Water Division Photovoltaic Project
BID '14/36/B

May 9, 2014

Addendum No. 3 – Answers to questions at received at pre-bid meeting

Project Manager: Nick Schiavo 505-955-4201 Dee Beingessner, 505-955-4231

This addendum is to address the questions received at the pre-bid meeting on May 8, 2014.

1. What is the contact information for the company that manages the gate card system?

   The contact information for the gate company is:

   HEI
   Fred Phillips
   Service Manager
   Office (505) 880-1819
   Cell (505) 980-9470
   Fax (505) 837-1516
   mailto:fred@heinm.com

2. Does the project require City or CID permits?

   The project will require a permit from CID.

3. Is the canopy structure open to other suppliers?

   Yes.

4. Does the design of the canopy have to look the same as the one provided by RBI Solar?

   Yes, the configuration must look similar and must meet all of the specifications outlined in the RFP including that structural drawings must be stamped by a professional engineer.

5. Is there a local preference, veterans preference and in-state preference?

   All of those preferences are available and are listed in the bid documents in the Instructions to Bidders Section 4.4. Specific questions regarding qualifying for

these preferences can be directed to the Purchasing Director Robert Rodarte at (505) 955-5712.

6. Can other solar panels be substituted?

   No, the panels and inverters must be bid as specified in the bid documents.

7. Did the project pass supplemental review?

   It did not need to go through a supplemental review.

8. Is the photovoltaic module a 310 or 327W.

   The correct PV module is an E19-310.

9. Is there a geotechnical report available?

   Yes, it is attached to this addendum.

10. Will the existing transformer be used?

    That will be PNM's discretion.

11. The replacement of the main electrical services at the facility requires power to be interrupted to the facility twice for 4-12 hours each time. Are there any requirements for timing of this shutdown? Performance of this activity outside of normal working hours will increase the cost. Also, are there special startup procedures that should be considered when power is reconnected? If so, please provide them.

    Specification section 01001, paragraph 1.3 is modified to read:

    CONTRACTOR USE OF PREMISES: For purposes of this paragraph, normal working hours shall be defined as 6:00 A.M. through 8:00 P.M., Monday through Saturday.

    And section 1.3 B is modified to read:

    Work that requires disruption of power at the entire facility must be performed outside of normal office hours (7:00AM thru 6:00PM). Length of power disruption shall be limited to 8 hours at a time. Contractor shall schedule all outages with owner 14 days in advance.

12. Does the PNM allowance cover the shutdown costs and the transformer and what happens if the costs are more than $10,000?

The $10,000 PNM allowance includes the shutdown costs and the cost of a new transformer (minus any credit given for the old transformer) if required. If the costs are beyond $10,000, the City would compensate the contractor.

13. What is the final day to submit questions?

The final day to submit questions is Monday May 12th at 4pm. Submit questions to Dee Beingessner in writing at dabeingessner@santafenm.gov

In addition to the questions addressed at the bid opening, we are also modifying the qualifications in Exhibit II - Technical Specifications Section 01010 1.02 C.a. to read:

The Contractor shall have installed at least one grid interconnected photovoltaic system utilizing carport structures, with a minimum output of 100KW.

GEO-TEST

GEOTECHNICAL ENGINEERING SERVICES
JOB NO. 1-30806
PROTEKPARK SOLAR PANEL CANOPIES
CITY OF SANTA FE WATER DIVISION
SANTA FE, NEW MEXICO

PREPARED FOR:

CITY OF SANTA FE

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GEO-TEST

September 26, 2013
Job No. 1-30806

City of Santa Fe
Long Range Planning
200 Lincoln Avenue
Santa Fe, New Mexico 87501

ATTN: **Mr. Nick Schiavo, PE**

RE: **Geotechnical Engineering Services Report**
ProtekPark Solar Panel Canopies
City of Santa Fe Water Division
Santa Fe, New Mexico

Mr. Schiavo:

Submitted herein is the Geotechnical Engineering Services Report for the above referenced project. The report contains the results of our field investigation, laboratory testing, and recommendations for foundation design, as well as criteria for site grading.

It has been a pleasure to serve you on this project. If you should have any questions, please contact this office.

Respectfully submitted:

GEO-TEST, INC.

Timothy Matson, Geologist

CHARLES M. MILLER
NEW MEXICO
6018
LICENSED PROFESSIONAL ENGINEER

Reviewed by:

Charles M. Miller, P.E.

cc: Addressee (3)

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INTRODUCTION

This report presents the results of the geotechnical engineering services investigation performed for the proposed ProteckPark solar panel canopies to be located in the parking lot for the City of Santa Fe Water Division in Santa Fe, New Mexico.

The objectives of this investigation were to:

1) Evaluate the nature and engineering properties of the subsurface soils underlying the site.

2) Provide recommendations for foundation design, as well as criteria for site grading.

The investigation includes subsurface exploration, selected soil sampling, laboratory testing of the samples, performing an engineering analysis and preparation of this report.

PROPOSED CONSTRUCTION

It is understood that the project consists of constructing parking shade canopy structures upon which PV panels will be mounted. The solar canopies will be supported on rectangular shaped HSS (hollow structural sections) approximately 18" x 6" bearing on 36 inch diameter drilled, straight, cast-in-place concrete shaft foundations. Maximum foundation loads as provided by ProtecPark Solar, Inc., are as follows.

LOAD	LOADING
Downward	49,500 pounds
Lateral	2,600 pounds
Moment	1,214,400 inch pounds

Should structural loads or other project details vary significantly from those outlined above, this firm should be notified for review and revision of recommendations contained herein.

FIELD EXPLORATION

A total of four (4) exploratory borings were drilled within the existing parking lot to approximately 21 feet below existing site grades. The locations of the borings are shown on the attached Boring Location Maps, Figure 1. During the test drilling, the soils encountered in the borings were continuously

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examined, visually classified, and logged. The boring logs are presented in a following section of this report. Drilling was accomplished with a truck mounted drill rig using 6.5-inch diameter continuous flight hollow stem auger. Subsurface materials were sampled at five foot intervals or less utilizing an open tube split barrel sampler and brass ring lined sampler driven by a standard penetration test hammer.

LABORATORY TESTING

Selected soil samples were tested in the laboratory to determine certain engineering properties of the soils. Moisture contents and dry densities were determined to evaluate the various soil deposits with depth. The results of these tests are presented on the boring logs.

Sieve analysis and Atterberg limits tests were performed on selected samples to aid in soil classification. In addition, direct shear tests were performed on selected samples to evaluate the strength characteristics of the soils. Results of these tests are presented in the Summary of Laboratory Results and on the individual test reports presented in a following section of this report.

SITE CONDITIONS

A brief site reconnaissance was performed during our site exploration. The site for the proposed solar canopies is located in the paved parking lot for the city water division.

SUBSURFACE SOIL CONDITIONS

As indicated by the exploratory borings, the soils underlying the pavement section consist predominantly of clayey sands. The soils are generally of low plasticity, range from loose to medium dense and extend to depths ranging from approximately 13 to 18½ feet below existing site grade. Directly below the clayey sands, interbedded silty sands and sandy, silty clays were encountered and extended to full depth explored. These soils range from non-plastic to low plasticity and range from medium dense and moderately firm to very dense and hard.

No groundwater was encountered and soil moisture contents were relatively low to moderate throughout the extent of the borings.

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CONCLUSIONS AND RECOMMENDATIONS

The near surface soils are loose to medium dense and the deeper soils, below 15.0 feet are medium dense and moderately firm to very dense and hard, however, based on laboratory results the native soils in their present condition will be suitable to provide adequate support of the proposed solar panel shade canopies on concrete pier foundations.

