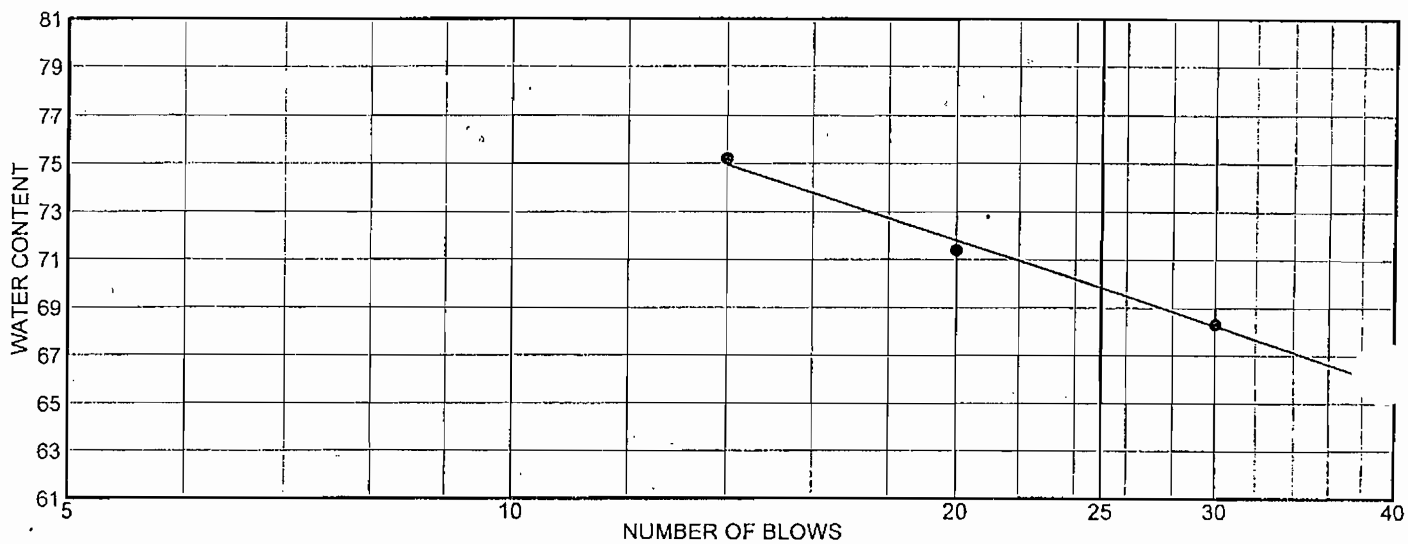
LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Plate

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	reddish brown CLAY with trace gravel and sand	70	24	46			

Project No. 212-042 **Client:** Hultgren / Black & Veatch

Project: GWF Power

● **Source:** BV5 **Sample No.:** TW 10 **Elev./Depth:** 38.5-40'

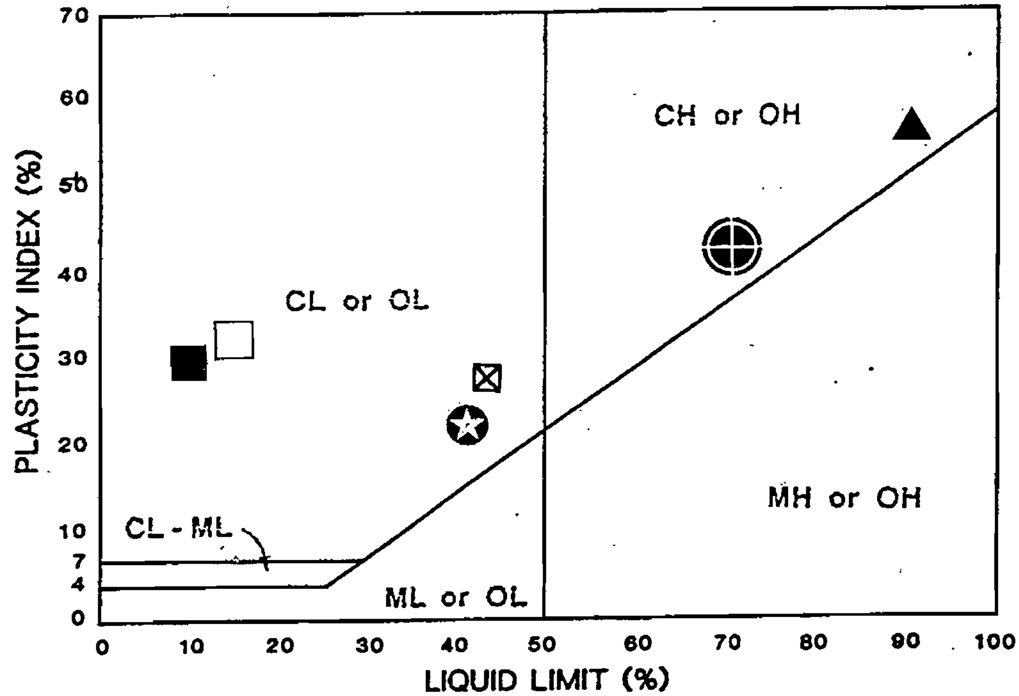
Remarks:

●

LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Plate



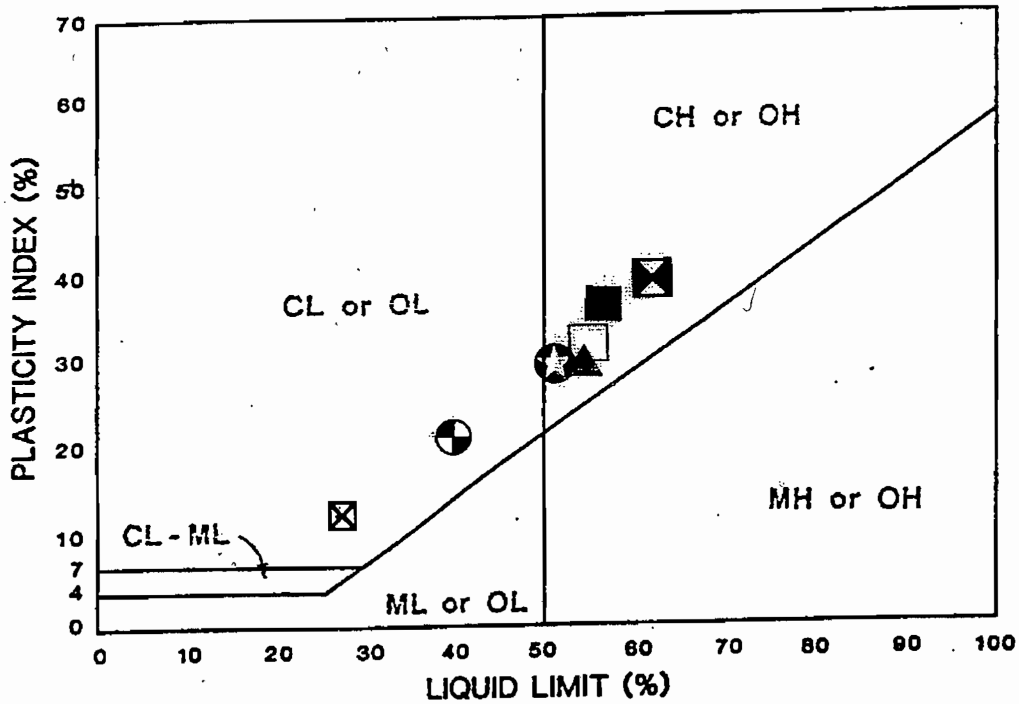
Reference: ASTM D-4318

SYMBOL	BORING NUMBER	DEPTH (feet)	CLASSIFICATION	LL (%)	PL (%)	PI (%)	MOISTURE CONTENT (%)
⊠	1	1-2.5	Lean Clay	44	16	28	
	1	9-9.5			Non-Plastic		
▲	1	43.5-45	Fat Clay	89	33	56	
✪	1	69-69.5	Lean Clay	41	20	21	
■	2	64-64.5	Lean Clay	30	19	11	
□	3	19-19.5	Lean Clay	32	17	15	
⊕	3	43.5-45	Fat Clay	71	27	44	

GWF Tracy Peaker Plant
Tracy, California

Plasticity Chart

Hultgren - Tillis Engineers | Project No. 474.01 | Plate No.



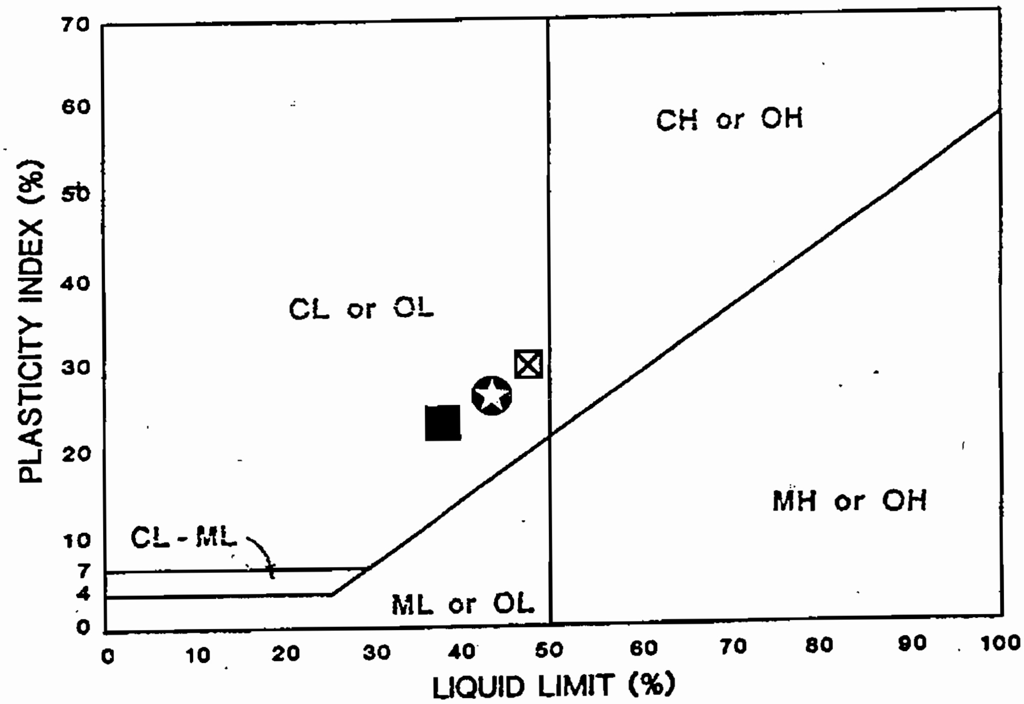
Reference: ASTM D-4318

SYMBOL	BORING NUMBER	DEPTH (feet)	CLASSIFICATION	LL (%)	PL (%)	PI (%)	MOISTURE CONTENT (%)
⊠	3	69.5-70	Lean Clay	28	15	13	
▲	3	79-79.5	Fat Clay	54	24	30	
✪	4	8.5-10	Fat Clay	52	22	30	
□	4	44.5-45	Fat Clay	54	23	31	
■	4	48.5-50	Fat Clay	57	21	36	
◕	4	68.5-70	Lean Clay	40	19	21	
⧗	5	23.5-25	Fat Clay	62	24	38	

GWF Tracy Peaker Plant
Tracy, California

Plasticity Chart

Hultgren - Tillis Engineers	Project No. 474.01	Plate No.



Reference: ASTM D-4318

SYMBOL	BORING NUMBER	DEPTH (feet)	CLASSIFICATION	LL (%)	PL (%)	PI (%)	MOISTURE CONTENT (%)
✪	TP-1	2	Lean Clay	43	16	27	
■	TP-2	3	Lean Clay	40	16	24	
⊠	TP-5	3	Lean Clay	48	18	30	

GWF Tracy Peaker Plant
Tracy, California

Plasticity Chart

Hultgren - Tillis Engineers	Project No. 474.01	Plate No.

RESISTANCE (R) VALUE

CONSTRUCTION MATERIALS TESTING, INC.

Job Name: BV/GWF Tracy

Sample Description: Vy Dk Gry -Brn Si Cl

Source: TP-1 @ 2

Client Name: Hultgren-Tillis #69516.0142

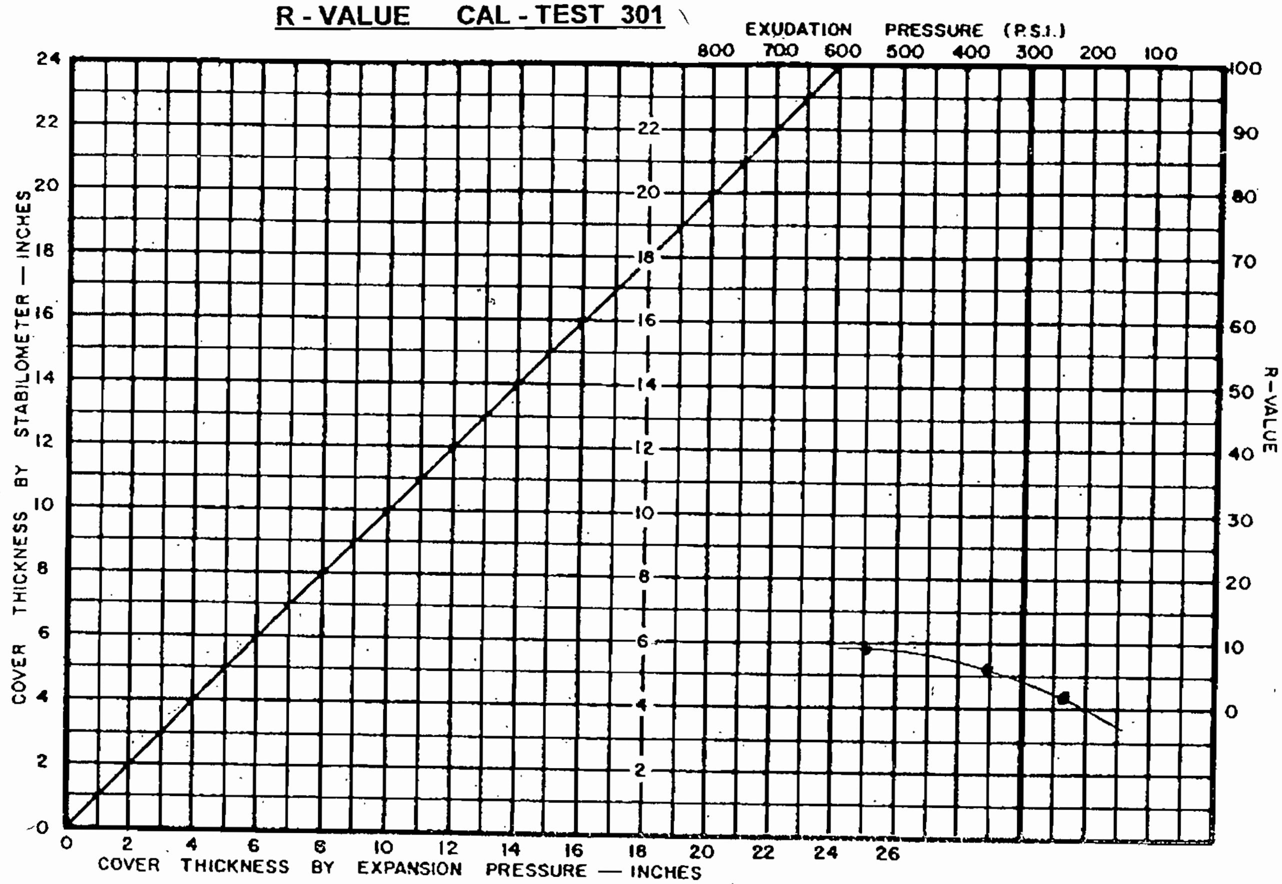
Job No: 95333

Sample No: No. 1

Date: 10/5/01

Sampled: client Tested: MR/BR

R - VALUE CAL - TEST 301



Exudation psi	Expansion (.0001")	Expansion psf	Moisture %	Dry Density pcf	Resistance Value
549	28	121	22.4	100.3	9
354	14	61	25.8	95.6	6
239	11	48	29.8	89.6	2

Remarks:

Resistance Value
4

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CONSTRUCTION MATERIALS TESTING, INC.

Job Name: BV/GWF - Tracy

Job No: 95333

Sample Description: Olv-Brn Sandy Clay

Sample No:

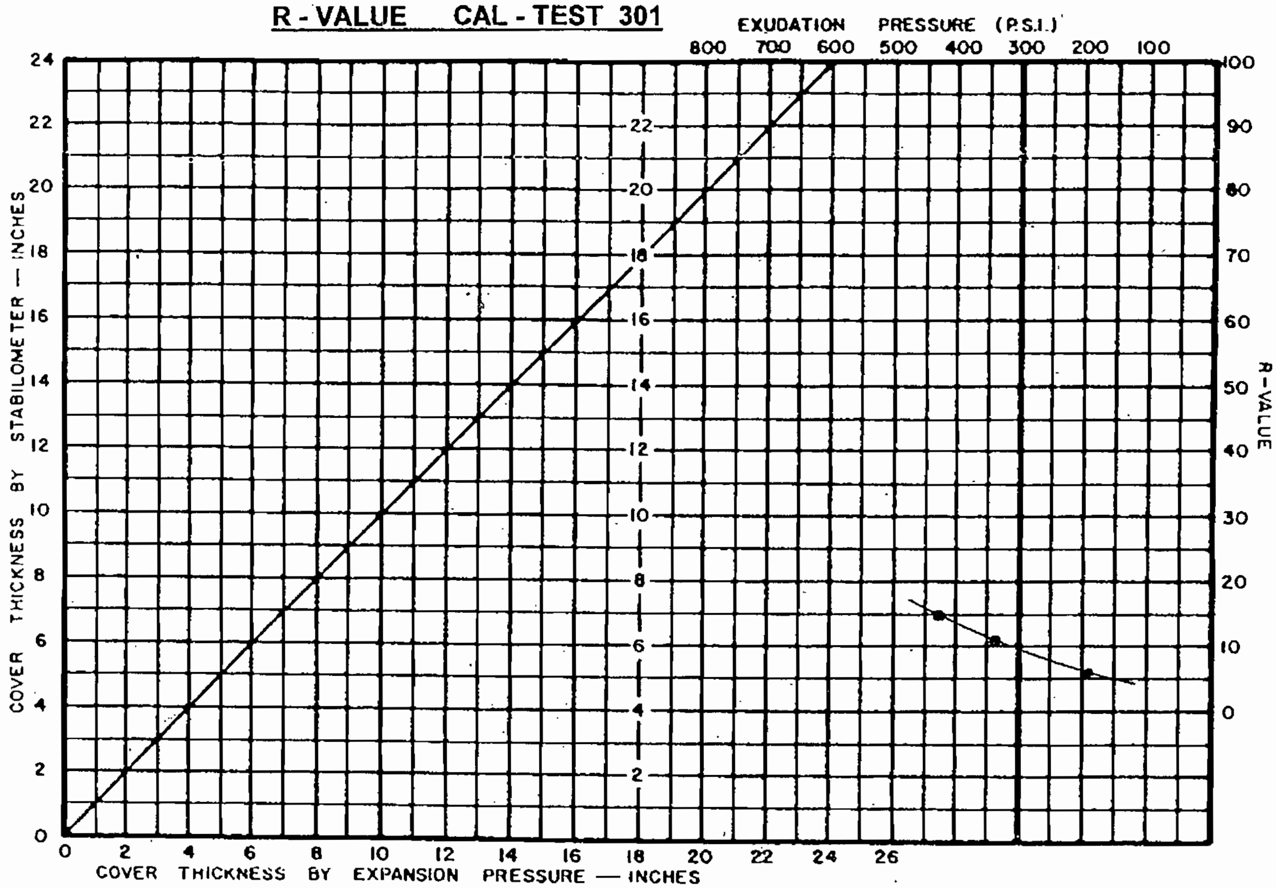
Source: TP-1 @ 7'

Date: 10/10/01

Client Name: Hultgren-Tillis #474.02

Sampled: client Tested: MR/BR

R - VALUE CAL - TEST 301



Exudation psi	Expansion (.0001")	Expansion psf	Moisture %	Dry Density pcf	Resistance Value
430	7	30	16.2	114.5	15
343	3	13	17.6	110.4	11
194	3	13	19.1	108.0	6

Remarks:

Resistance Value

9

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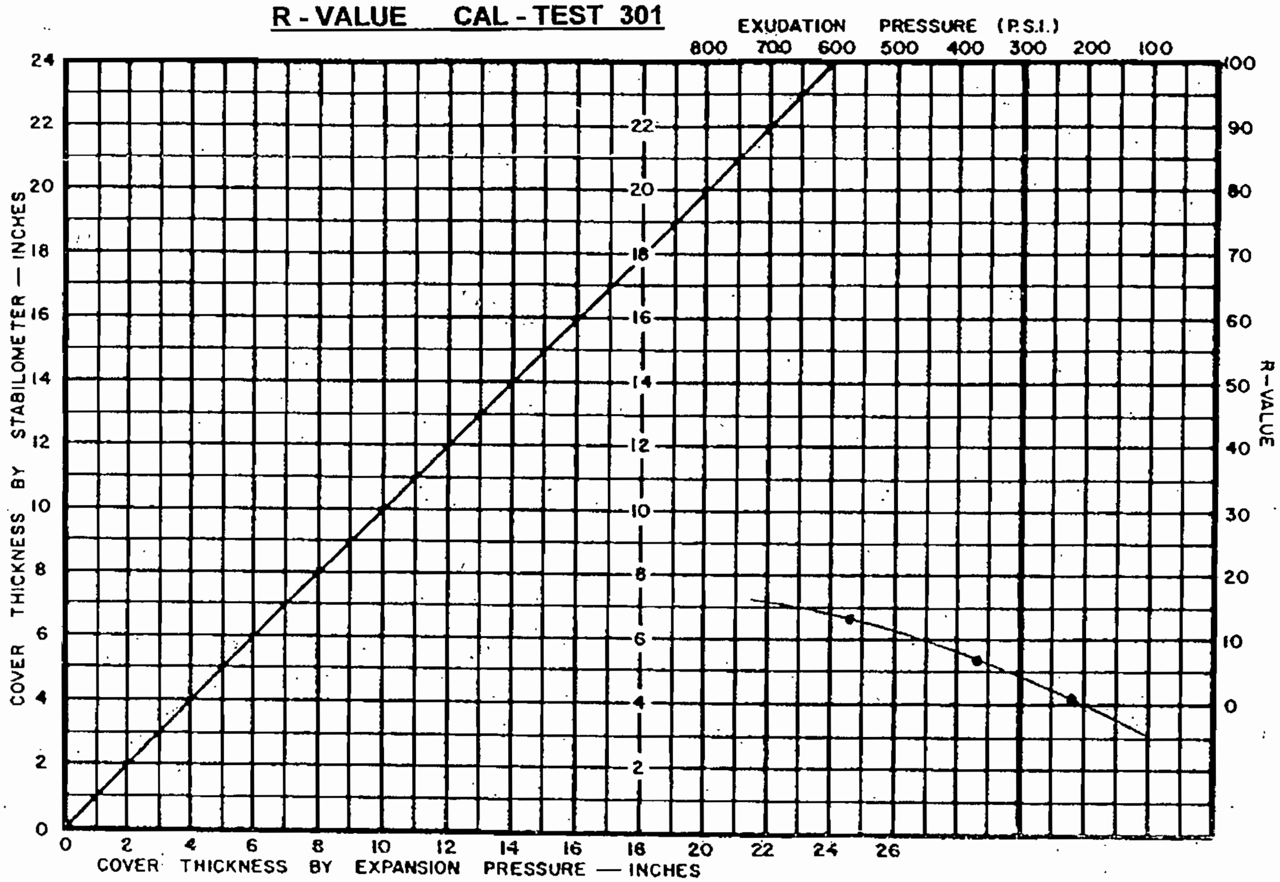
CONSTRUCTION MATERIALS TESTING, INC.

Job Name: BV/GWF Tracy
Sample Description: Olv-Brn Clay
Source: TP-2 @ 3'
Client Name: Hultgren-Tillis #474.02

Job No: 95333
Sample No: 1
Date: 10/5/01
Sampled: client Tested: MR/BR



Exudation psi	Expansion (.0001")	Expansion psf	Moisture %	Dry Density pcf	Resistance Value
570	8	35	21.8	103.8	13
363	2	9	24.8	97.4	7
217	0	0	28.0	91.2	1

Remarks:

Resistance Value
4

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CMT

CONSTRUCTION MATERIALS TESTING, INC.

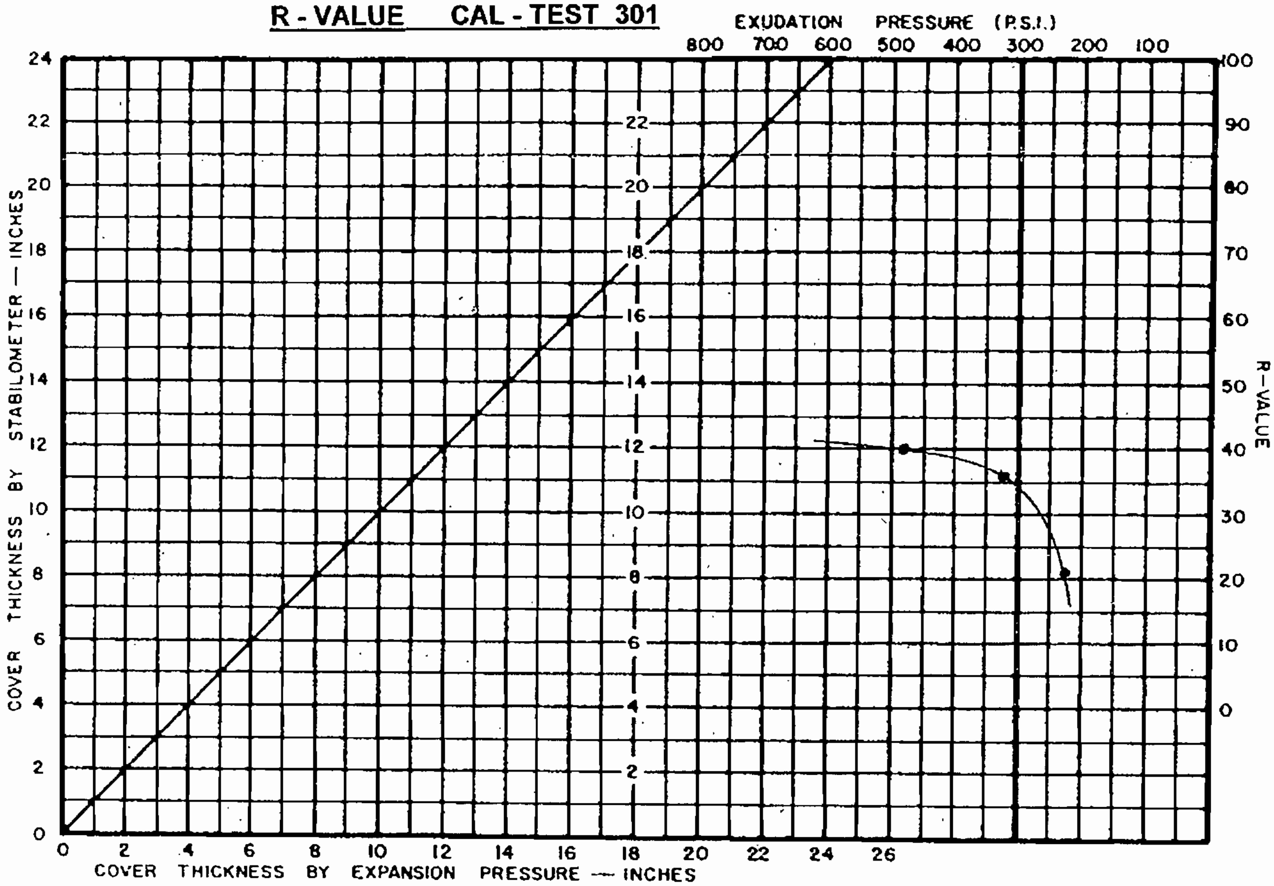
Job Name: BV/GWF - Tracy
Job No: 95333

Sample Description: Olv-Brn Sandy Silt
Sample No:

Source: TP-3 @ 5'
Date: 10/10/01

Client Name: Hultgren-Tillis #474.02
Sampled: client Tested: MR/BR

R - VALUE CAL - TEST 301



Exudation psi	Expansion (.0001")	Expansion psf	Moisture %	Dry Density pcf	Resistance Value
484	19	82	14.7	115.5	40
324	11	48	15.3	113.7	36
228	11	48	16.1	112.8	21

Remarks:

Resistance Value

34

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CONSTRUCTION MATERIALS TESTING, INC.

Job Name: BV/GWF - Tracy

Job No: 95333

Sample Description: Olv-Brn Silty Sand

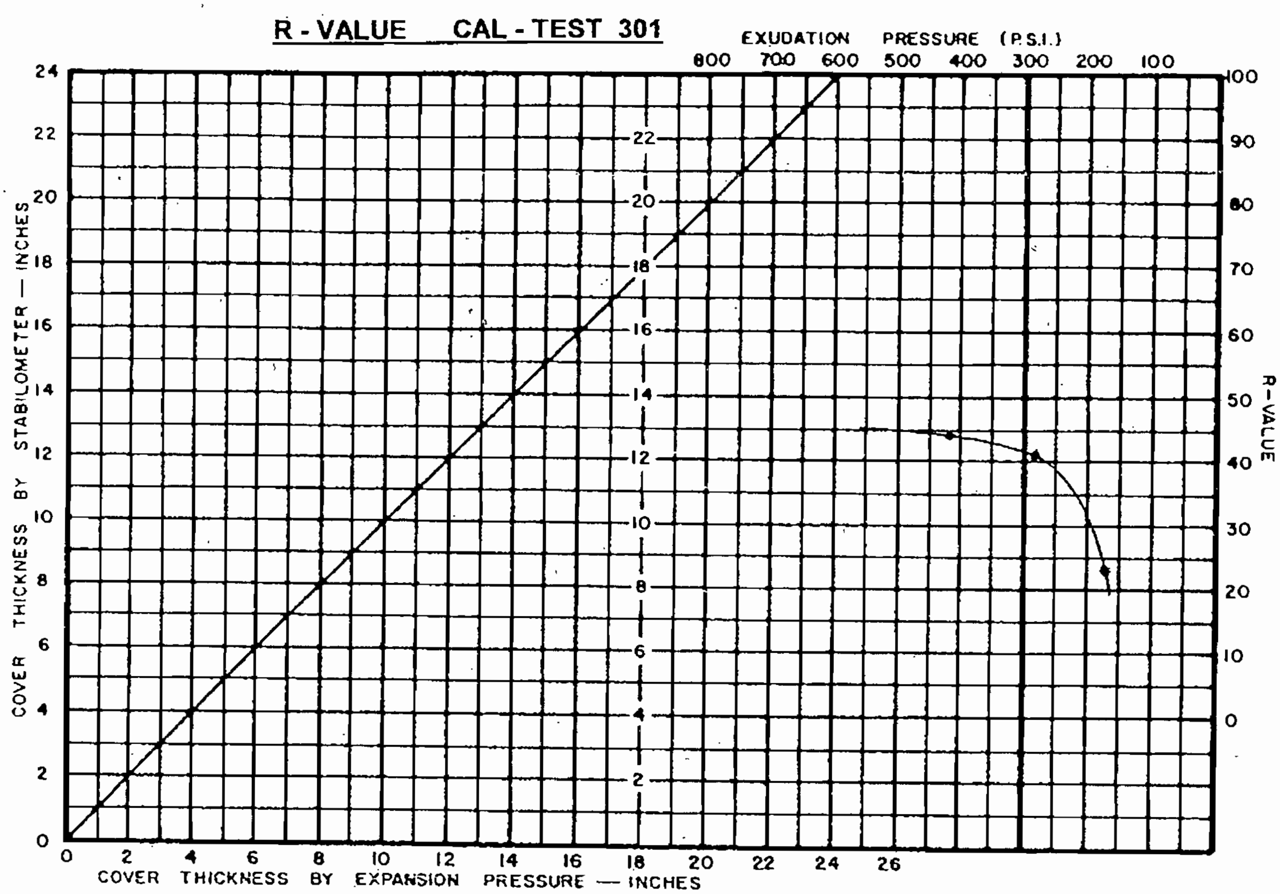
Sample No:

Source: TP-4 @ 3.5'

Date: 10/10/01

Client Name: Hultgren-Tillis #474.02

Sampled: client Tested: MR/BR



Exudation psi	Expansion (.0001")	Expansion psf	Moisture %	Dry Density pcf	Resistance Value
413	14	61	15.0	114.7	44
286	11	48	16.1	111.2	41
170	5	22	17.6	109.1	23

Remarks:

Resistance Value
42

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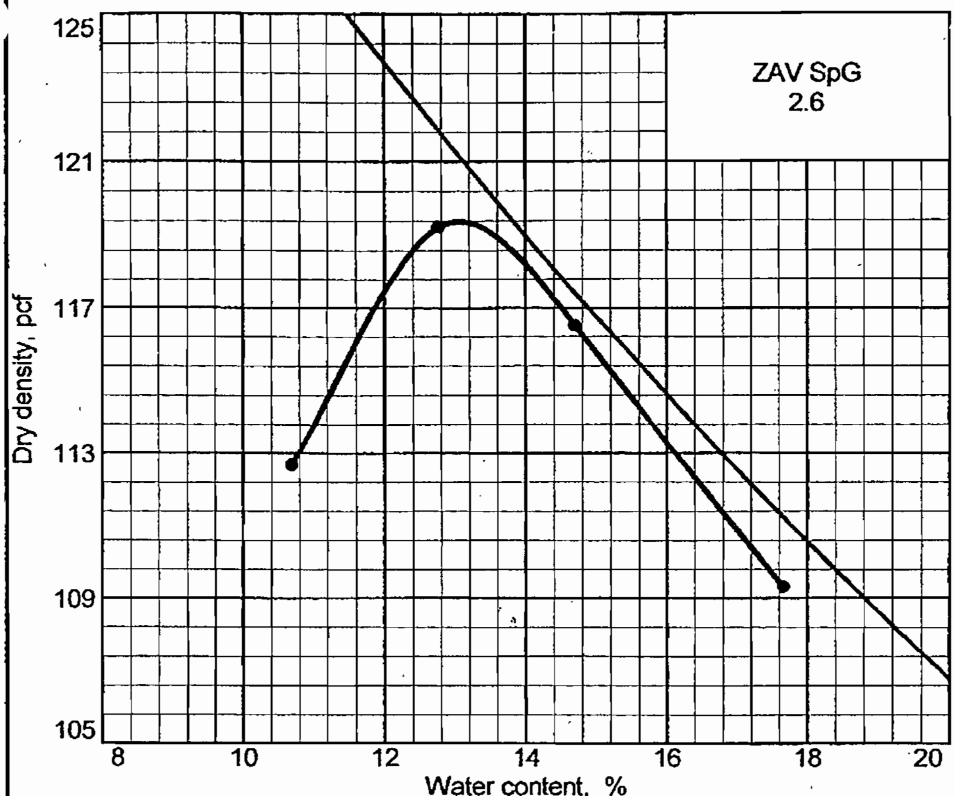
COMPACTION CURVES

COMPACTION TEST REPORT



Curve No.
TP-1@2'

Test Specification:
ASTM D 1557-91 A MODIFIED

Hammer Wt.: 10
Hammer Drop: 18
Number of Layers: FIVE
Blows per Layer: 25
Mold Size: .03334 cu.ft.
Test Performed on Material Passing No.4 **Sieve**

Soil Data
NM ______ **Sp.G.** ______
LL ______ **PI** ______
%>No.4 ______ **%<#200** ______
USCS ______ **AASHTO** ______

TESTING DATA

	1	2	3	4	5	6
WM + WS	1886.0	2033.0	2021.0	1945.0		
WM	0.0	0.0	0.0	0.0		
WW + T #1	1886.00	2033.00	2021.00	1945.00		
WD + T #1	1704.00	1803.00	1762.00	1653.00		
TARE #1	0.00	0.00	0.00	0.00		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	10.7	12.8	14.7	17.7		
DRY DENSITY	112.7	119.2	116.5	109.3		

TEST RESULTS

Maximum dry density = 119.4 pcf

Optimum moisture = 13.1 %

Material Description

VERY DARK BROWN SILTY CLAY

Project No. 95333 **Client:** HULTGREN-TILLIS
Project: BV/GWF TRACY

● **Location:** TP-1@2'

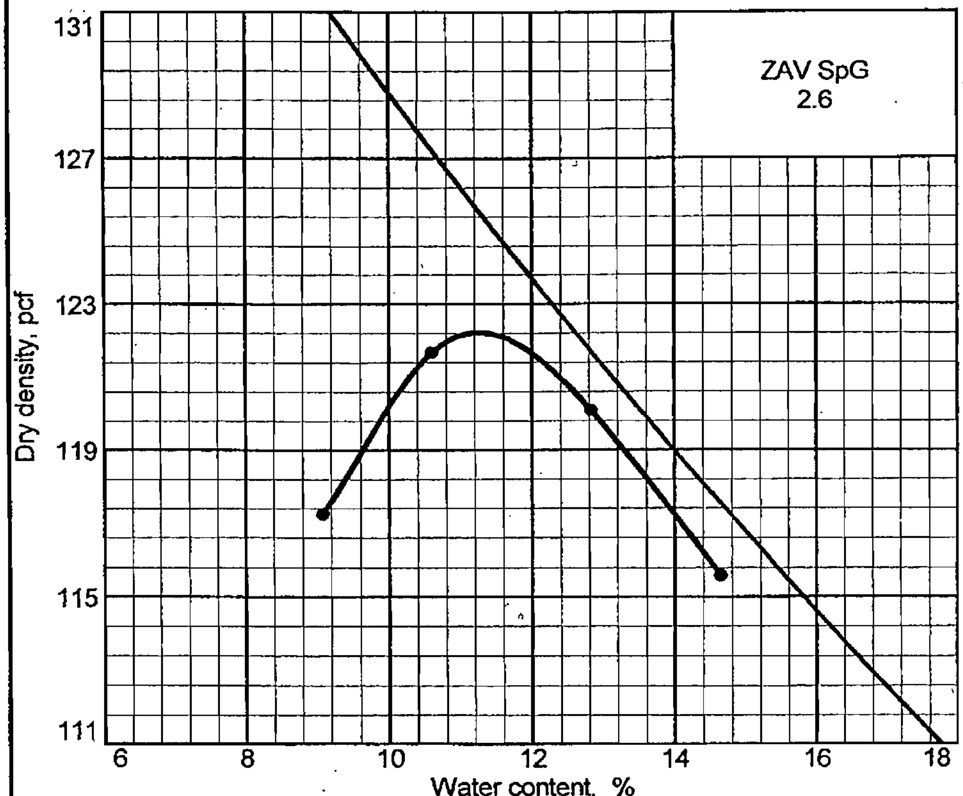
Remarks:
10-3-2001
CLIENT/AMc

COMPACTION TEST REPORT

CONSTRUCTION MATERIALS TESTING INC.

Plate

COMPACTION TEST REPORT



Curve No.
TP-1@7'

Test Specification:
ASTM D 1557-91 A MODIFIED

Hammer Wt.: 10
Hammer Drop: 18
Number of Layers: FIVE
Blows per Layer: 25
Mold Size: .03334 cu.ft.
Test Performed on Material Passing No.4 **Sieve**

Soil Data

NM ______ **Sp.G.** ______
LL ______ **PI** ______
%>No.4 ______ **%<#200** ______
USCS ______ **AASHTO** ______

TESTING DATA

	1	2	3	4	5	6
WM + WS	1934.0	2035.0	2049.0	2004.0		
WM	0.0	0.0	0.0	0.0		
WW + T #1	1934.00	2035.00	2049.00	2004.00		
WD + T #1	1773.00	1840.00	1816.00	1748.00		
TARE #1	0.00	0.00	0.00	0.00		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	9.1	10.6	12.8	14.6		
DRY DENSITY	117.2	121.7	120.1	115.6		

TEST RESULTS

Maximum dry density = 122.2 pcf

Optimum moisture = 11.3 %

Material Description

LIGHT OLIVE BROWN SILTY SAND

Project No. 95333 **Client:** HULTGREN-TILLIS
Project: BV/GWF TRACY

● **Location:** TP-1@7'

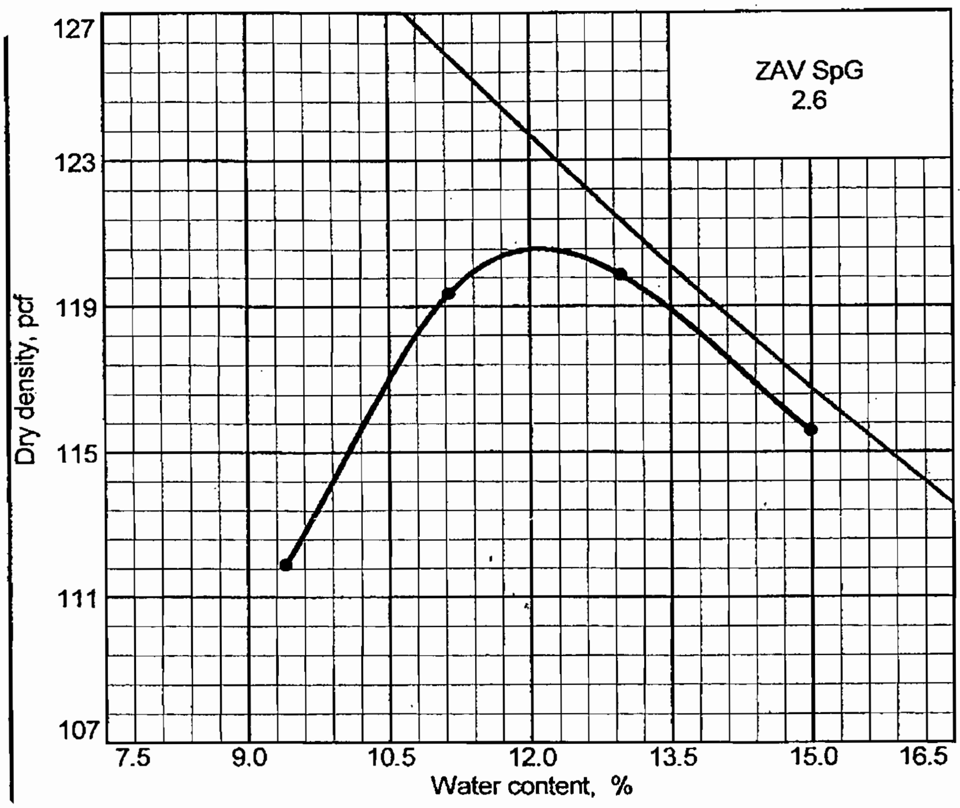
Remarks:
10-3-2001
CLIENT/AMc

COMPACTION TEST REPORT

CONSTRUCTION MATERIALS TESTING INC.

Plate

COMPACTION TEST REPORT



Curve No.
TP-2@3'

Test Specification:
ASTM D 1557-91 A MODIFIED

Hammer Wt.: 10
Hammer Drop: 18
Number of Layers: FIVE
Blows per Layer: 25
Mold Size: .03334 cu.ft.

Test Performed on Material Passing No.4 **Sieve**

Soil Data

NM ______ **Sp.G.** ______
LL ______ **PI** ______
%>No.4 ______ **%<#200** ______
USCS ______ **AASHTO** ______

TESTING DATA

	1	2	3	4	5	6
WM + WS	1851.0	2006.0	2048.0	2010.0		
WM	0.0	0.0	0.0	0.0		
WW + T #1	1851.00	2006.00	2048.00	2010.00		
WD + T #1	1692.00	1805.00	1813.00	1748.00		
TARE #1	0.00	0.00	0.00	0.00		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	9.4	11.1	13.0	15.0		
DRY DENSITY	111.9	119.4	119.9	115.6		

TEST RESULTS

Maximum dry density = 120.6 pcf

Optimum moisture = 12.1 %

Material Description

BROWN SANDY CLAY

Project No. 95333 **Client:** HULTGREN-TILLIS
Project: BV/GWF TRACY

● **Location:** TP-2@3'

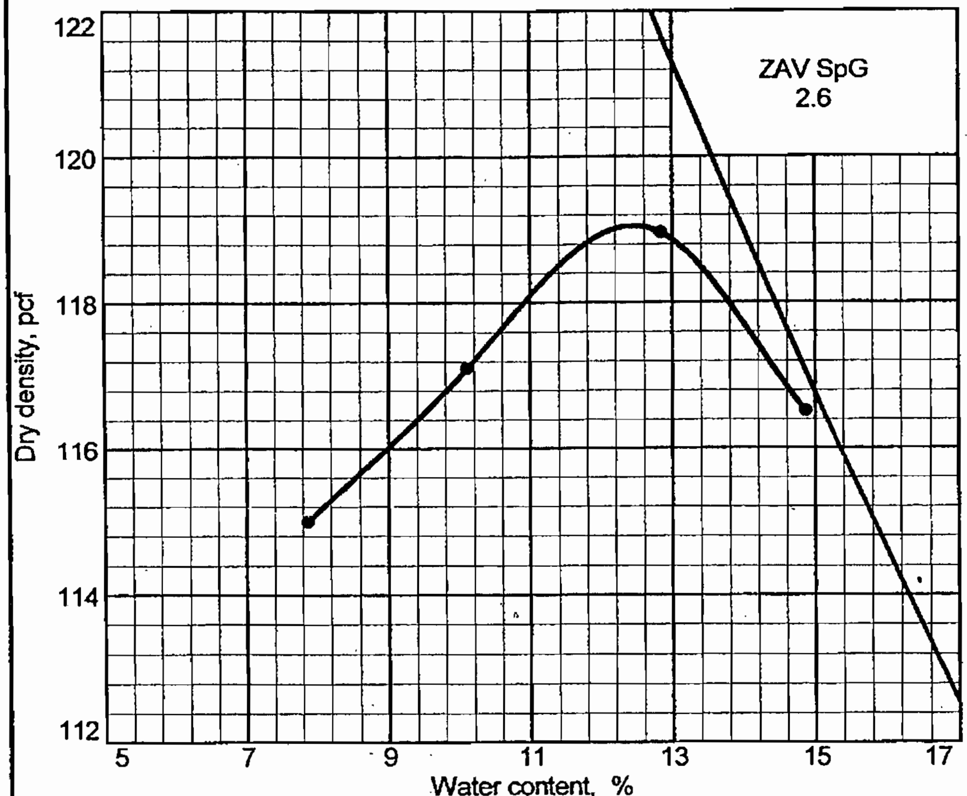
Remarks:
10-3-2001
CLIENT/JPM

COMPACTION TEST REPORT

CONSTRUCTION MATERIALS TESTING INC.