Detailed recommendations for the design of drilled, straight, cast-in-place concrete piers, along with recommended criteria for site grading, drainage, and moisture protection are presented in the following sections of this report.

FOUNDATIONS

PIER FOUNDATIONS

Based on the loads provided, as summarized in a previous section of this report, it is concluded that the lateral forces against the piers will control foundation design.

Lateral soil resistance against the sides of the piers was evaluated using the computer program LPILE Plus for windows, Version 5.0 by Ensoft, Inc. The following soil parameters were used in the analyses:

Depth (feet)	Soil Type (USCS)	Cohesion (psf)	Angle of Internal Friction (degrees)	Unit Weight (pcf)
0 - 20	(SC/SM)	200	30	110

The results of the L-Pile analyses for the drilled piers are presented in Appendix A of this report. The analyses were performed using 36 inch diameter concrete piers extending to depths of 15 feet below existing site grades. Based on the analyses, the minimum recommended depth of pier is 15.0 feet below existing pavement or lowest adjacent finished grade, whichever is the lower elevation. It is estimated that pier head deflections will not exceed ¼ inch and maximum estimated settlements will be less than ½ inch.

The pile head deflections are based on the soil moisture contents encountered in the borings at the time of our field investigation. Significant soil moisture increases would create additional pile head deflections and, thus, the moisture protection provisions as recommended in a following section of this report are considered important.

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The parameters apply to the allowable soil supporting capability of the piles and do not consider the structural strength of the piers. The parameters apply to full dead plus realistic live load and can be safely increased by one-third for total loads including wind or seismic forces. Piers can be considered isolated when they are spaced at least three diameters center-to-center perpendicular to the line of thrust and 6 diameters parallel to the line of thrust.

CONSTRUCTION CONSIDERATIONS

Straight, drilled pier excavations should be advanced with a single flight auger, or bucket auger bits, to the design depth. It should be verified by observation and measurement that the excavations are open to that depth. The auger should then be placed back into the excavations and two additional passes made to clean loose material present in the bottom of the excavations.

Our borings were drilled with a hollow-stem auger, therefore we were not able to evaluate the potential for caving of site soils, which may become a factor during installation. The contractor is responsible for evaluating excavation difficulties prior to construction. Pilot holes using proposed production drilling equipment may be prudent, to evaluate possible excavation difficulties such as caving soils and/or other excavation difficulties. However, based on the results of this investigation, it is estimated that only minor caving and/or sloughing will occur during the drilling operations. As a result, concrete quantities will be near the neat quantities as indicated by the plans.

Concrete should be placed through a hopper or other device so that it is channeled in such a manner to free fall and clear the walls of the excavation and reinforcing steel until it strikes the bottom. Adequate compaction will be achieved by free fall of the concrete up to the top 5 feet. The top 5 feet of concrete should be vibrated in order to achieve proper compaction. The concrete should have an ultimate compressive strength of not less than 4,000 psi and be workable and plastic. A design slump of 4 to 6 inches should be achieved.

Continuous observation of the construction of drilled piers should performed by a representative of the geotechnical engineer to insure that they meet the requirements.

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SITE-GRADING

The following general guidelines should be included in the project construction specifications to provide a basis for quality control during site grading. It is recommended that all structural fill and backfill be placed and compacted under engineering observation and in accordance with the following:

1) After site stripping, clearing and making any required excavations, the exposed cut surface should be moisture conditioned and densified as outlined below prior to placement of structural fill, base course or construction.

2) Densification of the exposed native soils should consist of scarifying to a depth of 8 inches, moisture conditioning to the optimum moisture content or above to as deep as practicable, and compacting the area to a minimum of 95 percent of maximum dry density as determined in accordance with ASTM D-1557.

3) The results of this investigation indicate that most of the on site soils will be suitable for reuse as structural fill; however, blending of the soils may be required to meet the specifications for structural fill. All structural fill or backfill material should be free of vegetation and debris and contain no rocks larger than 3 inches. Gradation of the backfill material, as determined in accordance with ASTM D-422, should be as follows:

Size	Percent Passing
3 inch	100
No. 4	60 -100
No. 200	15 - 45

4) The plasticity index of the structural fill should be no greater than 15 when tested in accordance with ASTM D-4318.

5) Fill or backfill, consisting of soil approved by the geotechnical engineer, shall be placed in 8 inch loose lifts and compacted with approved compaction equipment. Loose lifts should be reduced to 4 inches if hand held compaction equipment is used. All compaction of fill or backfill shall be accomplished to a minimum of 95 percent of the maximum dry density as determined in accordance with ASTM D-

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1557. The moisture content of the structural fill during compaction should be within 2 percent of the optimum moisture content.

6) Tests for degree of compaction should be determined by the ASTM D-1556 method or ASTM D-6938. Observation and field tests should be carried on during fill and backfill placement by the geotechnical engineer to assist the contractor in obtaining the required degree of compaction. If less than 95 percent is indicated, additional compaction effort should be made with adjustment of the moisture content as necessary until 95 percent compaction is obtained.

MOISTURE PROTECTION

Precautions should be taken during and after construction to minimize moisture increase of foundation soils. Positive drainage should be established away from the structures. A typical adequate slope is 6 inches in the first 5 feet with positive drainage being provided from those points to streets or natural water courses. Backfill should be well compacted and should meet the specifications outlined in the Site Grading section of this report. Irrigation within 10 feet of foundations should be carefully controlled.

If any water line leaks or if irrigation system leaks are detected, they should be promptly repaired. And, if any depressions develop from the settlement of soils in utility trenches or other areas, they should be backfilled to maintain the grade so that surface water drains rapidly away from the structures.

The foregoing recommendations should only be considered minimum requirements for overall site development. It is recommended that a civil/drainage engineer be consulted more detailed grading and drainage recommendations.

FOUNDATION REVIEW AND INSPECTION

This report has been prepared to aid in the evaluation of this site and to assist in the design of this project. It is recommended that the geotechnical engineer be provided the opportunity to review the final design drawings and specifications in order to determine whether the recommendations in this report are applicable to the final design. Review of the final design drawings and specifications should be noted in writing by the geotechnical engineer.

In order to permit correlation between the conditions encountered during construction and to confirm recommendations presented herein, it is recommended that the geotechnical engineer be retained to perform

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continuous observations and testing during the earthwork portion of this project. Observation and testing should be performed during construction to confirm that suitable fill soils are placed upon competent materials and properly compacted and foundation elements penetrate the recommended soils.

CLOSURE

Our conclusions, recommendations and opinions presented herein are:

1) Based upon our evaluation and interpretation of the findings of the field and laboratory program.

2) Based upon an interpolation of soil conditions between and beyond the explorations.

3) Subject to confirmation of the conditions encountered during construction.

4) Based upon the assumption that sufficient observation will be provided during construction.

5) Prepared in accordance with generally accepted professional geotechnical engineering principles and practice.

This report has been prepared for the sole use of the City of Santa Fe, specifically, to aid in the design of the solar canopies to be located at the city water division parking lot in Santa Fe, New Mexico, and not for use by any third parties.

We make no other warranty, either express or implied. Any person using this report for bidding or construction purposes should perform such independent investigation as he deems necessary to satisfy himself as to the surface and subsurface conditions to be encountered and the procedures to be used in the performance of work on this project. If conditions encountered during construction appear to be different than indicated by this report, this office should be notified.

All soil samples will be discarded 60 days after the date of this report unless we receive a specific request to retain the samples for a longer period of time.

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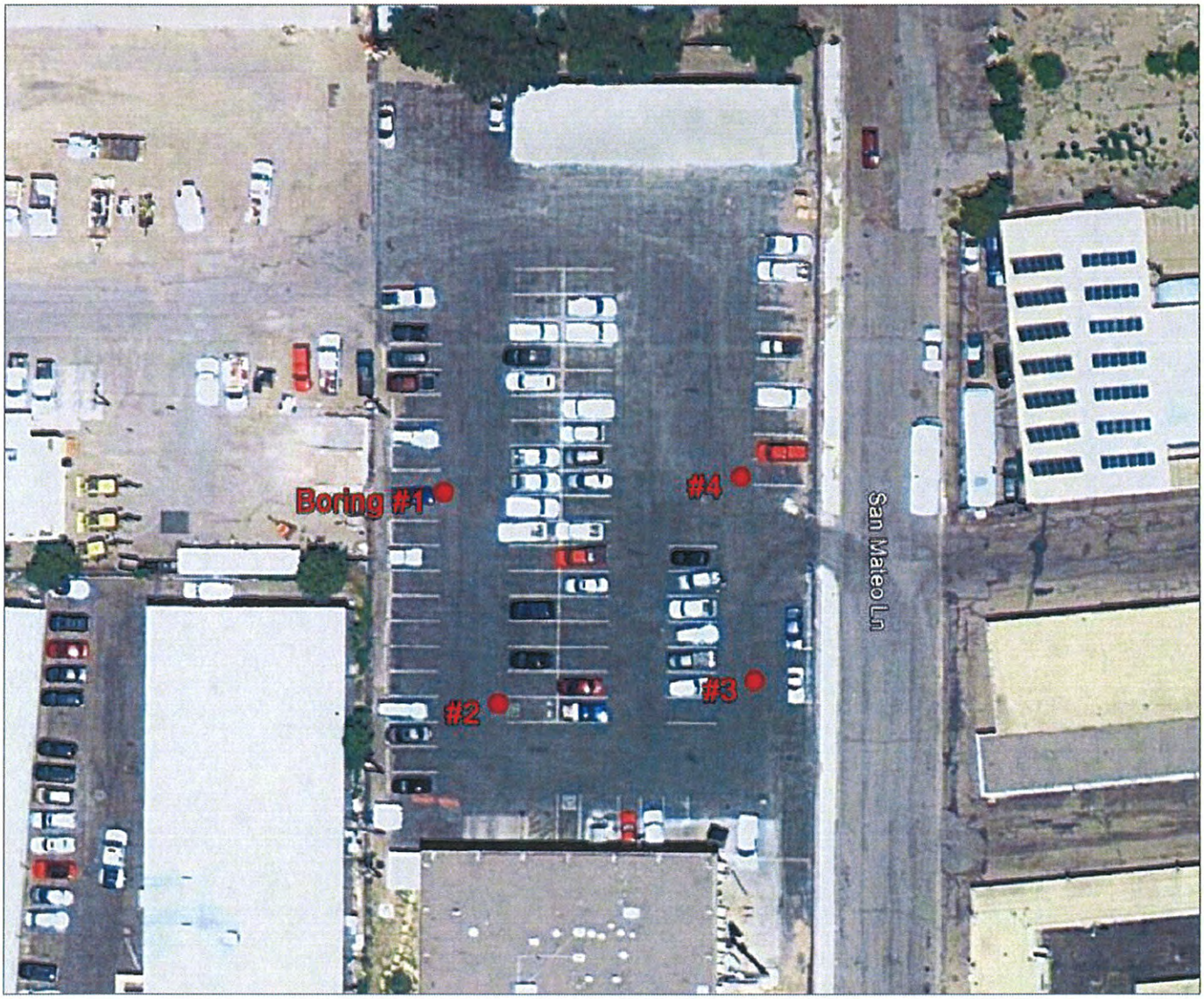
BORING LOCATION MAP



ProtekPark Solar Panel Canopies
Santa Fe, NM
Job No. 1-30806

FIGURE 1

GEO-TEST
GEOTECHNICAL ENGINEERING
AND MATERIAL TESTING
SANTA FE – ALBUQUERQUE – LAS CRUCES

GEO-TEST

Project: ProtekPark Solar Panel Canopies
Date: 08/26/2013 Project No: 1-30806
Elevation: Type: 6.5" OD HSA

LOG OF TEST BORINGS

GROUNDWATER DEPTH

NO: 1

During Drilling: None After 24 Hours:

DEPTH (Ft)	LOG	SAMPLE INTERVAL	TYPE	N. BLOWS/FT	MOISTURE %	DRY DENSITY (pcf)	USC	DESCRIPTION	N blows/ft (20 40 60 80)
							ASPHALT	6" Asphalt	
			SS	3-4-5 9	14		SC	CLAYEY SAND, fine to medium grained, low plasticity, loose, slightly moist to moist, tan	9
5			SS	3-4-3 7	10				7
10			SS	3-2-2 4	21				4
15			SS	10-15-16 31	3		SM	SILTY SAND, medium to coarse grained, non-plastic, dense, slightly moist, red/brown	31
20			SS	18-21-28 49	10		CL-ML	SANDY, SILTY CLAY, low plasticity, hard, slightly moist, brown	49
								STOPPED AUGER AT 19.5' STOPPED SAMPLER AT 21'	
25									

LOG OF TEST BORING 1-30806 PROTEKPARK.GPJ GEO TEST.GDT 9/13/13

LEGEND

SS - Split Spoon
AC - Auger Cuttings
UD/SL - Undisturbed Sleeve
AMSL - Above Mean Sea Level
CS - Continuous Sampler
UD - Undisturbed
ST - Shelby Tube

Stratification lines represent approximate boundaries between soil types. Transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurments were made.

GEO-TEST

Project: ProtekPark Solar Panel Canopies
Date: 08/26/2013 Project No: 1-30806
Elevation: Type: 6.5" OD HSA

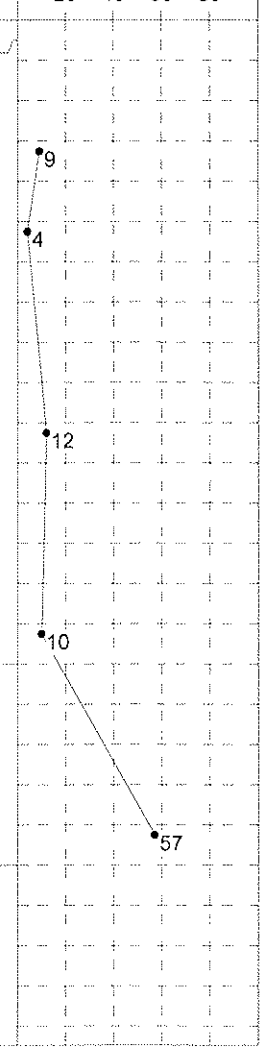
LOG OF TEST BORINGS

GROUNDWATER DEPTH

NO: 2

During Drilling: None After 24 Hours:

DEPTH (Ft)	LOG	SAMPLE INTERVAL	TYPE	N. BLOWS/FT	MOISTURE %	DRY DENSITY (pcf)	USC	DESCRIPTION
							ASPHALT	5" Asphalt
			SS	3-4-5 9	12		SC	CLAYEY SAND, fine to medium grained, some gravel, low plasticity, loose to medium dense, slightly moist to moist, tan
5			SS	3-2-2 4	10			
10			SS	6-6-6 12	7			
15			UD	3-5-5 10	10			
							SM	SILTY SAND, fine to coarse grained, non-plastic, very dense, slightly moist, red/brown
20			SS	18-26-31 57	3			
								STOPPED AUGER AT 19.5' STOPPED SAMPLER AT 21'
25								