Plate

COMPACTION TEST REPORT



Curve No.
TP-3@5'

Test Specification:
ASTM D 1557-91 A MODIFIED

Hammer Wt.: 10
Hammer Drop: 18
Number of Layers: FIVE
Blows per Layer: 25
Mold Size: .03334 cu.ft.

Test Performed on Material Passing No.4 **Sieve**

Soil Data

NM ______ **Sp.G.** ______
LL ______ **PI** ______
%>No.4 ______ **%<#200** ______
USCS ______ **AASHTO** ______

TESTING DATA

	1	2	3	4	5	6
WM + WS	1876.0	1950.0	2030.0	2024.0		
WM	0.0	0.0	0.0	0.0		
WW + T #1	1876.00	1950.00	2030.00	2024.00		
WD + T #1	1739.00	1771.00	1799.00	1762.00		
TARE #1	0.00	0.00	0.00	0.00		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	7.9	10.1	12.8	14.9		
DRY DENSITY	115.0	117.1	119.0	116.5		

TEST RESULTS

Maximum dry density = 119.1 pcf

Optimum moisture = 12.5 %

Material Description

LIGHT OLIVE BROWN SILTY SAND

Project No. 95333 **Client:** HULTGREN-TILLIS

Project: BV/GWF TRACY

● **Location:** TP-3@5'

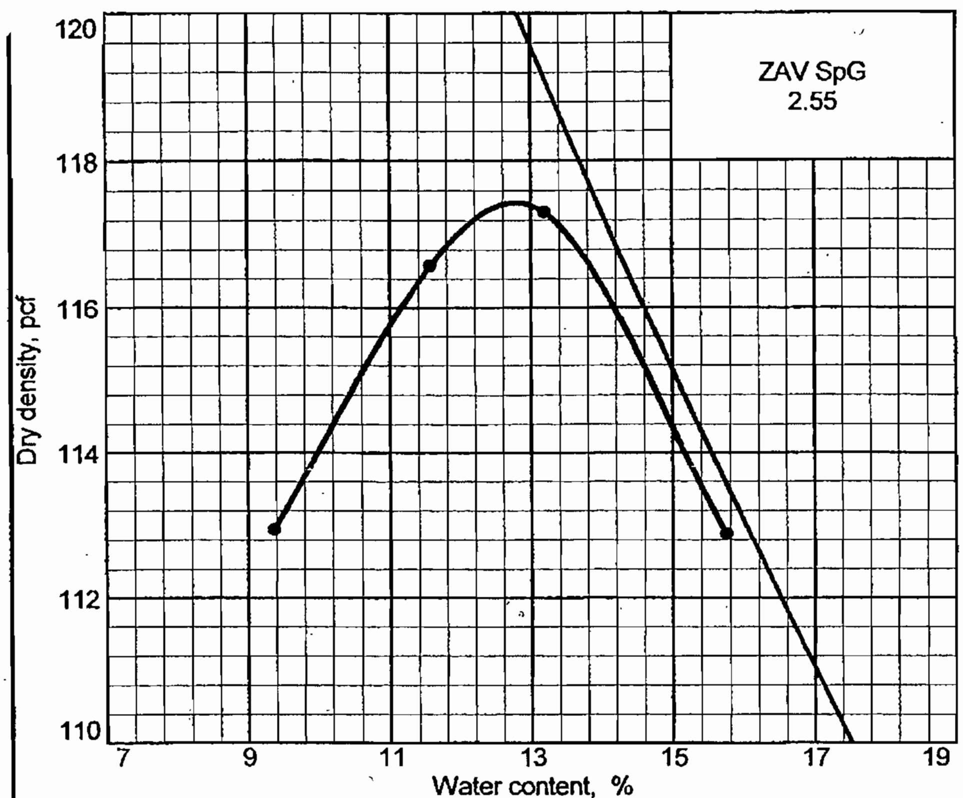
Remarks:
10-4-2001
CLIENT/JPM

COMPACTION TEST REPORT

CONSTRUCTION MATERIALS TESTING INC.

Plate

COMPACTION TEST REPORT



Curve No.
TP-4@3.5'

Test Specification:
ASTM D 1557-91 A MODIFIED

Hammer Wt.: 10
Hammer Drop: 18
Number of Layers: FIVE
Blows per Layer: 25
Mold Size: .03334 cu.ft.
Test Performed on Material Passing No.4 **Sieve**

Soil Data

NM ____ Sp.G. ____
LL ____ PI ____
%>No.4 ____ %<#200 ____
USCS ____ AASHTO ____

TESTING DATA

	1	2	3	4	5	6
WM + WS	1868.0	1967.0	2008.0	1976.0		
WM	0.0	0.0	0.0	0.0		
WW + T #1	1868.00	1967.00	2008.00	1976.00		
WD + T #1	1708.00	1763.00	1774.00	1707.00		
TARE #1	0.00	0.00	0.00	0.00		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	9.4	11.6	13.2	15.8		
DRY DENSITY	112.9	116.6	117.3	112.9		

TEST RESULTS

Maximum dry density = 117.4 pcf

Optimum moisture = 12.8 %

Material Description

LIGHT OLIVE BROWN SILT

Project No. 95333 **Client:** HULTGREN-TILLIS
Project: BV/GWF TRACY

● **Location:** TP-4@3.5'

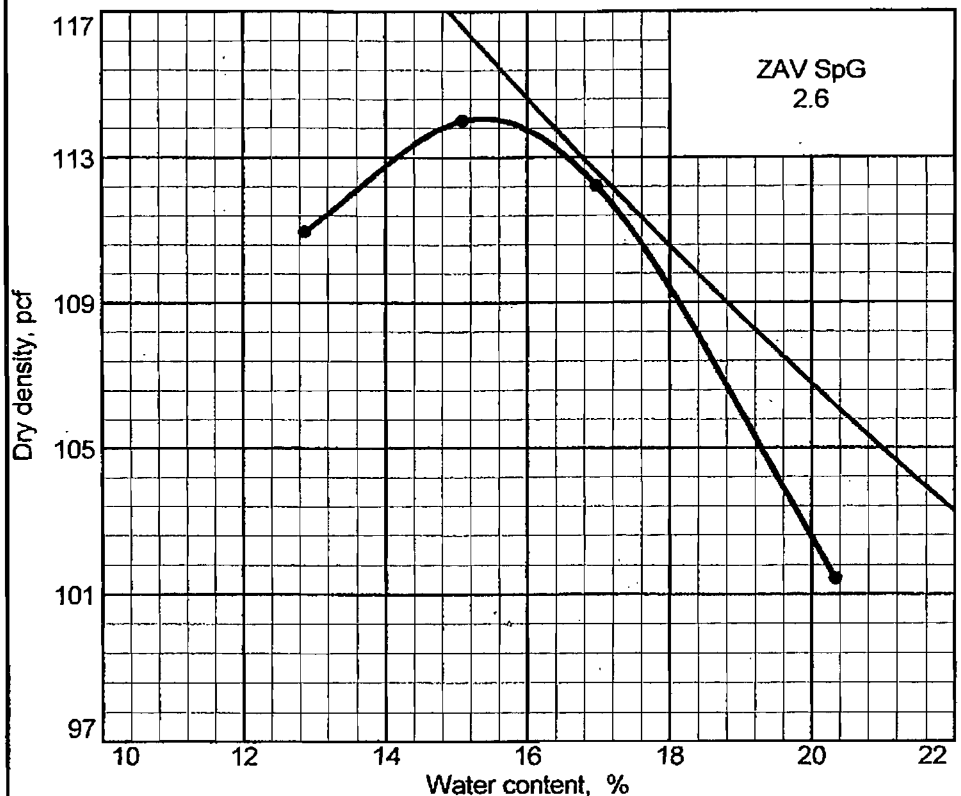
Remarks:
10-5-2001
CLIENT/AMc

COMPACTION TEST REPORT

CONSTRUCTION MATERIALS TESTING INC.

Plate

COMPACTION TEST REPORT



Curve No.
TP-5 @ 3'

Test Specification:
ASTM D 1557-91 A MODIFIED

Hammer Wt.: 10
Hammer Drop: 18
Number of Layers: FIVE
Blows per Layer: 25
Mold Size: .03334 cu.ft.
Test Performed on Material Passing No.4 **Sieve**

Soil Data

NM ____ **Sp.G.** ____
LL ____ **PI** ____
%>No.4 ____ **%<#200** ____
USCS ____ **AASHTO** ____

TESTING DATA

	1	2	3	4	5	6
WM + WS	1894.0	1984.0	1985.0	1846.0		
WM	0.0	0.0	0.0	0.0		
WW + T #1	1894.00	1984.00	1985.00	1846.00		
WD + T #1	1678.00	1724.00	1697.00	1534.00		
TARE #1	0.00	0.00	0.00	0.00		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	12.9	15.1	17.0	20.3		
DRY DENSITY	111.0	114.0	112.2	101.4		

TEST RESULTS

Maximum dry density = 114.1 pcf

Optimum moisture = 15.4 %

Material Description

DRK GRY BRN SD CLAY

Project No. 95333 **Client:** HULTGREN-TILLIS
Project: BV/GWF TRACY

● **Location:** TP-5 @ 3'

Remarks:
CLIENT/JPM 10-3-01

COMPACTION TEST REPORT

CONSTRUCTION MATERIALS TESTING INC.

Plate

SIEVE ANALYSIS

Wash Analysis
ASTM D 1140
Cooper Testing Labs, Inc.

Job No.:	212-041		Project:	GWF Power		
Client:	Hultgren		Date:	10/15/2001	By:	DC
Boring:	BV1	BV3	BV3	BV3	BV3	BV4
Sample:	4	2	5	6	8	10
Depth, ft.:	8.5-10	3.5-4.5	13.5-15	18.5-20	28.5-30	38.5-40
Soil Type:	grayish brown clayey SAND	brown clayey SAND	brown CLAY w/sand	brown sandy CLAY	brown CLAY w/sand	brown sandy CLAY
Total Wt.	227.2	266.4	121.8	136.0	152.8	170.9
Wt. Retained	168.6	157.5	36.1	47.0	38.7	72.8
% Course	74.2%	59.1%	29.6%	34.6%	25.3%	42.6%
% Fines	25.8%	40.88%	70.4%	65.4%	74.7%	57.4%

Remarks: "Fines" represents the material passing the #200 sieve, (silt and/or clay).

Wash Analysis
ASTM D 1140
Cooper Testing Labs, Inc.

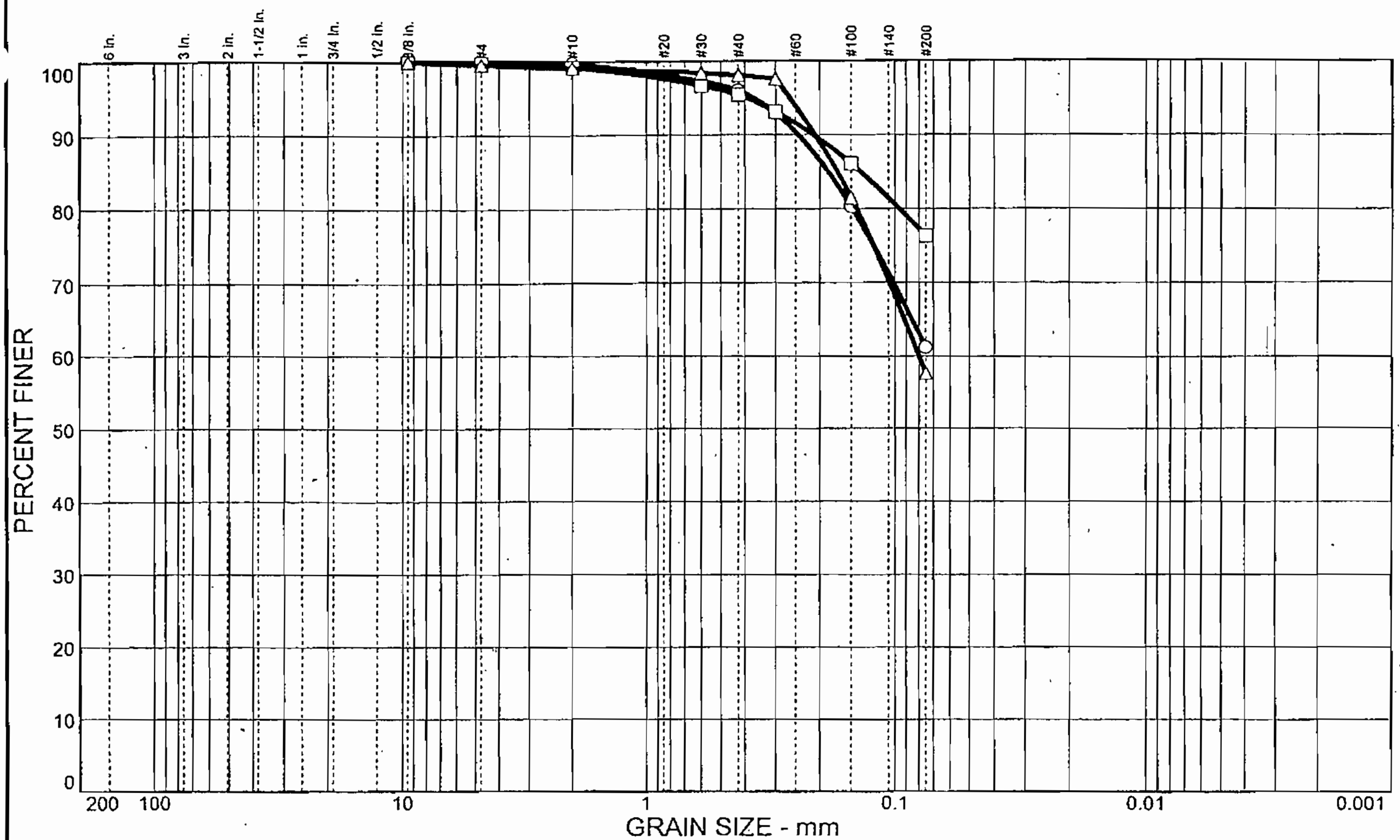
Job No.: 212-041a | Project: GWF Power

Client: Hultgren | Date: 10/15/2001 | By: DC

Boring:	TP1	TP3	TP4			
Sample:	2	2	1			
Depth, ft.:	7	2.5-14	3.5			
Soil Type:	brown sandy CLAY	brown sandy SILT	brown silty SAND			
Total Wt.	227.8	170.8	269.6			
Wt. Retained	97.3	81.6	161.2			
% Course	42.7%	47.8%	59.8%	#DIV/0!	#DIV/0!	#DIV/0!
% Fines	57.3%	52.22%	40.2%	#DIV/0!	#DIV/0!	#DIV/0!

Remarks: "Fines" represents the material passing the #200 sieve, (silt and/or clay).

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			38.8			ML			
□		0.2	23.5			ML			
△		0.4	42.0			ML			

SIEVE inches size	PERCENT FINER ○	□	△
3/8	100.0	100.0	100.0
GRAIN SIZE			
D_{60}			0.0800
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	100.0	99.8	99.6
#10	99.7	99.2	99.1
#30	97.3	96.7	98.4
#40	96.0	95.4	98.1
#50	92.9	93.1	97.6
#100	80.3	86.1	81.5
#200	61.2	76.3	57.6

SOIL DESCRIPTION

○ brown sandy CLAY

□ brown CLAY with sand

△ brown sandy SILT

REMARKS:

○

□

△

○ Source: BV-1	Sample No.: 2	Elev./Depth: 3.5-4'
□ Source: BV-1	Sample No.: 8	Elev./Depth: 28.5-29'
△ Source: BV-1	Sample No.: 14	Elev./Depth: 58.5-60'

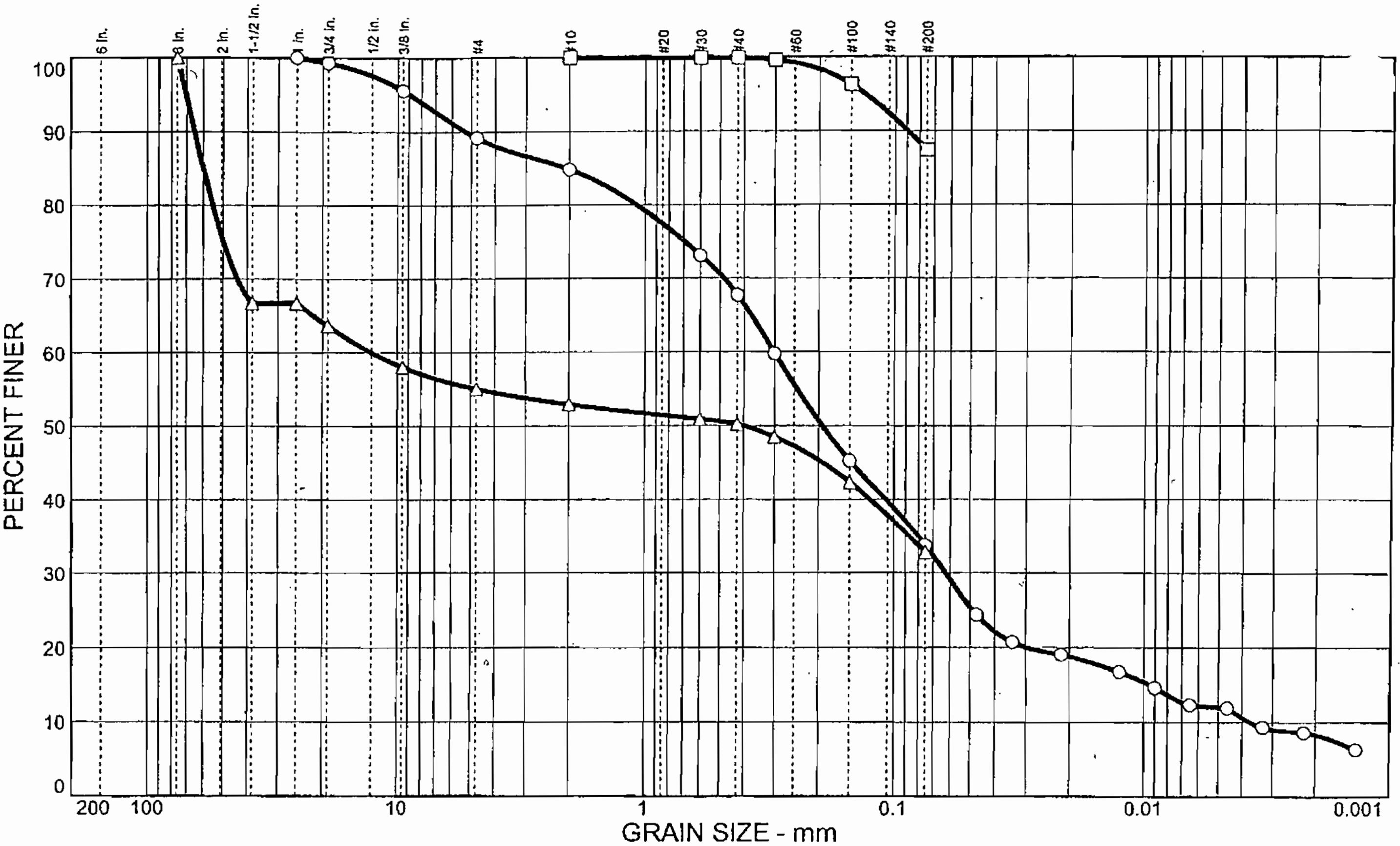
COOPER TESTING LABORATORY

Client: Hultgren-Tillis
Project: GWF Power

Project No.: 212-041

Plate

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	
○		10.8	55.5	21.7	12.0	SC-SM		17	24
□			12.6			ML			
△		45.0	22.2			GM			

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □	PERCENT FINER △
3			100.0
1.5			66.7
1	100.0		66.7
3/4	99.3		63.6
3/8	95.6		58.0
	GRAIN SIZE		
D_{60}	0.304		12.8
D_{30}	0.0627		
D_{10}	0.0037		
	COEFFICIENTS		
C_c	3.50		
C_u	82.19		

SIEVE number size	PERCENT FINER ○	PERCENT FINER □	PERCENT FINER △
#4	89.2		55.0
#10	84.8	100.0	52.9
#30	73.1	99.9	50.9
#40	67.7	99.9	50.2
#50	59.7	99.6	48.5
#100	45.2	96.3	42.3
#200	33.7	87.4	32.8

SOIL DESCRIPTION

○ brown silty clayey SAND

□ brown CLAY (silty)

△ olive-brown clayey GRAVEL with sand

REMARKS:

○

□

△

○ Source: BV-2 Sample No.: 1 Elev./Depth: 1-3.5'

□ Source: BV-2 Sample No.: 2 Elev./Depth: 3.5-5'

△ Source: BV-2 Sample No.: 5 Elev./Depth: 13.5-15'

COOPER TESTING LABORATORY

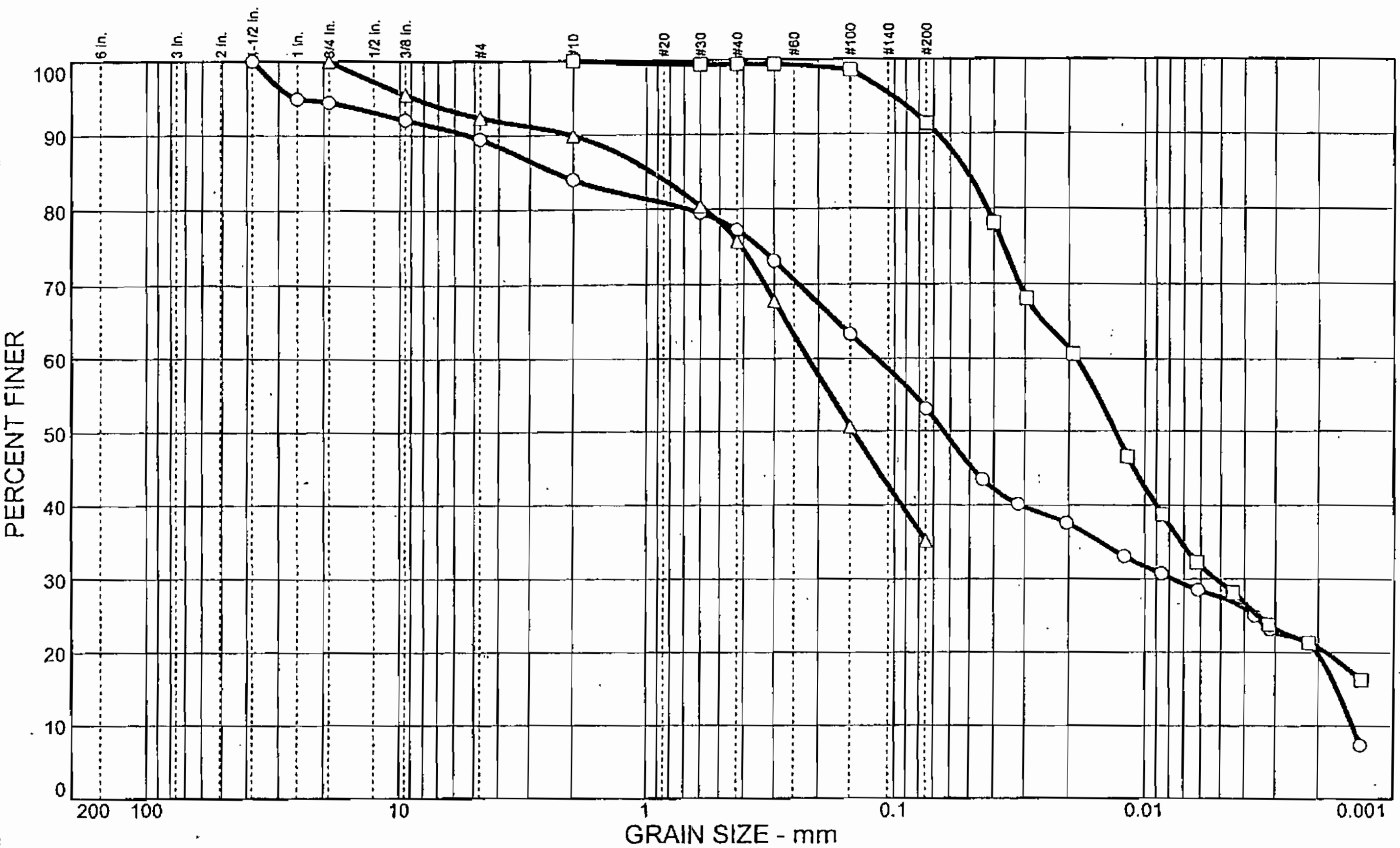
Client: Hultgren-Tillis

Project: GWF Power

Project No.: 212-041

Plate

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		10.5	36.5	25.5	27.5	CL		20	46
□			8.6	61.9	29.5	CL		18	33
△		7.6	57.3			SM			

SIEVE inches size	PERCENT FINER ○	□	△
1.5	100.0		
1	94.9		
3/4	94.5		100.0
3/8	92.1		95.5
GRAIN SIZE			
D_{60}	0.118	0.0187	0.220
D_{30}	0.0078	0.0052	
D_{10}	0.0014		
COEFFICIENTS			
C_c	0.35		
C_u	81.57		

SIEVE number size	PERCENT FINER ○	□	△
#4	89.5		92.4
#10	84.0	100.0	89.9
#30	79.5	99.4	80.4
#40	77.2	99.4	75.7
#50	73.1	99.4	67.8
#100	63.3	98.6	50.6
#200	53.0	91.4	35.1

SOIL DESCRIPTION

○ brown sandy lean CLAY

□ brown lean CLAY w/trace sand

△ light brown silty SAND

REMARKS:

○ Sample fell out of suspension over night. Possibly due to a reaction with the deflocculant and some naturally or artificially made

□

△

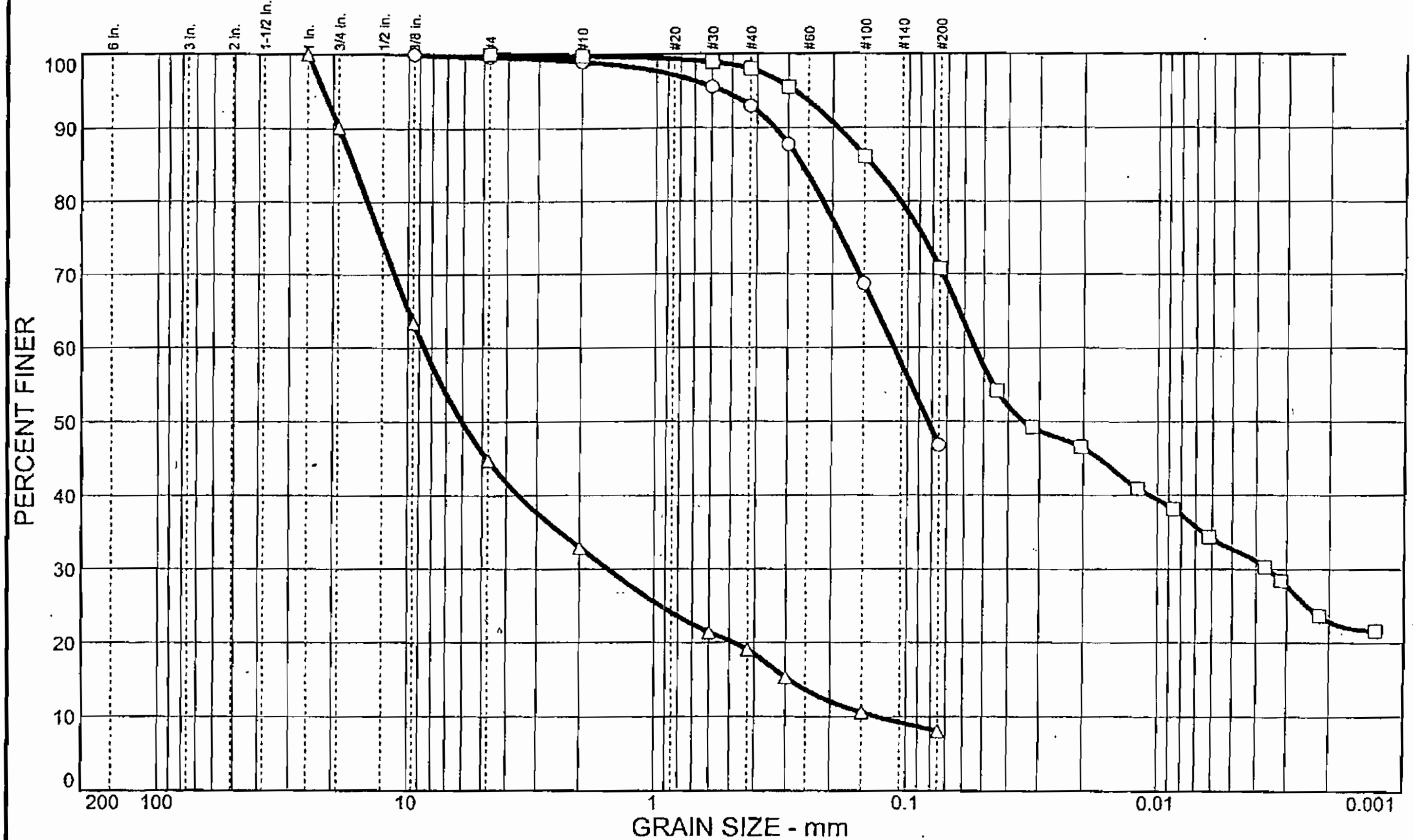
○ Source: BV-2	Sample No.: 11	Elev./Depth: 43.5 (Tip)
□ Source: BV-2	Sample No.: 16	Elev./Depth: 68.5-70'
△ Source: BV-3	Sample No.: 15	Elev./Depth: 63.5-65'

COOPER TESTING LABORATORY

Client: Hultgren-Tillis
Project: GWF Power

Project No.: 212-041 Plate

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		0.4	52.8			SC		23	34
□			29.2	38.1	32.7	CL		19	36
△		55.2	36.7			GW-GM			

SIEVE inches size	PERCENT FINER ○	□	△
1			100.0
3/4			90.2
3/8	100.0		63.4
GRAIN SIZE			
D_{60}	0.114	0.0543	8.61
D_{30}		0.0036	1.53
D_{10}			0.130
COEFFICIENTS			
C_c			2.10
C_u			66.29

SIEVE number size	PERCENT FINER ○	□	△
#4	99.6	100.0	44.8
#10	99.0	99.8	32.9
#30	95.6	98.9	21.4
#40	93.0	98.0	19.0
#50	87.7	95.6	15.3
#100	68.7	86.1	10.6
#200	46.8	70.8	8.1

SOIL DESCRIPTION

○ brown mottled gray clayey SAND

□ brown lean CLAY with sand

△ olive brown well graded GRAVEL with sand and silt

REMARKS:

○

□

△

○ Source: BV-4 Sample No.: 1 Elev./Depth: 1-3.5'

□ Source: BV-4 Sample No.: 5 Elev./Depth: 13.5-15'

△ Source: BV-4 Sample No.: 14 Elev./Depth: 58.5-60'

COOPER TESTING LABORATORY

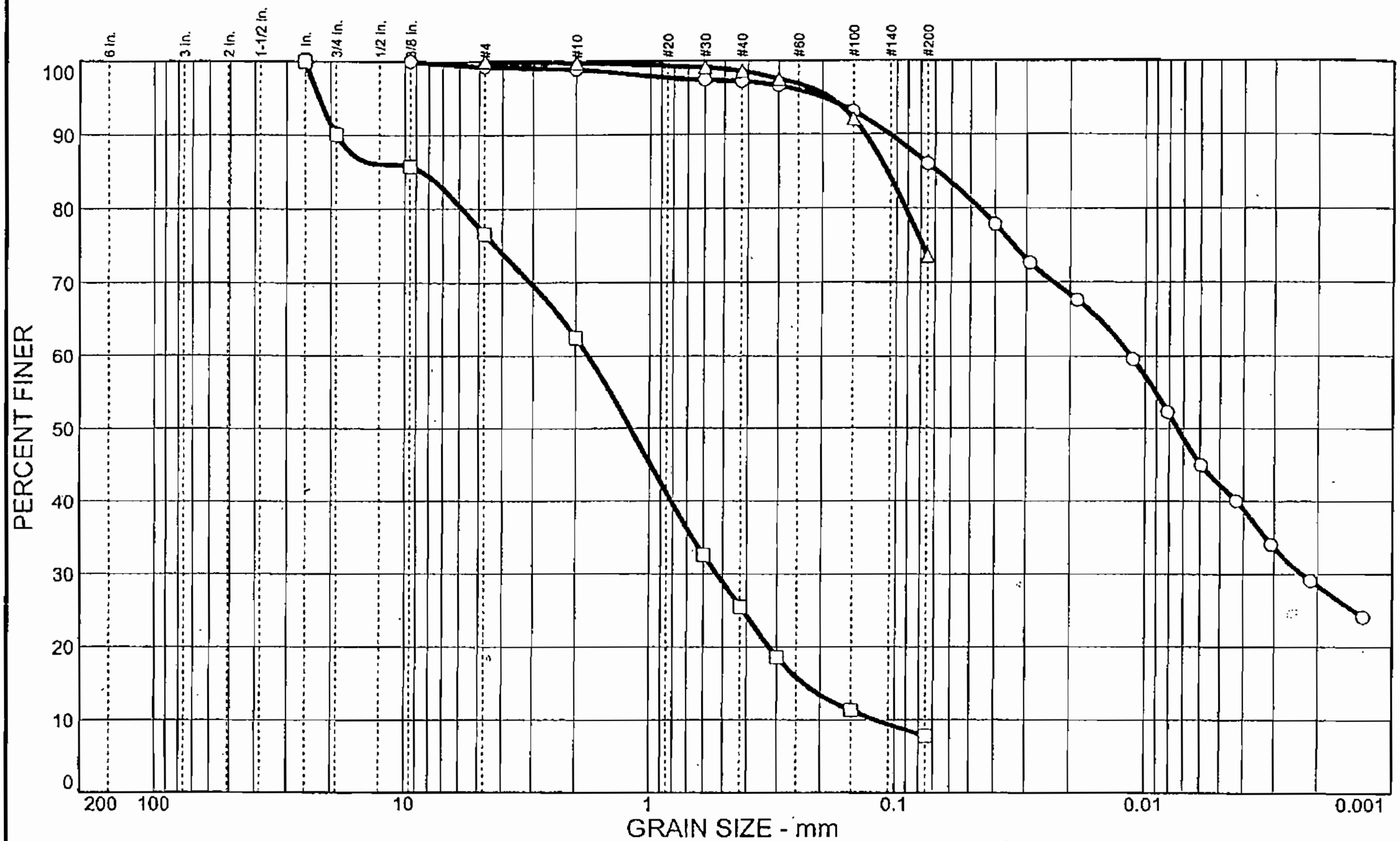
Client: Hultgren-Tillis

Project: GWF Power

Project No.: 212-041

Plate

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		0.7	13.3	43.8	42.2	CL		20	38
□		23.4	68.8			SW-SM			
△			26.4			ML			

SIEVE inches size	PERCENT FINER ○	□	△
1		100.0	
3/4		90.1	
3/8	100.0	85.7	
GRAIN SIZE			
D_{60}	0.0114	1.78	
D_{30}	0.0023	0.531	
D_{10}		0.120	
COEFFICIENTS			
C_c		1.32	
C_u		14.89	

SIEVE number size	PERCENT FINER ○	□	△
#4	99.3	76.6	100.0
#10	98.9	62.5	99.8
#30	97.4	32.6	99.1
#40	97.2	25.5	98.6
#50	96.6	18.6	97.5
#100	93.1	11.3	92.1
#200	86.0	7.8	73.6

SOIL DESCRIPTION

○ brown lean CLAY

□ brown well graded SAND with silt and gravel

△ brown SILT with saand

REMARKS:

○

□

△

○ Source: BV-4 Sample No.: 15 Elev./Depth: 63.5-66'

□ Source: BV-5 Sample No.: 6 Elev./Depth: 18.5-20'

△ Source: TP5 Sample No.: 2 Elev./Depth: 6.5'

COOPER TESTING LABORATORY

Client: Hultgren-Tillis

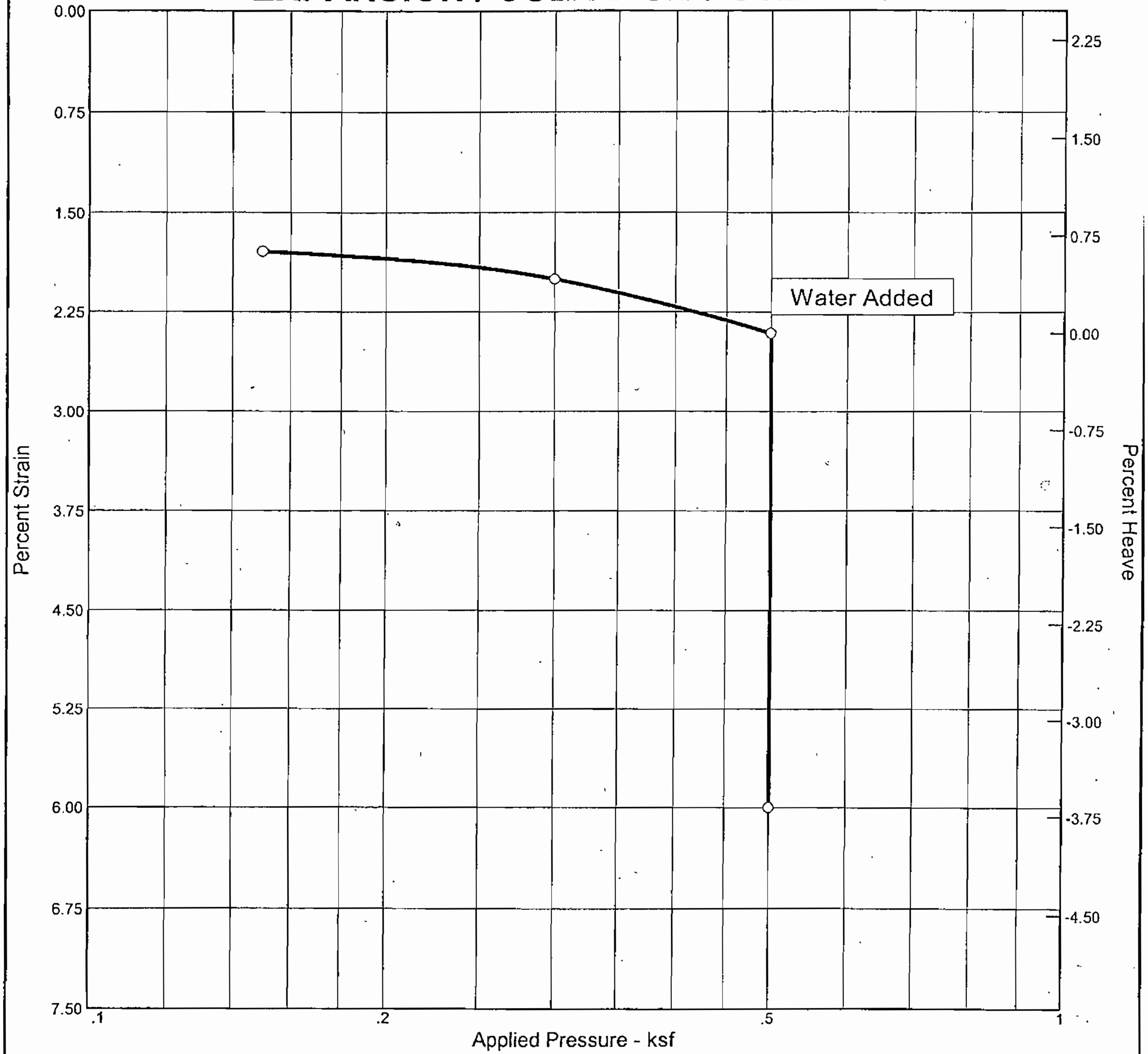
Project: GWF Power

Project No.: 212-041

Plate

SWELL

EXPANSION / COLLAPSE POTENTIAL



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
32.4 %	8.3 %	99.8			2.7	SM		0.689

MATERIAL DESCRIPTION

brown clayey SAND

Project No. 212-041 **Client:** Hultgren-Tillis

Project: GWF Power

Source: BV-2 **Sample No.:** 1 **Elev./Depth:** 1-3.5'

Remarks:

An expansion test was requested. Collapse occured instead.

EXPANSION / COLLAPSE POTENTIAL

COOPER TESTING LABORATORY

Plate

CONSOLIDATION TEST DATA

Client: Hultgren-Tillis
Project: GWF Power
Project Number: 212-041

Sample Data

Source: BV-2
Sample No.: 1
Elev. or Depth: 1-3.5'
Sample Length (in./cm.):
Location:
Description: brown clayey SAND
Liquid Limit:
Plasticity Index:
USCS: SM
AASHTO:
Figure No.:
Testing Remarks:

Test Specimen Data

TOTAL SAMPLE	BEFORE TEST	AFTER TEST
Wet w+t = 182.20 g.	Consolidometer # = 1	Wet w+t = 204.70 g.
Dry w+t = 168.30 g.		Dry w+t = 168.30 g.
Tare Wt. = .00 g.	Spec. Gravity = 2.7	Tare Wt. = .00 g.
Height = 1.00 in.	Height = 1.00 in.	
Diameter = 2.86 in.	Diameter = 2.86 in.	
Weight = 182.20 g.	Defl. Table = n/a	
Moisture = 8.3 %	Ht. Solids = 0.5921 in.	Moisture = 21.6 %
Wet Den. = 108.0 pcf	Dry Wt. = 168.30 g.*	Dry Wt. = 168.30 g.
Dry Den. = 99.8 pcf	Void Ratio = 0.689	Void Ratio = 0.588
	Saturation = 32.4 %	

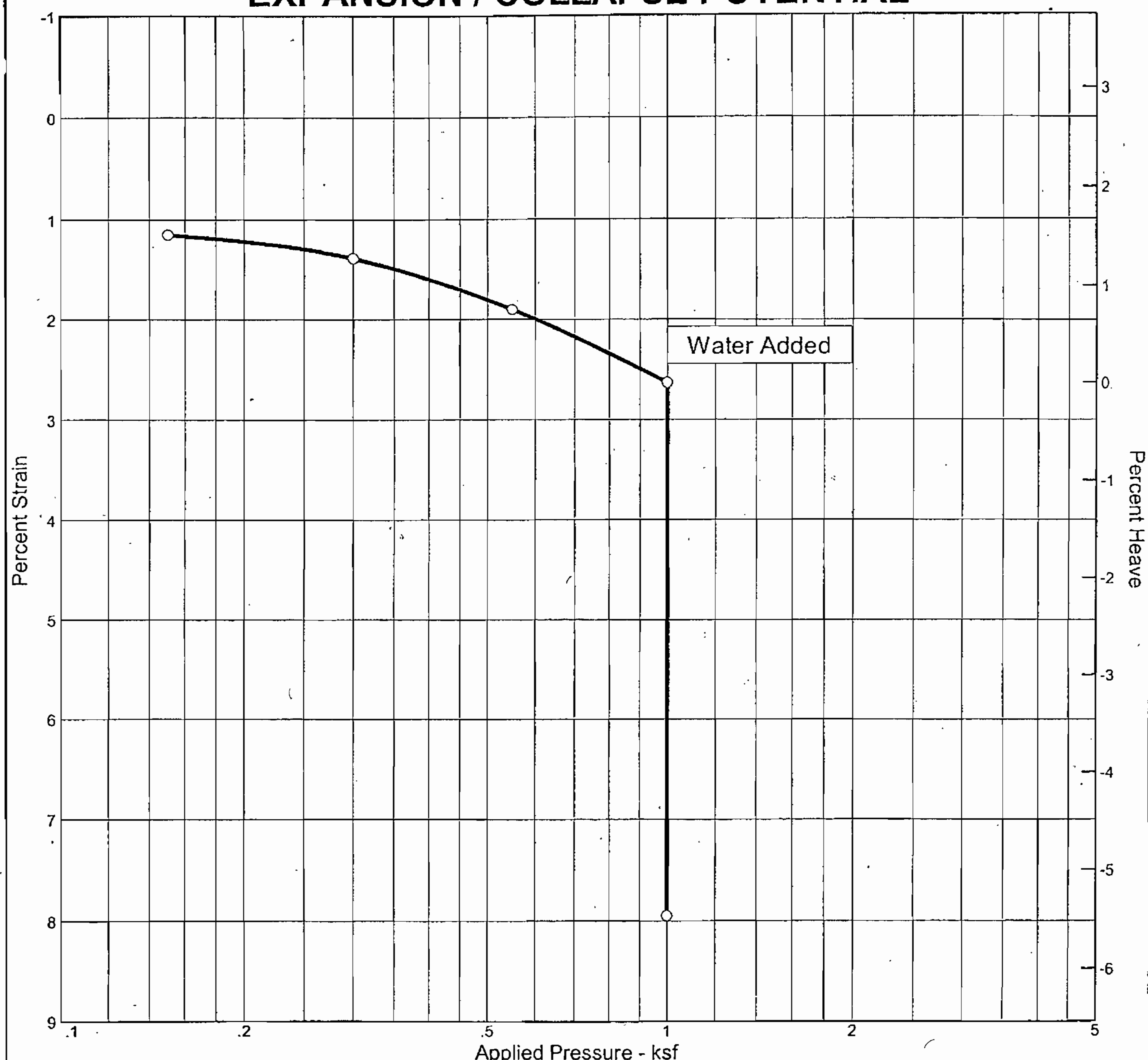
* Initial dry weight used in calculations

End-of-Load Summary

Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	C_v (ft.^{2}/day)	Void Ratio	% Compression /Swell
start	0.00000			0.689	
0.15	0.01790	0.00000		0.659	1.8 Comprs.
0.30	0.02000	0.00000		0.655	2.0 Comprs.
0.50	0.02410	0.00000		0.648	2.4 Comprs.
water	0.06000	0.00000		0.588	6.0 Comprs.