LOG OF TEST BORING 1-30806 PROTEKPARK.GPJ GEO TEST.GDT 9/13/13

LEGEND

SS - Split Spoon
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GEO-TEST

Project: ProtekPark Solar Panel Canopies
Date: 08/26/2013 Project No: 1-30806
Elevation: Type: 6.5" OD HSA

LOG OF TEST BORINGS

GROUNDWATER DEPTH

NO: 3

During Drilling: None After 24 Hours:

DEPTH (Ft)	LOG	SAMPLE INTERVAL	TYPE	N. BLOWS/FT	MOISTURE %	DRY DENSITY (pcf)	USC	DESCRIPTION	N blows/ft (20 40 60 80)
							ASPHALT	5" Asphalt	
			UD	6-9-11 20	5		SM	SILTY SAND, fine to medium grained, non-plastic, medium denses, slightly moist, brown	20
5			SS	6-6-6 12	7		SC		12
10			SS	4-6-6 12	10		SC	CLAYEY SAND, fine to medium grained, low plasticity, medium dense, moist, brown * some gravel at 15'	12
15			SS	6-8-10 18	5		SC		18
20			SS	8-13-14 27	15		CL-ML	SANDY, SILTY CLAY, low plasticity, firm, moist, tan	27
								STOPPED AUGER AT 19.5' STOPPED SAMPLER AT 21' *Boring caved to 16'	
25									

LOG OF TEST BORING 1-30806 PROTEKPARK.GPJ GEO TEST.GDT 9/13/13

LEGEND

SS - Split Spoon
AC - Auger Cuttings
UD/SL - Undisturbed Sleeve
AMSL - Above Mean Sea Level
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GEO-TEST

Project: ProtekPark Solar Panel Canopies
Date: 08/26/2013 Project No: 1-30806
Elevation: Type: 6.5" OD HSA

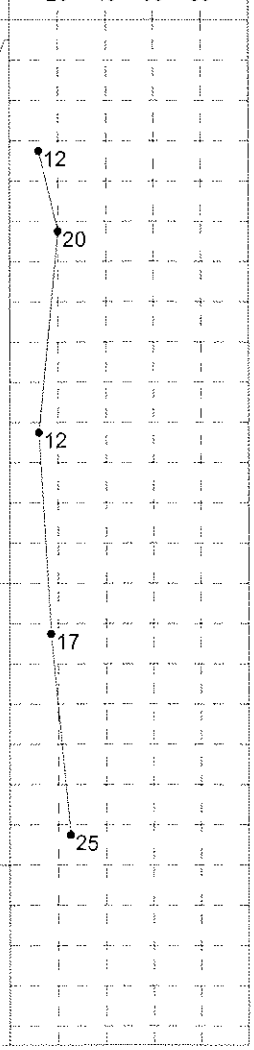
LOG OF TEST BORINGS

GROUNDWATER DEPTH

NO: 4

During Drilling: None After 24 Hours:

DEPTH (Ft)	LOG	SAMPLE INTERVAL	TYPE	N. BLOWS/FT	MOISTURE %	DRY DENSITY (pcf)	USC	DESCRIPTION
							ASPHALT	5" Asphalt
			SS	3-6-6 12	10		SC	CLAYEY SAND, fine to medium grained, medium plasticity, medium dense, moist, red/brown
5			UD	6-10-10 20	13			
10			SS	4-6-6 12	11			
15			SS	6-8-9 17	10		SM	SILTY SAND, medium to coarse grained, non-plastic, medium dense to dense, slightly moist to moist, red/brown
20			SS	10-12-13 25	4			
25								STOPPED AUGER AT 19.5' STOPPED SAMPLER AT 21' *Boring caved to 17.5'



LOG OF TEST BORING 1-30806 PROTEKPARK.GPJ GEO TEST.GDT 9/13/13

LEGEND

SS - Split Spoon
AC - Auger Cuttings
UD/SL - Undisturbed Sleeve
AMSL - Above Mean Sea Level
CS - Continuous Sampler
UD - Undisturbed
ST - Shelby Tube

Stratification lines represent approximate boundaries between soil types. Transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurments were made.

SUMMARY OF LABORATORY RESULTS

						SIEVE ANALYSIS PERCENT PASSING											
TEST HOLE	DEPTH (FEET)	UNIFIED CLASS	(%) MOIST	LL	PI	NO 200	NO 100	NO 40	NO 10	NO 4	3/8"	1/2"	3/4"	1"	1 1/2"	2"	4"
1	2.5		13.6														
1	4.5	SC	9.8	29	13	42	59	74	89	94	95	95	100				
1	9.5		21.1														
1	14.5		2.5														
1	19.5	CL-ML	10.4	24	7	61	73	85	97	99	100						
2	2.5		11.9														
2	4.5	SC	10.3	28	11	27	35	45	66	82	83	86	86	100			
2	9.5		7.2														
2	14.5	SC	10.0	23	8	43	54	67	86	91	94	94	100				
2	19.5		3.4														
3	2.5	SM	5.4	NP	NP	22	33	52	84	92	95	98	100				
3	4.5	SC	7.4	25	8	32	44	60	88	97	100						
3	9.5		10.0														
3	14.5	SC	4.7	24	8	18	23	31	64	80	88	89	100				
3	19.5		15.4														
4	2.5		10.0														
4	4.5	SC	13.3	40	24	44	55	67	83	90	93	95	100				
4	9.5		11.1														
4	14.5	SM	9.8	NP	NP	33	45	62	88	95	98	98	100				

GEO-TEST

LL = LIQUID LIMIT
PI = PLASTICITY INDEX
NP = NON PLASTIC or NO VALUE

Project: ProtekPark Solar Panel Canopies

Location: Santa Fe, New Mexico

Number: 1-30806

SUMMARY OF LABORATORY RESULTS

						SIEVE ANALYSIS PERCENT PASSING											
TEST HOLE	DEPTH (FEET)	UNIFIED CLASS	(%) MOIST	LL	PI	NO 200	NO 100	NO 40	NO 10	NO 4	3/8"	1/2"	3/4"	1"	1 1/2"	2"	4"
4	19.5		3.9														

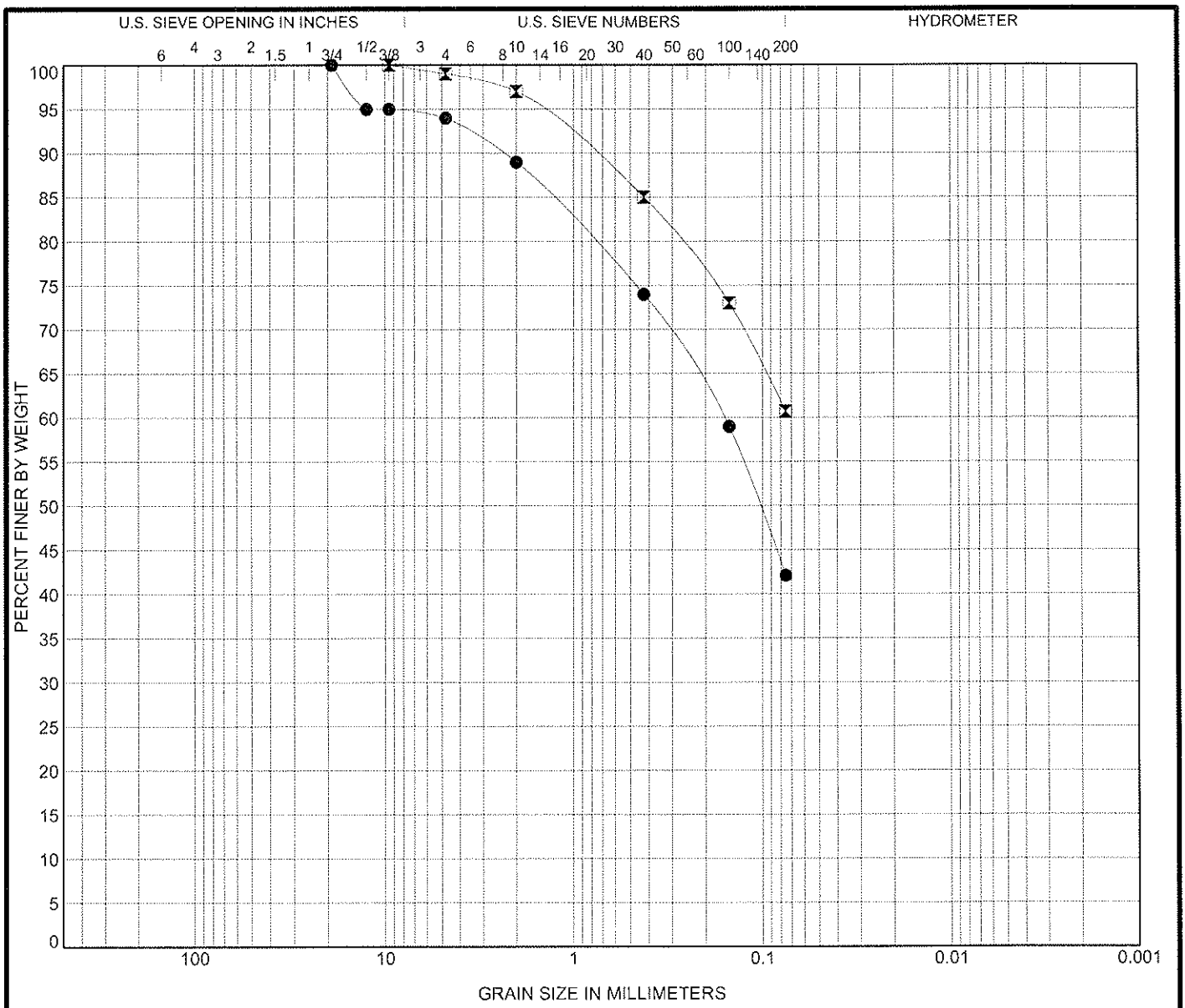
GEO-TEST

LL = LIQUID LIMIT
PI = PLASTICITY INDEX
NP = NON PLASTIC or NO VALUE

Project: ProtekPark Solar Panel Canopies

Location: Santa Fe, New Mexico

Number: 1-30806



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	1	4.5	**CLAYEY SAND(SC)**	**29**	**16**	**13**		
⧗	1	19.5	**SANDY SILTY CLAY(CL-ML)**	**24**	**17**	**7**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	1	4.5	19	0.161			6.0	51.9	42.1	
⧗	1	19.5	9.5				1.0	38.3	60.7	

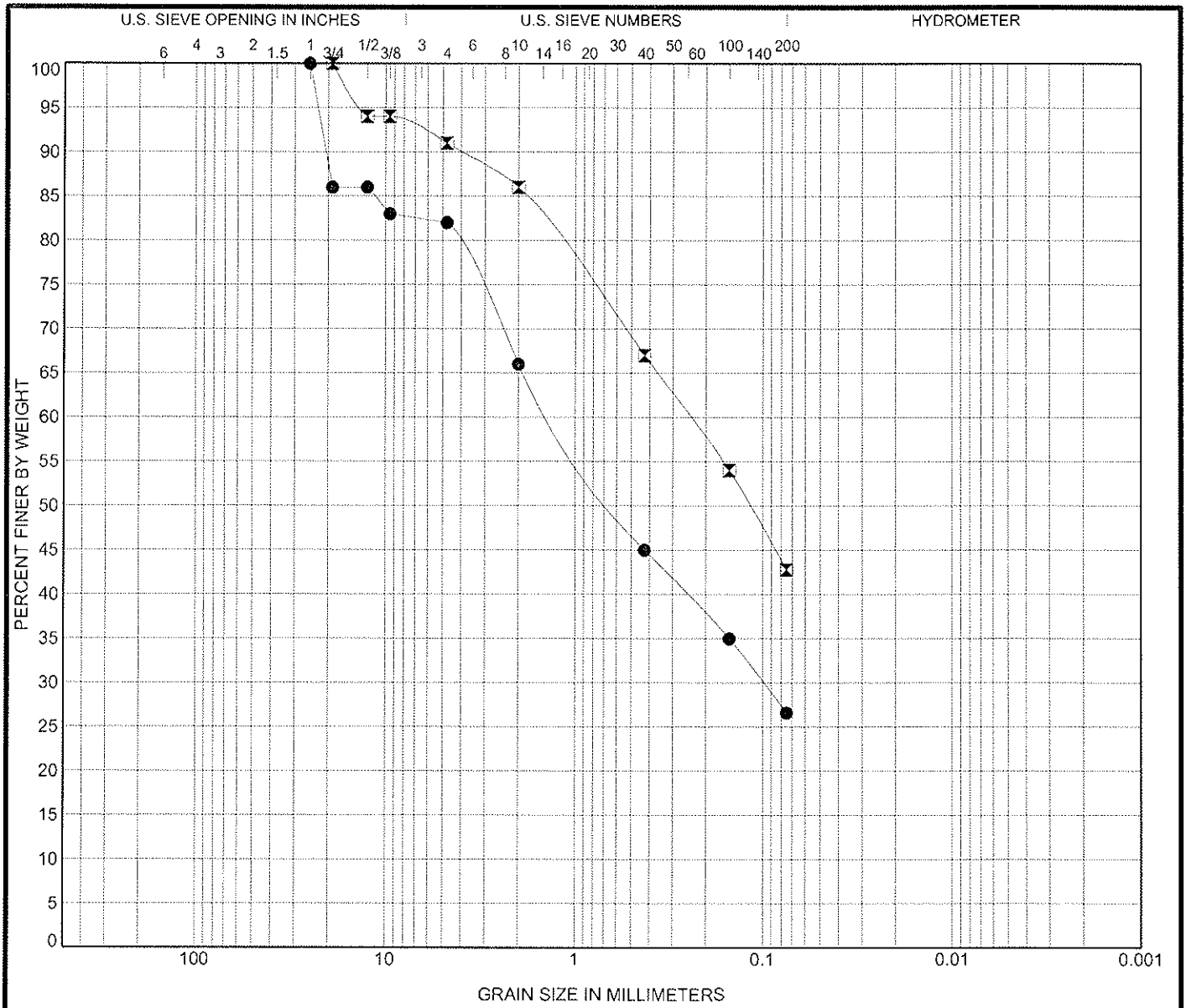
GEO-TEST

GRAIN SIZE DISTRIBUTION

Project: ProtekPark Solar Panel Canopies

Location: Santa Fe, New Mexico

Number: 1-30806



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	2	4.5	**CLAYEY SAND with GRAVEL(SC)**	**28**	**17**	**11**		
⧗	2	14.5	**CLAYEY SAND(SC)**	**23**	**15**	**8**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	2	4.5	**25**	**1.285**	**0.099**		**18.0**	**55.4**	**26.6**	
⧗	2	14.5	**19**	**0.243**			**9.0**	**48.2**	**42.8**	