Heave percentage = -3.7

EXPANSION / COLLAPSE POTENTIAL



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
31.0 %	8.9 %	95.1			2.7			0.772

MATERIAL DESCRIPTION

brown silty SAND

Project No. 212-041 **Client:** Hultgren-Tillis

Project: GWF Power

Source: BV-2 **Sample No.:** 1-1k **Elev./Depth:** 1-3.5'

Remarks:

An expansion test was requested. Collapse occured instead.

EXPANSION / COLLAPSE POTENTIAL

COOPER TESTING LABORATORY

Plate

CONSOLIDATION TEST DATA

Client: Hultgren-Tillis
Project: GWF Power
Project Number: 212-041

Sample Data

Source: BV-2
Sample No.: 1-1k
Elev. or Depth: 1-3.5' Sample Length (in./cm.):
Location:
Description: brown silty SAND
Liquid Limit: Plasticity Index:
USCS: AASHTO: Figure No.:
Testing Remarks: An expansion test was requested. Collapse occured instead.

Test Specimen Data

TOTAL SAMPLE	BEFORE TEST	AFTER TEST
Wet w+t = 174.60 g.	Consolidometer # = 1	Wet w+t = 196.10 g.
Dry w+t = 160.40 g.		Dry w+t = 160.40 g.
Tare Wt. = .00 g.	Spec. Gravity = 2.7	Tare Wt. = .00 g.
Height = 1.00 in.	Height = 1.00 in.	
Diameter = 2.86 in.	Diameter = 2.86 in.	
Weight = 174.60 g.	Defl. Table = n/a	
Moisture = 8.9 %	Ht. Solids = 0.5643 in.	Moisture = 22.3 %
Wet Den. = 103.5 pcf	Dry Wt. = 160.40 g.*	Dry Wt. = 160.40 g.
Dry Den. = 95.1 pcf	Void Ratio = 0.772	Void Ratio = 0.631
	Saturation = 31.0 %	

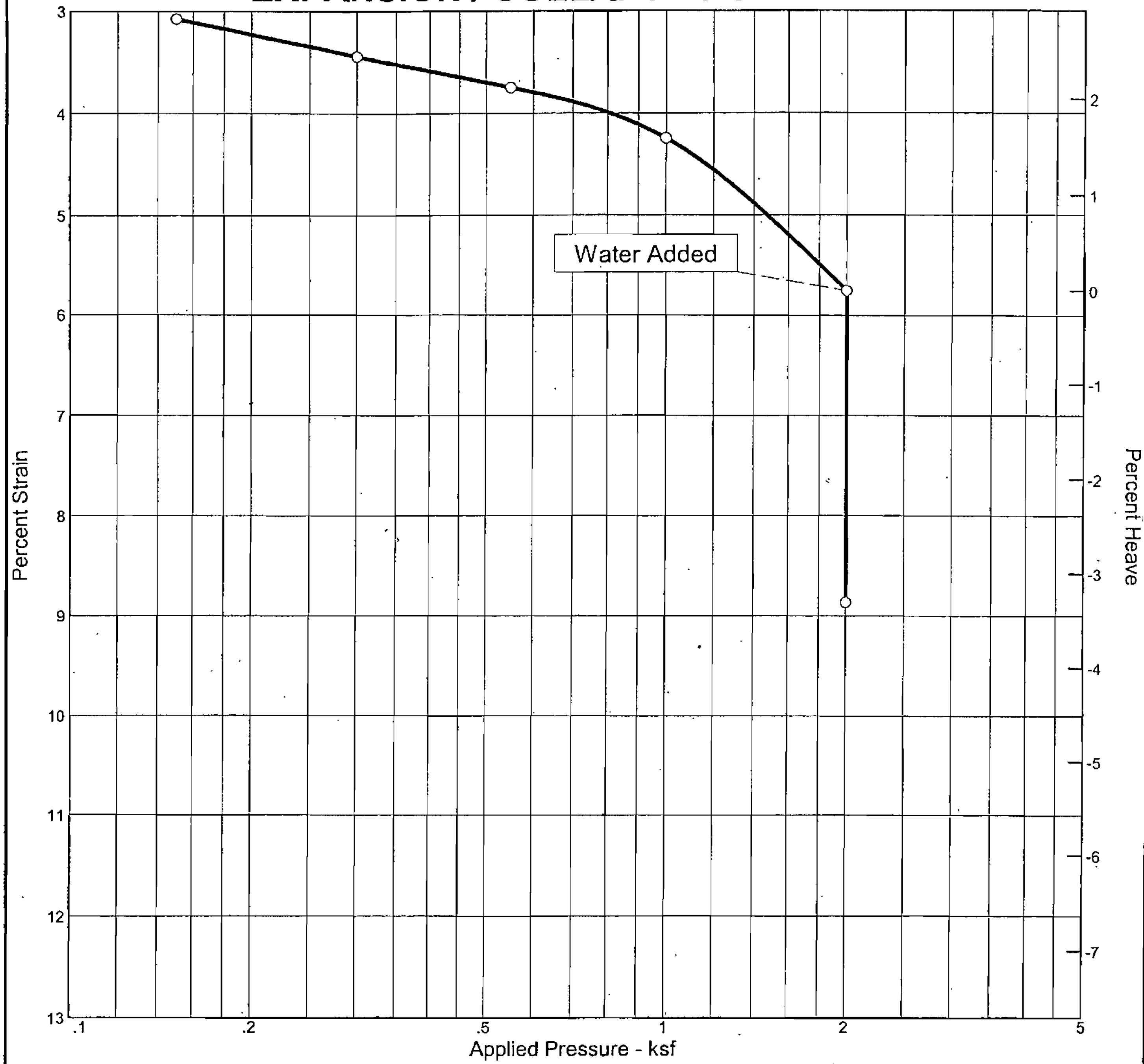
* Initial dry weight used in calculations

End-of-Load Summary

Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	C_v (ft.^{2}/day)	Void Ratio	% Compression /Swell
start	0.00000	-		0.772	
0.15	0.01150	0.00000		0.752	1.2 Comprs.
0.30	0.01380	0.00000		0.748	1.4 Comprs.
0.55	0.01900	0.00000		0.738	1.9 Comprs.
1.00	0.02630	0.00000		0.725	2.6 Comprs.
water	0.07950	0.00000		0.631	8.0 Comprs.

Heave percentage = -5.5

EXPANSION / COLLAPSE POTENTIAL



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
34.3 %	9.2 %	97.6			2.7			0.726

MATERIAL DESCRIPTION

brown silty SAND

Project No. 212-041 **Client:** Hultgren-Tillis

Project: GWF Power

Source: BV-2 **Sample No.:** 1-2k **Elev./Depth:** 1-3.5'

EXPANSION / COLLAPSE POTENTIAL

COOPER TESTING LABORATORY

Remarks:

An expansion test was requested. Collapse occured instead.

Plate

CONSOLIDATION TEST DATA

:lient: Hultgren-Tillis
roject: GWF Power
roject Number: 212-041

Sample Data

ource: BV-2
ample No.: 1-2k
lev. or Depth: 1-3.5'   Sample Length (in./cm.):
ocation:
escription: brown silty SAND
iquid Limit: Plasticity Index:
ISCS: AASHTO: Figure No.:
esting Remarks: An expansion test was requested. Collapse occured instead.

Test Specimen Data

TOTAL SAMPLE	BEFORE TEST	AFTER TEST
et w+t = 181.10 g.	Consolidometer # = 1	Wet w+t = 200.80 g.
ry w+t = 165.80 g.		Dry w+t = 165.80 g.
are Wt. = .00 g.	Spec. Gravity = 2.7	Tare Wt. = .00 g.
eight = 1.00 in.	Height = 1.00 in.	
iameter = 2.87 in.	Diameter = 2.87 in.	
eight = 181.10 g.	Defl. Table = n/a	
oisture = 9.2 %	Ht. Solids = 0.5792 in.	Moisture = 21.1 %
et Den. = 106.6 pcf	Dry Wt. = 165.80 g.*	Dry Wt. = 165.80 g.
ry Den. = 97.6 pcf	Void Ratio = 0.726	Void Ratio = 0.573
	Saturation = 34.3 %	

Initial dry weight used in calculations

End-of-Load Summary

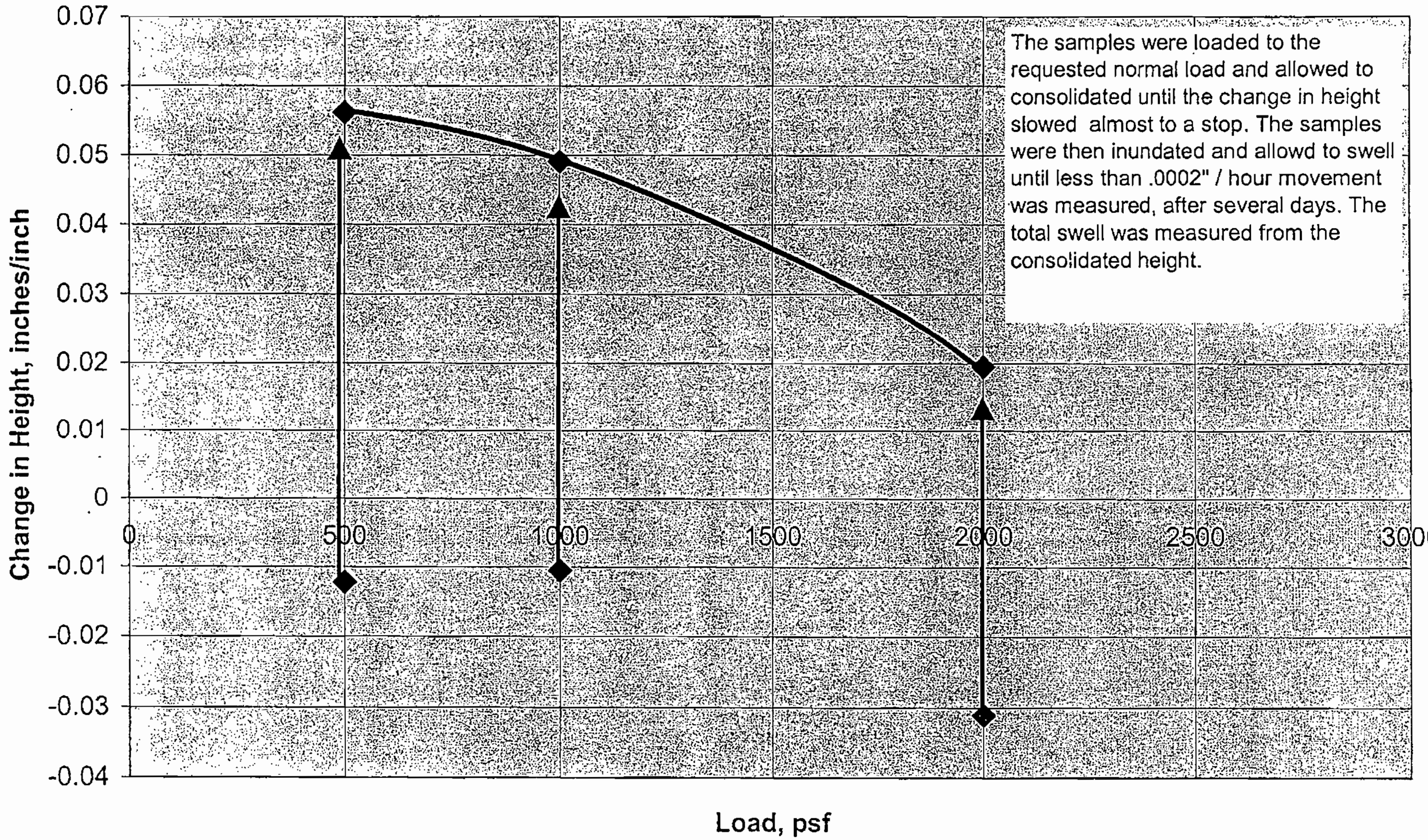
Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	C_v (ft.^{2}/day)	Void Ratio	% Compression /Swell
start	0.00000			0.726	
0.15	0.03080	0.00000		0.673	3.1 Comprs.
0.30	0.03440	0.00000		0.667	3.4 Comprs.
0.55	0.03750	0.00000		0.662	3.8 Comprs.
1.00	0.04250	0.00000		0.653	4.3 Comprs.
2.00	0.05750	0.00000		0.627	5.8 Comprs.
water	0.08870	0.00000		0.573	8.9 Comprs.

leave percentage = -3.3

Expansion vs Load

Cooper Testing Labs, Inc.

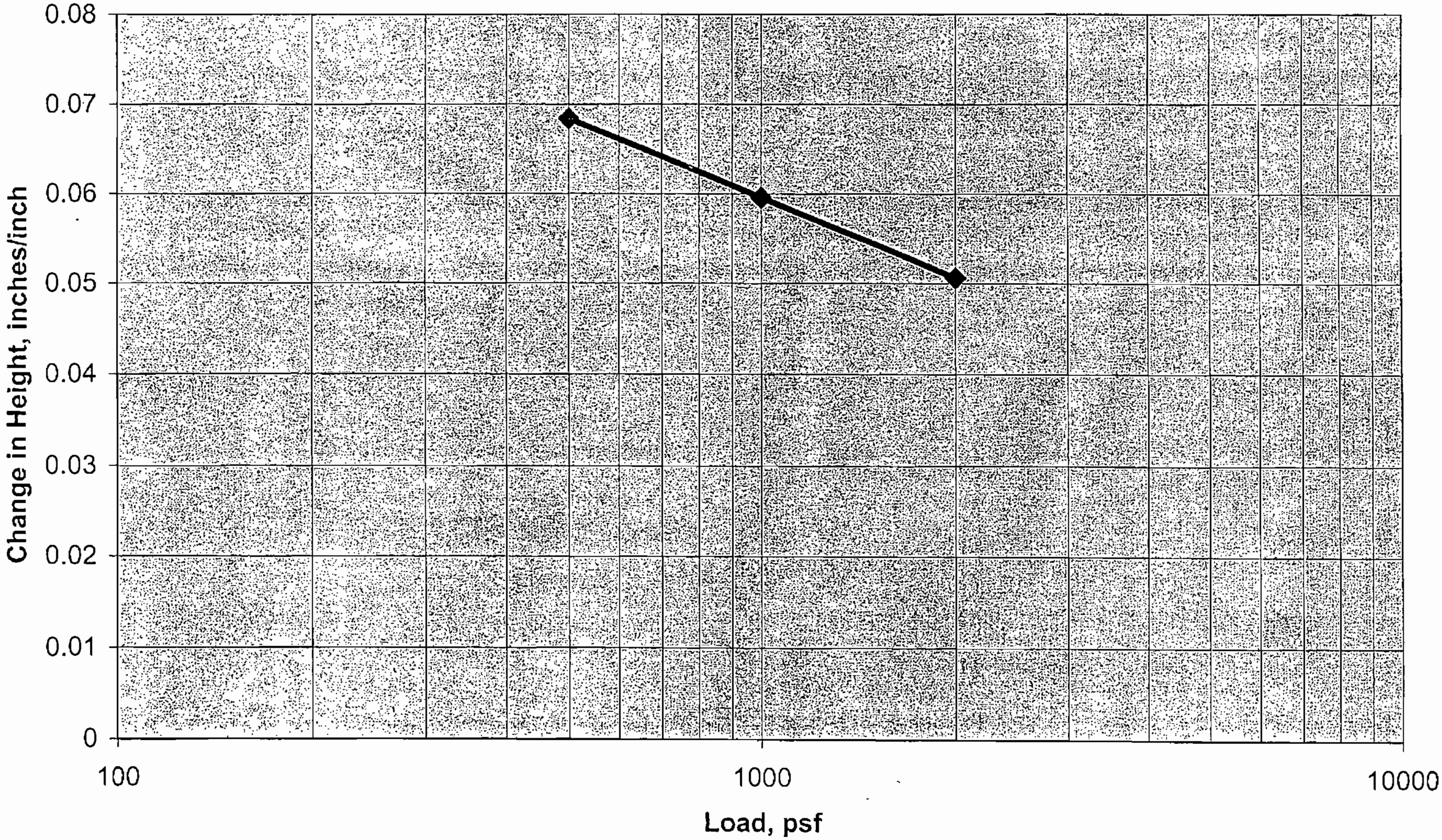
Sample BV5-2



Expansion vs Load

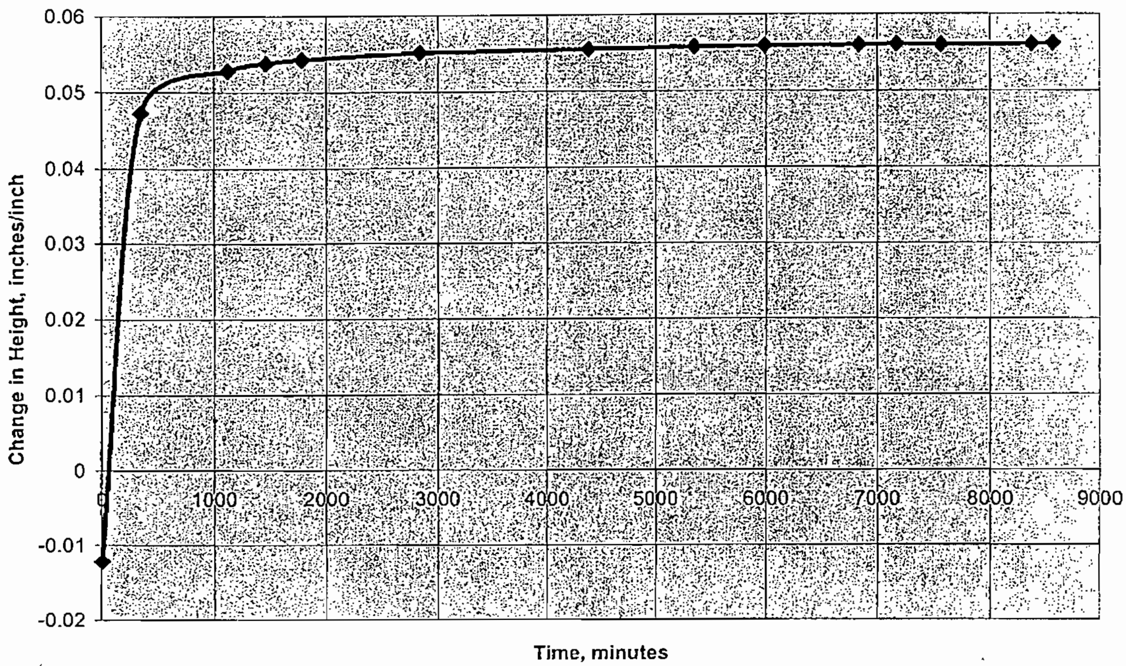
Cooper Testing Labs, Inc.

Sample BV5-2



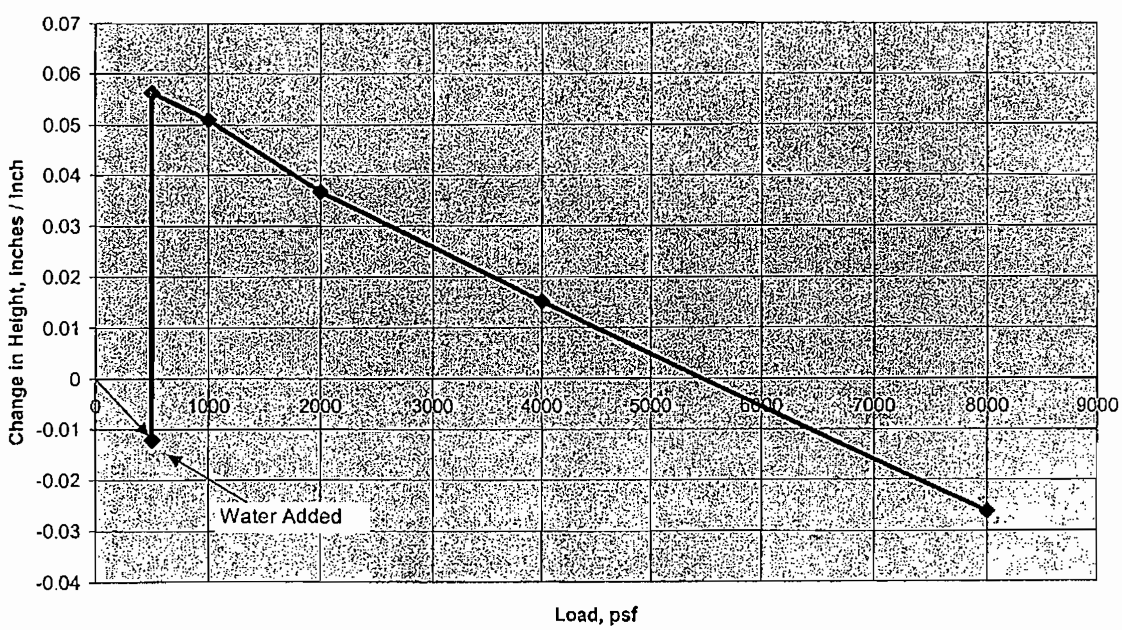
Expansion Test, ASTM D 4546

Sample BV5-2



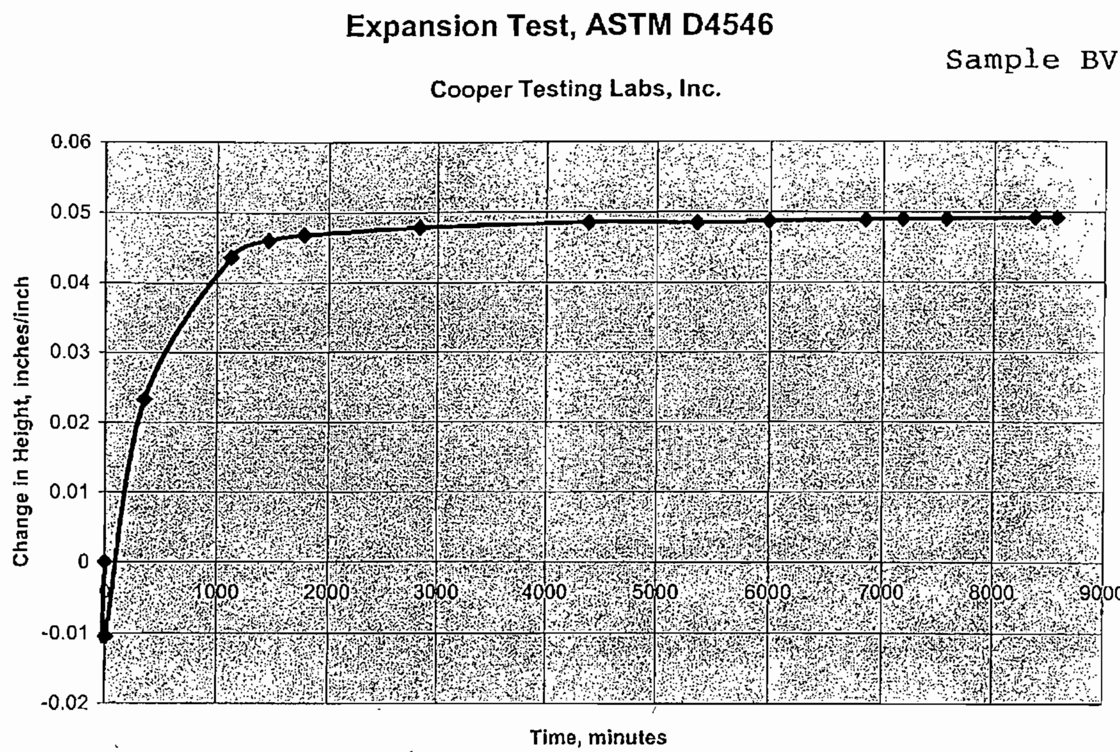
Expansion Pressure Test

Cooper Testing Labs, Inc.

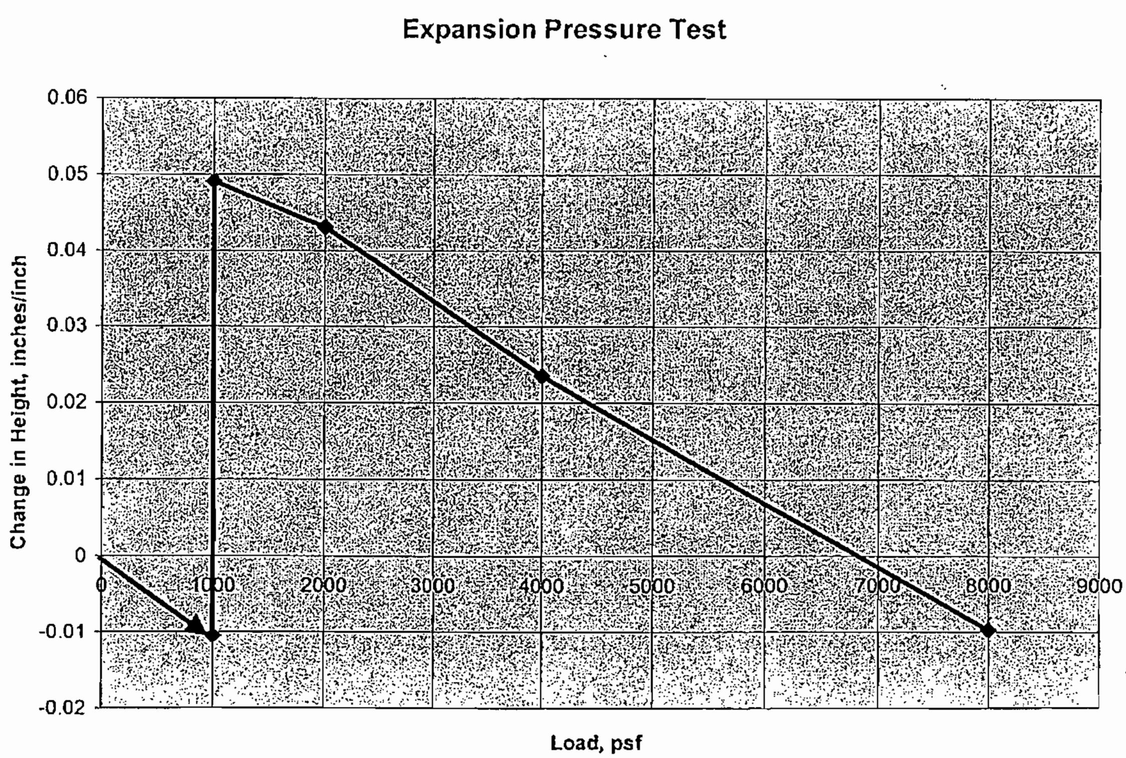


212-041c

Sample BV5-2



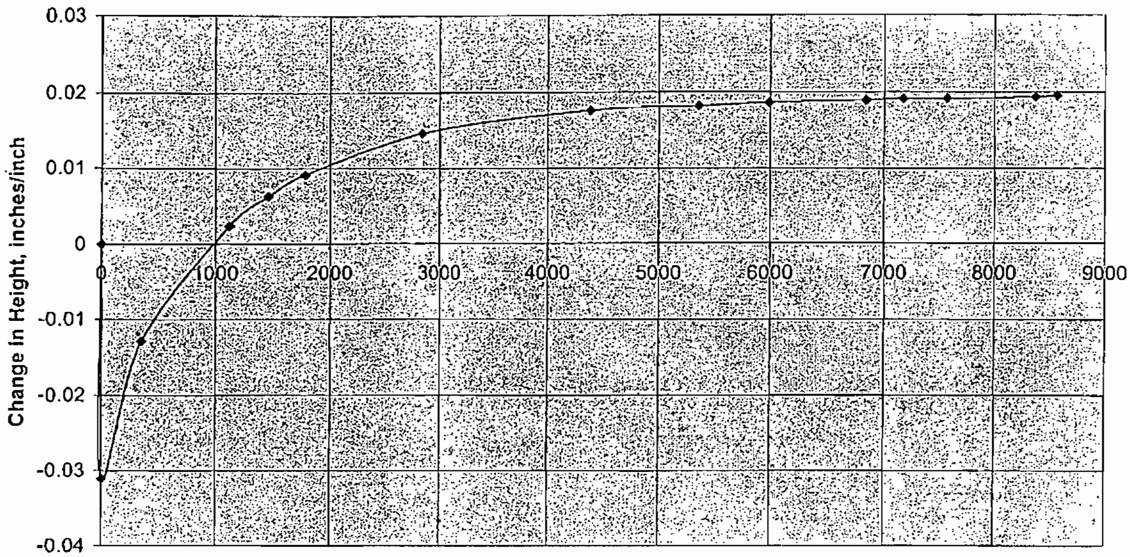
212-
041b



Cooper Testing Labs, Inc.

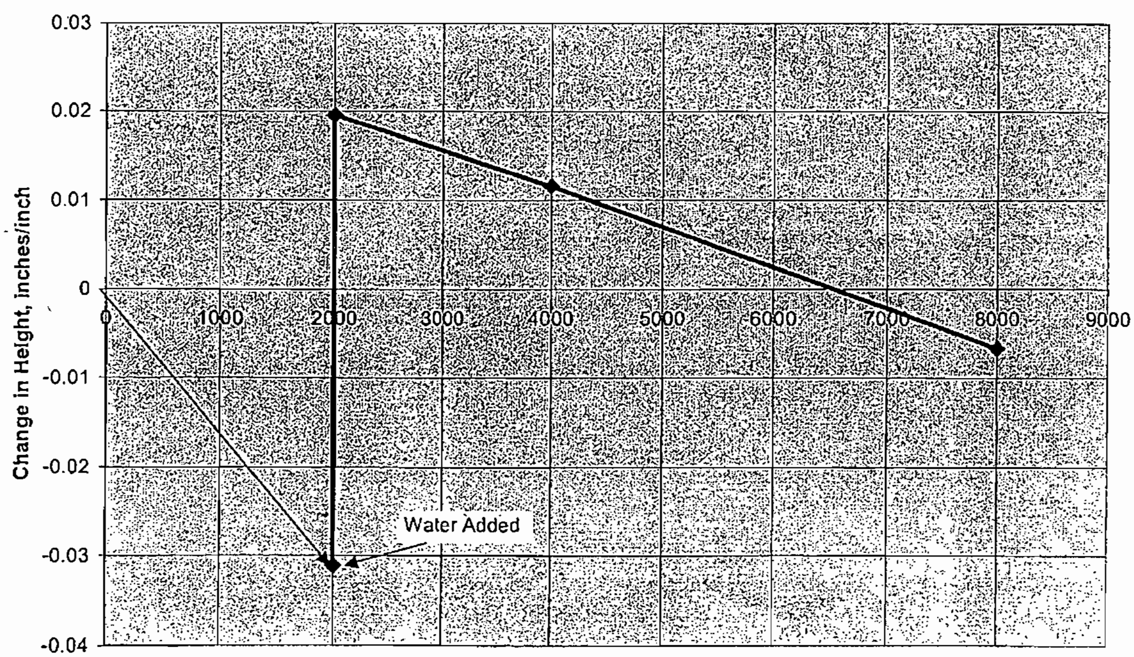
Sample BV5-2

Expansion Test, ASTM D4546



Expansion Pressure Test

Sample BV5-2 @



Hultgren
GWF Power
10/15/2001
DC

Sample BV5-2 @ 3.5-5'

	2000 load		1000 psf Load		500 psf Load		Composite	
	Time, min.	Delta h, "	Time, min.	Delta h, "	Time, min.	Delta h, "	Load	Delta h, "
	0	0	0	0	0	0		
Water Added	4	-0.0311	3	-0.0105	3	-0.0122	500	-0.0122
	353	-0.0129	351	0.0233	350	0.0472	500	0.0562
	1126	0.0023	1125	0.0436	1124	0.0528	1000	-0.0105
	1463	0.0061	1461	0.046	1461	0.0538	1000	0.0491
	1785	0.0091	1783	0.0468	1782	0.0543	2000	-0.0311
	2838	0.0146	2837	0.0478	2836	0.0551	2000	0.0195
	4391	0.0176	4389	0.0485	4389	0.0555		
	5358	0.0182	5356	0.0485	5356	0.0558		
	5993	0.0186	5991	0.0487	5990	0.0559		
	6843	0.0189	6836	0.0489	6835	0.056		
	7173	0.0191	7173	0.049	7170	0.0561		
	7568	0.0191	7568	0.049	7568	0.056		
	8371	0.0193	8371	0.0491	8371	0.0561		
	8568	0.0195	8568	0.0491	8568	0.0562		
	Consolidation		Consolidation		Consolidation			
	2000	-0.0311	1000	-0.0105	500	-0.0122		
	2000	0.0195	1000	0.0491	500	0.0562		
	4000	0.0116	2000	0.0431	1000	0.0509		
	8000	-0.0067	4000	0.0235	2000	0.0367		
			8000	-0.0098	4000	0.0152		
					8000	-0.0263		

COOPER TESTING LABS

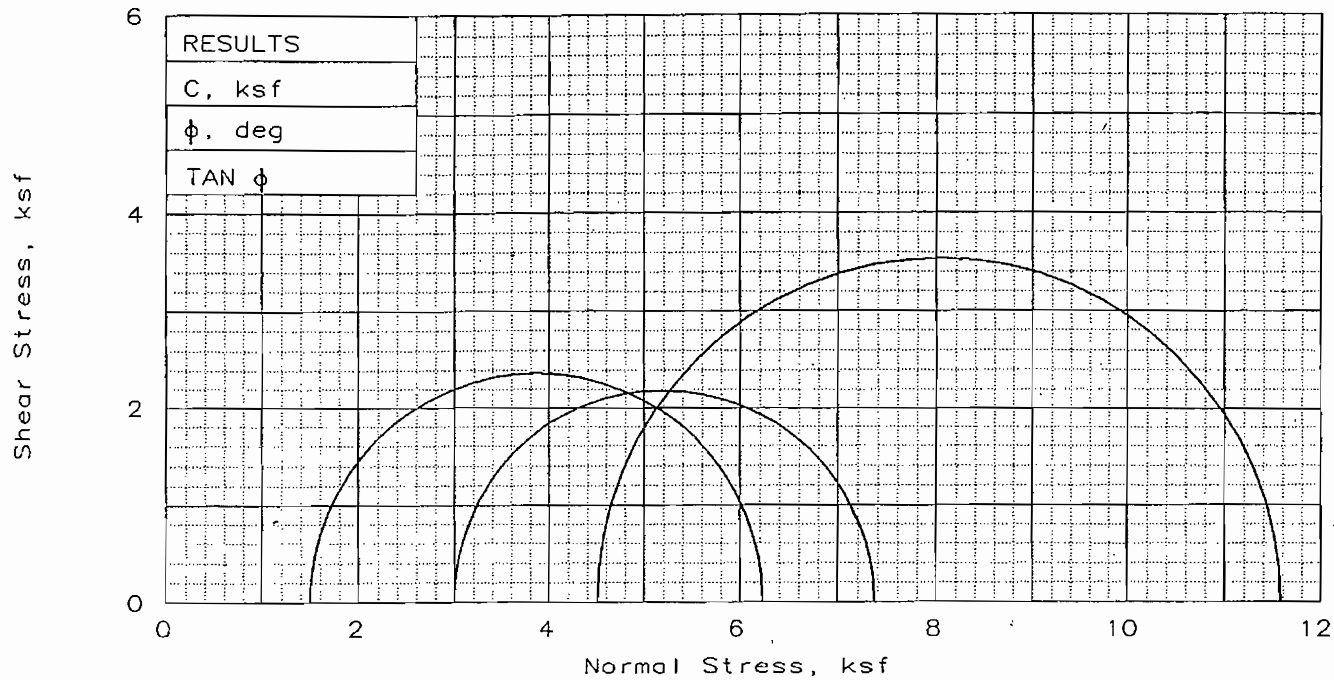
MOISTURE DENSITY - POROSITY DATA SHEET

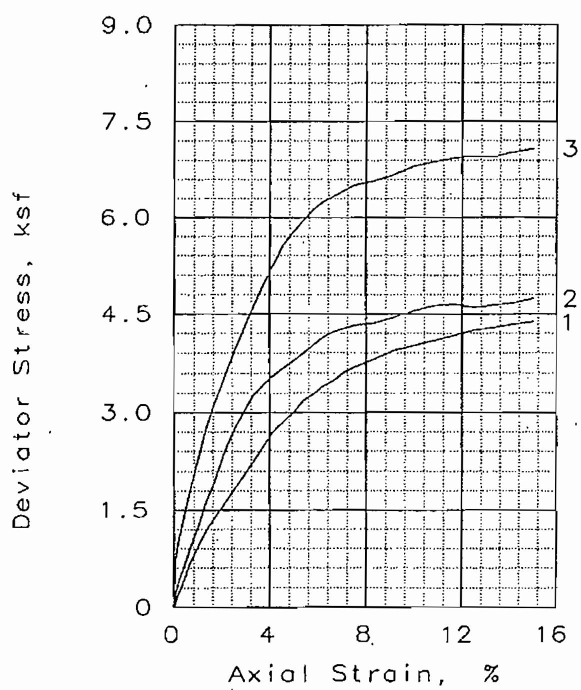
Job #	212-041A
Client	Hultgren
Project/Location	GWF Power
Date	10/16/01

Boring #	BV5-2	BV5-2	BV5-2		
Depth (ft)	3.5-5	3.5-5	3.5-5		
Soil Type	dark brown sandy CLAY	dark brown sandy CLAY	dark brown sandy CLAY		
Specific Gravity	2.70 ASSUMED	2.70 ASSUMED	2.70 ASSUMED		
Volume Total cc	75.374	75.374	75.374		
lume of Solids	51.131	48.972	49.243		
Volume of Voids	24.243	26.402	26.131		
Void Ratio	0.474	0.539	0.531		
Porosity %	32.2%	35.0%	34.7%		
Saturation %	86.0%	71.1%	74.8%		
Moisture %	15.1%	14.2%	14.7%		
Dry Density (pcf)	114.3	109.5	110.1		

Remarks

TRIAXIAL SHEAR STRENGTH





SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	19.7	18.9	22.1
	DRY DENSITY, pcf	106.2	104.1	101.5
	SATURATION, %	90.7	82.2	90.6
	VOID RATIO	0.588	0.620	0.660
	DIAMETER, in	2.86	2.85	2.86
	HEIGHT, in	6.00	6.00	6.00
AT TEST	WATER CONTENT, %	19.7	18.9	22.1
	DRY DENSITY, pcf	106.2	104.1	101.5
	SATURATION, %	90.7	82.2	90.6
	VOID RATIO	0.588	0.620	0.660
	DIAMETER, in	2.86	2.85	2.86
	HEIGHT, in	6.00	6.00	6.00
Strain rate, %/min		1.00	1.00	1.00
BACK PRESSURE, ksf		0.0	0.0	0.0
CELL PRESSURE, ksf		3.0	1.5	4.5
DEVIATOR STRESS, ksf		4.4	4.7	7.1
STRAIN, %		15.0	15.0	15.0
ULT. STRESS, ksf				
STRAIN, %				
σ_1 FAILURE, ksf		7.4	6.2	11.6
σ_3 FAILURE, ksf		3.0	1.5	4.5

TYPE OF TEST:
Unconsolidated Undrained

SAMPLE TYPE: Undisturbed

DESCRIPTION: See Remarks

ASSUMED SPECIFIC GRAVITY= 2.7

REMARKS: 1)brn. clayey SAND
2)brn. clayey SAND with grav.
3)brn. clayey SAND

Fig. No.: ______

CLIENT: Hultgren-Tillis

PROJECT: GWF Power

SAMPLE LOCATION: B1 /11 @ 43.5-46 tip-6"
B1/ 11 @ 43.5-46 tip 12" B2/11 43.5 tip

PROJ. NO.: 212-041 DATE: 10/09/01

TRIAXIAL SHEAR TEST REPORT

COOPER TESTING LABORATORY

	TRIAXIAL COMPRESSION TEST Unconsolidated Undrained	10-09-2001 9:38 am

Project and Sample Data

Date: 10/09/01
Client: Hultgren-Tillis
Project: GWF Power
Sample location: B1 /11 @ 43.5-46 tip-6" B1/ 11 @ 43.5-46 tip 12" B2/11 43.5 tip
Sample description: See Remarks
Remarks: 1)brn. clayey SAND 2)brn. clayey SAND with grav.
3)brn. clayey SAND
Fig no.: 2nd page Fig no. (if applicable):
Type of sample: Undisturbed
Assumed specific gravity= 2.70 LL= PL= PI=
Test method: ASTM - Method A

Specimen Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Final
Wt. moist soil and tare:	1440.600		1440.600
Wt. dry soil and tare:	1229.600		1229.600
Wt. of tare:	160.900		160.900
Weight, gms:	1281.6		
Diameter, in:	2.855	2.855	
Area, in²:	6.402	6.402	
Height, in:	6.000	6.000	
Net decrease in height, in:		0.000	
% Moisture:	19.7	19.7	19.7
Wet density, pcf:	127.1	127.1	
Dry density, pcf:	106.2	106.2	
Void ratio:	0.5879	0.5879	
% Saturation:	90.7	90.7	

Test Readings Data for Specimen No. 1

Deformation dial constant= 0.001 in per input unit
Primary load ring constant= 1 lbs per input unit
Secondary load ring constant= 0 lbs per input unit
Crossover reading for secondary load ring= 0 input units
Cell pressure = 20.80 psi = 3.00 ksf
Back pressure = 0.00 psi = 0.00 ksf
Effective confining stress = 3.00 ksf
Strain rate, %/min = 1.00
DEVIATOR STRESS = 4.38 ksf at reading no. 25
ULT. STRESS = not selected

4

Test Readings Data for Specimen No. 1

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs	Strain %	Deviator Stress ksf	Principal Stresses Minor ksf	Principal Stresses Major ksf	1:3 Ratio	P ksf	Q ksf
0	0.0	0.000	0.00	0.0	0.0	0.00	3.00	3.00	1.00	3.00	0.00
1	5.0	0.005	2.00	2.0	0.1	0.04	3.00	3.04	1.02	3.02	0.02
2	10.0	0.010	8.00	8.0	0.2	0.18	3.00	3.17	1.06	3.09	0.09
3	20.0	0.020	15.00	15.0	0.3	0.34	3.00	3.33	1.11	3.16	0.17
4	40.0	0.040	30.00	30.0	0.7	0.67	3.00	3.67	1.22	3.33	0.34
5	60.0	0.060	42.00	42.0	1.0	0.94	3.00	3.93	1.31	3.46	0.47
6	80.0	0.080	53.00	53.0	1.3	1.18	3.00	4.17	1.39	3.58	0.59
7	100.0	0.100	62.00	62.0	1.7	1.37	3.00	4.37	1.46	3.68	0.69
8	125.0	0.125	72.00	72.0	2.1	1.59	3.00	4.58	1.53	3.79	0.79
9	175.0	0.175	93.00	93.0	2.9	2.03	3.00	5.03	1.68	4.01	1.02
10	250.0	0.250	126.00	126.0	4.2	2.72	3.00	5.71	1.91	4.35	1.36
11	300.0	0.300	141.00	141.0	5.0	3.01	3.00	6.01	2.01	4.50	1.51
12	325.0	0.325	150.00	150.0	5.4	3.19	3.00	6.19	2.07	4.59	1.60
13	350.0	0.350	155.00	155.0	5.8	3.28	3.00	6.28	2.10	4.64	1.64
14	375.0	0.375	162.00	162.0	6.3	3.42	3.00	6.41	2.14	4.70	1.71
15	400.0	0.400	166.00	166.0	6.7	3.49	3.00	6.48	2.16	4.74	1.74
16	425.0	0.425	173.00	173.0	7.1	3.62	3.00	6.61	2.21	4.80	1.81
17	450.0	0.450	177.00	177.0	7.5	3.68	3.00	6.68	2.23	4.84	1.84
18	500.0	0.500	185.00	185.0	8.3	3.81	3.00	6.81	2.27	4.90	1.91
19	550.0	0.550	193.00	193.0	9.2	3.94	3.00	6.94	2.32	4.97	1.97
20	600.0	0.600	198.00	198.0	10.0	4.01	3.00	7.00	2.34	5.00	2.00
21	700.0	0.700	210.00	210.0	11.7	4.17	3.00	7.17	2.39	5.08	2.09
22	750.0	0.750	216.00	216.0	12.5	4.25	3.00	7.25	2.42	5.12	2.13
23	800.0	0.800	220.00	220.0	13.3	4.29	3.00	7.28	2.43	5.14	2.14
24	850.0	0.850	225.00	225.0	14.2	4.34	3.00	7.34	2.45	5.17	2.17
25	900.0	0.900	229.00	229.0	15.0	4.38	3.00	7.37	2.46	5.18	2.19