GEO-TEST

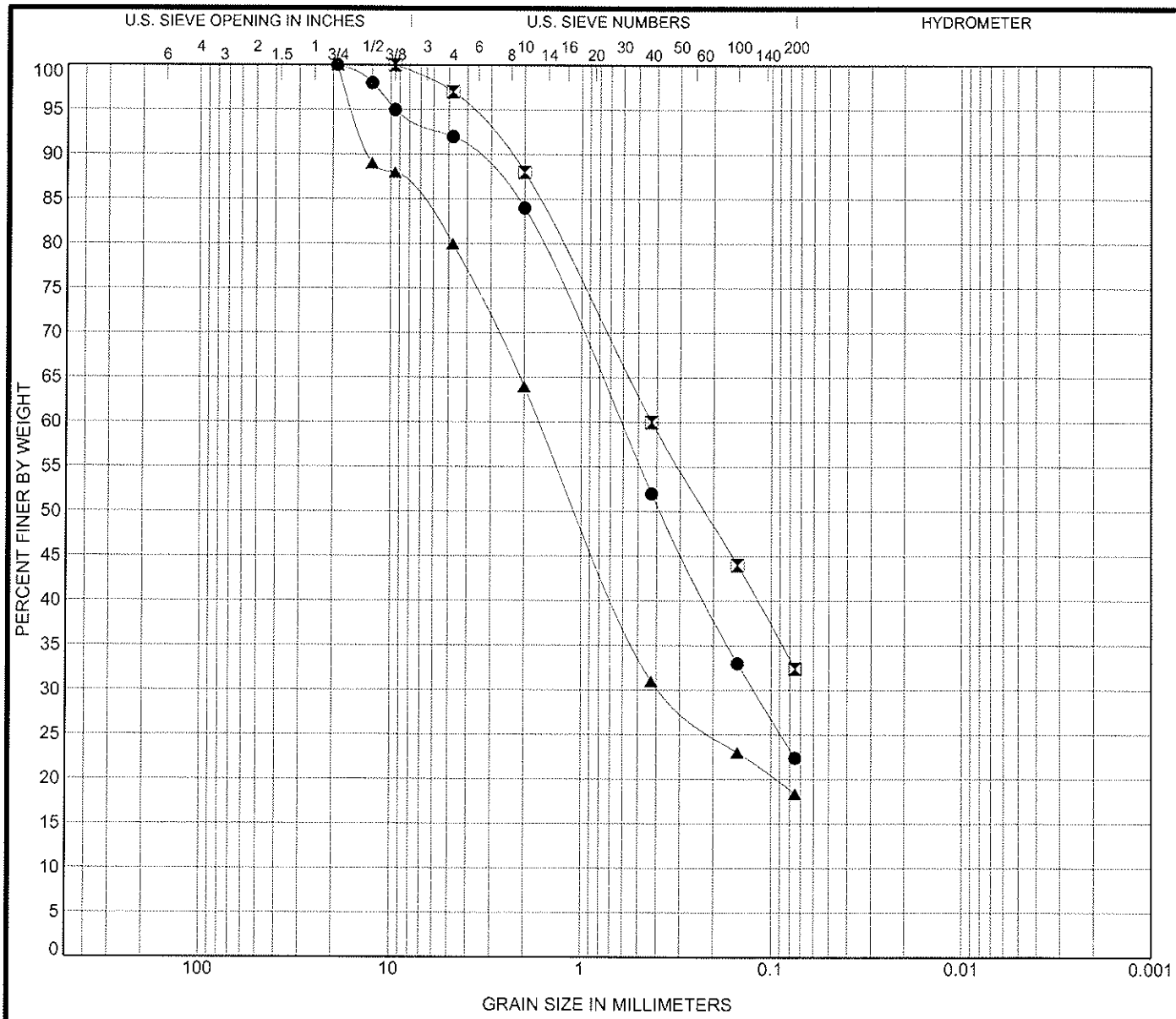
GRAIN SIZE DISTRIBUTION

Project: ProtekPark Solar Panel Canopies

Location: Santa Fe, New Mexico

Number: 1-30806

US GRAIN SIZE 1-30806 PROTEKPARK.GPJ GEO TEST.GDT 9/10/13



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	3	2.5	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		
⧗	3	4.5	**CLAYEY SAND(SC)**	**25**	**17**	**8**		
▲	3	14.5	**CLAYEY SAND with GRAVEL(SC)**	**24**	**16**	**8**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	3	2.5	**19**	**0.626**	**0.123**		**8.0**	**69.6**	**22.4**	
⧗	3	4.5	**9.5**	**0.425**			**3.0**	**64.6**	**32.4**	
▲	3	14.5	**19**	**1.658**	**0.373**		**20.0**	**61.6**	**18.4**	

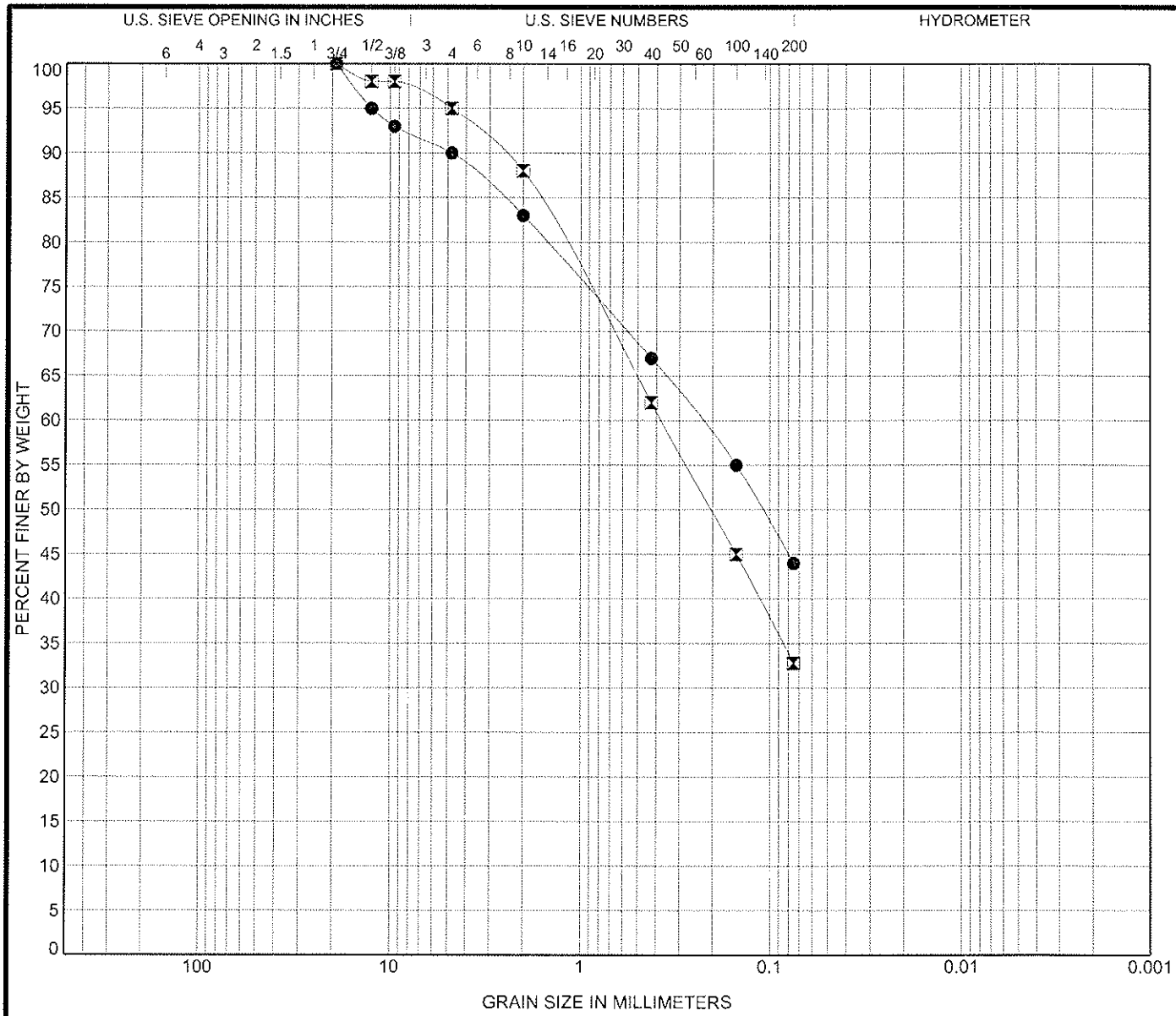
GEO-TEST

GRAIN SIZE DISTRIBUTION

Project: ProtekPark Solar Panel Canopies

Location: Santa Fe, New Mexico

Number: 1-30806



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	4	4.5	**CLAYEY SAND(SC)**	**40**	**16**	**24**		
⧗	4	14.5	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	4	4.5	**19**	**0.231**			**10.0**	**46.0**	**44.0**	
⧗	4	14.5	**19**	**0.376**			**5.0**	**62.2**	**32.8**	

GEO-TEST

GRAIN SIZE DISTRIBUTION

Project: ProtekPark Solar Panel Canopies

Location: Santa Fe, New Mexico

Number: 1-30806

September 24, 2013

DIRECT SHEAR (ASTM D-3080)

PROJECT: Protek Park Solar **PROJECT NO.:** 1-30806

LOCATION: 3

DEPTH: 2 1/2'

Device used in performance of the above referenced test, is a single shear device.

Soil Description:

Initial Moisture:	13.9 %	Initial Moisture:	%	Initial Moisture:	13.9 %
Initial Wet Unit Weight:	122.3 lbs/cuft	Initial Wet Unit Weight:	lbs/cuft	Initial Wet Unit Weight:	131.3 lbs/cuft
Initial Dry Unit Weight:	107.4 lbs/cuft	Initial Dry Unit Weight:	lbs/cuft	Initial Dry Unit Weight:	115.3 lbs/cuft
Initial thickness:	1 in.	Initial thickness:	1 in.	Initial thickness:	1 in.
Normal Stress:	1 KSF	Normal Stress:	2 KSF	Normal Stress:	4 KSF

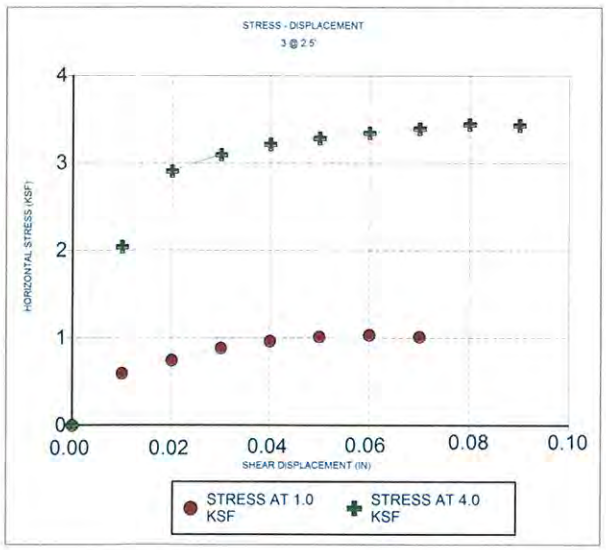
DIAL (IN)	RING DIV	STRESS (KSF)
0	0	0.000
0.01	55	0.597
0.02	70	0.746
0.03	84	0.885
0.04	92	0.965
0.05	97	1.015
0.06	99	1.035
0.07	97	1.015
0.08	0	0.0
0.09	0	0.0
0.1	0	0.0
0.11	0	0.0
0.12	0	0.0
0.13	0	0.0
0.14	0	0.0
0.15	0	0.0
0.16	0	0.0
0.17	0	0.0
0.18	0	0.0
0.19	0	0.0
0.2	0	0.0

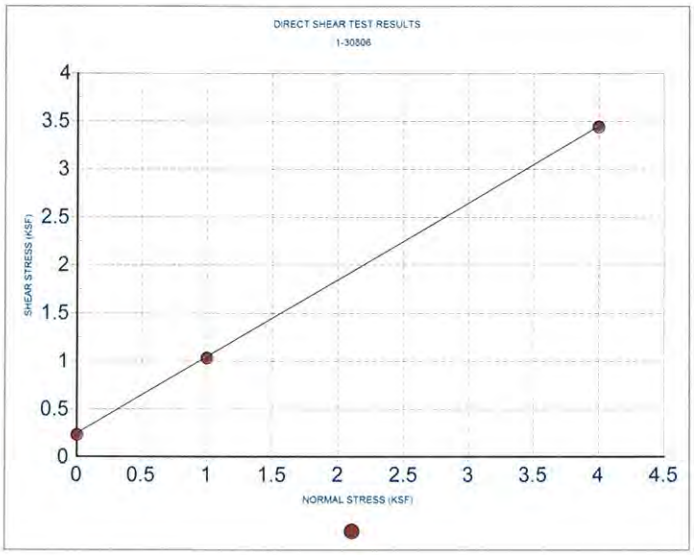
DIAL (IN)	RING DIV	STRESS (KSF)
0	0	0.0
0.01	0	0.0
0.02	0	0.0
0.03	0	0.0
0.04	0	0.0
0.05	0	0.0
0.06	0	0.0
0.07	0	0.0
0.08	0	0.0
0.09	0	0.0
0.1	0	0.0
0.11	0	0.0
0.12	0	0.0
0.13	0	0.0
0.14	0	0.0
0.15	0	0.0
0.16	0	0.0
0.17	0	0.0
0.18	0	0.0
0.19	0	0.0
0.2	0	0.0

DIAL (IN)	RING DIV	STRESS (KSF)
0	0	0.000
0.01	200	2.039
0.02	287	2.905
0.03	306	3.094
0.04	318	3.213
0.05	325	3.283
0.06	331	3.342
0.07	336	3.392
0.08	341	3.442
0.09	340	3.432
0.1	0	0.0
0.11	0	0.0
0.12	0	0.0
0.13	0	0.0
0.14	0	0.0
0.15	0	0.0
0.16	0	0.0
0.17	0	0.0
0.18	0	0.0
0.19	0	0.0
0.2	0	0.0

Angle of Internal Friction: **39 Degrees**

Cohesion: **0.23 KSF**





September 23, 2013

DIRECT SHEAR (ASTM D-3080)

PROJECT: Protek Park Solar **PROJECT NO.:** 1-30806

LOCATION: 2

DEPTH: 14 1/2'

Device used in performance of the above referenced test, is a single shear device.