Specimen Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Final
Vt. moist soil and tare:	1383.200		1383.200
t. dry soil and tare:	1189.600		1189.600
t. of tare:	163.000		163.000
Veight, gms:	1242.8		
iameter, in:	2.850	2.850	
rea, in²:	6.379	6.379	
ieight, in:	6.000	6.000	
Vet decrease in height, in:		0.000	
Moisture:	18.9	18.9	18.9
et density, pcf:	123.7	123.7	
ry density, pcf:	104.1	104.1	
oid ratio:	0.6197	0.6197	
Saturation:	82.2	82.2	

Test Readings Data for Specimen No. 2

eformation dial constant= 0.001 in per input unit
Primary load ring constant= 1 lbs per input unit
econdary load ring constant= 0 lbs per input unit
rossover reading for secondary load ring= 0 input units
Cell pressure = 10.40 psi = 1.50 ksf
ack pressure = 0.00 psi = 0.00 ksf
ffective confining stress = 1.50 ksf
Strain rate, %/min = 1.00
EVIATOR STRESS = 4.74 ksf at reading no. 25
LT. STRESS = not selected

lo.	Def. Dial Units	Def. in	Load Dial Units	Load lbs	Strain %	Deviator Stress ksf	Principal Stresses Minor ksf	Major ksf	1:3 Ratio	P ksf	Q ksf
0	0.0	0.000	0.00	0.0	0.0	0.00	1.50	1.50	1.00	1.50	0.00
1	5.0	0.005	8.00	8.0	0.1	0.18	1.50	1.68	1.12	1.59	0.09
2	10.0	0.010	15.00	15.0	0.2	0.34	1.50	1.84	1.23	1.67	0.17
3	30.0	0.030	32.00	32.0	0.5	0.72	1.50	2.22	1.48	1.86	0.36
4	40.0	0.040	40.00	40.0	0.7	0.90	1.50	2.39	1.60	1.95	0.45
5	60.0	0.060	56.00	56.0	1.0	1.25	1.50	2.75	1.84	2.12	0.63
6	80.0	0.080	73.00	73.0	1.3	1.63	1.50	3.12	2.09	2.31	0.81
7	100.0	0.100	87.00	87.0	1.7	1.93	1.50	3.43	2.29	2.46	0.97
8	125.0	0.125	107.00	107.0	2.1	2.36	1.50	3.86	2.58	2.68	1.18
9	150.0	0.150	124.00	124.0	2.5	2.73	1.50	4.23	2.82	2.86	1.36
10	200.0	0.200	150.00	150.0	3.3	3.27	1.50	4.77	3.19	3.13	1.64
11	225.0	0.225	158.00	158.0	3.8	3.43	1.50	4.93	3.29	3.21	1.72
12	250.0	0.250	165.00	165.0	4.2	3.57	1.50	5.07	3.38	3.28	1.78
13	300.0	0.300	177.00	177.0	5.0	3.80	1.50	5.29	3.53	3.40	1.90
14	375.0	0.375	196.00	196.0	6.3	4.15	1.50	5.65	3.77	3.57	2.07
15	400.0	0.400	201.00	201.0	6.7	4.23	1.50	5.73	3.83	3.61	2.12
16	450.0	0.450	207.00	207.0	7.5	4.32	1.50	5.82	3.89	3.66	2.16
17	500.0	0.500	211.00	211.0	8.3	4.37	1.50	5.86	3.92	3.68	2.18
18	550.0	0.550	217.00	217.0	9.2	4.45	1.50	5.95	3.97	3.72	2.22
19	600.0	0.600	224.00	224.0	10.0	4.55	1.50	6.05	4.04	3.77	2.28
20	650.0	0.650	230.00	230.0	10.8	4.63	1.50	6.13	4.09	3.81	2.31
21	700.0	0.700	233.00	233.0	11.7	4.65	1.50	6.14	4.10	3.82	2.32
22	750.0	0.750	233.00	233.0	12.5	4.60	1.50	6.10	4.07	3.80	2.30
23	800.0	0.800	237.00	237.0	13.3	4.64	1.50	6.13	4.10	3.82	2.32

Test Readings Data for Specimen No. 2

lo.	Def. Dial ᶦts	Def. in	Load Dial Units	Load lbs	Strain %	Deviator Stress ksf	Principal Stresses Minor ksf	Major ksf	1:3 Ratio	P ksf	Q ksf
?4	850.0	0.850	241.00	241.0	14.2	4.67	1.50	6.17	4.12	3.83	2.33
?5	900.0	0.900	247.00	247.0	15.0	4.74	1.50	6.24	4.16	3.87	2.37

Specimen Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Final
Wt. moist soil and tare:	1001.100		1001.100
Wt. dry soil and tare:	848.900		848.900
Wt. of tare:	161.600		161.600
Weight, gms:	1250.3		
Diameter, in:	2.855	2.855	
Area, in²:	6.402	6.402	
Height, in:	6.000	6.000	
Net decrease in height, in:		0.000	
Moisture:	22.1	22.1	22.1
Wet density, pcf:	124.0	124.0	
Dry density, pcf:	101.5	101.5	
Void ratio:	0.6603	0.6603	
Saturation:	90.6	90.6	

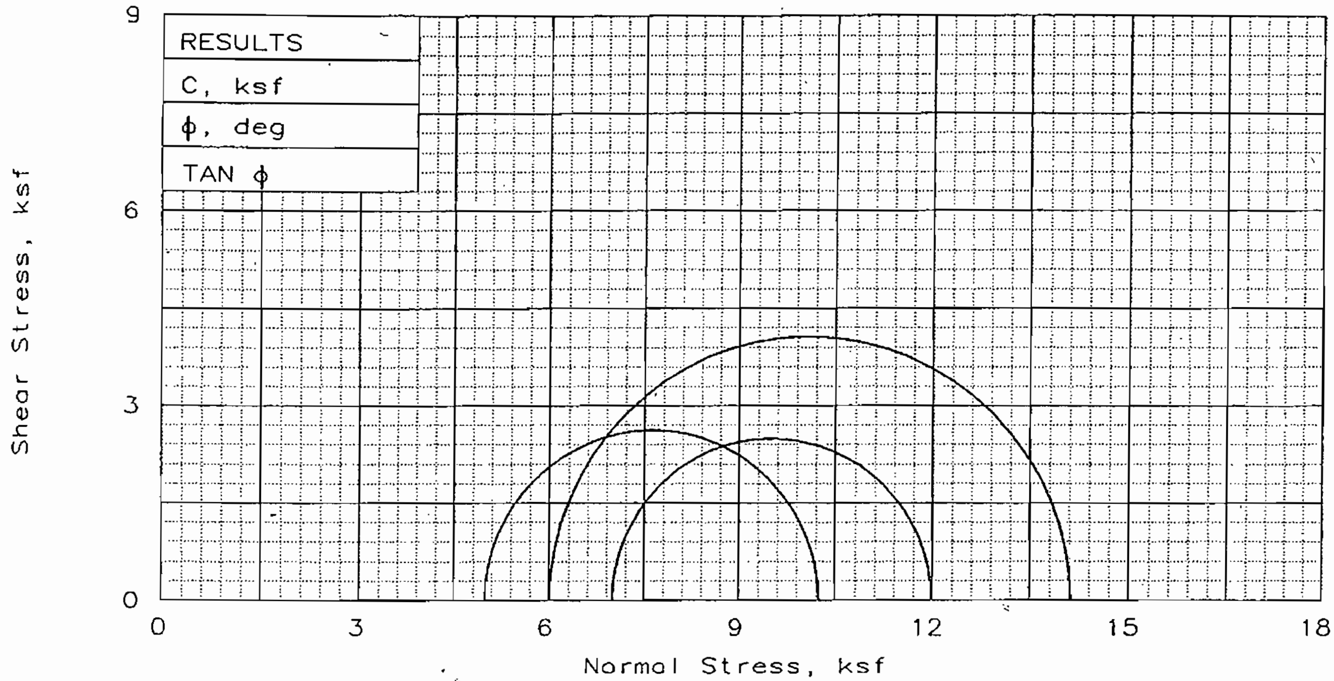
Test Readings Data for Specimen No. 3

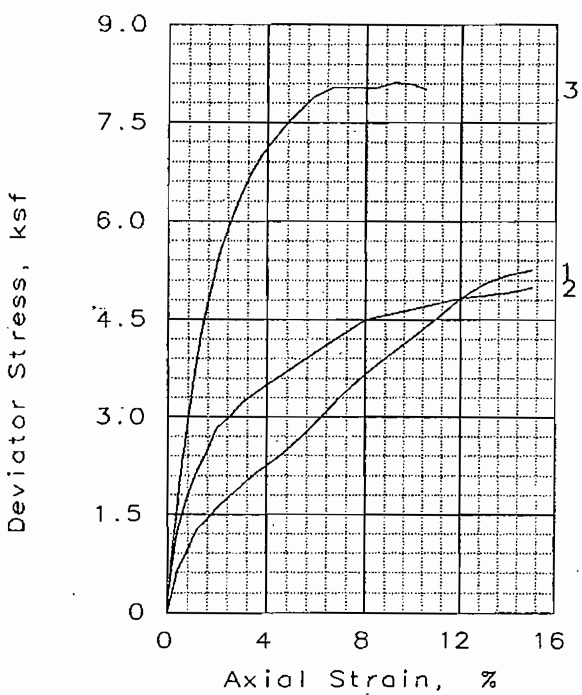
Deformation dial constant= 0.001 in per input unit
Primary load ring constant= 1 lbs per input unit
Secondary load ring constant= 0 lbs per input unit
Crossover reading for secondary load ring= 0 input units
Cell pressure = 31.30 psi = 4.51 ksf
Back pressure = 0.00 psi = 0.00 ksf
Effective confining stress = 4.51 ksf
Strain rate, %/min = 1.00
DEVIATOR STRESS = 7.07 ksf at reading no. 27
ULT. STRESS = not selected

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs	Strain %	Deviator Stress ksf	Principal Stresses Minor ksf	Principal Stresses Major ksf	1:3 Ratio	P ksf	Q ksf
0	0.0	0.000	0.00	0.0	0.0	0.00	4.51	4.51	1.00	4.51	0.00
1	5.0	0.005	33.00	33.0	0.1	0.74	4.51	5.25	1.16	4.88	0.37
2	10.0	0.010	42.00	42.0	0.2	0.94	4.51	5.45	1.21	4.98	0.47
3	20.0	0.020	57.00	57.0	0.3	1.28	4.51	5.79	1.28	5.15	0.64
4	30.0	0.030	69.00	69.0	0.5	1.54	4.51	6.05	1.34	5.28	0.77
5	40.0	0.040	81.00	81.0	0.7	1.81	4.51	6.32	1.40	5.41	0.90
6	60.0	0.060	103.00	103.0	1.0	2.29	4.51	6.80	1.51	5.65	1.15
7	80.0	0.080	124.00	124.0	1.3	2.75	4.51	7.26	1.61	5.88	1.38
8	100.0	0.100	142.00	142.0	1.7	3.14	4.51	7.65	1.70	6.08	1.57
9	150.0	0.150	179.00	179.0	2.5	3.93	4.51	8.43	1.87	6.47	1.96
10	200.0	0.200	213.00	213.0	3.3	4.63	4.51	9.14	2.03	6.82	2.32
11	225.0	0.225	230.00	230.0	3.8	4.98	4.51	9.49	2.10	7.00	2.49
12	275.0	0.275	260.00	260.0	4.6	5.58	4.51	10.09	2.24	7.30	2.79
13	300.0	0.300	271.00	271.0	5.0	5.79	4.51	10.30	2.28	7.40	2.90
14	325.0	0.325	280.00	280.0	5.4	5.96	4.51	10.46	2.32	7.49	2.98
15	350.0	0.350	290.00	290.0	5.8	6.14	4.51	10.65	2.36	7.58	3.07
16	375.0	0.375	297.00	297.0	6.3	6.26	4.51	10.77	2.39	7.64	3.13
17	400.0	0.400	302.00	302.0	6.7	6.34	4.51	10.85	2.41	7.68	3.17
18	450.0	0.450	313.00	313.0	7.5	6.51	4.51	11.02	2.44	7.76	3.26
19	500.0	0.500	319.00	319.0	8.3	6.58	4.51	11.08	2.46	7.80	3.29
20	550.0	0.550	327.00	327.0	9.2	6.68	4.51	11.19	2.48	7.85	3.34
21	600.0	0.600	336.00	336.0	10.0	6.80	4.51	11.31	2.51	7.91	3.40
22	650.0	0.650	343.00	343.0	10.8	6.88	4.51	11.39	2.53	7.95	3.44
23	700.0	0.700	349.00	349.0	11.7	6.93	4.51	11.44	2.54	7.97	3.47

Test Readings Data for Specimen No. 3

'o.	Def. Dial ᶦts	Def. in	Load Dial Units	Load lbs	Strain %	Deviator Stress ksf	Principal Stresses Minor ksf	Major ksf	1:3 Ratio	P ksf	Q ksf
?4	750.0	0.750	354.00	354.0	12.5	6.97	4.51	11.47	2.55	7.99	3.48
?5	800.0	0.800	357.00	357.0	13.3	6.96	4.51	11.47	2.54	7.99	3.48
26	850.0	0.850	364.00	364.0	14.2	7.03	4.51	11.53	2.56	8.02	3.51
?7	900.0	0.900	370.00	370.0	15.0	7.07	4.51	11.58	2.57	8.04	3.54





SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	25.0	33.5	28.4
	DRY DENSITY, pcf	102.1	89.2	95.1
	SATURATION, %	98.1	99.7	99.3
	VOID RATIO	0.713	0.925	0.772
	DIAMETER, in	2.42	2.42	2.86
	HEIGHT, in	5.00	5.00	6.00
AT TEST	WATER CONTENT, %	25.0	33.5	28.4
	DRY DENSITY, pcf	102.1	89.2	95.1
	SATURATION, %	98.1	99.7	99.3
	VOID RATIO	0.713	0.925	0.772
	DIAMETER, in	2.42	2.42	2.86
	HEIGHT, in	5.00	5.00	6.00
Strain rate, %/min		1.00	1.00	1.00
BACK PRESSURE, ksf		0.0	0.0	0.0
CELL PRESSURE, ksf		5.0	7.0	6.0
DEVIATOR STRESS, ksf		5.3	5.0	8.1
STRAIN, %		15.0	15.0	9.2
ULT. STRESS, ksf				
STRAIN, %				
σ_1 FAILURE, ksf		10.2	12.0	14.1
σ_3 FAILURE, ksf		5.0	7.0	6.0

TYPE OF TEST:
Unconsolidated Undrained

SAMPLE TYPE: Undisturbed

DESCRIPTION: See Remarks

ASSUMED SPECIFIC GRAVITY= 2.8

REMARKS: 1)brown silty SAND with clay
2)olive-brn. CLAY
3)tan orange CLAY w/ tr. sand

Fig. No.: ______

CLIENT: Hultgren-Tillis

PROJECT: GWF Power

SAMPLE LOCATION: 1)BV2/15 @ 63-65'
2)BV3/18 @ 78.5-80' 3)BV4/18 @ 78.5-81'

PROJ. NO.: 212-041A DATE: 10/11/01

TRIAXIAL SHEAR TEST REPORT

COOPER TESTING LABORATORY

TRIAXIAL COMPRESSION TEST
Unconsolidated Undrained

10-11-2001
1:12 pm

Project and Sample Data

ate: 10/11/01
lient: Hultgren-Tillis
roject: GWF Power
ample location: 1)BV2/15 @ 63-65' 2)BV3/18 @ 78.5-80' 3)BV4/18 @ 78.5-81'
ample description: See Remarks
emarks: 1)brown silty SAND with clay
2)olive-brn. CLAY 3)tan orange CLAY w/ tr. sand
ig no.: 2nd page Fig no. (if applicable):
ype of sample: Undisturbed
ssumed specific gravity= 2.80 LL= PL= PI=
est method: ASTM - Method A

Specimen Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Final
It. moist soil and tare:	443.700		443.700
t. dry soil and tare:	374.200		374.200
.t. of tare:	95.900		95.900
Ieight, gms:	768.7		
iameter, in:	2.418	2.418	
rea, in²:	4.592	4.592	
Ieight, in:	5.000	5.000	
et decrease in height, in:		0.000	
isture:	25.0	25.0	25.0
let density, pcf:	127.5	127.5	
)ry density, pcf:	102.1	102.1	
oid ratio:	0.7127	0.7127	
Saturation:	98.1	98.1	

Test Readings Data for Specimen No. 1

)eformation dial constant= 0.001 in per input unit
rimary load ring constant= 1 lbs per input unit
econdary load ring constant= 0 lbs per input unit
rossover reading for secondary load ring= 0 input units
Cell pressure = 34.70 psi = 5.00 ksf
ack pressure = 0.00 psi = 0.00 ksf
ffective confining stress = 5.00 ksf
Strain rate, %/min = 1.00
EVIATOR STRESS = 5.25 ksf at reading no. 24
LT. STRESS = not selected

Test Readings Data for Specimen No. 1

o.	Def. Dial Units	Def. in	Load Dial Units	Load lbs	Strain %	Deviator Stress ksf	Principal Stresses Minor ksf	Principal Stresses Major ksf	Principal Stresses 1:3 Ratio	P ksf	Q ksf
0	0.0	0.000	0.00	0.0	0.0	0.00	5.00	5.00	1.00	5.00	0.00
1	5.0	0.005	5.00	5.0	0.1	0.16	5.00	5.15	1.03	5.08	0.08
2	10.0	0.010	10.00	10.0	0.2	0.31	5.00	5.31	1.06	5.15	0.16
3	20.0	0.020	20.00	20.0	0.4	0.62	5.00	5.62	1.13	5.31	0.31
4	40.0	0.040	30.00	30.0	0.8	0.93	5.00	5.93	1.19	5.46	0.47
5	60.0	0.060	41.00	41.0	1.2	1.27	5.00	6.27	1.25	5.63	0.64
6	80.0	0.080	46.00	46.0	1.6	1.42	5.00	6.42	1.28	5.71	0.71
7	100.0	0.100	52.00	52.0	2.0	1.60	5.00	6.59	1.32	5.80	0.80
8	125.0	0.125	58.00	58.0	2.5	1.77	5.00	6.77	1.35	5.88	0.89
9	150.0	0.150	64.00	64.0	3.0	1.95	5.00	6.94	1.39	5.97	0.97
0	175.0	0.175	70.00	70.0	3.5	2.12	5.00	7.12	1.42	6.06	1.06
1	200.0	0.200	75.00	75.0	4.0	2.26	5.00	7.25	1.45	6.13	1.13
12	225.0	0.225	80.00	80.0	4.5	2.40	5.00	7.39	1.48	6.19	1.20
3	250.0	0.250	86.00	86.0	5.0	2.56	5.00	7.56	1.51	6.28	1.28
4	275.0	0.275	92.00	92.0	5.5	2.73	5.00	7.72	1.55	6.36	1.36
15	300.0	0.300	99.00	99.0	6.0	2.92	5.00	7.92	1.58	6.46	1.46
16	350.0	0.350	114.00	114.0	7.0	3.32	5.00	8.32	1.67	6.66	1.66
7	400.0	0.400	127.00	127.0	8.0	3.66	5.00	8.66	1.73	6.83	1.83
8	450.0	0.450	139.00	139.0	9.0	3.97	5.00	8.96	1.79	6.98	1.98
19	500.0	0.500	150.00	150.0	10.0	4.23	5.00	9.23	1.85	7.11	2.12
0	550.0	0.550	162.00	162.0	11.0	4.52	5.00	9.52	1.90	7.26	2.26
1	600.0	0.600	175.00	175.0	12.0	4.83	5.00	9.83	1.97	7.41	2.41
22	650.0	0.650	185.00	185.0	13.0	5.05	5.00	10.04	2.01	7.52	2.52
3	700.0	0.700	192.00	192.0	14.0	5.18	5.00	10.17	2.04	7.59	2.59
4	750.0	0.750	197.00	197.0	15.0	5.25	5.00	10.25	2.05	7.62	2.63

Specimen Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Final
Wt. moist soil and tare:	483.400		483.400
Wt. dry soil and tare:	386.200		386.200
Wt. of tare:	96.200		96.200
Weight, gms:	717.7		
Diameter, in:	2.418	2.418	
Area, in²:	4.592	4.592	
Height, in:	5.000	5.000	
Net decrease in height, in:		0.000	
Moisture:	33.5	33.5	33.5
Wet density, pcf:	119.1	119.1	
Dry density, pcf:	89.2	89.2	
Void ratio:	0.9249	0.9249	
Saturation:	99.7	99.7	

Test Readings Data for Specimen No. 2

Deformation dial constant= 0.001 in per input unit
Primary load ring constant= 1 lbs per input unit
Secondary load ring constant= 0 lbs per input unit
Crossover reading for secondary load ring= 0 input units
Cell pressure = 48.60 psi = 7.00 ksf
Back pressure = 0.00 psi = 0.00 ksf
Effective confining stress = 7.00 ksf
Strain rate, %/min = 1.00
DEVIATOR STRESS = 4.98 ksf at reading no. 18
STRESS = not selected

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs	Strain %	Deviator Stress ksf	Principal Stresses Minor ksf	Major ksf	1:3 Ratio	P ksf	Q ksf
0	0.0	0.000	0.00	0.0	0.0	0.00	7.00	7.00	1.00	7.00	0.00
1	5.0	0.005	14.00	14.0	0.1	0.44	7.00	7.44	1.06	7.22	0.22
2	15.0	0.015	31.00	31.0	0.3	0.97	7.00	7.97	1.14	7.48	0.48
3	20.0	0.020	39.00	39.0	0.4	1.22	7.00	8.22	1.17	7.61	0.61
4	40.0	0.040	57.00	57.0	0.8	1.77	7.00	8.77	1.25	7.88	0.89
5	60.0	0.060	70.00	70.0	1.2	2.17	7.00	9.17	1.31	8.08	1.08
6	80.0	0.080	80.00	80.0	1.6	2.47	7.00	9.47	1.35	8.23	1.23
7	100.0	0.100	92.00	92.0	2.0	2.83	7.00	9.83	1.40	8.41	1.41
8	125.0	0.125	98.00	98.0	2.5	3.00	7.00	9.99	1.43	8.50	1.50
9	150.0	0.150	106.00	106.0	3.0	3.22	7.00	10.22	1.46	8.61	1.61
10	200.0	0.200	116.00	116.0	4.0	3.49	7.00	10.49	1.50	8.74	1.75
11	250.0	0.250	126.00	126.0	5.0	3.75	7.00	10.75	1.54	8.88	1.88
12	300.0	0.300	136.00	136.0	6.0	4.01	7.00	11.01	1.57	9.00	2.00
13	350.0	0.350	146.00	146.0	7.0	4.26	7.00	11.26	1.61	9.13	2.13
14	400.0	0.400	156.00	156.0	8.0	4.50	7.00	11.50	1.64	9.25	2.25
15	500.0	0.500	165.00	165.0	10.0	4.66	7.00	11.66	1.67	9.33	2.33
16	600.0	0.600	175.00	175.0	12.0	4.83	7.00	11.83	1.69	9.41	2.41
17	700.0	0.700	182.00	182.0	14.0	4.91	7.00	11.91	1.70	9.45	2.45
18	750.0	0.750	187.00	187.0	15.0	4.98	7.00	11.98	1.71	9.49	2.49

Specimen Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Final
Vt. moist soil and tare:	1394.400		1394.400
t. dry soil and tare:	1120.500		1120.500
t. of tare:	156.200		156.200
Veight, gms:	1239.3		
iameter, in:	2.864	2.864	
rea, in²:	6.442	6.442	
ieight, in:	6.000	6.000	
Jet decrease in height, in:		0.000	
Moisture:	28.4	28.4	28.4
et density, pcf:	122.1	122.1	
)ry density, pcf:	95.1	95.1	
oid ratio:	0.7720	0.7720	
Saturation:	99.3	99.3	

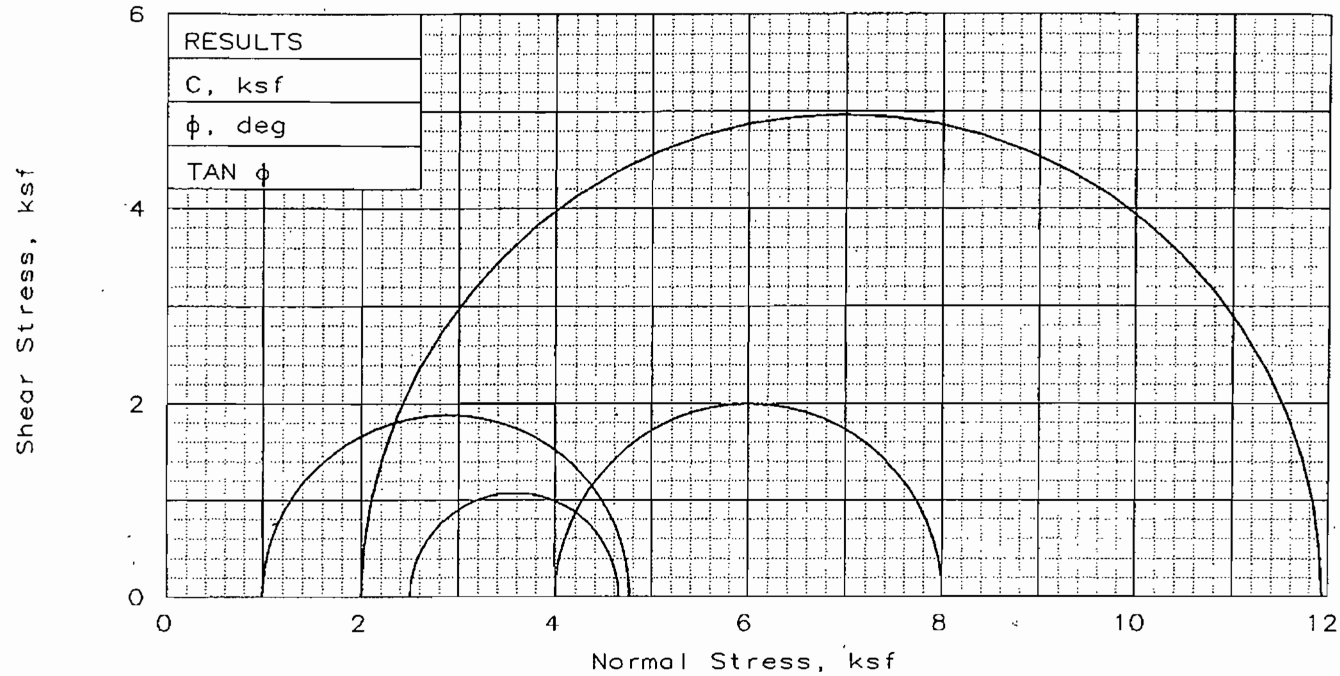
Test Readings Data for Specimen No. 3

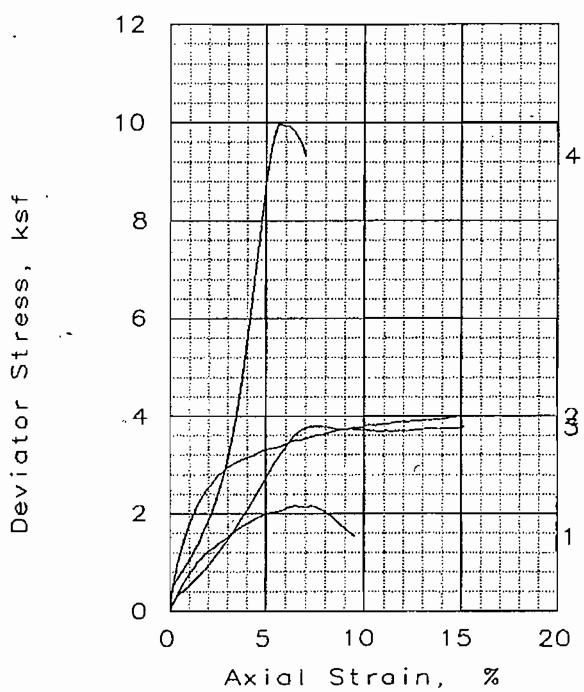
eformation dial constant= 0.001 in per input unit
Primary load ring constant= 1 lbs per input unit
econdary load ring constant= 0 lbs per input unit
rossover reading for secondary load ring= 0 input units
Cell pressure = 41.70 psi = 6.00 ksf
ack pressure = 0.00 psi = 0.00 ksf
ffective confining stress = 6.00 ksf
Strain rate, %/min = 1.00
DEVIATOR STRESS = 8.12 ksf at reading no. 21
LT. STRESS = not selected

o.	Def. Dial Units	Def. in	Load Dial Units	Load lbs	Strain %	Deviator Stress ksf	Principal Stresses Minor ksf	Major ksf	1:3 Ratio	P ksf	Q ksf
0	0.0	0.000	0.00	0.0	0.0	0.00	6.00	6.00	1.00	6.00	0.00
1	5.0	0.005	14.00	14.0	0.1	0.31	6.00	6.32	1.05	6.16	0.16
2	10.0	0.010	36.00	36.0	0.2	0.80	6.00	6.81	1.13	6.41	0.40
3	20.0	0.020	63.00	63.0	0.3	1.40	6.00	7.41	1.23	6.71	0.70
4	30.0	0.030	89.00	89.0	0.5	1.98	6.00	7.98	1.33	6.99	0.99
5	40.0	0.040	112.00	112.0	0.7	2.49	6.00	8.49	1.41	7.25	1.24
6	60.0	0.060	156.00	156.0	1.0	3.45	6.00	9.46	1.57	7.73	1.73
7	80.0	0.080	193.00	193.0	1.3	4.26	6.00	10.26	1.71	8.13	2.13
8	100.0	0.100	221.00	221.0	1.7	4.86	6.00	10.86	1.81	8.43	2.43
9	125.0	0.125	251.00	251.0	2.1	5.49	6.00	11.50	1.91	8.75	2.75
10	150.0	0.150	274.00	274.0	2.5	5.97	6.00	11.98	1.99	8.99	2.99
11	175.0	0.175	294.00	294.0	2.9	6.38	6.00	12.38	2.06	9.19	3.19
12	200.0	0.200	311.00	311.0	3.3	6.72	6.00	12.72	2.12	9.36	3.36
13	225.0	0.225	325.00	325.0	3.8	6.99	6.00	13.00	2.16	9.50	3.50
14	250.0	0.250	336.00	336.0	4.2	7.20	6.00	13.20	2.20	9.60	3.60
15	275.0	0.275	347.00	347.0	4.6	7.40	6.00	13.41	2.23	9.71	3.70
16	300.0	0.300	357.00	357.0	5.0	7.58	6.00	13.59	2.26	9.80	3.79
17	350.0	0.350	375.00	375.0	5.8	7.89	6.00	13.90	2.31	9.95	3.95
18	400.0	0.400	386.00	386.0	6.7	8.05	6.00	14.06	2.34	10.03	4.03
19	450.0	0.450	389.00	389.0	7.5	8.04	6.00	14.05	2.34	10.03	4.02
20	500.0	0.500	392.00	392.0	8.3	8.03	6.00	14.04	2.34	10.02	4.02
21	550.0	0.550	400.00	400.0	9.2	8.12	6.00	14.13	2.35	10.07	4.06
22	600.0	0.600	402.00	402.0	10.0	8.09	6.00	14.09	2.35	10.05	4.04
23	610.0	0.610	401.00	401.0	10.2	8.05	6.00	14.06	2.34	10.03	4.03

Test Readings Data for Specimen No. 3

^.	Def. Dial 'ts	Def. in	Load Dial Units	Load lbs	Strain %	Deviator Stress ksf	Principal Stresses Minor ksf	Major ksf	1:3 Ratio	P ksf	Q ksf
4	620.0	0.620	401.00	401.0	10.3	8.04	6.00	14.04	2.34	10.02	4.02
5	630.0	0.630	400.00	400.0	10.5	8.00	6.00	14.01	2.33	10.01	4.00





SAMPLE NO.:		1	2	3	4
INITIAL	WATER CONTENT, %	29.0	25.5	18.6	12.3
	DRY DENSITY, pcf	89.3	95.4	92.9	101.6
	SATURATION, %	88.2	89.8	61.5	50.6
	VOID RATIO	0.887	0.767	0.815	0.[illegible]58
	DIAMETER, in	2.87	2.87	2.87	[illegible]
	HEIGHT, in	6.00	6.00	6.00	6.[illegible]0
AT TEST	WATER CONTENT, %	29.0	25.5	18.6	12.3
	DRY DENSITY, pcf	89.3	95.4	92.9	101.6
	SATURATION, %	88.2	89.8	61.5	50.6
	VOID RATIO	0.887	0.767	0.815	0.658
	DIAMETER, in	2.87	2.87	2.87	2.87
	HEIGHT, in	6.00	6.00	6.00	6.00
Strain rate, %/min		1.00	1.00	1.00	1.00
BACK PRESSURE, ksf		0.0	0.0	0.0	0.0
CELL PRESSURE, ksf		2.5	4.0	1.0	2.0
DEVIATOR STRESS, ksf		2.1	4.0	3.8	9.9
STRAIN, %		7.5	15.1	15.1	6.2
ULT. STRESS, ksf					
STRAIN, %					
σ_1 FAILURE, ksf		4.7	8.0	4.8	11.9
σ_3 FAILURE, ksf		2.5	4.0	1.0	2.0

TYPE OF TEST:
Unconsolidated Undrained

SAMPLE TYPE: undisturbed

DESCRIPTION: See Remarks

ASSUMED SPECIFIC GRAVITY= 2.7

REMARKS: 1&2)Brn CLAY tr.sand & gravel
3&4)Brn Sandy SILT/SILT w/sa.

Fig. No.: ______

CLIENT: Hultgren/Black & Veatch

PROJECT: GWF Power

SAMPLE LOCATION: 1)B5-10@ 38.5 3)B5-3 @ 6.
2)B5-10@ 38.5 4)B5-3 @ 6

PROJ. NO.: 212-042 DATE: 10/26/01

TRIAXIAL SHEAR TEST REPORT

COOPER TESTING LABORATORY

TRIAXIAL COMPRESSION TEST 10-30-2001
Unconsolidated Undrained 9:49 am

Project and Sample Data

Date: 10/26/01
Client: Hultgren/Black & Veatch
Project: GWF Power
Sample location: 1)B5-10@ 38.5 3)B5-3 @ 6. 2)" " " 4)" " "
Sample description: See Remarks
Remarks: 1&2)Brn CLAY tr.sand & gravel
3&4)Brn Sandy SILT/SILT w/sa.
Fig no.: 2nd page Fig no. (if applicable):
Type of sample: undisturbed
Assumed specific gravity= 2.70 LL= PL= PI=
Test method: ASTM - Method A

Specimen Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Final
Wt. moist soil and tare:	891.280		891.280
Wt. dry soil and tare:	727.200		727.200
Wt. of tare:	160.800		160.800
Weight, gms:	1170.8		
Diameter, in:	2.866	2.866	
Area, in²:	6.451	6.451	
Height, in:	6.000	6.000	
Net decrease in height, in:		0.000	
% Moisture:	29.0	29.0	29.0
Wet density, pcf:	115.2	115.2	
Dry density, pcf:	89.3	89.3	
Void ratio:	0.8865	0.8865	
% Saturation:	88.2	88.2	

Test Readings Data for Specimen No. 1

Deformation dial constant= 1 in per input unit
Primary load ring constant= 1 lbs per input unit
Secondary load ring constant= 0 lbs per input unit
Crossover reading for secondary load ring= 0 input units
Cell pressure = 17.40 psi = 2.51 ksf
Back pressure = 0.00 psi = 0.00 ksf
Effective confining stress = 2.51 ksf
Strain rate, %/min = 1.00
DEVIATOR STRESS = 2.15 ksf at reading no. 38
ULT. STRESS = not selected

Test Readings Data for Specimen No. 1

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs	Strain %	Deviator Stress ksf	Principal Stresses Minor ksf	Major ksf	1:3 Ratio	P ksf	Q ksf
0	0.0000	0.000	2.00	0.0	0.0	0.00	2.51	2.51	1.00	2.51	0.00
1	0.0060	0.006	5.00	3.0	0.1	0.07	2.51	2.57	1.03	2.54	0.03
2	0.0160	0.016	11.00	9.0	0.3	0.20	2.51	2.71	1.08	2.61	0.10
3	0.0270	0.027	19.00	17.0	0.5	0.38	2.51	2.88	1.15	2.69	0.19
4	0.0370	0.037	24.00	22.0	0.6	0.49	2.51	2.99	1.19	2.75	0.24
5	0.0470	0.047	30.00	28.0	0.8	0.62	2.51	3.13	1.25	2.82	0.31
6	0.0570	0.057	35.00	33.0	1.0	0.73	2.51	3.24	1.29	2.87	0.36
7	0.0670	0.067	39.00	37.0	1.1	0.82	2.51	3.32	1.33	2.91	0.41
8	0.0780	0.078	43.00	41.0	1.3	0.90	2.51	3.41	1.36	2.96	0.45
9	0.0880	0.088	48.00	46.0	1.5	1.01	2.51	3.52	1.40	3.01	0.51
10	0.0980	0.098	51.00	49.0	1.6	1.08	2.51	3.58	1.43	3.04	0.54
11	0.1090	0.109	55.00	53.0	1.8	1.16	2.51	3.67	1.46	3.09	0.58
12	0.1190	0.119	58.00	56.0	2.0	1.23	2.51	3.73	1.49	3.12	0.61
13	0.1290	0.129	60.00	58.0	2.2	1.27	2.51	3.77	1.51	3.14	0.63
14	0.1400	0.140	62.00	60.0	2.3	1.31	2.51	3.81	1.52	3.16	0.65
15	0.1500	0.150	65.00	63.0	2.5	1.37	2.51	3.88	1.55	3.19	0.69
16	0.1610	0.161	68.00	66.0	2.7	1.43	2.51	3.94	1.57	3.22	0.72
17	0.1710	0.171	70.00	68.0	2.9	1.47	2.51	3.98	1.59	3.24	0.74
18	0.1810	0.181	72.00	70.0	3.0	1.52	2.51	4.02	1.60	3.26	0.76
19	0.1910	0.191	75.00	73.0	3.2	1.58	2.51	4.08	1.63	3.29	0.79
20	0.2010	0.201	77.00	75.0	3.4	1.62	2.51	4.12	1.65	3.31	0.81
21	0.2110	0.211	80.00	78.0	3.5	1.68	2.51	4.19	1.67	3.35	0.84
22	0.2220	0.222	82.00	80.0	3.7	1.72	2.51	4.23	1.69	3.37	0.86
23	0.2320	0.232	84.00	82.0	3.9	1.76	2.51	4.27	1.70	3.39	0.88
24	0.2430	0.243	86.00	84.0	4.1	1.80	2.51	4.30	1.72	3.41	0.90
25	0.2530	0.253	88.00	86.0	4.2	1.84	2.51	4.34	1.73	3.42	0.92
26	0.2630	0.263	90.00	88.0	4.4	1.88	2.51	4.38	1.75	3.44	0.94
27	0.2730	0.273	92.00	90.0	4.6	1.92	2.51	4.42	1.77	3.46	0.96
28	0.2930	0.293	95.00	93.0	4.9	1.97	2.51	4.48	1.79	3.49	0.99
29	0.3040	0.304	96.00	94.0	5.1	1.99	2.51	4.50	1.79	3.50	1.00
30	0.3140	0.314	98.00	96.0	5.2	2.03	2.51	4.54	1.81	3.52	1.02
31	0.3350	0.335	99.00	97.0	5.6	2.04	2.51	4.55	1.82	3.53	1.02
32	0.3560	0.356	101.00	99.0	5.9	2.08	2.51	4.58	1.83	3.54	1.04
33	0.3660	0.366	103.00	101.0	6.1	2.12	2.51	4.62	1.84	3.56	1.06
34	0.3860	0.386	105.00	103.0	6.4	2.15	2.51	4.66	1.86	3.58	1.08
35	0.4070	0.407	105.00	103.0	6.8	2.14	2.51	4.65	1.86	3.58	1.07
36	0.4280	0.428	105.00	103.0	7.1	2.14	2.51	4.64	1.85	3.57	1.07
37	0.4380	0.438	106.00	104.0	7.3	2.15	2.51	4.66	1.86	3.58	1.08
38	0.4480	0.448	106.00	104.0	7.5	2.15	2.51	4.65	1.86	3.58	1.07
39	0.4690	0.469	103.00	101.0	7.8	2.08	2.51	4.58	1.83	3.54	1.04
40	0.4790	0.479	101.00	99.0	8.0	2.03	2.51	4.54	1.81	3.52	1.02
41	0.4890	0.489	99.00	97.0	8.2	1.99	2.51	4.49	1.79	3.50	0.99
42	0.4990	0.499	97.00	95.0	8.3	1.94	2.51	4.45	1.78	3.48	0.97
43	0.5090	0.509	94.00	92.0	8.5	1.88	2.51	4.38	1.75	3.45	0.94
44	0.5200	0.520	91.00	89.0	8.7	1.81	2.51	4.32	1.72	3.41	0.91
45	0.5300	0.530	88.00	86.0	8.8	1.75	2.51	4.26	1.70	3.38	0.88
46	0.5400	0.540	86.00	84.0	9.0	1.71	2.51	4.21	1.68	3.36	0.85
47	0.5500	0.550	83.00	81.0	9.2	1.64	2.51	4.15	1.66	3.33	0.82
48	0.5610	0.561	80.00	78.0	9.4	1.58	2.51	4.08	1.63	3.29	0.79
49	0.5710	0.571	78.00	76.0	9.5	1.53	2.51	4.04	1.61	3.27	0.77

Specimen Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Final
Wt. moist soil and tare:	774.600		774.640
Wt. dry soil and tare:	650.000		650.000
Wt. of tare:	161.800		161.800
Weight, gms:	1216.4		
Diameter, in:	2.866	2.866	
Area, in²:	6.451	6.451	
Height, in:	6.000	6.000	
Net decrease in height, in:		0.000	
% Moisture:	25.5	25.5	25.5
Wet density, pcf:	119.7	119.7	
Dry density, pcf:	95.4	95.4	
Void ratio:	0.7673	0.7673	
% Saturation:	89.8	89.8	

Test Readings Data for Specimen No. 2

Deformation dial constant= 1 in per input unit
Primary load ring constant= 1 lbs per input unit
Secondary load ring constant= 0 lbs per input unit
Crossover reading for secondary load ring= 0 input units
Cell pressure = 27.80 psi = 4.00 ksf
Back pressure = 0.00 psi = 0.00 ksf
Effective confining stress = 4.00 ksf
Strain rate, %/min = 1.00
DEVIATOR STRESS = 4.00 ksf at reading no. 60
J STRESS = not selected

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs	Strain %	Deviator Stress ksf	Principal Stresses Minor ksf	Major ksf	1:3 Ratio	P ksf	Q ksf
0	0.0000	0.000	5.00	0.0	0.0	0.00	4.00	4.00	1.00	4.00	0.00
1	0.0110	0.011	30.00	25.0	0.2	0.56	4.00	4.56	1.14	4.28	0.28
2	0.0210	0.021	44.00	39.0	0.4	0.87	4.00	4.87	1.22	4.44	0.43
3	0.0310	0.031	56.00	51.0	0.5	1.13	4.00	5.14	1.28	4.57	0.57
4	0.0410	0.041	67.00	62.0	0.7	1.37	4.00	5.38	1.34	4.69	0.69
5	0.0510	0.051	77.00	72.0	0.9	1.59	4.00	5.60	1.40	4.80	0.80
6	0.0610	0.061	86.00	81.0	1.0	1.79	4.00	5.79	1.45	4.90	0.89
7	0.0720	0.072	93.00	88.0	1.2	1.94	4.00	5.94	1.48	4.97	0.97
8	0.0820	0.082	100.00	95.0	1.4	2.09	4.00	6.09	1.52	5.05	1.05
9	0.0920	0.092	107.00	102.0	1.5	2.24	4.00	6.25	1.56	5.12	1.12
10	0.1030	0.103	113.00	108.0	1.7	2.37	4.00	6.37	1.59	5.19	1.18
11	0.1130	0.113	118.00	113.0	1.9	2.47	4.00	6.48	1.62	5.24	1.24
12	0.1230	0.123	122.00	117.0	2.1	2.56	4.00	6.56	1.64	5.28	1.28
13	0.1340	0.134	126.00	121.0	2.2	2.64	4.00	6.64	1.66	5.32	1.32
14	0.1440	0.144	130.00	125.0	2.4	2.72	4.00	6.73	1.68	5.36	1.36
15	0.1540	0.154	134.00	129.0	2.6	2.81	4.00	6.81	1.70	5.41	1.40
16	0.1650	0.165	136.00	131.0	2.8	2.84	4.00	6.85	1.71	5.43	1.42
17	0.1750	0.175	140.00	135.0	2.9	2.93	4.00	6.93	1.73	5.47	1.46
18	0.1960	0.196	144.00	139.0	3.3	3.00	4.00	7.00	1.75	5.50	1.50
19	0.2160	0.216	148.00	143.0	3.6	3.08	4.00	7.08	1.77	5.54	1.54
20	0.2270	0.227	150.00	145.0	3.8	3.11	4.00	7.12	1.78	5.56	1.56
21	0.2470	0.247	153.00	148.0	4.1	3.17	4.00	7.17	1.79	5.59	1.58
22	0.2580	0.258	154.00	149.0	4.3	3.18	4.00	7.19	1.80	5.59	1.59
23	0.2780	0.278	158.00	153.0	4.6	3.26	4.00	7.26	1.81	5.63	1.63

Test Readings Data for Specimen No. 2

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs	Strain %	Deviator Stress ksf	Principal Stresses Minor ksf	Major ksf	1:3 Ratio	P ksf	Q ksf
24	0.2990	0.299	161.00	156.0	5.0	3.31	4.00	7.31	1.83	5.66	1.65
25	0.3190	0.319	163.00	158.0	5.3	3.34	4.00	7.34	1.83	5.67	1.67
26	0.3400	0.340	165.00	160.0	5.7	3.37	4.00	7.37	1.84	5.69	1.68
27	0.3600	0.360	168.00	163.0	6.0	3.42	4.00	7.42	1.85	5.71	1.71
28	0.3710	0.371	170.00	165.0	6.2	3.46	4.00	7.46	1.86	5.73	1.73
29	0.3910	0.391	173.00	168.0	6.5	3.51	4.00	7.51	1.88	5.76	1.75
30	0.4020	0.402	173.00	168.0	6.7	3.50	4.00	7.50	1.87	5.75	1.75
31	0.4230	0.423	176.00	171.0	7.1	3.55	4.00	7.55	1.89	5.78	1.77
32	0.4430	0.443	178.00	173.0	7.4	3.58	4.00	7.58	1.89	5.79	1.79
33	0.4540	0.454	180.00	175.0	7.6	3.61	4.00	7.61	1.90	5.81	1.81
34	0.4740	0.474	181.00	176.0	7.9	3.62	4.00	7.62	1.90	5.81	1.81
35	0.4950	0.495	184.00	179.0	8.3	3.67	4.00	7.67	1.92	5.84	1.83
36	0.5150	0.515	186.00	181.0	8.6	3.69	4.00	7.70	1.92	5.85	1.85
37	0.5350	0.535	188.00	183.0	8.9	3.72	4.00	7.72	1.93	5.86	1.86
38	0.5460	0.546	189.00	184.0	9.1	3.73	4.00	7.74	1.93	5.87	1.87
39	0.5670	0.567	191.00	186.0	9.5	3.76	4.00	7.76	1.94	5.88	1.88
40	0.5870	0.587	192.00	187.0	9.8	3.77	4.00	7.77	1.94	5.89	1.88
41	0.5980	0.598	193.00	188.0	10.0	3.78	4.00	7.78	1.94	5.89	1.89
42	0.6090	0.609	195.00	190.0	10.2	3.81	4.00	7.81	1.95	5.91	1.91
43	0.6290	0.629	196.00	191.0	10.5	3.82	4.00	7.82	1.95	5.91	1.91
44	0.6500	0.650	197.00	192.0	10.8	3.82	4.00	7.82	1.95	5.91	1.91
45	0.6700	0.670	199.00	194.0	11.2	3.85	4.00	7.85	1.96	5.93	1.92
46	0.6810	0.681	200.00	195.0	11.4	3.86	4.00	7.86	1.96	5.93	1.93
47	0.7010	0.701	202.00	197.0	11.7	3.88	4.00	7.89	1.97	5.94	1.94
48	0.7210	0.721	203.00	198.0	12.0	3.89	4.00	7.89	1.97	5.95	1.94
49	0.7320	0.732	203.00	198.0	12.2	3.88	4.00	7.88	1.97	5.94	1.94
50	0.7530	0.753	205.00	200.0	12.6	3.90	4.00	7.91	1.98	5.96	1.95
51	0.7740	0.774	206.00	201.0	12.9	3.91	4.00	7.91	1.98	5.96	1.95
52	0.7940	0.794	208.00	203.0	13.2	3.93	4.00	7.93	1.98	5.97	1.97
53	0.8050	0.805	208.00	203.0	13.4	3.92	4.00	7.93	1.98	5.96	1.96
54	0.8160	0.816	209.00	204.0	13.6	3.93	4.00	7.94	1.98	5.97	1.97
55	0.8360	0.836	210.00	205.0	13.9	3.94	4.00	7.94	1.98	5.97	1.97
56	0.8470	0.847	211.00	206.0	14.1	3.95	4.00	7.95	1.99	5.98	1.97
57	0.8670	0.867	213.00	208.0	14.5	3.97	4.00	7.98	1.99	5.99	1.99
58	0.8870	0.887	215.00	210.0	14.8	3.99	4.00	8.00	2.00	6.00	2.00
59	0.8980	0.898	216.00	211.0	15.0	4.00	4.00	8.01	2.00	6.01	2.00
60	0.9080	0.908	216.00	211.0	15.1	4.00	4.00	8.00	2.00	6.00	2.00

Specimen Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Final
W moist soil and tare:	876.100		876.100
Jt. dry soil and tare:	763.500		763.500
Jt. of tare:	157.300		157.300
Weight, gms:	1117.9		
Diameter, in:	2.865	2.865	
rea, in²:	6.447	6.447	
Height, in:	6.000	6.000	
Net decrease in height, in:		0.000	
Moisture:	18.6	18.6	18.6
Jet density, pcf:	110.1	110.1	
Dry density, pcf:	92.9	92.9	
'oid ratio:	0.8153	0.8153	
Saturation:	61.5	61.5	

Test Readings Data for Specimen No. 3

Deformation dial constant= 1 in per input unit
Primary load ring constant= 1 lbs per input unit
Secondary load ring constant= 0 lbs per input unit
Crossover reading for secondary load ring= 0 input units
Cell pressure = 6.90 psi = 0.99 ksf
Back pressure = 0.00 psi = 0.00 ksf
Effective confining stress = 0.99 ksf
Strain rate, %/min = 1.00
DEVIATOR STRESS = 3.77 ksf at reading no. 67
J STRESS = not selected

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs,	Strain %	Deviator Stress ksf	Principal Stresses Minor ksf	Major ksf	1:3 Ratio	P ksf	Q ksf
0	0.0000	0.000	2.00	0.0	0.0	0.00	0.99	0.99	1.00	0.99	0.00
1	0.0020	0.002	6.00	4.0	0.0	0.09	0.99	1.08	1.09	1.04	0.04
2	0.0110	0.011	11.00	9.0	0.2	0.20	0.99	1.19	1.20	1.09	0.10
3	0.0210	0.021	15.00	13.0	0.4	0.29	0.99	1.28	1.29	1.14	0.14
4	0.0310	0.031	18.00	16.0	0.5	0.36	0.99	1.35	1.36	1.17	0.18
5	0.0520	0.052	23.00	21.0	0.9	0.47	0.99	1.46	1.47	1.23	0.23
6	0.0620	0.062	26.00	24.0	1.0	0.53	0.99	1.52	1.53	1.26	0.27
7	0.0820	0.082	32.00	30.0	1.4	0.66	0.99	1.65	1.67	1.32	0.33
8	0.0920	0.092	35.00	33.0	1.5	0.73	0.99	1.72	1.73	1.36	0.36
9	0.1030	0.103	39.00	37.0	1.7	0.81	0.99	1.81	1.82	1.40	0.41
10	0.1130	0.113	42.00	40.0	1.9	0.88	0.99	1.87	1.88	1.43	0.44
11	0.1240	0.124	46.00	44.0	2.1	0.96	0.99	1.96	1.97	1.47	0.48
12	0.1340	0.134	50.00	48.0	2.2	1.05	0.99	2.04	2.05	1.52	0.52
13	0.1440	0.144	54.00	52.0	2.4	1.13	0.99	2.13	2.14	1.56	0.57
14	0.1540	0.154	58.00	56.0	2.6	1.22	0.99	2.21	2.23	1.60	0.61
15	0.1650	0.165	63.00	61.0	2.8	1.33	0.99	2.32	2.33	1.66	0.66
16	0.1750	0.175	67.00	65.0	2.9	1.41	0.99	2.40	2.42	1.70	0.70
17	0.1850	0.185	71.00	69.0	3.1	1.49	0.99	2.49	2.50	1.74	0.75
18	0.1960	0.196	76.00	74.0	3.3	1.60	0.99	2.59	2.61	1.79	0.80
1	2060	0.206	81.00	79.0	3.4	1.70	0.99	2.70	2.72	1.85	0.85
2	.2160	0.216	86.00	84.0	3.6	1.81	0.99	2.80	2.82	1.90	0.90
21	0.2260	0.226	91.00	89.0	3.8	1.91	0.99	2.91	2.93	1.95	0.96
22	0.2360	0.236	96.00	94.0	3.9	2.02	0.99	3.01	3.03	2.00	1.01
23	0.2470	0.247	101.00	99.0	4.1	2.12	0.99	3.11	3.13	2.05	1.06

Test Readings Data for Specimen No. 3

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs	Strain %	Deviator Stress ksf	Principal Stresses Minor ksf	Major ksf	1:3 Ratio	P ksf	Q ksf
24	0.2570	0.257	107.00	105.0	4.3	2.24	0.99	3.24	3.26	2.12	1.12
25	0.2670	0.267	113.00	111.0	4.5	2.37	0.99	3.36	3.38	2.18	1.18
26	0.2770	0.277	118.00	116.0	4.6	2.47	0.99	3.47	3.49	2.23	1.24
27	0.2870	0.287	124.00	122.0	4.8	2.59	0.99	3.59	3.61	2.29	1.30
28	0.2970	0.297	130.00	128.0	5.0	2.72	0.99	3.71	3.74	2.35	1.36
29	0.3080	0.308	135.00	133.0	5.1	2.82	0.99	3.81	3.84	2.40	1.41
30	0.3180	0.318	141.00	139.0	5.3	2.94	0.99	3.93	3.96	2.46	1.47
31	0.3280	0.328	147.00	145.0	5.5	3.06	0.99	4.06	4.08	2.52	1.53
32	0.3380	0.338	151.00	149.0	5.6	3.14	0.99	4.13	4.16	2.56	1.57
33	0.3480	0.348	156.00	154.0	5.8	3.24	0.99	4.23	4.26	2.61	1.62
34	0.3590	0.359	161.00	159.0	6.0	3.34	0.99	4.33	4.36	2.66	1.67
35	0.3690	0.369	166.00	164.0	6.2	3.44	0.99	4.43	4.46	2.71	1.72
36	0.3790	0.379	171.00	169.0	6.3	3.54	0.99	4.53	4.56	2.76	1.77
37	0.3900	0.390	175.00	173.0	6.5	3.61	0.99	4.61	4.64	2.80	1.81
38	0.4000	0.400	178.00	176.0	6.7	3.67	0.99	4.66	4.69	2.83	1.83
39	0.4100	0.410	181.00	179.0	6.8	3.73	0.99	4.72	4.75	2.86	1.86
40	0.4300	0.430	184.00	182.0	7.2	3.77	0.99	4.77	4.80	2.88	1.89
41	0.4410	0.441	185.00	183.0	7.4	3.79	0.99	4.78	4.81	2.89	1.89
42	0.4620	0.462	186.00	184.0	7.7	3.79	0.99	4.79	4.82	2.89	1.90
43	0.4830	0.483	186.00	184.0	8.1	3.78	0.99	4.77	4.80	2.88	1.89
44	0.5040	0.504	185.00	183.0	8.4	3.74	0.99	4.74	4.77	2.87	1.87
45	0.5240	0.524	185.00	183.0	8.7	3.73	0.99	4.72	4.75	2.86	1.87
46	0.5350	0.535	185.00	183.0	8.9	3.72	0.99	4.72	4.75	2.86	1.86
47	0.5550	0.555	186.00	184.0	9.3	3.73	0.99	4.72	4.75	2.86	1.86
48	0.5760	0.576	186.00	184.0	9.6	3.72	0.99	4.71	4.74	2.85	1.86
49	0.5960	0.596	186.00	184.0	9.9	3.70	0.99	4.70	4.73	2.84	1.85
50	0.6070	0.607	187.00	185.0	10.1	3.71	0.99	4.71	4.74	2.85	1.86
51	0.6280	0.628	187.00	185.0	10.5	3.70	0.99	4.69	4.72	2.84	1.85
52	0.6490	0.649	187.00	185.0	10.8	3.69	0.99	4.68	4.71	2.84	1.84
53	0.6690	0.669	188.00	186.0	11.2	3.69	0.99	4.69	4.72	2.84	1.85
54	0.6800	0.680	188.00	186.0	11.3	3.68	0.99	4.68	4.71	2.84	1.84
55	0.7010	0.701	189.00	187.0	11.7	3.69	0.99	4.68	4.71	2.84	1.84
56	0.7210	0.721	190.00	188.0	12.0	3.69	0.99	4.69	4.72	2.84	1.85
57	0.7420	0.742	191.00	189.0	12.4	3.70	0.99	4.69	4.72	2.84	1.85
58	0.7620	0.762	193.00	191.0	12.7	3.72	0.99	4.72	4.75	2.86	1.86
59	0.7730	0.773	193.00	191.0	12.9	3.72	0.99	4.71	4.74	2.85	1.86
60	0.7940	0.794	195.00	193.0	13.2	3.74	0.99	4.73	4.76	2.86	1.87
61	0.8140	0.814	196.00	194.0	13.6	3.75	0.99	4.74	4.77	2.87	1.87
62	0.8250	0.825	196.00	194.0	13.8	3.74	0.99	4.73	4.76	2.86	1.87
63	0.8460	0.846	197.00	195.0	14.1	3.74	0.99	4.74	4.77	2.86	1.87
64	0.8660	0.866	198.00	196.0	14.4	3.75	0.99	4.74	4.77	2.87	1.87
65	0.8770	0.877	198.00	196.0	14.6	3.74	0.99	4.73	4.76	2.86	1.87
66	0.8980	0.898	200.00	198.0	15.0	3.76	0.99	4.75	4.79	2.87	1.88
67	0.9080	0.908	201.00	199.0	15.1	3.77	0.99	4.77	4.80	2.88	1.89

Specimen Parameters for Specimen No. 4

Specimen Parameter	Initial	Saturated	Final
Wt. moist soil and tare:	1319.800		1319.800
Wt. dry soil and tare:	1192.600		1192.600
Wt. of tare:	161.100		161.100
Weight, gms:	1159.2		
Diameter, in:	2.865	2.865	
Area, in²:	6.447	6.447	
Height, in:	6.000	6.000	
Net decrease in height, in:		0.000	
% Moisture:	12.3	12.3	12.3
Wet density, pcf:	114.2	114.2	
Dry density, pcf:	101.6	101.6	
Void ratio:	0.6584	0.6584	
% Saturation:	50.6	50.6	

Test Readings Data for Specimen No. 4

Deformation dial constant= 1 in per input unit
Primary load ring constant= 1 lbs per input unit
Secondary load ring constant= 0 lbs per input unit
Crossover reading for secondary load ring= 0 input units
Cell pressure = 13.90 psi = 2.00 ksf
Back pressure = 0.00 psi = 0.00 ksf
Effective confining stress = 2.00 ksf
Strain rate, %/min = 1.00
DEVIATOR STRESS = 9.94 ksf at reading no. 35
[illegible] STRESS = not selected

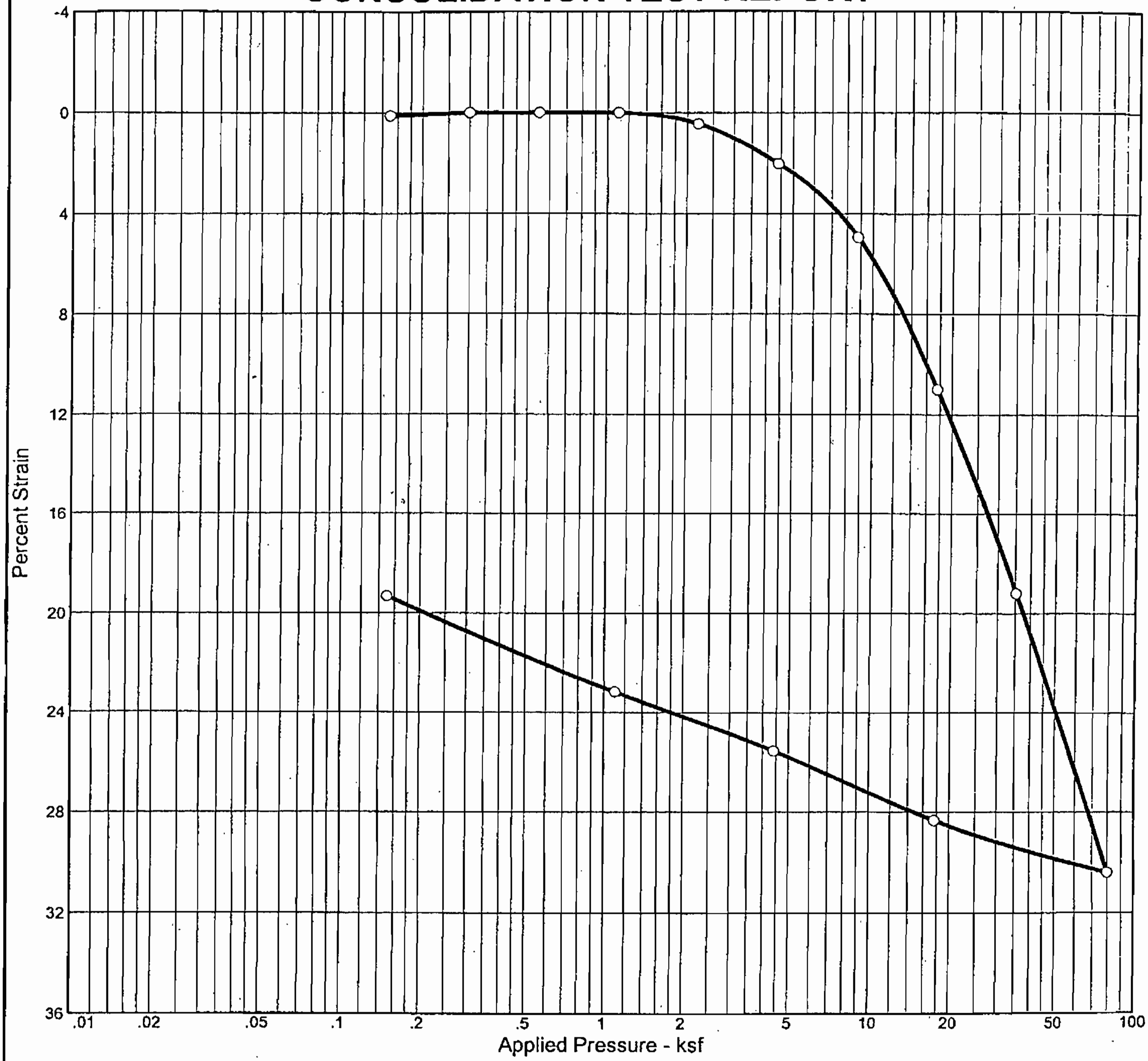
No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs	Strain %	Deviator Stress ksf	Principal Stresses Minor ksf	Major ksf	1:3 Ratio	P ksf	Q ksf
0	0.0000	0.000	2.00	0.0	0.0	0.00	2.00	2.00	1.00	2.00	0.00
1	0.0100	0.010	24.00	22.0	0.2	0.49	2.00	2.49	1.25	2.25	0.25
2	0.0200	0.020	29.00	27.0	0.3	0.60	2.00	2.60	1.30	2.30	0.30
3	0.0300	0.030	34.00	32.0	0.5	0.71	2.00	2.71	1.36	2.36	0.36
4	0.0410	0.041	40.00	38.0	0.7	0.84	2.00	2.84	1.42	2.42	0.42
5	0.0510	0.051	45.00	43.0	0.9	0.95	2.00	2.95	1.48	2.48	0.48
6	0.0620	0.062	50.00	48.0	1.0	1.06	2.00	3.06	1.53	2.53	0.53
7	0.0720	0.072	55.00	53.0	1.2	1.17	2.00	3.17	1.58	2.59	0.58
8	0.0820	0.082	61.00	59.0	1.4	1.30	2.00	3.30	1.65	2.65	0.65
9	0.0930	0.093	67.00	65.0	1.6	1.43	2.00	3.43	1.71	2.72	0.71
10	0.1030	0.103	75.00	73.0	1.7	1.60	2.00	3.60	1.80	2.80	0.80
11	0.1130	0.113	82.00	80.0	1.9	1.75	2.00	3.75	1.88	2.88	0.88
12	0.1230	0.123	88.00	86.0	2.1	1.88	2.00	3.88	1.94	2.94	0.94
13	0.1330	0.133	96.00	94.0	2.2	2.05	2.00	4.05	2.03	3.03	1.03
14	0.1440	0.144	105.00	103.0	2.4	2.25	2.00	4.25	2.12	3.12	1.12
15	0.1540	0.154	115.00	113.0	2.6	2.46	2.00	4.46	2.23	3.23	1.23
16	0.1640	0.164	125.00	123.0	2.7	2.67	2.00	4.67	2.34	3.34	1.34
17	0.1750	0.175	138.00	136.0	2.9	2.95	2.00	4.95	2.47	3.48	1.47
18	0.1850	0.185	152.00	150.0	3.1	3.25	2.00	5.25	2.62	3.63	1.62
[illegible]	[illegible].1950	0.195	166.00	164.0	3.3	3.54	2.00	5.55	2.77	3.77	1.77
[illegible]	[illegible].2050	0.205	183.00	181.0	3.4	3.90	2.00	5.91	2.95	3.95	1.95
21	0.2150	0.215	202.00	200.0	3.6	4.31	2.00	6.31	3.15	4.16	2.15
22	0.2250	0.225	223.00	221.0	3.8	4.75	2.00	6.75	3.37	4.38	2.38
23	0.2350	0.235	245.00	243.0	3.9	5.22	2.00	7.22	3.61	4.61	2.61

Test Readings Data for Specimen No. 4

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs	Strain %	Deviator Stress ksf	Principal Stresses Minor ksf	Major ksf	1:3 Ratio	P ksf	Q ksf
24	0.2450	0.245	269.00	267.0	4.1	5.72	2.00	7.72	3.86	4.86	2.86
25	0.2560	0.256	295.00	293.0	4.3	6.27	2.00	8.27	4.13	5.13	3.13
26	0.2660	0.266	323.00	321.0	4.4	6.85	2.00	8.85	4.42	5.43	3.43
27	0.2760	0.276	350.00	348.0	4.6	7.42	2.00	9.42	4.70	5.71	3.71
28	0.2870	0.287	380.00	378.0	4.8	8.04	2.00	10.04	5.02	6.02	4.02
29	0.2970	0.297	406.00	404.0	5.0	8.58	2.00	10.58	5.29	6.29	4.29
30	0.3070	0.307	430.00	428.0	5.1	9.07	2.00	11.07	5.53	6.54	4.54
31	0.3180	0.318	451.00	449.0	5.3	9.50	2.00	11.50	5.75	6.75	4.75
32	0.3280	0.328	465.00	463.0	5.5	9.78	2.00	11.78	5.88	6.89	4.89
33	0.3380	0.338	475.00	473.0	5.6	9.97	2.00	11.97	5.98	6.99	4.99
34	0.3590	0.359	475.00	473.0	6.0	9.93	2.00	11.93	5.96	6.97	4.97
35	0.3690	0.369	476.00	474.0	6.2	9.94	2.00	11.94	5.96	6.97	4.97
36	0.3900	0.390	472.00	470.0	6.5	9.82	2.00	11.82	5.90	6.91	4.91
37	0.4100	0.410	463.00	461.0	6.8	9.59	2.00	11.60	5.79	6.80	4.80
38	0.4210	0.421	451.00	449.0	7.0	9.33	2.00	11.33	5.66	6.66	4.66

CONSOLIDATION

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
99.1 %	20.8 %	110.1			2.8			0.588

MATERIAL DESCRIPTION

orange brown CLAY

Project No. 212-041 **Client:** Hultgren-Tillis

Project: GWF Power

Source: BV-1 **Sample No.:** 16 **Elev./Depth:** 68.5-70'

CONSOLIDATION TEST REPORT

COOPER TESTING LABORATORY

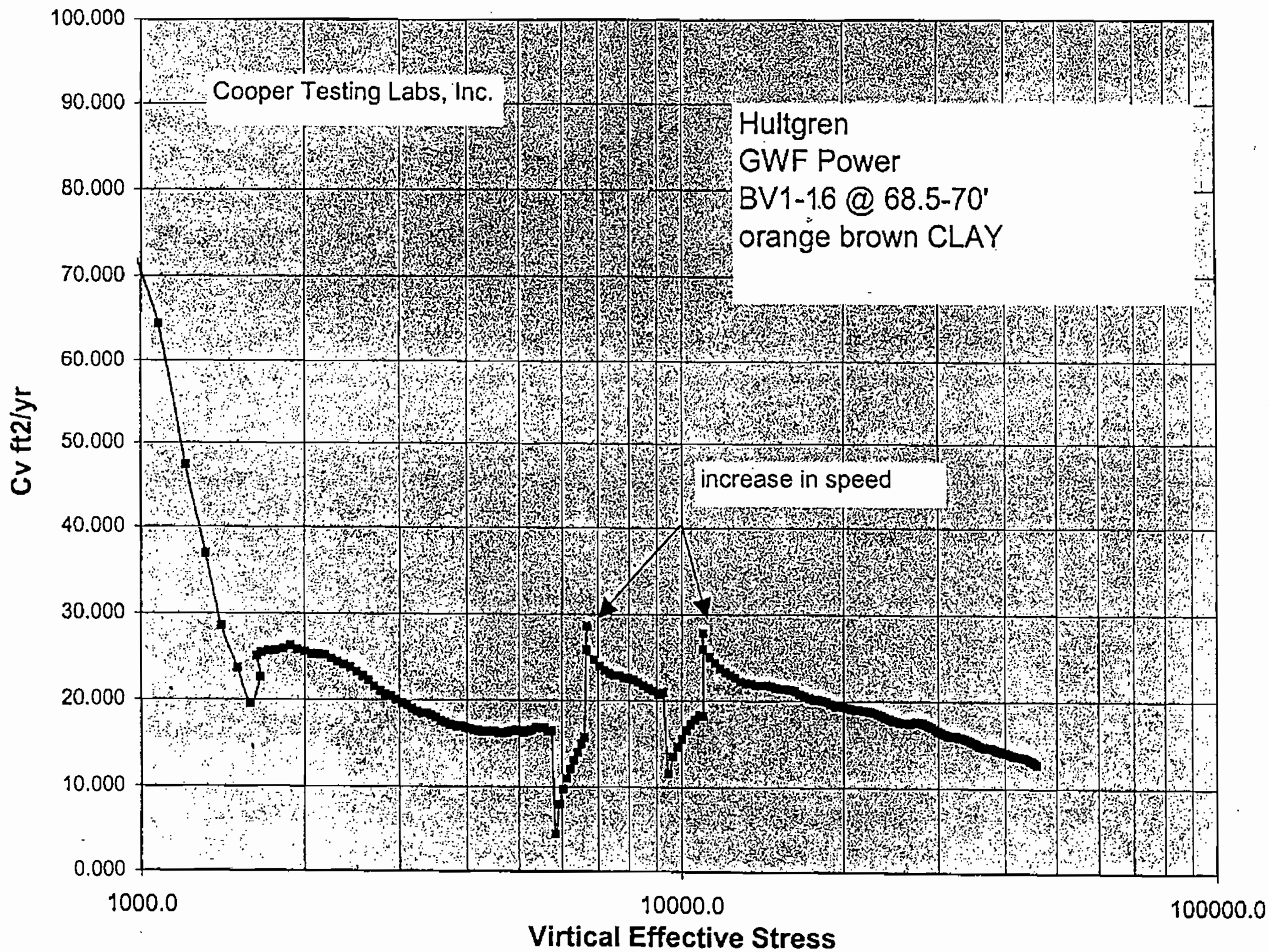
Remarks:

Final wet weight had to be estimated due to soil loss during test. Material is dispersive. Water very cloudy through entire test.

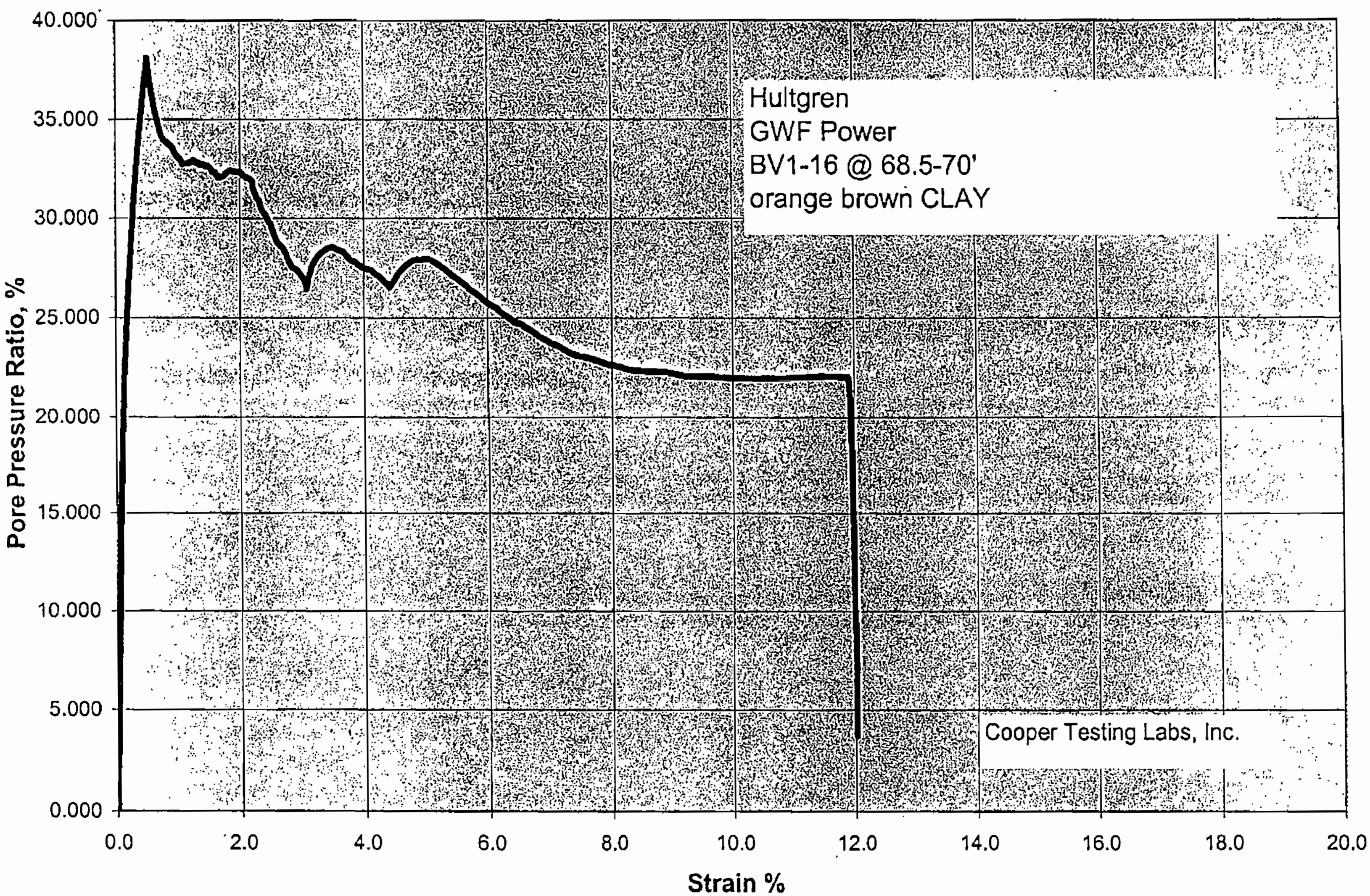
Plate

Cv-log-p

Constant Rate of Strain Consolidation Test



Pore Pressure Ratio



COOPER TESTING LABORATORY

COOPER TESTING LABORATORY

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10/17/01

To whom it may concern,

The reason that there are Cv values from a constant rate of strain test in with an incremental consolidation test is because the data file from the incremental test was lost. The equipment is automated and the wrong file was down-loaded. We have put in place safety measures so this cannot happen again. It is a problem that we never considered possible. We ran an emergency constant rate of strain consolidation test to get the Cv values that were lost from the original test. This is probably a first (reporting data from both types of tests) but the Cv values from a constant rate of strain test are continuous. The Cv values from an incremental test consist of one point taken at typically T50 of one load increment. So therefore it is an average Cv value that represents one whole load increment. In that same amount of strain you may get 50 or more points from a CRS test. So we have actually given you more than you would normally get.

We apologize for any incoveniance this may have caused. If you have any questions please call me.

Sincerely,

David Cooper
President
Cooper Testing Labs, Inc.

COOPER TESTING LABS

MOISTURE DENSITY - POROSITY DATA SHEET

Job # Client Project/Location Date	212-041D Hultgren GWF Power 10/17/01				
Boring #	BV1-16				
Depth (ft)	68.5-70'				
Soil Type	orange brown CLAY				
Specific Gravity	2.80 ASSUMED				
Volume Total cc	75.063				
lume of Solids	48.439				
Volume of Voids	26.624				
Void Ratio	0.550				
Porosity %	35.5%				
Saturation %	96.8%				
Moisture %	19.0%				
Dry Density (pcf)	112.8				

Remarks

								specimen area in2	piston area in2	piston weight lbs													
								4.599605804	0.1963	1.77													
	B					G			J		L	L											
[CONTACT] Clock Time	Elapsed Time min	Load Cell lbs	DCDT inch	Bottom Pressure psi	Cell Pressure psi	Excess Bottom Pore Pressure psi	Load Frame Encoder inch	Vertical Effective Load lbs	Vertical Total Stress psf	Vertical Effective Stress psf	DCDT Vertical Strain %	Encoder Vertical Strain %	DCDT Vertical Strain Rate %/hr	encoder Vertical Strain Rate %/hr	Pore Pressure Ratio %	Cv ft2/yr	Rolling Average Cv ft2/yr	H term	top log term	time term	bottom log term	S2/S1	Delta S1
																	272.782						
10/16/2001 8:34	0.0	43.76	-0.4158	100.74	100.92	0.000	0.0000	25.7	805.3	805.3	0.0	0.0	0.29	1.02	0.000		272.782	0.0069	0.0073	7E-07	-0.00052		
10/16/2001 8:34	0.2	44.20	-0.4158	100.75	100.91	0.013	0.0000	26.2	819.0	817.7	0.0	0.0	0.01	0.00	0.236		273.204						
10/16/2001 8:56	21.6	44.10	-0.4158	100.74	100.90	0.017	0.0000	26.1	816.1	814.5	0.0	0.0	0.83	1.00	0.291	1423.404	97.568						
10/16/2001 9:01	26.6	56.64	-0.4151	102.07	100.91	1.330	0.0009	38.6	1208.5	1077.2	0.1	0.1	0.87	1.00	15.848	285.799	64.498						
10/16/2001 9:06	31.6	63.87	-0.4144	103.02	100.91	2.280	0.0017	45.8	1435.0	1206.7	0.1	0.2	0.92	1.00	22.883	159.036	47.376						
10/16/2001 9:11	36.6	70.13	-0.4136	103.84	100.89	3.124	0.0025	52.1	1630.9	1315.2	0.2	0.3	0.90	1.00	27.581	105.949	36.942						
10/16/2001 9:16	41.6	75.76	-0.4128	104.67	100.91	3.932	0.0034	57.7	1807.0	1406.5	0.3	0.3	0.91	1.00	31.331	85.961	28.627						
10/16/2001 9:21	46.6	81.45	-0.4121	105.42	100.90	4.691	0.0042	63.4	1985.2	1504.5	0.4	0.4	0.91	1.00	34.028	65.756	23.678						
10/16/2001 9:26	51.6	86.66	-0.4113	106.15	100.89	5.439	0.0050	68.6	2148.6	1588.1	0.5	0.5	0.91	1.00	36.453	56.353	19.599						
10/16/2001 9:30	55.6	90.78	-0.4107	106.74	100.91	6.010	0.0057	72.7	2277.2	1655.7	0.5	0.6	-0.03	0.02	38.007		22.619						
10/16/2001 9:30	55.8	89.88	-0.4107	106.69	100.91	5.952	0.0057	71.8	2249.1	1633.4	0.5	0.6	0.48	0.50	38.109	3.373	25.089						
10/16/2001 9:35	60.8	90.19	-0.4103	106.53	100.90	5.804	0.0061	72.2	2259.0	1660.2	0.6	0.6	0.45	0.50	36.998	18.318	25.475						
10/16/2001 9:40	65.8	91.89	-0.4099	106.55	100.91	5.817	0.0065	73.8	2311.9	1712.8	0.6	0.7	0.43	0.50	36.234	21.240	25.698						
10/16/2001 9:45	70.8	93.85	-0.4096	106.58	100.89	5.869	0.0070	75.8	2373.4	1769.8	0.6	0.7	0.46	0.50	35.608	22.060	25.772						
10/16/2001 9:50	75.8	95.90	-0.4092	106.68	100.92	5.939	0.0074	77.9	2437.7	1827.6	0.7	0.7	0.44	0.50	35.084	22.478	25.918						
10/16/2001 9:55	80.8	98.03	-0.4088	106.78	100.92	6.031	0.0078	80.0	2504.1	1885.2	0.7	0.8	0.43	0.50	34.680	19.442	26.280						
10/16/2001 10:00	85.8	99.88	-0.4085	106.83	100.91	6.092	0.0082	81.8	2562.0	1937.5	0.7	0.8	0.47	0.50	34.237	26.160	25.822						
10/16/2001 10:05	90.8	102.40	-0.4081	106.97	100.91	6.232	0.0086	84.4	2641.1	2002.5	0.8	0.9	0.45	0.50	33.980	23.719	25.617						
10/16/2001 10:10	95.8	104.74	-0.4077	107.12	100.91	6.390	0.0090	86.7	2714.5	2059.8	0.8	0.9	0.45	0.50	33.900	24.166	25.313						
10/16/2001 10:15	100.8	107.19	-0.4073	107.29	100.92	6.547	0.0095	89.2	2791.2	2120.7	0.8	0.9	0.42	0.50	33.774	23.130	25.258						
10/16/2001 10:20	105.8	109.60	-0.4070	107.45	100.91	6.711	0.0099	91.6	2866.4	2179.1	0.9	1.0	0.41	0.50	33.713	21.408	25.186						
10/16/2001 10:25	110.8	111.87	-0.4066	107.59	100.91	6.848	0.0103	93.8	2937.6	2236.5	0.9	1.0	0.34	0.50	33.570	23.020	24.785						
10/16/2001 10:30	115.8	114.37	-0.4064	107.76	100.94	6.987	0.0107	96.3	3015.6	2300.7	0.9	1.1	0.41	0.50	33.363	22.656	24.402						
10/16/2001 10:35	120.8	116.87	-0.4060	107.90	100.95	7.130	0.0111	98.8	3094.0	2364.7	1.0	1.1	0.37	0.50	33.183	23.645	24.074						
10/16/2001 10:40	125.8	119.54	-0.4057	108.06	100.93	7.301	0.0115	101.5	3177.6	2431.0	1.0	1.2	0.43	0.50	33.084	22.334	23.742						
10/16/2001 10:45	130.8	122.13	-0.4054	108.26	100.98	7.457	0.0120	104.1	3258.4	2496.0	1.0	1.2	0.40	0.50	32.955	22.498	23.253						
10/16/2001 10:50	135.8	124.79	-0.4050	108.42	101.00	7.600	0.0124	106.7	3341.6	2565.0	1.1	1.2	0.46	0.50	32.750	22.076	22.749						
10/16/2001 10:55	140.8	127.44	-0.4046	108.54	100.92	7.793	0.0128	109.4	3424.9	2628.5	1.1	1.3	0.54	0.50	32.767	21.736	22.293						
10/16/2001 11:00	145.8	130.13	-0.4042	108.74	100.92	7.993	0.0132	112.1	3509.0	2692.1	1.2	1.3	0.53	0.50	32.802	22.693	21.578						
10/16/2001 11:05	150.8	133.01	-0.4037	108.97	100.94	8.201	0.0136	115.0	3599.3	2761.1	1.2	1.4	0.51	0.50	32.810	20.833	21.035						
10/16/2001 11:10	155.8	135.73	-0.4033	109.21	100.95	8.429	0.0140	117.7	3684.4	2822.7	1.3	1.4	0.43	0.50	32.942	19.811	20.660						

10/16/2001 11:15	160.8	138.39	-0.4030	109.37	100.96	8.586	0.0145	120.3	3767.4	2889.8	1.3	1.4	0.47	0.50	32.819	19.593	20.461						
10/16/2001 11:20	165.8	141.06	-0.4026	109.56	100.96	8.776	0.0149	123.0	3851.1	2954.1	1.3	1.5	0.44	0.50	32.817	21.020	20.066						
10/16/2001 11:25	170.8	143.99	-0.4022	109.75	100.97	8.957	0.0153	125.9	3942.9	3027.7	1.4	1.5	0.50	0.50	32.711	19.681	19.662						
10/16/2001 11:30	175.8	146.79	-0.4018	109.91	100.92	9.159	0.0157	128.7	4030.7	3094.9	1.4	1.6	0.39	0.50	32.721	18.580	19.416						
10/16/2001 11:35	180.8	149.49	-0.4015	110.08	100.92	9.333	0.0161	131.5	4115.4	3162.0	1.4	1.6	0.49	0.50	32.655	18.043	19.073						
10/16/2001 11:40	185.8	152.18	-0.4011	110.27	100.93	9.523	0.0166	134.1	4199.4	3226.4	1.5	1.7	0.45	0.50	32.655	18.090	18.742						
10/16/2001 11:45	190.8	154.92	-0.4007	110.45	100.94	9.686	0.0170	136.9	4285.1	3295.7	1.5	1.7	0.43	0.50	32.551	16.973	18.510						
10/16/2001 11:50	195.8	157.53	-0.4003	110.58	100.95	9.814	0.0174	139.5	4366.8	3364.8	1.6	1.7	0.45	0.50	32.362	16.492	18.502						
10/16/2001 11:55	200.8	160.10	-0.3999	110.76	100.95	9.986	0.0178	142.1	4447.4	3427.9	1.6	1.8	0.37	0.50	32.332	16.810	18.298						
10/16/2001 12:00	205.8	162.77	-0.3996	110.90	100.95	10.129	0.0182	144.7	4530.9	3497.1	1.6	1.8	0.45	0.50	32.192	18.000	17.995						
10/16/2001 12:05	210.8	165.67	-0.3993	111.06	100.95	10.290	0.0186	147.6	4621.6	3571.7	1.7	1.9	0.49	0.50	32.061	17.862	17.652						
10/16/2001 12:10	215.8	168.59	-0.3989	111.26	100.92	10.507	0.0191	150.6	4713.4	3641.1	1.7	1.9	0.57	0.50	32.102	16.447	17.480						
10/16/2001 12:15	220.8	171.36	-0.3984	111.45	100.90	10.722	0.0195	153.3	4800.0	3705.7	1.7	1.9	0.60	0.50	32.166	16.612	17.245						
10/16/2001 12:20	225.8	174.21	-0.3979	111.70	100.91	10.969	0.0199	156.2	4889.2	3769.4	1.8	2.0	0.54	0.50	32.306	15.301	17.170						
10/16/2001 12:25	230.8	176.89	-0.3974	111.92	100.90	11.197	0.0203	158.9	4973.4	3830.0	1.8	2.0	0.50	0.50	32.419	15.442	17.034						
10/16/2001 12:30	235.8	179.66	-0.3970	112.11	100.91	11.372	0.0207	161.6	5059.9	3898.8	1.9	2.1	0.49	0.50	32.363	15.114	17.014						
10/16/2001 12:35	240.8	182.41	-0.3966	112.30	100.90	11.571	0.0211	164.4	5146.1	3964.6	1.9	2.1	0.49	0.50	32.380	16.426	16.856						
10/16/2001 12:40	245.8	185.47	-0.3962	112.51	100.90	11.776	0.0216	167.4	5241.8	4039.5	2.0	2.2	0.47	0.50	32.351	15.181	16.747						
10/16/2001 12:45	250.8	188.34	-0.3958	112.70	100.90	11.971	0.0220	170.3	5331.6	4109.3	2.0	2.2	0.46	0.50	32.334	15.577	16.576						
10/16/2001 12:50	255.8	191.32	-0.3954	112.87	100.91	12.137	0.0224	173.3	5425.1	4186.2	2.0	2.2	0.45	0.50	32.216	15.120	16.522						
10/16/2001 12:55	260.8	194.27	-0.3950	113.04	100.92	12.296	0.0228	176.2	5517.1	4262.3	2.1	2.3	0.47	0.50	32.094	15.067	16.428						
10/16/2001 13:00	265.8	197.23	-0.3946	113.22	100.91	12.488	0.0232	179.2	5610.1	4335.9	2.1	2.3	0.46	0.50	32.054	14.729	16.486						
10/16/2001 13:05	270.9	200.19	-0.3943	113.39	100.90	12.672	0.0236	182.2	5702.7	4410.0	2.2	2.4	0.45	0.50	31.997	14.702	16.401						
10/16/2001 13:10	275.9	203.18	-0.3939	113.56	100.91	12.829	0.0241	185.1	5796.2	4487.8	2.2	2.4	0.16	0.50	31.871	14.358	16.478						
10/16/2001 13:15	280.9	206.14	-0.3937	113.72	101.00	12.899	0.0245	188.1	5888.2	4573.6	2.2	2.4	0.33	0.50	31.545	14.952	16.272						
10/16/2001 13:20	285.9	209.21	-0.3935	113.80	100.98	13.001	0.0249	191.2	5984.6	4660.3	2.2	2.5	0.38	0.50	31.282	15.164	16.273						
10/16/2001 13:25	290.9	212.35	-0.3932	113.90	100.96	13.111	0.0253	194.3	6083.0	4748.2	2.3	2.5	0.48	0.50	31.037	14.304	16.338						
10/16/2001 13:30	295.9	215.34	-0.3928	114.05	100.97	13.252	0.0257	197.3	6176.7	4828.0	2.3	2.6	0.38	0.50	30.895	14.210	16.492						
10/16/2001 13:35	300.9	218.34	-0.3925	114.12	101.00	13.296	0.0262	200.3	6270.4	4918.2	2.3	2.6	0.43	0.50	30.534	14.688	16.554						
10/16/2001 13:40	305.9	221.44	-0.3921	114.21	100.99	13.393	0.0266	203.4	6367.6	5006.3	2.4	2.7	0.52	0.50	30.287	14.313	16.517						
10/16/2001 13:45	310.9	224.50	-0.3917	114.30	100.94	13.539	0.0270	206.5	6463.4	5087.7	2.4	2.7	0.41	0.50	30.163	15.201	16.328						
10/16/2001 13:50	315.9	227.78	-0.3913	114.45	100.99	13.633	0.0274	209.7	6565.8	5181.2	2.5	2.7	0.51	0.50	29.901	14.020	16.496						
10/16/2001 13:55	320.9	230.80	-0.3909	114.52	100.95	13.742	0.0278	212.8	6660.8	5265.7	2.5	2.8	0.41	0.50	29.709	14.974	16.605						
10/16/2001 14:00	325.9	234.08	-0.3906	114.60	100.96	13.808	0.0282	216.0	6763.2	5362.3	2.5	2.8	0.41	0.50	29.400	13.302	16.865						
10/16/2001 14:05	330.9	236.99	-0.3902	114.67	101.01	13.840	0.0287	218.9	6854.1	5450.9	2.6	2.9	0.45	0.50	29.078	15.169	16.821						
10/16/2001 14:10	335.9	240.31	-0.3898	114.74	101.01	13.912	0.0291	222.2	6958.0	5548.4	2.6	2.9	0.54	0.50	28.793	14.828	16.836						
10/16/2001 14:15	340.9	243.56	-0.3894	114.82	100.94	14.049	0.0295	225.5	7060.2	5637.2	2.6	2.9	0.57	0.50	28.654	15.443	16.492						
10/16/2001 14:20	345.9	246.99	-0.3889	114.94	100.94	14.180	0.0299	229.0	7167.8	5731.9	2.7	3.0	0.50	0.50	28.488	15.178	16.516						
10/16/2001 14:25	350.9	250.41	-0.3885	115.08	100.96	14.292	0.0303	232.4	7274.7	5828.1	2.7	3.0	0.41	0.50	28.292	14.020	4.430						
10/16/2001 14:30	355.9	253.58	-0.3882	115.14	100.99	14.322	0.0307	235.5	7373.5	5924.9	2.8	3.1	0.44	0.50	27.970	13.684	7.974						
10/16/2001 14:35	360.9	256.66	-0.3878	115.16	100.94	14.393	0.0312	238.6	7470.2	6015.1	2.8	3.1	0.48	0.50	27.745	15.372	9.743						
10/16/2001 14:40	365.9	260.13	-0.3874	115.20	100.90	14.485	0.0316	242.1	7579.4	6115.7	2.8	3.2	0.59	0.50	27.520	15.840	11.033						
10/16/2001 14:45	370.9	263.77	-0.3869	115.40	100.92	14.659	0.0320	245.7	7692.9	6211.9	2.9	3.2	0.56	0.50	27.440	15.381	12.109						
10/16/2001 14:50	375.9	267.32	-0.3864	115.54	100.90	14.813	0.0324	249.3	7804.4	6308.2	2.9	3.2	0.50	0.50	27.332	14.823	13.152						
10/16/2001 14:55	380.9	270.80	-0.3860	115.68	100.94	14.919	0.0328	252.8	7913.2	6406.8	3.0	3.3	0.46	0.50	27.149	14.942	14.073						
10/16/2001 15:00	385.9	274.32	-0.3856	115.76	100.93	15.025	0.0333	256.3	8023.2	6506.7	3.0	3.3	0.46	0.50	26.967	12.693	15.035						
10/16/2001 15:05	390.9	277.33	-0.3852	115.82	100.92	15.070	0.0337	259.3	8117.4	6597.1	3.1	3.4	0.31	0.50	26.733	15.368	15.774						
10/16/2001 15:09	394.3	279.79	-0.3851	115.89	101.00	15.064	0.0339	261.7	8194.0	6675.2	3.1	3.4	-0.77	0.02	26.473	-82.664	28.618						
10/16/2001 15:09	394.5	279.01	-0.3851	115.85	101.03	14.997	0.0339	261.0	8169.6	6657.6	3.1	3.4	0.41	0.75	26.435	42.036	25.920						
10/16/2001 15:14	399.5	289.23	-0.3848	116.66	100.96	15.883	0.0346	271.2	8489.8	6886.8	3.1	3.5	0.61	0.75	26.940	29.521	24.778						
10/16/2001 15:19	404.5	296.81	-0.3843	117.46	100.95	16.681	0.0352	278.8	8727.3	7041.7	3.2	3.5	0.53	0.75	27.524	26.165	24.004						
10/16/2001 15:24	409.5	303.86	-0.3838	118.08	100.98	17.279	0.0358	285.8	8947.7	7200.6	3.2	3.6	0.67	0.75	27.808	23.983	23.513						
10/16/2001 15:29	414.5	310.54	-0.3833	118.60	100.93	17.846	0.0365	292.5	9157.3	7351.9	3.3	3.6	0.67	0.75	28.064	23.173	23.144						
10/16/2001 15:34	419.5	317.23	-0.3827	119.12	100.93	18.366	0.0371	299.2	9366.7	7508.0	3.3	3.7	0.76	0.75	28.236	22.312	22.907						
10/16/2001 15:39	424.5	323.90	-0.3821	119.67	100.97	18.873	0.0377	305.8	9575.2	7664.6	3.4	3.8	0.70	0.75	28.383	20.382	22.942						
10/16/2001 15:44	429.5	330.13	-0.3815	120.09	100.93	19.335	0.0383	312.1	9770.4	7812.7	3.4	3.8	0.75	0.75	28.496	21.282	22.697						
10/16/2001 15:49	434.5	336.80	-0.3809	120.53	100.94	19.773	0.0390	318.8	9979.4	7977.2	3.5	3.9	0.62	0.75	28.531	20.091	22.587						
10/16/2001 15:54	439.5	343.25	-0.3803	120.94	100.99	20.125	0.0396	325.2	10180.9	8143.3	3.5	4.0	0.54	0.75	28.465	20.448	22.400						

10/16/2001 15:59	444.5	349.92	-0.3799	121.27	100.95	20.490	0.0402	331.9	10389.9	8315.5	3.6	4.0	0.71	0.75	28.399	20.386	22.137						
10/16/2001 16:04	449.5	356.70	-0.3793	121.65	100.96	20.865	0.0408	338.7	10602.2	8490.1	3.7	4.1	0.60	0.75	28.340	19.975	21.766						
10/16/2001 16:09	454.5	363.47	-0.3788	122.03	101.03	21.176	0.0415	345.4	10813.8	8671.0	3.7	4.1	0.56	0.75	28.198	20.058	21.454						
10/16/2001 16:14	459.5	370.35	-0.3783	122.26	100.97	21.462	0.0421	352.3	11029.4	8858.4	3.8	4.2	0.65	0.75	28.020	20.220	21.160						
10/16/2001 16:19	464.6	377.42	-0.3778	122.63	101.04	21.764	0.0427	359.4	11250.4	9049.7	3.8	4.3	0.70	0.75	27.857	20.417	20.756						
10/16/2001 16:24	469.5	384.60	-0.3772	122.91	100.93	22.154	0.0433	366.6	11475.9	9235.9	3.9	4.3	0.67	0.75	27.799	20.658	20.983						
10/16/2001 16:29	474.6	392.07	-0.3766	123.31	100.99	22.488	0.0440	374.0	11709.4	9436.4	3.9	4.4	0.68	0.75	27.656	19.324	11.677						
10/16/2001 16:34	479.6	399.13	-0.3761	123.59	100.97	22.796	0.0446	381.1	11930.4	9626.9	4.0	4.5	0.87	0.75	27.515	19.211	13.633						
10/16/2001 16:39	484.6	406.27	-0.3753	123.93	100.94	23.164	0.0452	388.2	12154.2	9813.9	4.0	4.5	0.87	0.75	27.444	18.951	14.717						
10/16/2001 16:44	489.6	413.42	-0.3746	124.32	100.95	23.545	0.0458	395.4	12378.1	9999.6	4.1	4.6	0.70	0.75	27.391	18.282	15.633						
10/16/2001 16:49	494.6	420.42	-0.3740	124.61	100.97	23.819	0.0465	402.4	12597.2	10191.8	4.2	4.6	0.76	0.75	27.227	17.006	16.596						
10/16/2001 16:54	499.6	427.00	-0.3734	124.83	100.92	24.090	0.0471	409.0	12803.4	10371.3	4.2	4.7	0.74	0.75	27.094	17.560	17.297						
10/16/2001 16:59	504.6	433.88	-0.3728	125.07	100.93	24.316	0.0477	415.8	13018.6	10564.8	4.3	4.8	0.72	0.75	26.896	17.873	17.819						
10/16/2001 17:04	509.6	440.97	-0.3722	125.33	100.93	24.573	0.0483	422.9	13240.6	10761.7	4.4	4.8	0.68	0.75	26.724	17.180	18.340						
10/16/2001 17:09	514.6	447.83	-0.3716	125.54	100.92	24.789	0.0490	429.8	13455.4	10955.7	4.4	4.9	-3.22	1.00	26.529	22.474	18.301						
10/16/2001 17:09	514.6	447.86	-0.3716	125.54	100.92	24.788	0.0490	429.8	13456.3	10956.7	4.4	4.9	0.27	0.02	26.526	-55.119	27.835						
10/16/2001 17:09	514.8	447.20	-0.3716	125.49	100.93	24.741	0.0490	429.2	13435.6	10940.7	4.4	4.9	0.88	1.00	26.517	34.860	26.008						
10/16/2001 17:14	519.8	461.50	-0.3709	126.64	100.92	25.900	0.0498	443.5	13883.4	11269.8	4.5	5.0	0.86	1.00	26.864	27.623	25.074						
10/16/2001 17:19	524.8	473.38	-0.3702	127.70	100.92	26.954	0.0506	455.3	14255.3	11533.3	4.6	5.1	0.87	1.00	27.228	25.610	24.384						
10/16/2001 17:24	529.8	484.89	-0.3695	128.63	100.91	27.892	0.0515	466.8	14615.7	11797.4	4.6	5.1	0.87	1.00	27.481	24.707	23.739						
10/16/2001 17:29	534.8	496.36	-0.3687	129.52	100.91	28.787	0.0523	478.3	14974.9	12065.0	4.7	5.2	0.86	1.00	27.682	23.168	23.322						
10/16/2001 17:34	539.8	507.49	-0.3680	130.37	100.90	29.646	0.0531	489.4	15323.2	12325.4	4.8	5.3	0.84	1.00	27.860	22.051	22.974						
10/16/2001 17:39	544.8	518.43	-0.3673	131.10	100.91	30.366	0.0540	500.4	15665.7	12594.7	4.9	5.4	0.86	1.00	27.913	21.347	22.695						
10/16/2001 17:44	549.8	529.25	-0.3666	131.77	100.92	31.028	0.0548	511.2	16004.4	12866.4	4.9	5.5	0.87	1.00	27.917	22.163	22.286						
10/16/2001 17:49	554.8	540.75	-0.3659	132.47	100.90	31.748	0.0556	522.7	16364.6	13153.7	5.0	5.6	0.88	1.00	27.937	21.150	22.075						
10/16/2001 17:54	559.8	551.99	-0.3651	133.14	100.91	32.403	0.0565	534.0	16716.5	13439.6	5.1	5.6	0.87	1.00	27.913	20.243	21.984						
10/16/2001 17:59	564.8	562.96	-0.3644	133.66	100.91	32.929	0.0573	544.9	17060.0	13730.6	5.1	5.7	0.86	1.00	27.795	20.155	21.856						
10/16/2001 18:04	569.8	574.10	-0.3637	134.15	100.91	33.419	0.0581	556.1	17408.7	14031.0	5.2	5.8	0.84	1.00	27.643	20.089	21.819						
10/16/2001 18:09	574.8	585.34	-0.3630	134.61	100.90	33.886	0.0590	567.3	17760.4	14336.6	5.3	5.9	0.85	1.00	27.474	19.548	21.828						
10/16/2001 18:14	579.8	596.42	-0.3623	135.05	100.91	34.323	0.0598	578.4	18107.5	14640.9	5.4	6.0	0.85	1.00	27.295	19.832	21.712						
10/16/2001 18:19	584.8	607.82	-0.3616	135.52	100.91	34.782	0.0606	589.8	18464.4	14952.7	5.4	6.1	0.84	1.00	27.126	19.264	21.528						
10/16/2001 18:24	589.8	619.09	-0.3609	135.99	100.91	35.261	0.0615	601.1	18817.3	15258.2	5.5	6.1	0.85	1.00	26.984	19.114	21.439						
10/16/2001 18:29	594.8	630.39	-0.3602	136.41	100.91	35.681	0.0623	612.4	19171.0	15570.9	5.6	6.2	0.86	1.00	26.801	18.896	21.371						
10/16/2001 18:34	599.8	641.70	-0.3594	136.82	100.89	36.108	0.0631	623.7	19525.1	15883.2	5.6	6.3	0.86	1.00	26.630	19.461	21.303						
10/16/2001 18:39	604.8	653.49	-0.3587	137.25	100.91	36.520	0.0640	635.5	19894.2	16212.3	5.7	6.4	0.87	1.00	26.434	19.513	21.171						
10/16/2001 18:44	609.8	665.47	-0.3580	137.72	100.91	36.988	0.0648	647.4	20269.1	16541.1	5.8	6.5	0.85	1.00	26.278	19.132	20.791						
10/16/2001 18:49	614.8	677.40	-0.3573	138.14	100.89	37.426	0.0656	659.4	20642.6	16871.9	5.9	6.6	0.87	1.00	26.108	19.795	20.592						
10/16/2001 18:54	619.8	689.85	-0.3566	138.58	100.90	37.858	0.0665	671.8	21032.6	17219.8	5.9	6.6	0.85	1.00	25.919	19.615	20.373						
10/16/2001 18:59	624.8	702.35	-0.3559	139.03	100.91	38.298	0.0673	684.3	21423.8	17568.1	6.0	6.7	0.86	1.00	25.742	18.902	20.183						
10/16/2001 19:04	629.8	714.54	-0.3551	139.49	100.90	38.760	0.0681	696.5	21805.5	17904.5	6.1	6.8	0.87	1.00	25.598	17.798	20.178						
10/16/2001 19:09	634.9	726.21	-0.3544	139.96	100.90	39.242	0.0690	708.2	22170.8	18222.2	6.1	6.9	0.85	1.00	25.488	18.398	20.066						
10/16/2001 19:14	639.9	738.37	-0.3537	140.29	100.91	39.551	0.0698	720.3	22551.3	18573.5	6.2	7.0	0.87	1.00	25.255	18.353	19.943						
10/16/2001 19:19	644.9	750.61	-0.3530	140.72	100.90	39.999	0.0706	732.6	22934.8	18913.1	6.3	7.1	0.87	1.00	25.114	18.916	19.643						
10/16/2001 19:24	649.9	763.39	-0.3523	141.17	100.91	40.439	0.0715	745.4	23334.7	19270.1	6.4	7.1	0.85	1.00	24.955	18.459	19.428						
10/16/2001 19:29	654.9	776.04	-0.3516	141.56	100.92	40.822	0.0723	758.0	23730.6	19629.0	6.4	7.2	0.88	1.00	24.771	16.094	19.520						
10/16/2001 19:34	659.9	787.16	-0.3508	142.12	100.90	41.393	0.0732	769.1	24079.1	19920.3	6.5	7.3	0.89	1.00	24.754	18.204	19.381						
10/16/2001 19:39	664.9	799.92	-0.3501	142.53	100.91	41.792	0.0740	781.9	24478.4	20280.9	6.6	7.4	0.87	1.00	24.585	17.864	19.225						
10/16/2001 19:44	669.9	812.57	-0.3494	142.95	100.90	42.223	0.0748	794.5	24874.4	20634.9	6.6	7.5	0.87	1.00	24.443	17.377	19.138						
10/16/2001 19:49	674.9	825.01	-0.3486	143.38	100.92	42.638	0.0757	807.0	25263.9	20984.0	6.7	7.6	0.85	1.00	24.303	17.763	19.042						
10/16/2001 19:54	679.9	837.87	-0.3479	143.80	100.91	43.062	0.0765	819.8	25666.4	21345.1	6.8	7.6	0.86	1.00	24.160	17.499	19.015						
10/16/2001 19:59	684.9	850.71	-0.3472	144.22	100.93	43.464	0.0773	832.7	26068.4	21708.1	6.9	7.7	0.87	1.00	24.009	17.372	18.875						
10/16/2001 20:04	689.9	863.55	-0.3465	144.65	100.91	43.920	0.0782	845.5	26470.5	22065.5	6.9	7.8	0.86	1.00	23.892	16.509	18.856						
10/16/2001 20:09	694.9	875.89	-0.3458	145.05	100.91	44.319	0.0790	857.8	26856.7	22412.8	7.0	7.9	0.85	1.00	23.763	16.744	18.810						
10/16/2001 20:14	699.9	888.58	-0.3450	145.53	100.90	44.800	0.0798	870.5	27254.1	22762.8	7.1	8.0	0.86	1.00	23.671	16.826	18.695						
10/16/2001 20:19	704.9	901.45	-0.3443	146.04	100.92	45.297	0.0807	883.4	27657.0	23116.7	7.1	8.1	0.82	1.00	23.585	17.091	18.551						
10/16/2001 20:24	709.9	914.67	-0.3436	146.46	100.92	45.718	0.0815	896.6	28070.9	23489.6	7.2	8.1	0.87	1.00	23.453	16.623	18.375						
10/16/2001 20:29	714.9	927.66	-0.3429	146.88	100.91	46.142	0.0823	909.6	28477.6	23855.0	7.3	8.2	0.85	1.00	23.332	16.674	18.161						
10/16/2001 20:34	719.9	940.83	-0.3422	147.33	100.91	46.588	0.0832	922.8	28889.8	24223.6	7.4	8.3	0.87	1.00	23.222	17.001	17.997						

10/16/2001 20:39	724.9	954.42	-0.3415	147.86	100.92	47.117	0.0840	936.4	29315.2	24596.6	7.4	8.4	0.85	1.00	23.145	17.279	17.794
10/16/2001 20:44	729.9	968.45	-0.3408	148.45	100.92	47.711	0.0848	950.4	29754.7	24977.1	7.5	8.5	0.89	1.00	23.090	16.251	17.709
10/16/2001 20:49	734.9	981.80	-0.3400	149.05	100.92	48.304	0.0857	963.8	30172.5	25336.0	7.6	8.6	0.88	1.00	23.053	16.359	17.582
10/16/2001 20:54	739.9	995.42	-0.3393	149.64	100.94	48.877	0.0865	977.4	30598.8	25705.4	7.7	8.6	0.87	1.00	23.002	16.377	17.501
10/16/2001 20:59	744.9	1009.23	-0.3386	150.17	100.93	49.419	0.0873	991.2	31031.1	26084.2	7.7	8.7	0.85	1.00	22.933	15.901	17.513
10/16/2001 21:04	749.9	1022.80	-0.3379	150.69	100.93	49.940	0.0882	1004.8	31456.0	26457.6	7.8	8.8	0.85	1.00	22.861	15.944	17.478
10/16/2001 21:09	754.9	1036.56	-0.3372	151.17	100.93	50.417	0.0890	1018.5	31886.9	26841.7	7.9	8.9	0.85	1.00	22.768	15.214	17.546
10/16/2001 21:14	759.9	1049.85	-0.3365	151.75	100.93	50.993	0.0898	1031.8	32303.0	27200.5	7.9	9.0	0.85	1.00	22.732	14.964	17.627
10/16/2001 21:19	764.9	1063.08	-0.3357	152.25	100.90	51.519	0.0907	1045.0	32717.3	27562.7	8.0	9.1	0.87	1.00	22.675	15.683	17.589
10/16/2001 21:24	769.9	1077.12	-0.3350	152.82	100.92	52.069	0.0915	1059.1	33156.7	27947.8	8.1	9.1	0.83	1.00	22.614	15.660	17.529
10/16/2001 21:29	774.9	1091.36	-0.3343	153.41	100.92	52.666	0.0923	1073.3	33602.5	28334.3	8.1	9.2	0.84	1.00	22.569	15.572	17.374
10/16/2001 21:34	779.9	1105.64	-0.3336	153.93	100.94	53.169	0.0932	1087.6	34049.6	28732.0	8.2	9.3	0.87	1.00	22.486	15.340	17.220
10/16/2001 21:39	784.9	1119.87	-0.3329	154.46	100.91	53.732	0.0940	1101.8	34495.0	29121.8	8.3	9.4	0.86	1.00	22.430	15.732	17.065
10/16/2001 21:44	790.0	1134.70	-0.3322	155.12	100.92	54.379	0.0948	1116.7	34959.4	29521.7	8.4	9.5	0.88	1.00	22.399	15.998	16.804
10/16/2001 21:49	795.0	1149.94	-0.3315	155.81	100.92	55.058	0.0957	1131.9	35436.5	29931.3	8.4	9.6	0.86	1.00	22.373	15.659	16.601
10/16/2001 21:54	800.0	1165.13	-0.3307	156.53	100.94	55.771	0.0965	1147.1	35911.9	30335.4	8.5	9.6	0.86	1.00	22.363	15.762	16.429
10/16/2001 21:59	805.0	1180.59	-0.3300	157.26	100.93	56.503	0.0973	1162.5	36396.0	30746.4	8.6	9.7	0.84	1.00	22.355	15.609	16.291
10/16/2001 22:04	810.0	1196.14	-0.3293	158.03	100.94	57.265	0.0982	1178.1	36882.6	31156.8	8.7	9.8	0.84	1.00	22.358	15.380	16.150
10/16/2001 22:09	815.0	1211.74	-0.3286	158.78	100.94	58.021	0.0990	1193.7	37370.9	31569.5	8.7	9.9	0.86	1.00	22.357	15.178	16.048
10/16/2001 22:14	820.0	1227.30	-0.3279	159.49	100.91	58.748	0.0998	1209.3	37858.3	31984.4	8.8	10.0	0.87	1.00	22.346	14.334	16.075
10/16/2001 22:19	825.0	1242.21	-0.3272	160.17	100.91	59.432	0.1007	1224.2	38325.0	32383.0	8.9	10.1	0.85	1.00	22.330	14.110	16.033
10/16/2001 22:24	830.0	1257.06	-0.3265	160.77	100.91	60.028	0.1015	1239.0	38790.2	32789.1	8.9	10.2	0.88	1.00	22.284	14.486	15.907
10/16/2001 22:29	835.0	1272.50	-0.3257	161.42	100.90	60.695	0.1023	1254.5	39273.6	33206.1	9.0	10.2	0.84	1.00	22.254	13.915	15.866
10/16/2001 22:34	840.0	1287.51	-0.3250	162.02	100.92	61.277	0.1032	1269.5	39743.5	33618.5	9.1	10.3	0.83	1.00	22.202	14.036	15.757
10/16/2001 22:39	845.0	1302.82	-0.3243	162.62	100.91	61.894	0.1040	1284.8	40222.9	34036.7	9.1	10.4	0.86	1.00	22.159	14.384	15.600
10/16/2001 22:44	850.0	1318.76	-0.3236	163.30	100.92	62.562	0.1048	1300.7	40721.7	34469.3	9.2	10.5	0.86	1.00	22.123	14.502	15.458
10/16/2001 22:49	855.0	1334.98	-0.3229	164.01	100.92	63.269	0.1057	1316.9	41229.4	34906.6	9.3	10.6	0.85	1.00	22.098	14.252	15.320
10/16/2001 22:54	860.0	1351.12	-0.3222	164.75	100.92	64.014	0.1065	1333.1	41734.9	35337.8	9.4	10.7	0.85	1.00	22.087	14.363	15.160
10/16/2001 22:59	865.0	1367.63	-0.3215	165.59	100.93	64.838	0.1073	1349.6	42251.7	35772.0	9.4	10.7	0.88	1.00	22.098	14.556	14.957
10/16/2001 23:04	870.0	1384.60	-0.3208	166.39	100.93	65.638	0.1082	1366.6	42782.9	36223.5	9.5	10.8	0.85	1.00	22.093	13.774	14.818
10/16/2001 23:09	875.0	1400.89	-0.3200	167.18	100.91	66.445	0.1090	1382.8	43292.8	36652.5	9.6	10.9	0.83	1.00	22.101	13.472	14.770
10/16/2001 23:14	880.0	1417.09	-0.3194	167.94	100.93	67.189	0.1098	1399.0	43800.0	37085.5	9.6	11.0	0.85	1.00	22.090	13.587	14.730
10/16/2001 23:19	885.0	1433.59	-0.3186	168.70	100.93	67.947	0.1107	1415.5	44316.5	37526.4	9.7	11.1	0.83	1.00	22.078	13.165	14.726
10/16/2001 23:24	890.0	1449.77	-0.3180	169.42	100.94	68.653	0.1115	1431.7	44823.2	37962.9	9.8	11.2	0.89	1.00	22.056	13.131	14.648
10/16/2001 23:29	895.0	1466.11	-0.3172	170.12	100.92	69.368	0.1123	1448.1	45334.8	38403.3	9.9	11.2	0.84	1.00	22.034	13.369	14.471
10/16/2001 23:34	900.0	1482.96	-0.3165	170.90	100.94	70.138	0.1132	1464.9	45862.2	38854.0	9.9	11.3	0.83	1.00	22.022	13.147	14.400
10/16/2001 23:39	905.0	1499.80	-0.3158	171.67	100.93	70.915	0.1140	1481.8	46389.3	39303.5	10.0	11.4	0.85	1.00	22.013	13.081	14.277
10/16/2001 23:44	910.0	1516.71	-0.3151	172.47	100.94	71.703	0.1148	1498.7	46918.8	39754.4	10.1	11.5	0.86	1.00	22.007	12.933	14.215
10/16/2001 23:49	915.0	1533.65	-0.3144	173.26	100.93	72.510	0.1157	1515.6	47449.1	40204.1	10.1	11.6	0.83	1.00	22.005	12.660	14.166
10/16/2001 23:54	920.0	1550.44	-0.3137	174.03	100.92	73.286	0.1165	1532.4	47974.9	40652.5	10.2	11.7	0.86	1.00	21.997	13.092	14.035
10/16/2001 23:59	925.0	1568.03	-0.3130	174.83	100.92	74.087	0.1173	1550.0	48525.6	41123.3	10.3	11.7	0.82	1.00	21.985	13.264	13.924
10/17/2001 0:04	930.0	1586.09	-0.3123	175.70	100.95	74.925	0.1182	1568.0	49090.7	41604.7	10.4	11.8	0.85	1.00	21.978	13.135	13.833
10/17/2001 0:09	935.0	1604.20	-0.3116	176.58	100.95	75.803	0.1190	1586.2	49657.8	42084.1	10.4	11.9	0.86	1.00	21.982	12.507	13.787
10/17/2001 0:14	940.0	1621.69	-0.3109	177.49	100.94	76.723	0.1198	1603.6	50205.3	42539.3	10.5	12.0	0.84	1.00	22.006	11.952	13.758
10/17/2001 0:19	945.1	1638.68	-0.3102	178.32	100.95	77.550	0.1207	1620.6	50737.4	42988.7	10.6	12.1	0.83	1.00	22.010	12.574	13.687
10/17/2001 0:24	950.1	1656.73	-0.3095	179.16	100.93	78.405	0.1215	1638.7	51302.4	43468.3	10.6	12.2	0.86	1.00	22.007	12.097	13.644
10/17/2001 0:29	955.1	1674.31	-0.3088	180.00	100.92	79.249	0.1223	1656.3	51852.9	43934.6	10.7	12.2	0.87	1.00	22.008	12.441	13.509
10/17/2001 0:34	960.1	1692.63	-0.3080	180.88	100.94	80.118	0.1232	1674.6	52426.4	44421.2	10.8	12.3	0.84	1.00	22.006	12.270	13.332
10/17/2001 0:39	965.1	1710.93	-0.3073	181.78	100.94	81.007	0.1240	1692.9	52999.3	44905.2	10.8	12.4	0.85	1.00	22.010	12.041	13.215
10/17/2001 0:44	970.1	1729.12	-0.3066	182.67	100.94	81.906	0.1248	1711.1	53568.8	45384.8	10.9	12.5	0.86	1.00	22.017	12.374	13.043
10/17/2001 0:49	975.1	1748.07	-0.3059	183.64	100.95	82.865	0.1257	1730.0	54162.0	45881.9	11.0	12.6	0.85	1.00	22.031	12.410	12.826
10/17/2001 0:54	980.1	1767.40	-0.3052	184.64	100.94	83.874	0.1265	1749.4	54767.2	46386.0	11.1	12.7	0.84	1.00	22.053	12.133	12.686
10/17/2001 0:59	985.1	1786.50	-0.3045	185.61	100.93	84.857	0.1273	1768.5	55365.2	46885.4	11.1	12.7	0.83	1.00	22.071	11.723	12.613
10/17/2001 1:04	990.1	1805.20	-0.3038	186.54	100.96	85.757	0.1282	1787.2	55950.5	47380.8	11.2	12.8	0.83	1.00	22.071	12.007	12.510
10/17/2001 1:09	995.1	1824.66	-0.3031	187.50	100.95	86.722	0.1290	1806.6	56559.9	47893.6	11.3	12.9	0.85	1.00	22.079	11.755	9.545
10/17/2001 1:14	1000.1	1843.90	-0.3024	188.41	100.96	87.627	0.1299	1825.9	57162.0	48405.4	11.3	13.0	0.82	1.00	22.074	11.358	6.474
10/17/2001 1:19	1005.1	1862.72	-0.3017	189.37	100.94	88.605	0.1307	1844.7	57751.3	48896.5	11.4	13.1	0.86	1.00	22.093	10.857	3.675
10/17/2001 1:24	1010.1	1881.00	-0.3010	190.28	100.94	89.513	0.1315	1863.0	58323.6	49378.1	11.5	13.2	0.82	1.00	22.101	11.105	0.945

10/17/2001 1:29	1015.1	1899.86	-0.3003	191.18	100.95	90.410	0.1324	1881.8	58914.1	49878.9	11.6	13.2	0.83	1.00	22.098	10.998	-1.597						
10/17/2001 1:34	1020.1	1918.76	-0.2996	192.06	100.95	91.291	0.1332	1900.7	59505.8	50382.6	11.6	13.3	0.82	1.00	22.092	10.674	-4.204						
10/17/2001 1:39	1025.1	1937.32	-0.2989	192.94	100.95	92.166	0.1340	1919.3	60086.7	50876.2	11.7	13.4	0.83	1.00	22.088	11.010	-6.716						
10/17/2001 1:44	1030.1	1956.74	-0.2983	193.79	100.95	93.023	0.1349	1938.7	60694.7	51399.0	11.8	13.5	0.82	1.00	22.070	11.138	-9.215						
10/17/2001 1:49	1035.1	1976.55	-0.2976	194.73	100.95	93.951	0.1357	1958.5	61314.8	51926.4	11.8	13.6	0.84	1.00	22.065	11.183	-11.643						
10/17/2001 1:54	1040.1	1996.68	-0.2969	195.73	100.93	94.973	0.1365	1978.6	61945.1	52454.3	11.9	13.7	0.26	0.19	22.078	-11.962	-11.308						
10/17/2001 1:59	1045.1	1975.32	-0.2966	193.10	100.98	92.294	0.1367	1957.3	61276.3	52060.3	11.9	13.7	0.11	0.00	21.689	-13.211	-10.717						
10/17/2001 2:04	1050.1	1952.75	-0.2966	188.29	100.98	87.479	0.1367	1934.7	60569.7	51849.9	11.9	13.7	0.11	0.00	20.797	-11.536	-10.323						
10/17/2001 2:09	1055.1	1934.21	-0.2965	183.43	100.99	82.614	0.1367	1916.2	59989.1	51769.9	11.9	13.7	0.07	0.00	19.831	-10.732	-10.004						
10/17/2001 2:14	1060.1	1918.02	-0.2964	178.80	100.99	77.980	0.1367	1900.0	59482.2	51738.3	11.9	13.7	0.08	0.00	18.878	-9.336	-9.815						
10/17/2001 2:19	1065.1	1904.74	-0.2963	174.55	100.99	73.733	0.1367	1886.7	59066.5	51757.0	11.9	13.7	0.05	0.00	17.976	-10.184	-9.522						
10/17/2001 2:24	1070.1	1891.16	-0.2963	170.51	101.00	69.687	0.1367	1873.1	58641.4	51744.5	12.0	13.7	0.06	0.00	17.112	-9.088	-9.363						
10/17/2001 2:29	1075.1	1879.76	-0.2962	166.79	101.00	65.973	0.1367	1861.7	58284.4	51765.1	12.0	13.7	0.05	0.00	16.300	-8.854	-9.252						
10/17/2001 2:34	1080.1	1869.28	-0.2962	163.34	100.99	62.530	0.1367	1851.2	57956.4	51786.3	12.0	13.7	0.06	0.00	15.536	-8.238	-9.196						
10/17/2001 2:39	1085.2	1860.05	-0.2961	160.12	101.00	59.296	0.1367	1842.0	57667.4	51824.4	12.0	13.7	0.03	0.00	14.807	-9.285	-9.007						
10/17/2001 2:44	1090.2	1850.25	-0.2961	157.11	100.98	56.302	0.1367	1832.2	57360.6	51819.5	12.0	13.7	0.05	0.00	14.134	-8.482	-8.838						
10/17/2001 2:49	1095.2	1841.78	-0.2961	154.31	100.99	53.491	0.1367	1823.7	57095.3	51837.2	12.0	13.7	0.04	0.00	13.491	-8.385	-8.754						
10/17/2001 2:54	1100.2	1833.84	-0.2960	151.71	101.00	50.884	0.1367	1815.8	56846.9	51850.6	12.0	13.7	0.04	0.00	12.890	-8.183	-8.686						
10/17/2001 2:59	1105.2	1826.49	-0.2960	149.32	100.99	48.505	0.1367	1808.4	56616.8	51858.9	12.0	13.7	0.04	0.00	12.337	-7.822	-8.679						
10/17/2001 3:04	1110.2	1819.82	-0.2960	147.07	100.99	46.254	0.1367	1801.8	56407.8	51875.1	12.0	13.7	0.02	0.00	11.808	-7.844	-8.623						
10/17/2001 3:09	1115.2	1813.42	-0.2960	144.97	100.99	44.153	0.1367	1795.4	56207.7	51884.8	12.0	13.7	0.04	0.00	11.312	-7.808	-8.526						
10/17/2001 3:14	1120.2	1807.38	-0.2959	142.98	100.99	42.166	0.1367	1789.3	56018.6	51893.8	12.0	13.7	0.03	0.00	10.839	-7.967	-8.184						
10/17/2001 3:19	1125.2	1801.51	-0.2959	141.13	101.00	40.307	0.1367	1783.5	55834.8	51895.0	12.0	13.7	0.03	0.00	10.395	-7.794	-8.209						
10/17/2001 3:24	1130.2	1796.03	-0.2959	139.40	101.00	38.575	0.1367	1778.0	55663.1	51895.5	12.0	13.7	0.03	0.00	9.979	-7.771	-8.083						
10/17/2001 3:29	1135.2	1790.81	-0.2959	137.73	100.99	36.923	0.1367	1772.8	55499.8	51896.0	12.0	13.7	0.04	0.00	9.580	-7.132	-8.102						
10/17/2001 3:34	1140.2	1786.22	-0.2958	136.21	100.99	35.398	0.1367	1768.2	55355.9	51903.3	12.0	13.7	0.01	0.00	9.208	-7.712	-7.841						
10/17/2001 3:39	1145.2	1781.48	-0.2958	134.73	100.99	33.916	0.1367	1763.4	55207.6	51901.7	12.0	13.7	0.01	0.00	8.846	-7.638	-7.861						
10/17/2001 3:44	1150.2	1776.99	-0.2958	133.32	100.98	32.510	0.1367	1758.9	55067.2	51900.3	12.0	13.7	0.02	0.00	8.501	-7.763	-7.809						
10/17/2001 3:49	1155.2	1772.63	-0.2958	131.99	100.98	31.182	0.1367	1754.6	54930.6	51894.8	12.0	13.7	0.02	0.00	8.174	-7.398	-7.823						
10/17/2001 3:54	1160.2	1768.64	-0.2958	130.73	100.98	29.931	0.1367	1750.6	54805.8	51893.4	12.0	13.7	0.02	0.00	7.864	-7.031	-7.902						
10/17/2001 3:59	1165.2	1765.02	-0.2958	129.54	100.99	28.722	0.1367	1747.0	54692.2	51899.0	12.0	13.7	0.05	0.00	7.562	-5.232	-8.156						
10/17/2001 4:04	1170.2	1762.42	-0.2957	128.49	100.97	27.699	0.1367	1744.4	54611.1	51918.5	12.0	13.7	0.01	0.00	7.304	-7.998	-8.142						
10/17/2001 4:09	1175.2	1758.61	-0.2957	127.42	100.97	26.625	0.1367	1740.6	54491.7	51904.8	12.0	13.7	0.03	0.00	7.036	-6.763	-7.870						
10/17/2001 4:14	1180.2	1755.51	-0.2957	126.42	100.96	25.633	0.1367	1737.5	54394.8	51905.3	12.0	13.7	-0.01	0.00	6.786	-7.285	-8.001						
10/17/2001 4:19	1185.2	1752.30	-0.2957	125.52	100.99	24.705	0.1367	1734.2	54294.0	51895.7	12.0	13.7	-0.01	0.00	6.552	-5.619	-8.231						
10/17/2001 4:24	1190.2	1749.92	-0.2957	124.63	101.00	23.801	0.1367	1731.9	54219.5	51909.8	12.0	13.7	-0.02	0.00	6.321	-7.800	-8.254						
10/17/2001 4:29	1195.2	1746.74	-0.2957	123.73	100.99	22.916	0.1367	1728.7	54119.9	51896.9	12.0	13.7	0.00	0.00	6.098	-7.349	-8.247						
10/17/2001 4:34	1200.2	1743.84	-0.2957	122.89	100.97	22.091	0.1367	1725.8	54029.3	51887.3	12.0	13.7	0.01	0.00	5.888	-7.510	-8.231						
10/17/2001 4:39	1205.2	1741.00	-0.2957	122.08	100.97	21.284	0.1367	1723.0	53940.5	51877.4	12.0	13.7	0.02	0.00	5.682	-7.661	-8.255						
10/17/2001 4:44	1210.2	1738.22	-0.2957	121.32	100.98	20.510	0.1367	1720.2	53853.3	51865.9	12.0	13.7	0.00	0.00	5.484	-7.266	-8.400						
10/17/2001 4:49	1215.2	1735.68	-0.2957	120.57	101.00	19.749	0.1367	1717.6	53773.8	51860.7	12.0	13.7	0.00	0.00	5.289	-7.887	-7.815						
10/17/2001 4:54	1220.2	1733.02	-0.2957	119.84	100.99	19.032	0.1367	1715.0	53690.4	51847.4	12.0	13.7	0.01	0.00	5.104	-4.580	-8.268						
10/17/2001 4:59	1225.2	1731.53	-0.2957	119.17	100.98	18.368	0.1367	1713.5	53643.8	51865.7	12.0	13.7	0.00	0.00	4.931	-8.337	-8.133						
10/17/2001 5:04	1230.2	1728.92	-0.2957	118.53	100.97	17.735	0.1367	1710.9	53562.2	51845.8	12.0	13.7	0.01	0.00	4.768	-7.459	-8.248						
10/17/2001 5:09	1235.2	1726.67	-0.2957	117.91	100.97	17.112	0.1367	1708.6	53491.7	51836.1	12.0	13.7	0.01	0.00	4.606	-7.980	-8.183						
10/17/2001 5:14	1240.2	1724.35	-0.2957	117.28	100.98	16.481	0.1367	1706.3	53419.1	51825.0	12.0	13.7	-0.02	0.00	4.443	-7.299	-8.307						
10/17/2001 5:19	1245.2	1722.31	-0.2957	116.67	100.98	15.865	0.1367	1704.3	53355.2	51821.2	12.0	13.7	0.01	0.00	4.282	-7.384	-8.490						
10/17/2001 5:24	1250.3	1720.32	-0.2957	116.09	100.98	15.285	0.1367	1702.3	53292.8	51815.2	12.0	13.7	0.00	0.00	4.130	-7.847	-8.511						
10/17/2001 5:29	1255.3	1718.28	-0.2957	115.54	100.98	14.735	0.1367	1700.2	53229.2	51805.1	12.0	13.7	0.01	0.00	3.986	-8.424	-8.618						
10/17/2001 5:34	1260.3	1716.18	-0.2957	115.02	100.98	14.218	0.1367	1698.1	53163.4	51789.5	12.0	13.7	0.04	0.00	3.851	-3.211	-9.212						
10/17/2001 5:39	1265.3	1715.40	-0.2956	114.55	100.96	13.761	0.1367	1697.4	53139.1	51809.7	12.0	13.7	0.01	0.00	3.729	-8.205	-9.321						
10/17/2001 5:44	1270.3	1713.49	-0.2956	114.09	100.98	13.304	0.1367	1695.4	53079.2	51794.2	12.0	13.7	0.00	0.00	3.609	-7.259	-9.598						
10/17/2001 5:49	1275.3	1711.86	-0.2956	113.60	100.97	12.804	0.1367	1693.8	53028.2	51791.7	12.0	13.7	0.05	0.00	3.477	-8.373	-9.664						
10/17/2001 5:54	1280.3	1710.04	-0.2956	113.19	100.96	12.399	0.1367	1692.0	52971.3	51774.2	12.0	13.7	0.07	0.00	3.371	-7.464	-9.750						
10/17/2001 5:59	1285.3	1708.47	-0.2955	112.82	100.95	12.039	0.1367	1690.4	52922.2	51760.1	12.0	13.7	0.05	0.00	3.276	-8.287	-9.758						
10/17/2001 6:04	1290.3	1706.79	-0.2955	112.48	100.97	11.687	0.1367	1688.7	52869.3	51741.3	12.0	13.7	0.02	0.00	3.183	-8.847	-9.663						
10/17/2001 6:09	1295.3	1705.03	-0.2955	112.15	100.96	11.364	0.1367	1687.0	52814.5	51717.8	12.0	13.7	0.03	0.00	3.099	-8.017	-9.710						
10/17/2001 6:14	1300.3	1703.49	-0.2955	111.82	100.96	11.034	0.1367	1685.4	52766.2	51701.6	12.0	13.7	0.01	0.00	3.011	-9.281	-9.566						

CONSOLIDATION TEST DATA

Client: Hultgren-Tillis
Project: GWF Power
Project Number: 212-041

Sample Data

Source: BV-1
Sample No.: 16
Elev. or Depth: 68.5-70'
Sample Length (in./cm.):
Location:
Description: orange brown CLAY
Liquid Limit:
Plasticity Index:
USCS:
AASHTO:
Figure No.:
Testing Remarks: Final wet weight had to be estimated due to soil loss during test. Material is dispersive. Water very cloudy through entire test.

Test Specimen Data

TOTAL SAMPLE	BEFORE TEST	AFTER TEST
Wet w+t = 161.90 g.	**Consolidometer #** = 1	**Wet w+t** = 160.00 g.
Dry w+t = 134.00 g.		**Dry w+t** = 134.00 g.
Tare Wt. = .00 g.	**Spec. Gravity** = 2.8	**Tare Wt.** = .00 g.
Height = 1.00 in.	**Height** = 1.00 in.	
Diameter = 2.43 in.	**Diameter** = 2.43 in.	
Weight = 161.90 g.	**Defl. Table** = n/a	
Moisture = 20.8 %	**Ht. Solids** = 0.6297 in.	**Moisture** = 19.4 %
Wet Den. = 133.0 pcf	**Dry Wt.** = 134.00 g.*	**Dry Wt.** = 134.00 g.
Dry Den. = 110.1 pcf	**Void Ratio** = 0.588	**Void Ratio** = 0.281
	Saturation = 99.1 %	

*** Initial dry weight used in calculations**

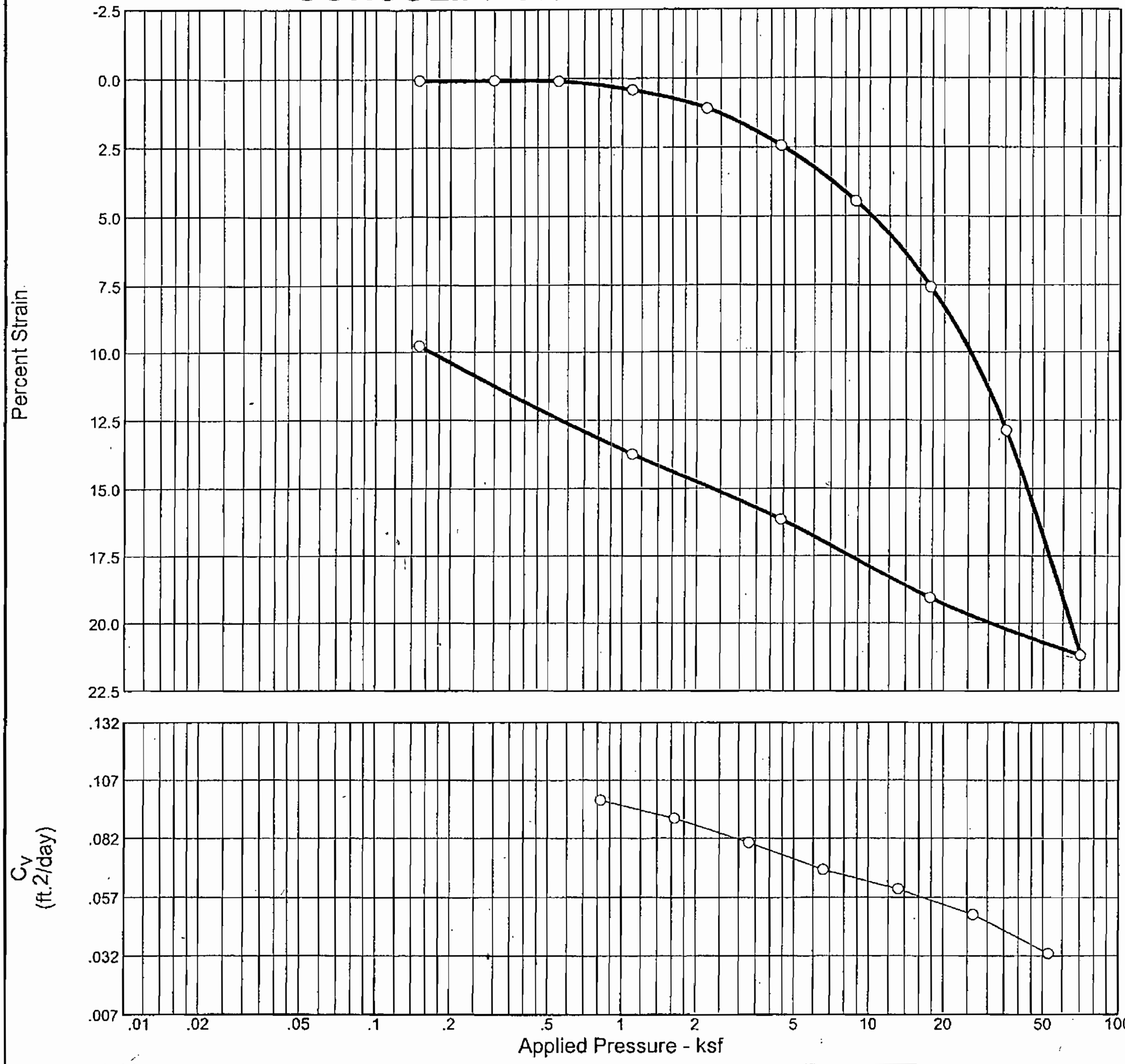
End-of-Load Summary

Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	C_v (ft.^{2}/day)	Void Ratio	% Compression /Swell
start	0.00000			0.588	
0.15	0.00120	0.00000		0.586	0.1 Comprs.
0.30	0.00000	0.00000		0.588	0.0 Swell
0.55	0.00000	0.00000		0.588	0.0 Swell
1.10	0.00000	0.00000		0.588	0.0 Swell
2.20	0.00440	0.00000		0.581	0.4 Comprs.
4.40	0.02020	0.00000		0.556	2.0 Comprs.
8.80	0.04940	0.00000		0.510	4.9 Comprs.
17.60	0.11010	0.00000		0.413	11.0 Comprs.
35.20	0.19200	0.00000		0.283	19.2 Comprs.
80.00	0.30400	0.00000		0.105	30.4 Comprs.
17.60	0.28340	0.00000		0.138	28.3 Comprs.

Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	C_v (ft.^{2}/day)	Void Ratio	% Compression /Swell
4.40	0.25550	0.00000		0.182	25.6 Comprs.
1.10	0.23170	0.00000		0.220	23.2 Comprs.
0.15	0.19320	0.00000		0.281	19.3 Comprs.

[illegible]$_c$ = 0.50 P_c = 14.04 ksf

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
99.6 %	33.4 %	90.2	59	35	2.8			0.939

MATERIAL DESCRIPTION

light brown mottled orange CLAY

Project No. 212-041 **Client:** Hultgren-Tillis

Project: GWF Power

Source: BV-4 **Sample No.:** 16 **Elev./Depth:** 78.5-81

Remarks:

CONSOLIDATION TEST REPORT

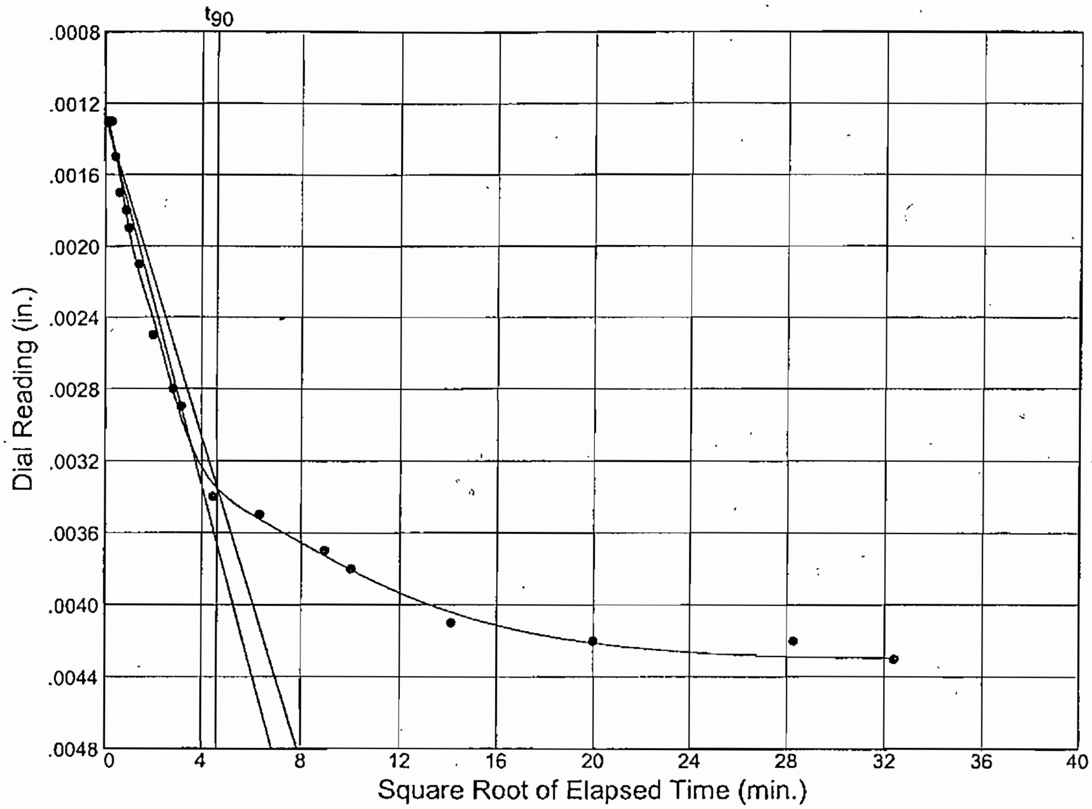
COOPER TESTING LABORATORY

Plate

Dial Reading vs. Time

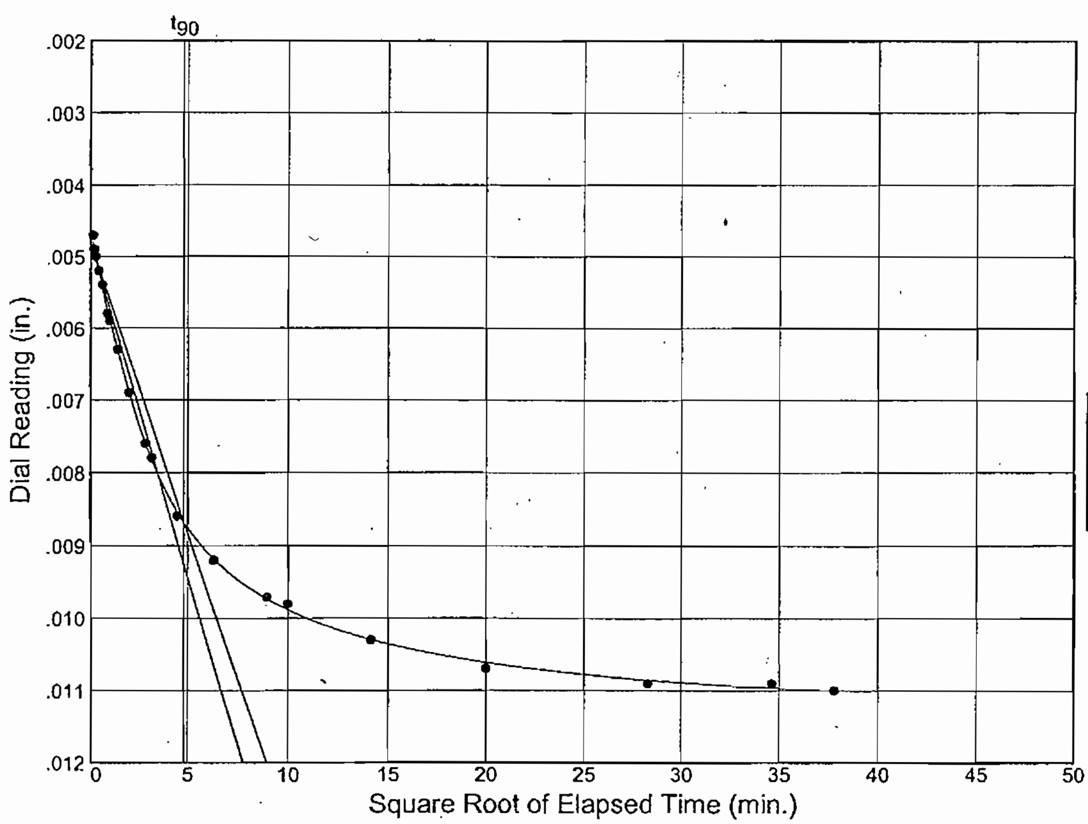
Project No.: 212-041
Project: GWF Power

Source: BV-4 | Sample No.: 16 | Elev./Depth: 78.5-81



Load No.= 4
Load= 1.10 ksf
D_0 = 0.00128
D_{90} = 0.00335
D_{100} = 0.00358
T_{90} = 21.44 min.

C_v @ T_{90}
0.10 ft.^{2}/day



Load No.= 5
Load= 2.20 ksf
D_0 = 0.00482
D_{90} = 0.00868
D_{100} = 0.00911
T_{90} = 23.04 min.

C_v @ T_{90}
0.09 ft.^{2}/day

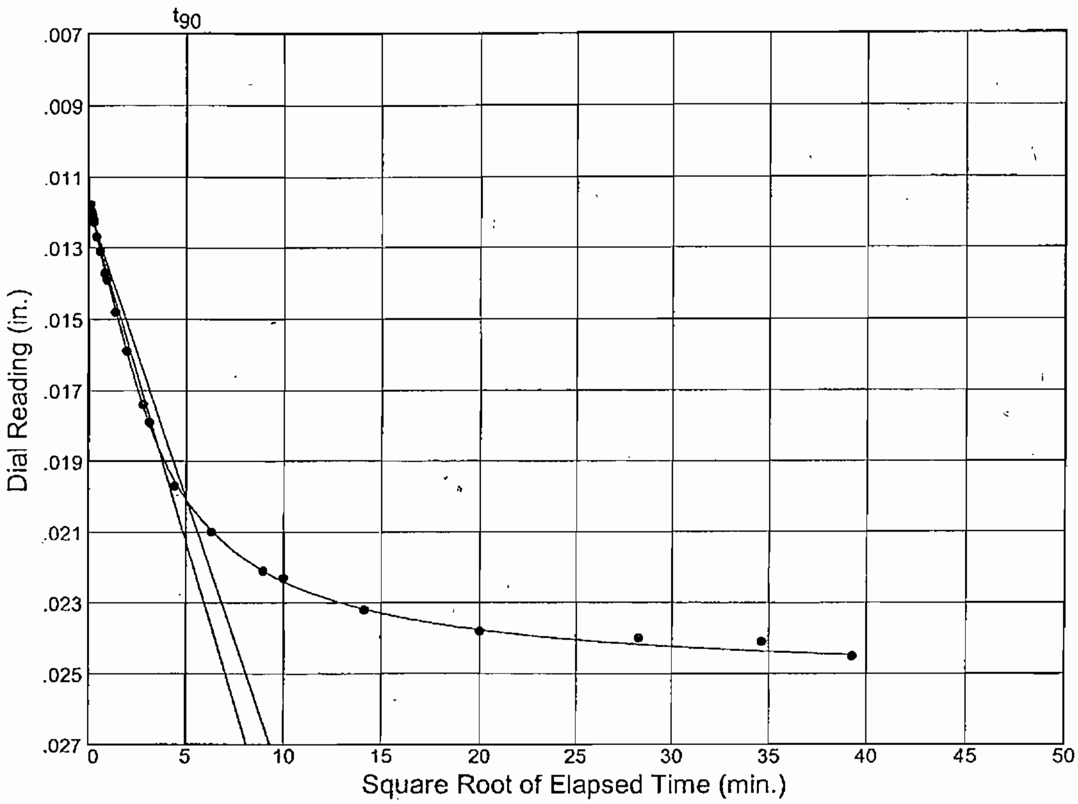
Plate

COOPER TESTING LABORATORY

Dial Reading vs. Time

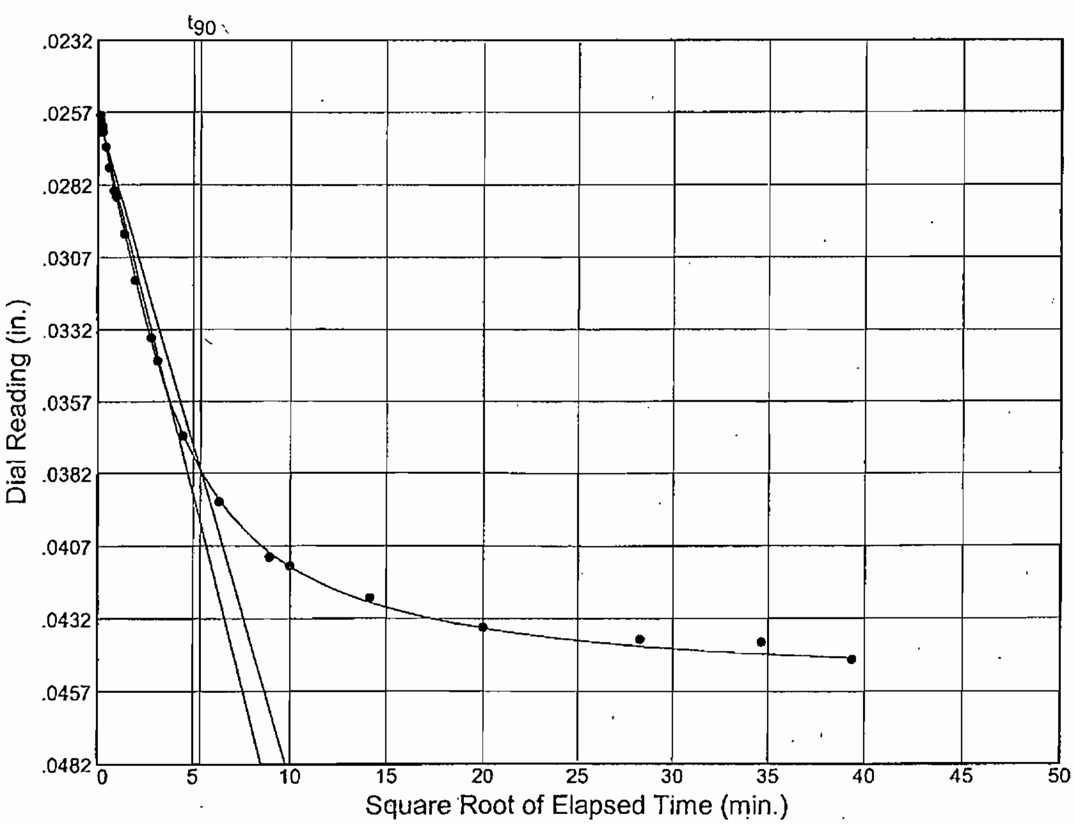
Project No.: 212-041
Project: GWF Power

Source: BV-4 Sample No.: 16 Elev./Depth: 78.5-81



Load No.= 6
Load= 4.40 ksf
D_0 = 0.01186
D_{90} = 0.02008
D_{100} = 0.02100
T_{90} = 25.52 min.

C_v @ T_{90}
0.08 ft.^{2}/day



Load No.= 7
Load= 8.80 ksf
D_0 = 0.02580
D_{90} = 0.03809
D_{100} = 0.03946
T_{90} = 28.79 min.

C_v @ T_{90}
0.07 ft.^{2}/day

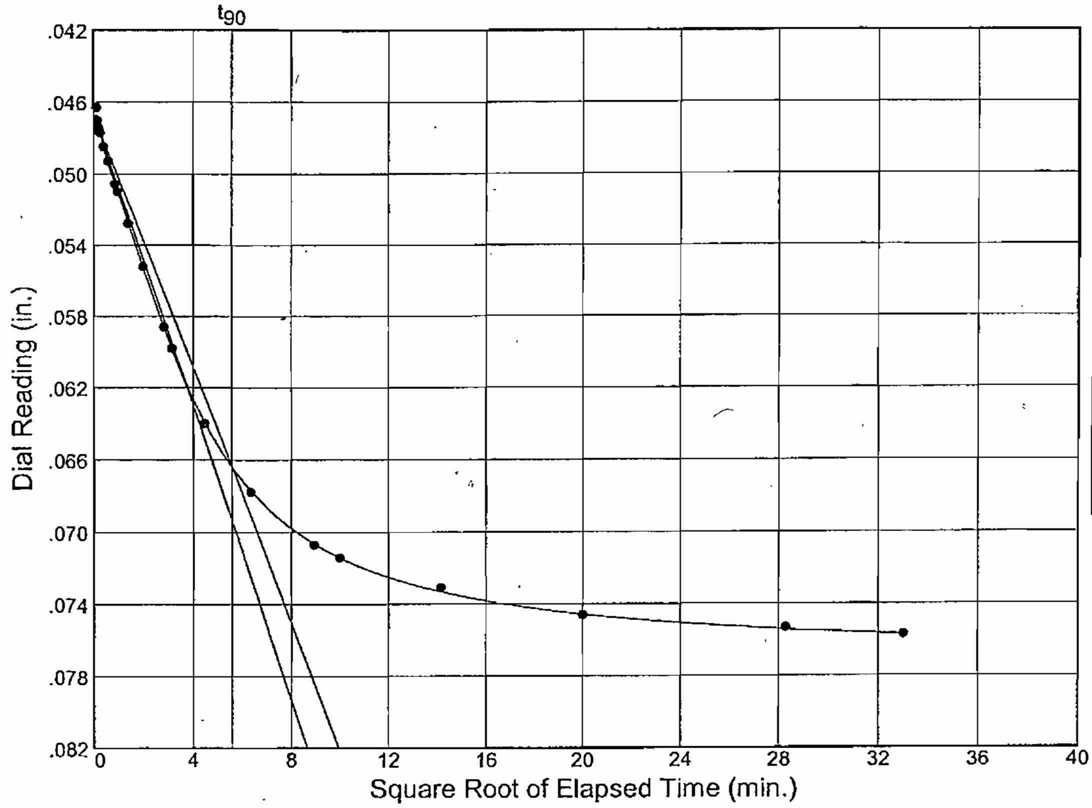
Plate

COOPER TESTING LABORATORY

Dial Reading vs. Time

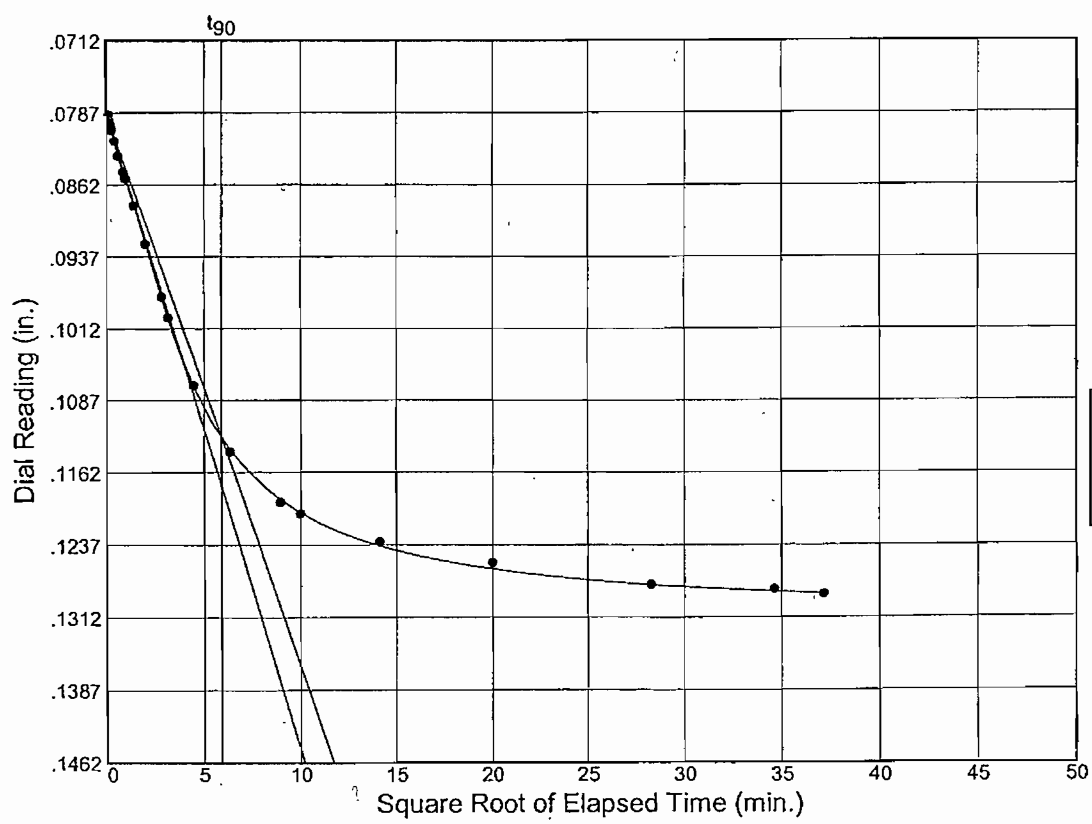
Project No.: 212-041
Project: GWF Power

Source: BV-4 | Sample No.: 16 | Elev./Depth: 78.5-81



Load No.= 8
Load= 17.60 ksf
D_0 = 0.04663
D_{90} = 0.06639
D_{100} = 0.06858
T_{90} = 30.94 min.

C_v @ T_{90}
0.06 ft.^{2}/day



Load No.= 9
Load= 35.20 ksf
D_0 = 0.07877
D_{90} = 0.11250
D_{100} = 0.11625
T_{90} = 34.54 min.

C_v @ T_{90}
0.05 ft.^{2}/day

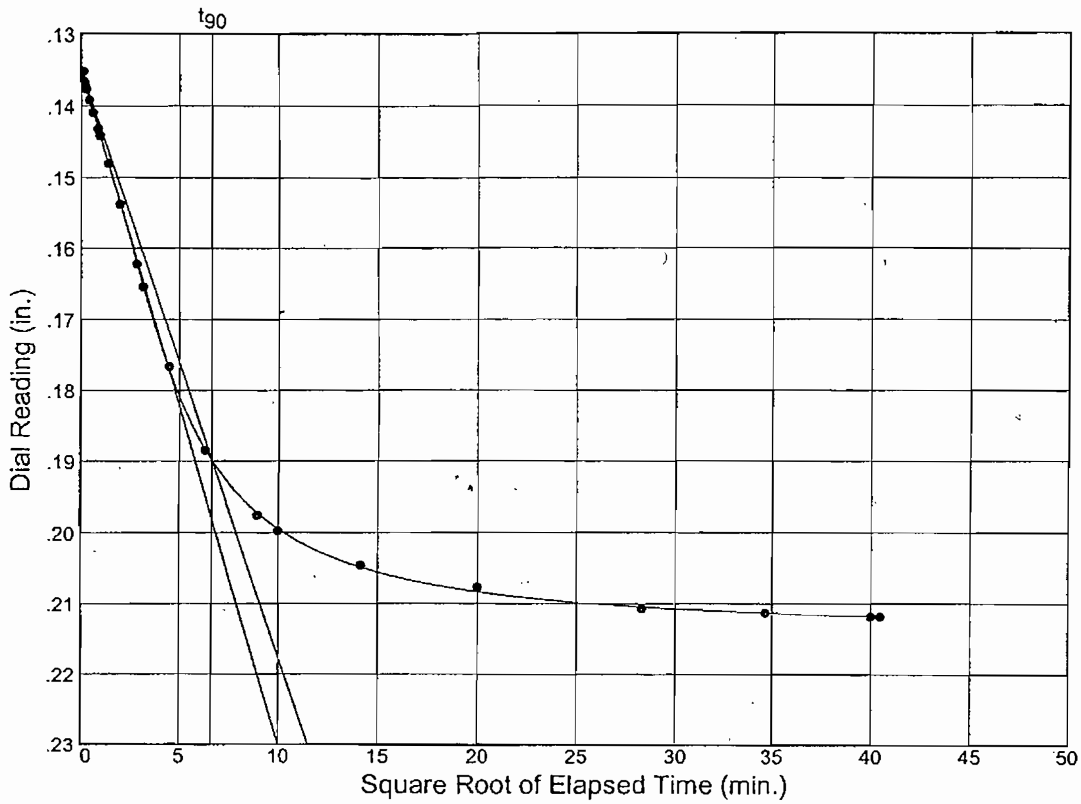
Plate

COOPER TESTING LABORATORY

Dial Reading vs. Time

Project No.: 212-041
Project: GWF Power

Source: BV-4 | Sample No.: 16 | Elev./Depth: 78.5-81



Load No.= 10

Load= 70.40 ksf

D_0 = 0.13483

D_{90} = 0.18987

D_{100} = 0.19599

T_{90} = 44.26 min.

C_v @ T_{90}

0.03 ft.^{2}/day

CONSOLIDATION TEST DATA

Client: Hultgren-Tillis
Project: GWF Power
Project Number: 212-041

Sample Data

Source: BV-4
Sample No.: 16
Elev. or Depth: 78.5-81 Sample Length (in./cm.):
Location:
Description: light brown mottled orange CLAY
Liquid Limit: 59 Plasticity Index: 35
USCS: AASHTO: Figure No.:
Testing Remarks:

Test Specimen Data

TOTAL SAMPLE	BEFORE TEST	AFTER TEST
Wet w+t = 145.80 g.	Consolidometer # = 1	Wet w+t = 137.60 g.
Dry w+t = 109.30 g.		Dry w+t = 109.30 g.
Tare Wt. = .00 g.	Spec. Gravity = 2.8	Tare Wt. = .00 g.
Height = 1.00 in.	Height = 1.00 in.	
Diameter = 2.42 in.	Diameter = 2.42 in.	
Weight = 145.80 g.	Defl. Table = n/a	
Moisture = 33.4 %	Ht. Solids = 0.5158 in.	Moisture = 25.9 %
Wet Den. = 120.3 pcf	Dry Wt. = 109.30 g.*	Dry Wt. = 109.30 g.
Dry Den. = 90.2 pcf	Void Ratio = 0.939	Void Ratio = 0.749
	Saturation = 99.6 %	

Initial dry weight used in calculations

End-of-Load Summary

Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	C_v (ft.^{2}/day)	Void Ratio	% Compression /Swell
start	0.00000			0.939	
0.15	0.00060	0.00000		0.938	0.1 Comprs.
0.30	0.00070	0.00000		0.938	0.1 Comprs.
0.55	0.00100	0.00000		0.937	0.1 Comprs.
1.10	0.00430	0.00000	0.10	0.931	0.4 Comprs.
2.20	0.01100	0.00000	0.09	0.918	1.1 Comprs.
4.40	0.02450	0.00000	0.08	0.891	2.5 Comprs.
8.80	0.04460	0.00000	0.07	0.852	4.5 Comprs.
17.60	0.07570	0.00000	0.06	0.792	7.6 Comprs.
35.20	0.12880	0.00000	0.05	0.689	12.9 Comprs.
70.40	0.21180	0.00000	0.03	0.528	21.2 Comprs.
17.60	0.19050	0.00000		0.570	19.1 Comprs.
4.40	0.16150	0.00000		0.626	16.2 Comprs.
1.10	0.13750	0.00000		0.672	13.8 Comprs.
0.15	0.09780	0.00000		0.749	9.8 Comprs.

C_c = 0.55 P_c = 29.17 ksf

Pressure: 0.15 ksf   TEST READINGS   Load No. 1

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00000	11	1.60	0.00110
2	0.62	0.00080	12	2.60	0.00100
3	0.63	0.00080	13	4.60	0.00060
4	0.65	0.00090			
5	0.67	0.00090			
6	0.68	0.00090			
7	0.70	0.00090			
8	0.80	0.00100			
9	1.00	0.00110			
10	1.40	0.00110			

Void Ratio = 0.938   Compression = 0.1 %

Pressure: 0.30 ksf   TEST READINGS   Load No. 2

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00060	11	1.98	0.00090
2	0.02	0.00090	12	3.98	0.00090
3	0.03	0.00090	13	7.98	0.00070
4	0.05	0.00090	14	9.98	0.00070
5	0.07	0.00090			
6	0.08	0.00090			
7	0.18	0.00090			
8	0.38	0.00090			
9	0.78	0.00090			
10	0.98	0.00090			

Void Ratio = 0.938   Compression = 0.1 %

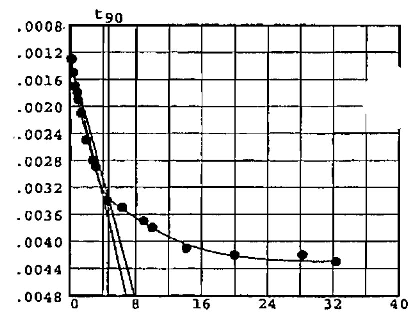
Pressure: 0.55 ksf   TEST READINGS   Load No. 3

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00070	11	1.98	0.00100
2	0.02	0.00100	12	3.98	0.00100
3	0.03	0.00100	13	7.98	0.00100
4	0.05	0.00100	14	9.98	0.00100
5	0.07	0.00100	15	19.98	0.00100
6	0.08	0.00100	16	29.13	0.00100
7	0.18	0.00100			
8	0.38	0.00100			
9	0.78	0.00100			
10	0.98	0.00100			

Void Ratio = 0.937   Compression = 0.1 %

Pressure: 1.10 ksf	TEST READINGS	Load No. 4

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00100	12	3.98	0.00250
2	0.02	0.00130	13	7.98	0.00280
3	0.03	0.00130	14	9.98	0.00290
4	0.05	0.00130	15	19.98	0.00340
5	0.07	0.00130	16	39.98	0.00350
6	0.08	0.00130	17	79.98	0.00370
7	0.18	0.00150	18	99.98	0.00380
8	0.38	0.00170	19	199.98	0.00410
9	0.78	0.00180	20	399.98	0.00420
10	0.98	0.00190	21	799.98	0.00420
11	1.98	0.00210	22	1048.97	0.00430



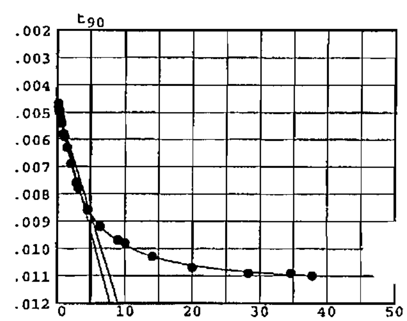
Void Ratio = 0.931 Compression = 0.4 %

D_0 = 0.00128 D_{90} = 0.00335 D_{100} = 0.00358

C_v at 21.4 min. = 0.10 ft.^{2}/day

Pressure: 2.20 ksf	TEST READINGS	Load No. 5

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.00430	13	7.98	0.00760
2	0.02	0.00470	14	9.98	0.00780
3	0.03	0.00490	15	19.98	0.00860
4	0.05	0.00490	16	39.98	0.00920
5	0.07	0.00500	17	79.98	0.00970
6	0.08	0.00500	18	99.98	0.00980
7	0.18	0.00520	19	199.98	0.01030
8	0.38	0.00540	20	399.98	0.01070
9	0.78	0.00580	21	799.98	0.01090
10	0.98	0.00590	22	1199.98	0.01090
11	1.98	0.00630	23	1429.38	0.01100
12	3.98	0.00690			



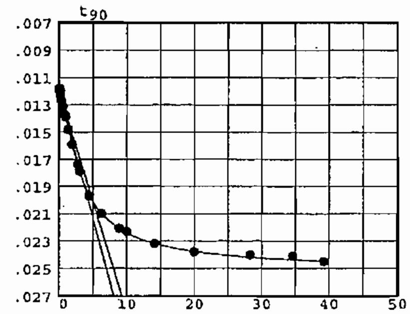
Void Ratio = 0.918 Compression = 1.1 %

D_0 = 0.00482 D_{90} = 0.00868 D_{100} = 0.00911

C_v at 23.0 min. = 0.09 ft.^{2}/day

Pressure: 4.40 ksf	TEST READINGS	Load No. 6

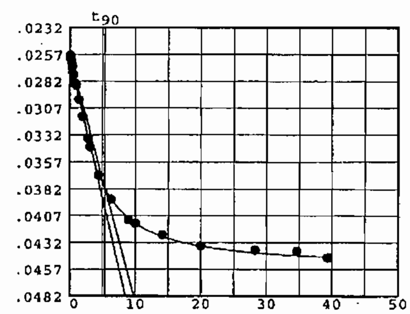
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
	0.00	0.01100	13	7.98	0.01740
[illegible]	0.02	0.01180	14	9.98	0.01790
3	0.03	0.01200	15	19.98	0.01970
4	0.05	0.01210	16	39.98	0.02100
5	0.07	0.01220	17	79.98	0.02210
6	0.08	0.01230	18	99.98	0.02230
7	0.18	0.01270	19	199.98	0.02320
8	0.38	0.01310	20	399.98	0.02380
9	0.78	0.01370	21	799.98	0.02400
10	0.98	0.01390	22	1199.98	0.02410
11	1.98	0.01480	23	1542.73	0.02450
12	3.98	0.01590			



Void Ratio = 0.891 Compression = 2.5 %
D_0 = 0.01186 D_{90} = 0.02008 D_{100} = 0.02100
C_v at 25.5 min. = 0.08 ft.^{2}/day

Pressure: 8.80 ksf	TEST READINGS	Load No. 7

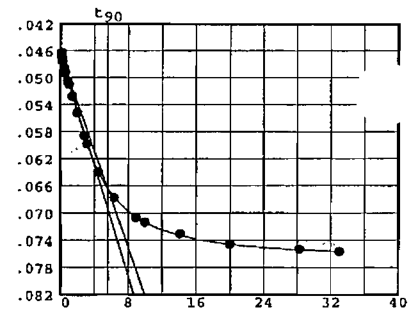
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.02450	13	7.98	0.03350
2	0.02	0.02580	14	9.98	0.03430
3	0.03	0.02600	15	19.98	0.03690
	0.05	0.02620	16	39.98	0.03920
	0.07	0.02620	17	79.98	0.04110
6	0.08	0.02640	18	99.98	0.04140
7	0.18	0.02690	19	199.98	0.04250
8	0.38	0.02760	20	399.98	0.04350
9	0.78	0.02840	21	799.98	0.04390
10	0.98	0.02860	22	1199.98	0.04400
11	1.98	0.02990	23	1550.57	0.04460
12	3.98	0.03150			



Void Ratio = 0.852 Compression = 4.5 %
D_0 = 0.02580 D_{90} = 0.03809 D_{100} = 0.03946
C_v at 28.8 min. = 0.07 ft.^{2}/day

Pressure: 17.60 ksf — TEST READINGS — Load No. 8

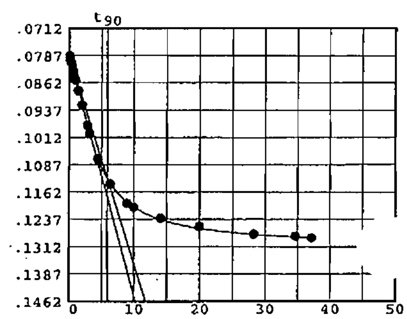
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.04460	12	3.98	0.05520
2	0.02	0.04630	13	7.98	0.05860
3	0.03	0.04700	14	9.98	0.05980
4	0.05	0.04740	15	19.98	0.06400
5	0.07	0.04760	16	39.98	0.06780
6	0.08	0.04770	17	79.98	0.07070
7	0.18	0.04850	18	99.98	0.07140
8	0.38	0.04930	19	199.98	0.07310
9	0.78	0.05060	20	399.98	0.07460
10	0.98	0.05100	21	799.98	0.07530
11	1.98	0.05280	22	1090.68	0.07570



Void Ratio = 0.792 Compression = 7.6 %
D_0 = 0.04663 D_{90} = 0.06639 D_{100} = 0.06858
C_v at 30.9 min. = 0.06 ft.^{2}/day

Pressure: 35.20 ksf — TEST READINGS — Load No. 9

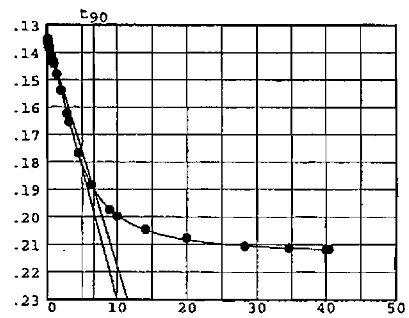
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.00	0.07570	13	7.98	0.09790
2	0.02	0.07890	14	9.98	0.10010
3	0.03	0.07950	15	19.98	0.10720
4	0.05	0.07990	16	39.98	0.11410
5	0.07	0.08030	17	79.98	0.11930
6	0.08	0.08060	18	99.98	0.12050
7	0.18	0.08170	19	199.98	0.12340
8	0.38	0.08320	20	399.98	0.12560
9	0.78	0.08490	21	799.98	0.12780
10	0.98	0.08560	22	1199.98	0.12830
11	1.98	0.08840	23	1381.02	0.12880
12	3.98	0.09240			



Void Ratio = 0.689 Compression = 12.9 %
D_0 = 0.07877 D_{90} = 0.11250 D_{100} = 0.11625
C_v at 34.5 min. = 0.05 ft.^{2}/day

Pressure: 70.40 ksf	TEST READINGS	Load No. 10

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
	0.00	0.12880	13	7.98	0.16220
[illegible]	0.02	0.13520	14	9.98	0.16540
3	0.03	0.13660	15	19.98	0.17670
4	0.05	0.13690	16	39.98	0.18850
5	0.07	0.13750	17	79.98	0.19760
6	0.08	0.13770	18	99.98	0.19980
7	0.18	0.13920	19	199.98	0.20460
8	0.38	0.14090	20	399.98	0.20770
9	0.78	0.14320	21	799.98	0.21070
10	0.98	0.14410	22	1199.98	0.21130
11	1.98	0.14800	23	1599.98	0.21180
12	3.98	0.15390	24	1637.63	0.21180



Void Ratio = 0.528   Compression = 21.2 %

D_0 = 0.13483 D_{90} = 0.18987 D_{100} = 0.19599

C_v at 44.3 min. = 0.03 ft.^{2}/day

CORROSION AND RESISTIVITY

TABLE 1

ConCeCo Engineering, Inc.

Client: Hultgren Tillis Engineers

Project No: 474.01

ConCeCo Job No. 2S01107

SOIL TEST SUMMARY

Sample No.	pH	Chlorides (ppm)	Chlorides (%)	Sulfates (ppm)	Sulfates (%)	Soil Description
Sample B-3@5'	7.9	28	0.0028	90	0.009	Brown, fine sand
Sample B-1@7'	7.6	31	0.0031	130	0.013	Brown, fine silty sand
Sample TP-1@2'	6.0	300	0.03	650	0.065	Dark brown clay
Sample B-2@3'	7.2	280	0.028	660	0.066	Brown silty clay

Notes:

1 Appendix A of ANSI/AWWA C105/A215, TABLE A, provides soil test methods and evaluation for conditions corrosive to gray or ductile-cast iron pipe and fittings.

2 The above test were performed in accordance with the following Caltrans Test Methods:

a. California Test 643 (1993): METHODS FOR ESTIMATING THE SERVICE LIFE OF STEEL CULVERTS.

b. California Test 532 (1993): METHOD FOR ESTIMATING THE TIME TO CORROSION OF REINFORCED CONCRETE SUBSTRUCTURES.

c. California Test 422 (1978): METHOD OF TESTING SOILS AND WATERS FOR CHLORIDE CONTENT.

d. California Test 417 (1986): METHOD OF TESTING SOILS AND WATERS FOR SULFATE CONTENT.

Table 2

LAYER RESISTIVITY CALCULATIONS
GWF POWER-TRACY PEAKER PLANT

Client: Hultgren Tillis Engineers
Project No: 474.01
ConCeCo Job No. 2S01107

Barnes Layer resistivity formula:

$\rho = 191.51 * R * (a2 - a1)$

Where:

ρ (2.5–5) = Resistivity soil layer from 2.5' to 5' below grade (ohm-cm)
ρ (5–10) = Resistivity soil layer from 5' to 10' below grade (ohm-cm)
ρ (10–15) = Resistivity soil layer from 10' to 15' below grade (ohm-cm
R = (4 pin) Resistance measurement (ohms)
a = Pin spacing (feet)

$$\frac{1}{RL} = \frac{1}{R2} - \frac{1}{R1}$$

		$R_{2.5}$	R_5	R_{10}	R_{15}	R_L	R_L	R_L	ρ (2.5–5)	ρ (5–10)	ρ (10–15)
Test		Resistance Measurement (ohms)				Layer Resistance (ohms)			Soil Resistivity (ohm-cm)		
No.	Location	2.5 ft	5 ft	10 ft	15 ft	2.5-5 ft	5-10 ft	10-15 ft	2.5-5 ft	5-10 ft	10-15 ft
1	R-1 (E-W)	4.060	2.430	0.894	---	6.05	1.41		2898	1354	
2	R-1 (N-S)	4.690	1.850	0.913	---	3.06	1.80		1463	1726	
3	R-4 (E-W)	5.320	2.560	1.250	---	4.93	2.44		2363	2339	
4	R-4 (N-S)	5.250	2.640	1.301	---	5.31	2.57		2542	2456	
5	R-2 (E-W)	5.390	3.730	1.694	0.931	12.11	3.10	2.07	5799	2972	1979
6	R-2 (N-S)	5.590	3.330	1.646	1.111	8.24	3.25	3.42	3943	3117	3273
7	R-3 (E-W)	2.130	1.803	0.904	---	11.74	1.81		5623	1736	
8	R-3 (N-S)	2.240	1.524	0.852	---	4.77	1.93		2283	1850	
9	R-5 (E-W)	5.420	2.470	1.238	---	4.54	2.48		2173	2377	
10	R-5 (N-S)	5.080	2.270	1.243	---	4.10	2.75		1965	2631	
11	R-6 (E-W)	5.586	3.010	1.801	---	6.53	4.48		3125	4294	
12	R-6 (N-S)	6.410	3.040	1.600	---	5.78	3.38		2768	3234	
13	R-8 (E-W)	5.800	2.650	1.369	---	4.88	2.83		2336	2712	
14	R-8 (N-S)	5.490	2.700	1.410	---	5.31	2.95		2544	2826	
15	R-7 (E-W)	5.020	2.220	0.993	---	3.98	1.80		1906	1720	
16	R-7 (N-S)	4.160	2.140	1.083	---	4.41	2.19		2110	2100	

THERMAL RESISTIVITY

Virginia Tech
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Department of Civil and Environmental Engineering
Geotechnical Division
22 Patton Hall, Blacksburg, VA 24061-0105
Office: 540.231.4454 Fax: 540.231.1620 E-mail: tb@vt.edu

November 3, 2001

Mr. R. Kevin Tillis
Hultgren-Tillis Engineers
2520 Stanwell Drive, Suite 100
Concord, CA 94520

Re: Thermal Resistivity Tests
GWF Tracy Peaker Plant

Dear Mr. Tillis:

Please find enclosed the results of the thermal resistivity tests which you requested. The test specimens were compacted at the appropriate moisture content in a 1/30 ft^3 compaction mold using a 10 lb (modified Proctor) hammer. A trial and error procedure was attempted to determine the appropriate number of tamps of the compactor required to achieve the target density.

After equilibration to the testing temperature, a thermal needle was inserted into the center of the test specimen via a predrilled hole, and a thermal needle test was conducted. Shown in the table below are the test conditions, and the resulting values of the thermal resistivities.

Sample I.D.	Depth feet	Dry Density γ_d (pcf)	Water content w (%)	Thermal resistivity, ρ (°C-cm/watt)
TP-1	2	111.2	13.1	55.0
TP-1	7	111.6	12.1	63.9
TP-2	3	112.4	13.0	63.2
TP-3	5	118.2	12.9	50.5

If you need further information, please do not hesitate to contact me.

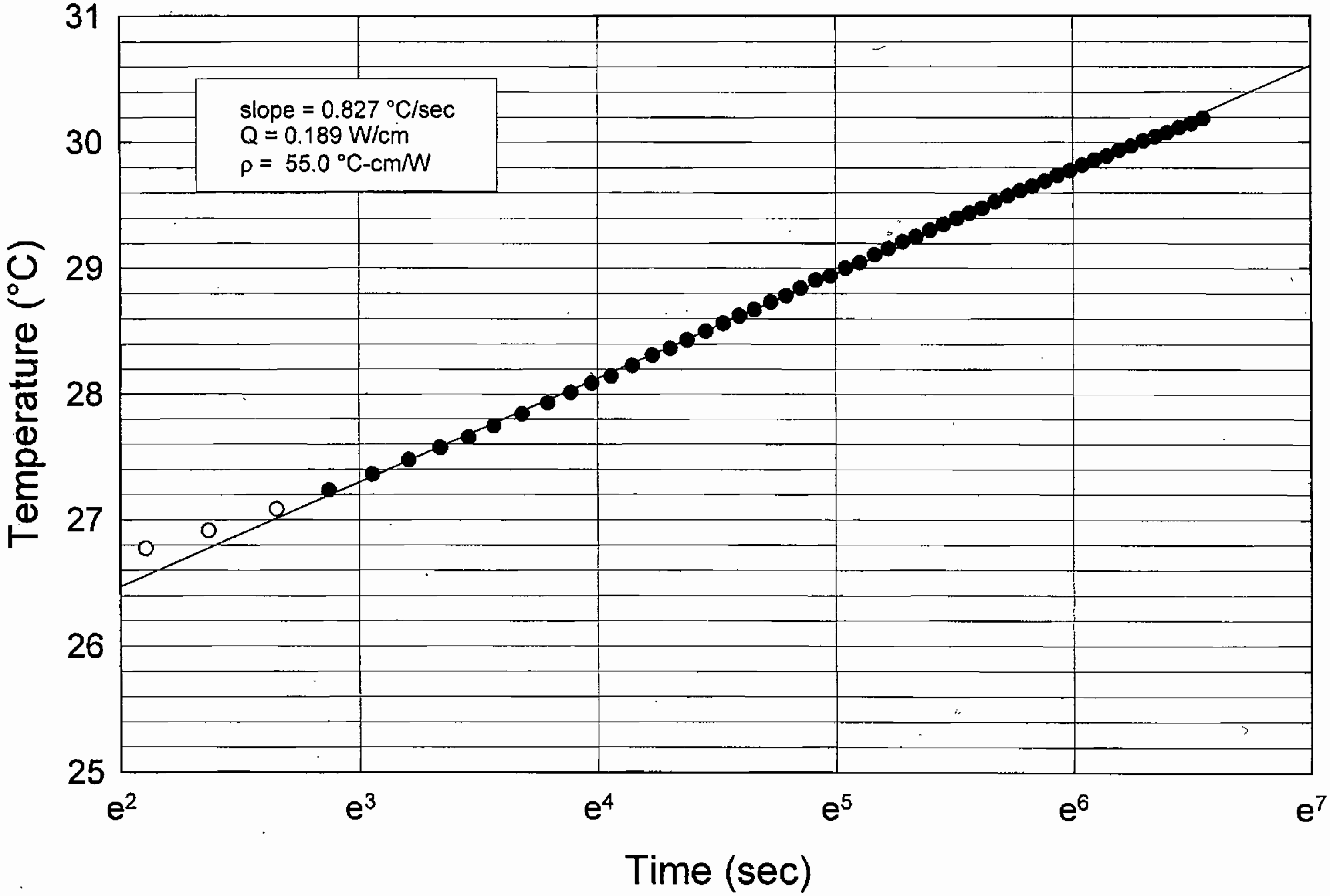
Sincerely,

Thomas Brandon

Thomas L. Brandon
Assoc. Prof. of Civil Engineering

encl: Resistivity Plots
Data Sheets
Invoice

GWF Tracy Peaker Plant
TP-1 z = 2 ft
γ_d =111.2 pcf w =13.1%



Thermal Needle Test

Virginia Tech Geotechnical Engineering Laboratory

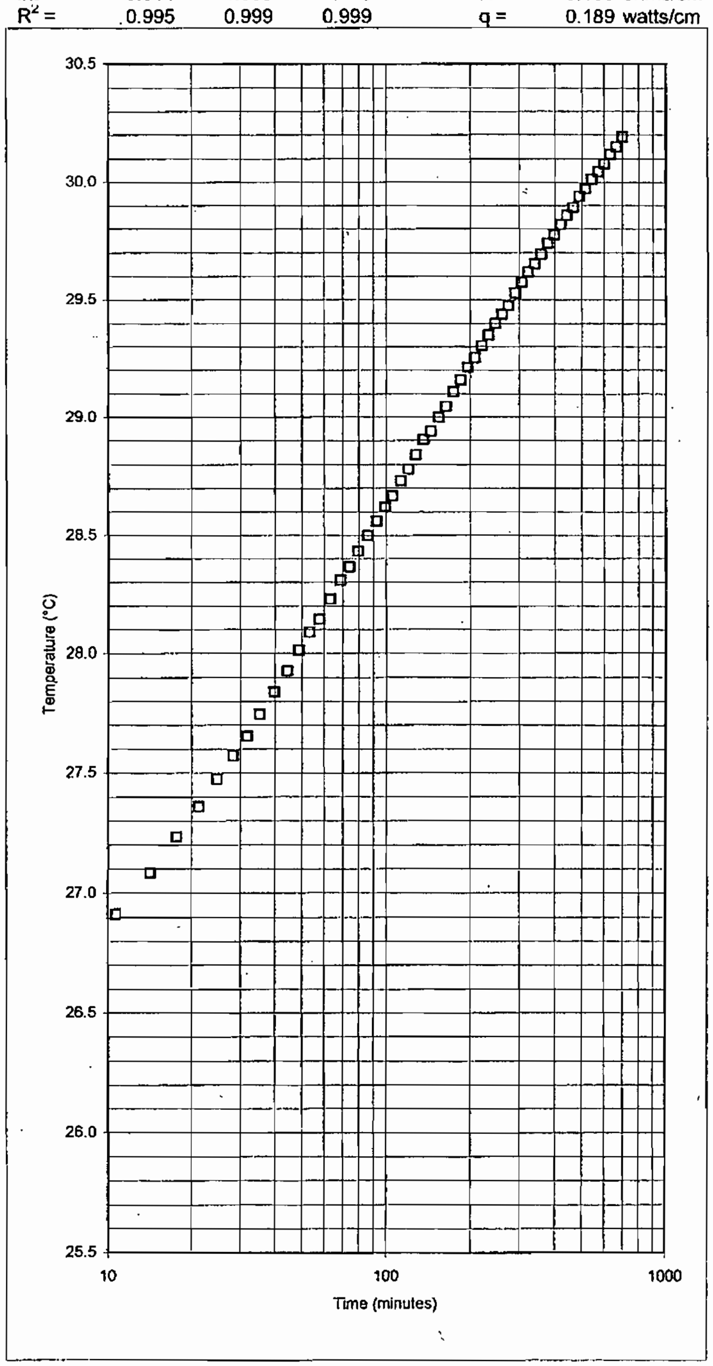
Client: Hultgren-Tillis Engineering
Project: GWF Tracy Peaker Plant
Boring: TP-1
Sample: Compacted Sample
Depth: 2 ft

w% = 13.1%
γ_d = 111.2 pcf
γ_m = 125.8 pcf

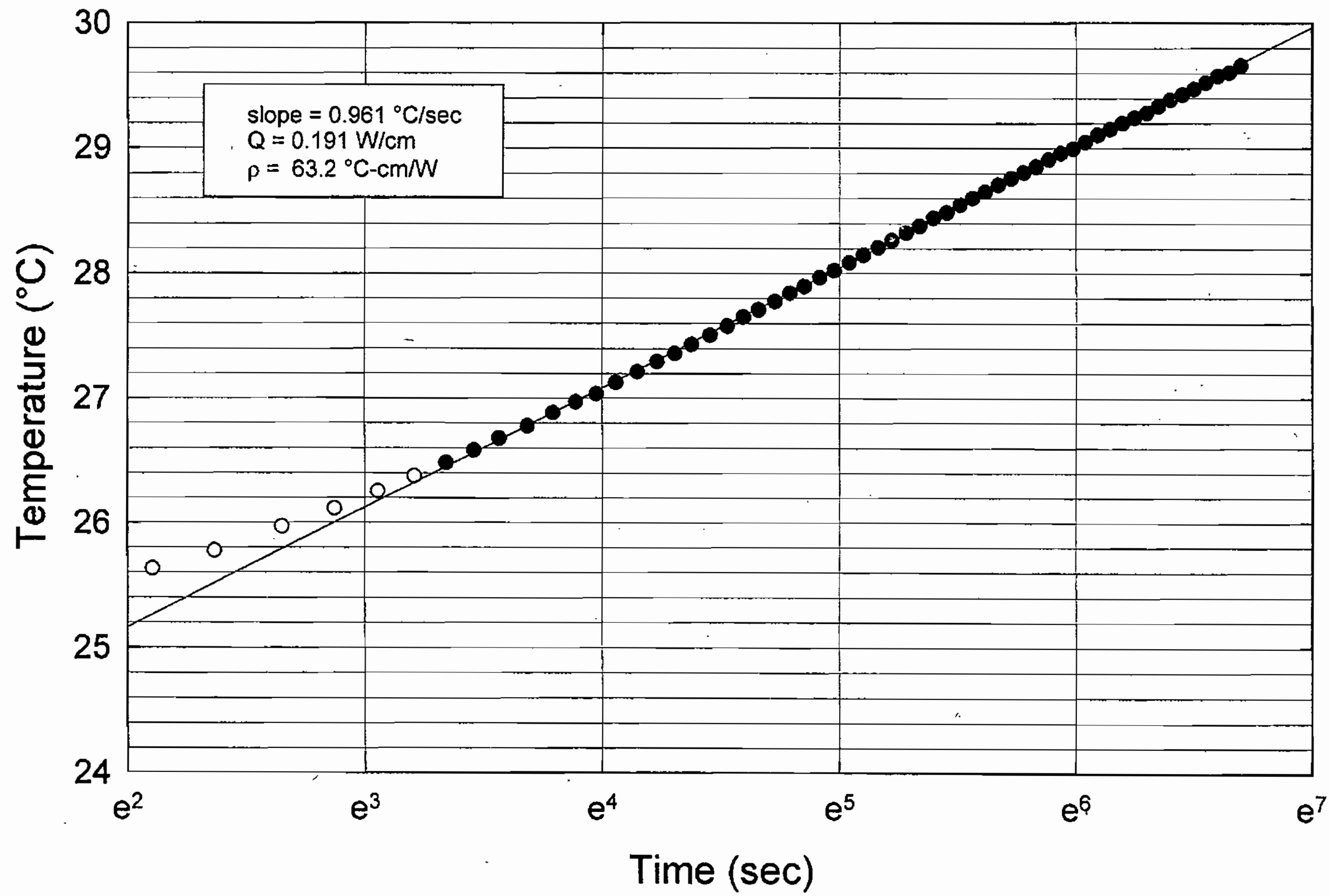
	Time Span		
	210-690	300-690	450-690
Slope	0.740	0.798	0.838
Int =	0.014	0.009	0.008
R^2 =	0.995	0.999	0.999

Calculation of q		
I =	1.003	amps
R =	0.188	ohms/cm
q =	0.189	watts/cm

Time Min	Temp °C
0.000	23.2310
0.270	26.1890
3.265	26.4403
5.735	26.6235
8.205	26.7733
10.680	26.9139
14.195	27.0851
17.710	27.2332
21.225	27.3590
24.740	27.4741
28.255	27.5700
31.770	27.6523
35.285	27.7452
39.790	27.8392
44.295	27.9269
48.795	28.0127
53.300	28.0878
57.805	28.1432
63.295	28.2277
68.790	28.3083
74.280	28.3640
79.775	28.4308
86.255	28.4990
92.735	28.5620
99.220	28.6205
105.700	28.6684
113.170	28.7300
120.640	28.7808
128.110	28.8405
136.620	28.9044
145.135	28.9397
154.635	28.9994
164.140	29.0453
174.630	29.1076
185.120	29.1585
196.600	29.2111
208.080	29.2520
220.550	29.3040
233.015	29.3494
246.530	29.3978
260.040	29.4381
274.540	29.4754
290.030	29.5282
306.505	29.5737
322.985	29.6166
340.450	29.6515
358.960	29.6926
378.460	29.7384
398.945	29.7754
420.425	29.8198
442.885	29.8583
466.395	29.8914
490.890	29.9383
516.375	29.9702
543.840	30.0119
572.345	30.0434
601.840	30.0773
633.315	30.1177
665.775	30.1486
700.265	30.1915



GWF Tracy Peaker Plant
TP-1 z = 7 ft
γ_d =112.4 pcf w =13.0%



Thermal Needle Test

Virginia Tech Geotechnical Engineering Laboratory

Client: Hultgren-Tillis Engineerg
Project: GWF Tracy Peaker Plant
Boring: TP-1
Sample: Remolded Sample
Depth: 7 ft

w% = 12.1%
γ_d = 111.6 pcf
γ_m = 125.1 pcf

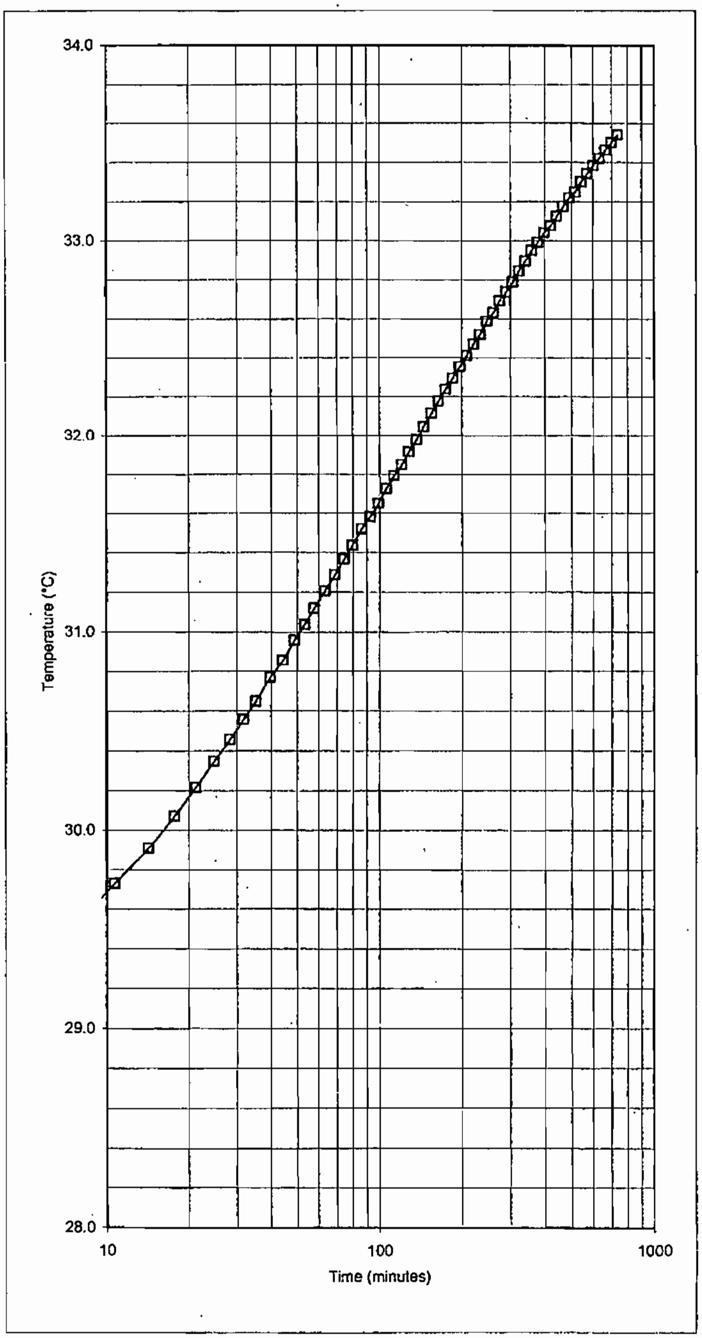
	Time Span		
	210-690	300-690	450-690
Slope	0.834	0.907	0.957
Int =	0.017	0.009	0.008
R^2 =	0.994	0.999	0.999

Calculation of q

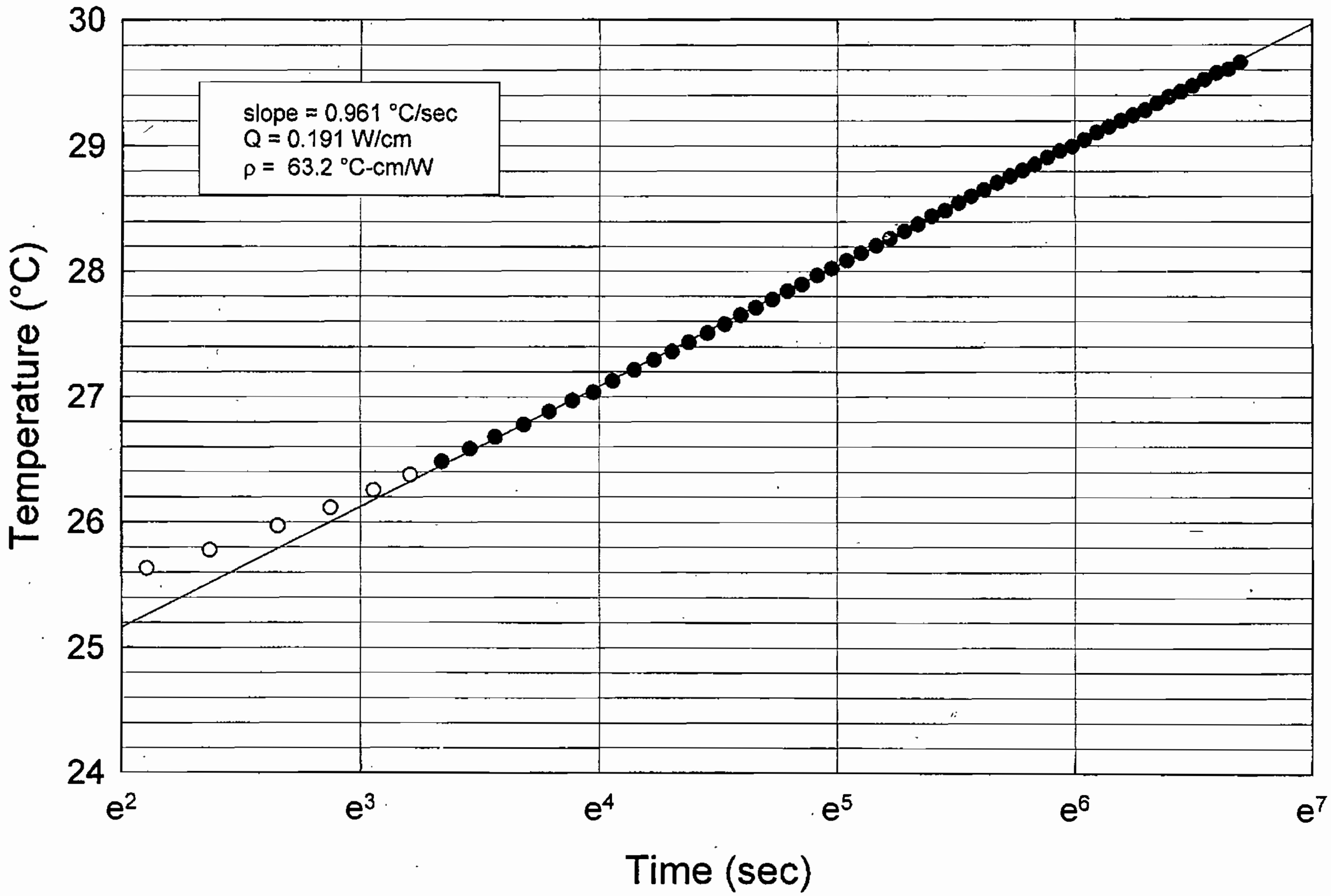
I =	1.008	amps
R =	0.188	ohms/cm
q =	0.191	watts/cm

ρ = See other plot for resistivity determination.

Time Min	Temp °C
0.000	25.2820
0.270	28.8624
3.265	29.1804
5.735	29.3938
8.205	29.5670
10.680	29.7302
14.195	29.9092
17.710	30.0713
21.225	30.2150
24.740	30.3455
28.255	30.4564
31.770	30.5570
35.285	30.6506
39.790	30.7691
44.295	30.8557
48.795	30.9557
53.300	31.0348
57.805	31.1176
63.295	31.2050
68.790	31.2849
74.280	31.3663
79.775	31.4363
86.255	31.5192
92.735	31.5810
99.220	31.6492
105.700	31.7244
113.170	31.7923
120.640	31.8500
128.110	31.9152
136.620	31.9798
145.135	32.0450
154.635	32.1152
164.140	32.1767
174.630	32.2379
185.120	32.2942
196.600	32.3533
208.080	32.4089
220.550	32.4688
233.015	32.5196
246.530	32.5867
260.040	32.6306
274.540	32.6917
290.030	32.7374
306.505	32.7880
322.985	32.8445
340.450	32.8943
358.960	32.9485
378.460	32.9919
398.945	33.0417
420.425	33.0774
442.885	33.1254
466.395	33.1749
490.890	33.2195
516.375	33.2487
543.840	33.3018
572.345	33.3429
601.840	33.3841
633.315	33.4213
665.775	33.4634
700.265	33.5006
736.740	33.5408



GWF Tracy Peaker Plant
TP-2 z = 3 ft
γ_d =112.4 pcf w =13.0%



Thermal Needle Test

Virginia Tech Geotechnical Engineering Laboratory

Client: Hultgren-Tillis Engineering
Project: GWF Tracy Peaker Plant
Boring: TP-2
Sample: Compacted Sample
Depth: 3 ft

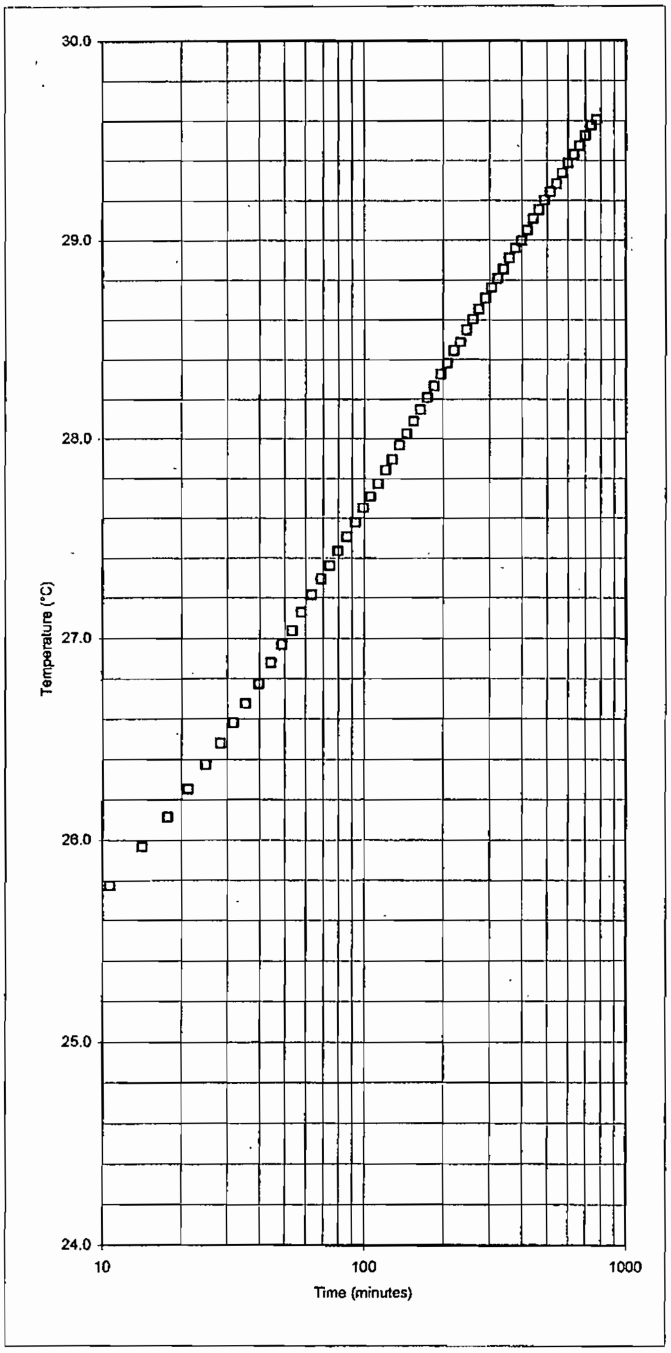
w% = 13.0%
γ_d = 112.4 pcf
γ_m = 127.0 pcf

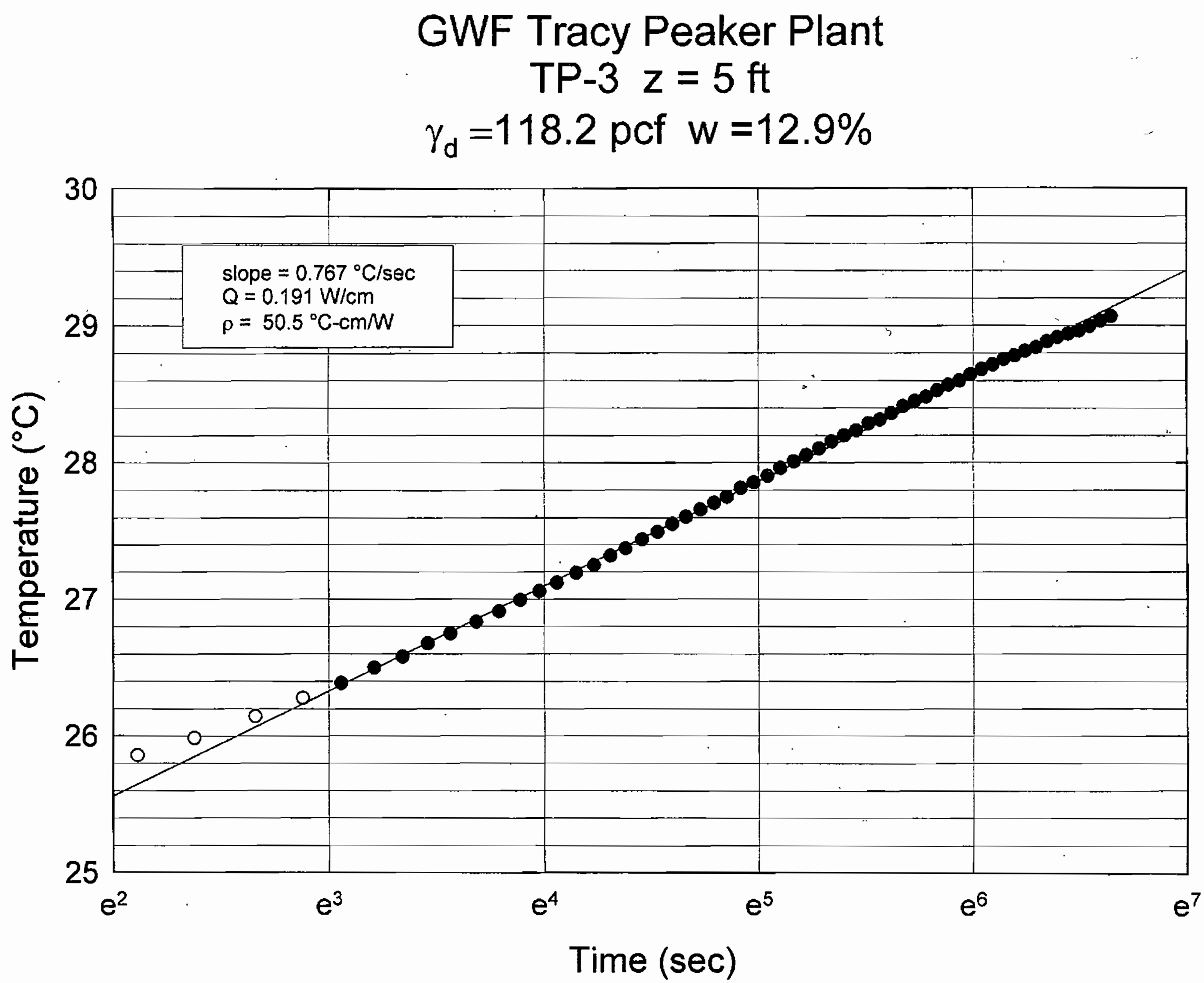
	Time Span		
	210-690	300-690	450-690
Slope	0.806	0.878	0.926
Int =	0.016	0.010	0.010
R^2 =	0.994	0.999	0.999

Calculation of q
I = 1.008 amps
R = 0.188 ohms/cm
q = 0.191 watts/cm

ρ = See other plot for resistivity determination.

Time Min	Temp °C
0.000	21.9370
0.270	24.9845
3.265	25.2614
5.735	25.4566
8.205	25.6297
10.680	25.7735
14.195	25.9672
17.710	26.1127
21.225	26.2532
24.740	26.3749
28.255	26.4813
31.770	26.5823
35.285	26.6761
39.790	26.7754
44.295	26.8808
48.795	26.9672
53.300	27.0358
57.805	27.1255
63.295	27.2119
68.790	27.2923
74.280	27.3589
79.775	27.4315
86.255	27.5045
92.735	27.5761
99.220	27.6485
105.700	27.7063
113.170	27.7732
120.640	27.8409
128.110	27.8937
136.620	27.9664
145.135	28.0231
154.635	28.0864
164.140	28.1456
174.630	28.2056
185.120	28.2628
196.600	28.3236
208.080	28.3769
220.550	28.4424
233.015	28.4857
246.530	28.5469
260.040	28.6011
274.540	28.6519
290.030	28.7070
306.505	28.7596
322.965	28.8066
340.450	28.8526
358.960	28.9081
378.460	28.9589
398.945	28.9950
420.425	29.0483
442.885	29.1063
466.395	29.1507
490.890	29.1999
516.375	29.2415
543.840	29.2811
572.345	29.3345
601.840	29.3857
633.315	29.4273
665.775	29.4707
700.265	29.5229
736.740	29.5759
774.195	29.6030
813.690	29.6590
855.155	29.6976





GWF Tracy Peaker Plant
TP-3 z = 5 ft
γ_d =118.2 pcf w =12.9%
slope = 0.767 °C/sec
Q = 0.191 W/cm
ρ = 50.5 °C-cm/W
Temperature (°C)
30
29
28
27
26
25
e^2
e^3
e^4
e^5
e^6
e^7
Time (sec)

Thermal Needle Test

Virginia Tech Geotechnical Engineering Laboratory

Client: Hultgren-Tillis Engineering
Project: GWF Tracy Peaker Plant
Boring: TP-3
Sample: Compacted Sample
Depth: 5 ft

w% = 12.9%
γ_d = 118.2 pcf
γ_m = 133.4 pcf

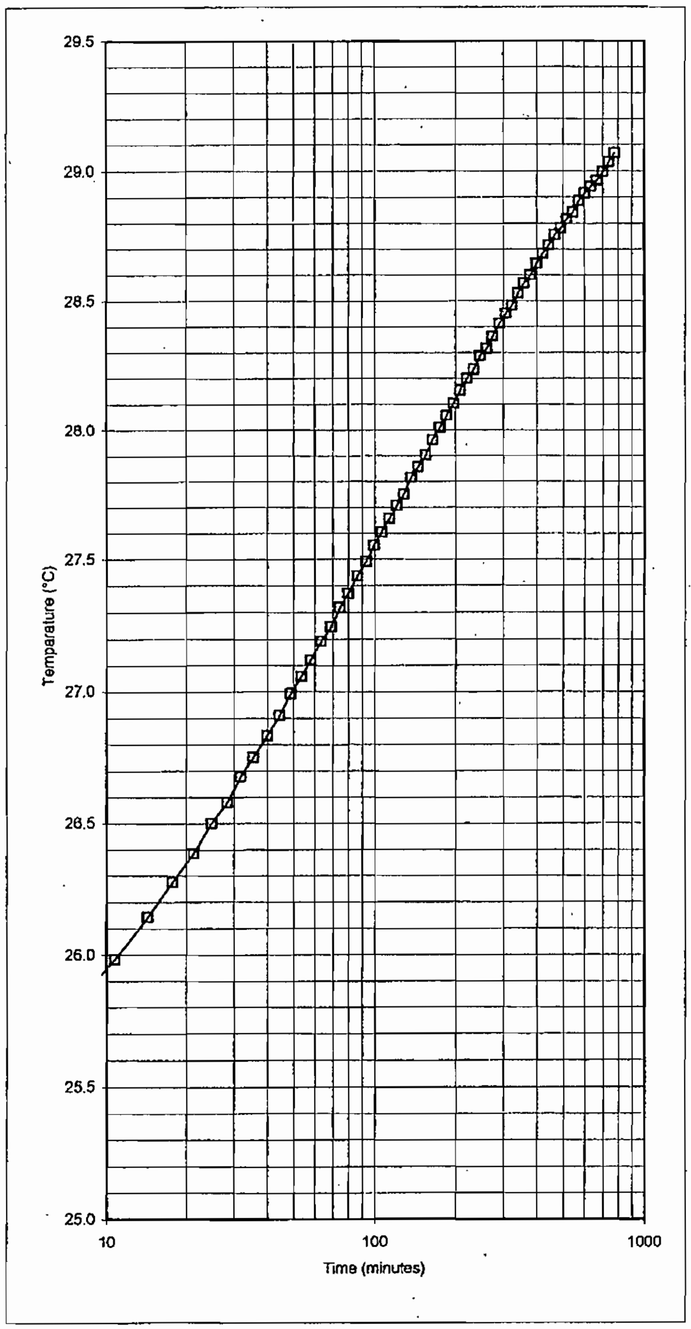
	Time Span		
	210-690	300-690	450-690
Slope	0.678	0.731	0.762
Int =	0.012	0.007	0.007
R^2 =	0.995	0.999	0.999

Calculation of q

I =	1.008	amps
R =	0.188	ohms/cm
q =	0.191	watts/cm

ρ = See other plot for resistivity determination.

Time Min	Temp °C
0.000	22.5490
0.270	25.3319
3.320	25.5502
5.790	25.7207
8.260	25.8585
10.735	25.9843
14.250	26.1441
17.765	26.2768
21.280	26.3865
24.795	26.5000
28.310	26.5791
31.825	26.6766
35.340	26.7495
39.845	26.8341
44.345	26.9091
48.850	26.9925
53.410	27.0572
57.915	27.1190
63.405	27.1903
68.900	27.2472
74.390	27.3173
79.885	27.3708
86.365	27.4374
92.845	27.4914
99.325	27.5533
105.810	27.6045
113.280	27.6578
120.750	27.7070
128.220	27.7517
136.730	27.8159
145.245	27.8566
154.745	27.9035
164.250	27.9615
174.740	28.0088
185.230	28.0551
196.710	28.1031
208.190	28.1534
220.660	28.1986
233.125	28.2347
246.640	28.2873
260.150	28.3145
274.650	28.3619
290.140	28.4128
306.615	28.4511
323.095	28.4815
340.560	28.5299
359.070	28.5681
378.570	28.5983
399.055	28.6424
420.530	28.6815
442.995	28.7145
466.505	28.7549
491.000	28.7807
516.485	28.8161
543.950	28.8417
572.455	28.8855
601.950	28.9147
633.425	28.9400
665.885	28.9633
700.375	28.9962
736.850	29.0338
774.305	29.0677



DOUBLE RING INFILTROMETER

Double Ring Infiltrometer

Client: Holtgren-Tillis Engineers
Project No. 20-4658-01
Project Name: GWF Site

DRI No. 1

Time	Elapsed Time	Water Level Drop (cm)	Water Qty (gal)	Water Qty (mL)	Infiltration Rate (cm/hr)	Infiltration Rate (in/hr)
10:00	0:00	0.00	0.00	0.00	0.00	0.00
10:30	0:30	0.00	0.00	0.00	0.00	0.00
11:00	0:30	1.00	2.17	8202.10	22.48	8.85
11:30	0:30	0.50	1.08	4101.05	11.24	4.43
12:00	0:30	0.40	0.87	3280.84	8.99	3.54
12:30	0:30	0.40	0.87	3280.84	8.99	3.54
13:00	0:30	0.30	0.65	2460.63	6.74	2.66
13:30	0:30	0.40	0.87	3280.84	8.99	3.54
14:00	0:30	0.50	1.08	4101.05	11.24	4.43

Note: Suggested inflitration rate of 8.99 cm/hr

DRI No. 2

Time	Elapsed Time	Water Level Drop (cm)	Water Qty (gal)	Water Qty (mL)	Infiltration Rate (cm/hr)	Infiltration Rate (in/hr)
10:00	0:00	0.00	0.00	0.00	0.00	0.00
10:30	0:30	0.50	1.08	4101.05	11.24	4.43
11:00	0:30	0.50	1.08	4101.05	11.24	4.43
11:30	0:30	0.30	0.65	2460.63	6.74	2.66
12:00	0:30	0.10	0.22	820.21	2.25	0.89
12:30	0:30	0.10	0.22	820.21	2.25	0.89
13:00	0:30	0.20	0.43	1640.42	4.50	1.77
13:30	0:30	0.20	0.43	1640.42	4.50	1.77
14:00	0:30	0.20	0.43	1640.42	4.50	1.77

Note: Suggested inflitration rate of 4.50 cm/hr

Double Ring Infiltrometer

Client: Holtgren-Tillis Engineers
Project No. 20-4658-01
Project Name: GWF Site

DRI No. 3

Time	Elapsed Time	Water Level Drop (cm)	Water Qty (gal)	Water Qty (mL)	Infiltration Rate (cm/hr)	Infiltration Rate (in/hr)
12:55	0:00	0.00	0.00	0.00	0.00	0.00
13:25	0:30	0.10	0.22	820.21	2.25	0.89
13:55	0:30	0.00	0.00	0.00	0.00	0.00
14:25	0:30	0.10	0.22	820.21	2.25	0.89
14:55	0:30	0.10	0.22	820.21	2.25	0.89
15:25	0:30	0.10	0.22	820.21	2.25	0.89
15:55	0:30	0.10	0.22	820.21	2.25	0.89
16:25	0:30	0.10	0.22	820.21	2.25	0.89
16:55	0:30	0.10	0.22	820.21	2.25	0.89

Note: Suggested inflitration rate of 2.25 cm/hr

DRI No. 4

Time	Elapsed Time	Water Level Drop (cm)	Water Qty (gal)	Water Qty (mL)	Infiltration Rate (cm/hr)	Infiltration Rate (in/hr)
12:57	0:00	0.00	0.00	0.00	0.00	0.00
13:27	0:30	0.00	0.00	0.00	0.00	0.00
13:57	0:30	0.10	0.22	820.21	2.25	0.89
14:27	0:30	0.10	0.22	820.21	2.25	0.89
14:57	0:30	0.10	0.22	820.21	2.25	0.89
15:27	0:30	0.10	0.22	820.21	2.25	0.89
15:57	0:30	0.10	0.22	820.21	2.25	0.89
16:27	0:30	0.10	0.22	820.21	2.25	0.89
16:57	0:30	0.10	0.22	820.21	2.25	0.89

Note: Suggested inflitration rate of 2.25 cm/hr

Plate 2

Double Ring Infiltrometer

Client: Holtgren-Tillis Engineers
Project No. 20-4658-01
Project Name: GWF Site

DRI No. 5

Time	Elapsed Time	Water Level Drop (cm)	Water Qty (gal)	Water Qty (mL)	Infiltration Rate (cm/hr)	Infiltration Rate (in/hr)
9:08	0:00	0.00	0.00	0.00	0.00	0.00
9:38	0:30	0.10	0.22	820.21	2.25	0.89
10:08	0:30	0.10	0.22	820.21	2.25	0.89
10:38	0:30	0.00	0.00	0.00	0.00	0.00
11:08	0:30	0.10	0.22	820.21	2.25	0.89
11:38	0:30	0.00	0.00	0.00	0.00	0.00
12:08	0:30	0.10	0.22	820.21	2.25	0.89
12:38	0:30	0.00	0.00	0.00	0.00	0.00
13:08	0:30	0.10	0.22	820.21	2.25	0.89

Note: Suggested infiltration rate of 1.12 cm/hr

DRI No. 6

Time	Elapsed Time	Water Level Drop (cm)	Water Qty (gal)	Water Qty (mL)	Infiltration Rate (cm/hr)	Infiltration Rate (in/hr)
12:57	0:00	0.00	0.00	0.00	0.00	0.00
13:27	0:30	0.00	0.00	0.00	0.00	0.00
13:57	0:30	0.10	0.22	820.21	2.25	0.89
14:27	0:30	0.10	0.22	820.21	2.25	0.89
14:57	0:30	0.10	0.22	820.21	2.25	0.89
15:27	0:30	0.10	0.22	820.21	2.25	0.89
15:57	0:30	0.10	0.22	820.21	2.25	0.89
16:27	0:30	0.10	0.22	820.21	2.25	0.89
16:57	0:30	0.10	0.22	820.21	2.25	0.89

Note: Suggested inflitration rate of 2.25 cm/hr

BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION OF THE STATE OF CALIFORNIA
1516 NINTH STREET, SACRAMENTO, CA 95814
1-800-822-6228 – WWW.ENERGY.CA.GOV

APPLICATION FOR CERTIFICATION FOR THE *GWF TRACY COMBINED CYCLE POWER PLANT PROJECT*

Docket No. 08-AFC-7
PROOF OF SERVICE
(Revised 10/28/2008)

INSTRUCTIONS: All parties shall either (1) send an original signed document plus 12 copies or (2) mail one original signed copy AND e-mail the document to the address for the Docket as shown below, AND (3) all parties shall also send a printed or electronic copy of the document, which includes a proof of service declaration to each of the individuals on the proof of service list shown below:

CALIFORNIA ENERGY COMMISSION
Attn: Docket No. 01-AFC-16
1516 Ninth Street, MS-15
Sacramento, CA 95814-5512
docket@energy.state.ca.us

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DECLARATION OF SERVICE

I, Mary Finn, declare that on November 19, 2008, I deposited copies of the attached Data Response, Set 1, in the United States mail at Sacramento, CA with first-class postage thereon fully prepaid and addressed to those identified on the Proof of Service list above.

OR

Transmission via electronic mail was consistent with the requirements of California Code of Regulations, title 20, sections 1209, 1209.5, and 1210. All electronic copies were sent to all those identified on the Proof of Service list above.

I declare under penalty of perjury that the foregoing is true and correct.

[signature]

Mary Finn

*indicates change