Soil Description:

Initial Moisture:	11.9 %	Initial Moisture:	%	Initial Moisture:	11.9 %
Initial Wet Unit Weight:	114.4 lbs/cuft	Initial Wet Unit Weight:	lbs/cuft	Initial Wet Unit Weight:	123.9 lbs/cuft
Initial Dry Unit Weight:	102.2 lbs/cuft	Initial Dry Unit Weight:	lbs/cuft	Initial Dry Unit Weight:	110.7 lbs/cuft
Initial thickness:	1 in.	Initial thickness:	1 in.	Initial thickness:	1 in.
Normal Stress:	1 KSF	Normal Stress:	2 KSF	Normal Stress:	4 KSF

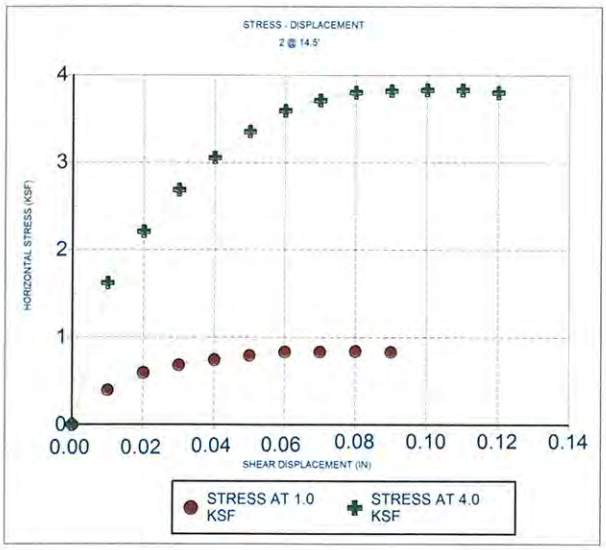
DIAL (IN)	RING DIV	STRESS (KSF)
0	0	0.000
0.01	35	0.398
0.02	55	0.597
0.03	64	0.686
0.04	70	0.746
0.05	75	0.796
0.06	79	0.836
0.07	79	0.836
0.08	80	0.846
0.09	79	0.836
0.1	0	0.0
0.11	0	0.0
0.12	0	0.0
0.13	0	0.0
0.14	0	0.0
0.15	0	0.0
0.16	0	0.0
0.17	0	0.0
0.18	0	0.0
0.19	0	0.0
0.2	0	0.0

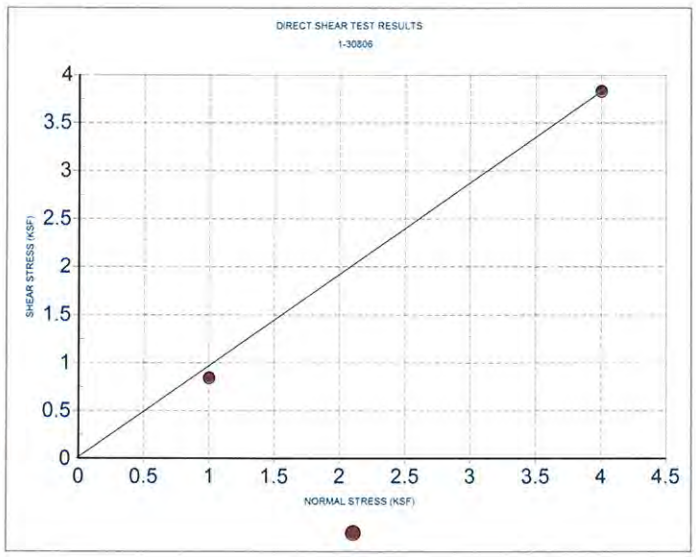
DIAL (IN)	RING DIV	STRESS (KSF)
0	0	0.0
0.01	0	0.0
0.02	0	0.0
0.03	0	0.0
0.04	0	0.0
0.05	0	0.0
0.06	0	0.0
0.07	0	0.0
0.08	0	0.0
0.09	0	0.0
0.1	0	0.0
0.11	0	0.0
0.12	0	0.0
0.13	0	0.0
0.14	0	0.0
0.15	0	0.0
0.16	0	0.0
0.17	0	0.0
0.18	0	0.0
0.19	0	0.0
0.2	0	0.0

DIAL (IN)	RING DIV	STRESS (KSF)
0	0	0.000
0.01	158	1.621
0.02	217	2.208
0.03	265	2.686
0.04	302	3.054
0.05	332	3.352
0.06	356	3.591
0.07	368	3.710
0.08	377	3.800
0.09	379	3.820
0.1	380	3.830
0.11	380	3.830
0.12	377	3.800
0.13	0	0.0
0.14	0	0.0
0.15	0	0.0
0.16	0	0.0
0.17	0	0.0
0.18	0	0.0
0.19	0	0.0
0.2	0	0.0

Angle of Internal Friction: **45 Degrees**

Cohesion: **-0.15 KSF**





APPENDIX A

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LPILE Plus for Windows, Version 5.0 (5.0.15)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

(c) 1985-2005 by Ensoft, Inc.
All Rights Reserved

==========

This program is licensed to:

Charles Miller
Geo-Test, Inc.

Path to file locations:	R:\Program Files\Ensoft\LpileP5\
Name of input data file:	H2O Div.lpd
Name of output file:	H2O Div.lpo
Name of plot output file:	H2O Div.lpp
Name of runtime file:	H2O Div.lpr

Time and Date of Analysis

Date: September 26, 2013 Time: 11:49:41

Problem Title

Water Div PV

Program Options

Units Used in Computations - US Customary Units, inches, pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 100

- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 180.00 in
Depth of ground surface below top of pile = .00 in
Slope angle of ground surface = .00 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	36.00000000	82448.0000	1018.0000	3834256.
2	180.0000	36.00000000	82448.0000	1018.0000	3834256.

Soil and Rock Layering Information

The soil profile is modelled using 1 layers

Layer 1 is silt with cohesion and friction
Distance from top of pile to top of layer = .000 in
Distance from top of pile to bottom of layer = 180.000 in
p-y subgrade modulus k for top of soil layer = 25.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 25.000 lbs/in**3

(Depth of lowest layer extends .00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Distribution of effective unit weight of soil with depth is defined using 2 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	.00	.06400
2	180.00	.06400

Shear Strength of Soils

Distribution of shear strength parameters with depth
defined using 2 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	.000	1.39000	30.00	.00700	.0
2	180.000	1.39000	30.00	.00700	.0

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Cyclic loading criteria was used for computation of p-y curves

Number of cycles of loading = 5000.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load Case Number 1

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head = 2400.000 lbs
Bending moment at pile head = 1214400.000 in-lbs
Axial load at pile head = 49500.000 lbs

Non-zero moment at pile head for this load case indicates the pile-head may rotate under the applied pile-head loading, but is not a free-head (zero moment) condition.

Computed Values of Load Distribution and Deflection for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Specified shear force at pile head = 2400.000 lbs
Specified moment at pile head = 1214400.000 in-lbs
Specified axial load at pile head = 49500.000 lbs

Non-zero moment for this load case indicates the pile-head may rotate under the applied pile-head loading, but is not a free-head (zero moment)condition.

Depth X	Deflect. y	Moment M	Shear V	Slope S	Total Stress	Soil Res p

in	in	lbs-in	lbs	Rad.	lbs/in**2	lbs/in
0.000	.270868	1214400.	2400.0000	-.0024486	313.7519	0.0000
1.800	.266467	1218938.	2389.2080	-.0024417	314.7426	-11.9910
3.600	.262078	1223436.	2357.1878	-.0024347	315.7247	-23.5870
5.400	.257702	1227858.	2304.6487	-.0024277	316.6899	-34.7898
7.200	.253338	1232166.	2232.2971	-.0024207	317.6304	-45.6009
9.000	.248987	1236325.	2140.8363	-.0024137	318.5386	-56.0222
10.800	.244649	1240303.	2030.9666	-.0024066	319.4069	-66.0553
12.600	.240324	1244066.	1903.3851	-.0023996	320.2284	-75.7019
14.400	.236011	1247583.	1758.7860	-.0023925	320.9963	-84.9639
16.200	.231711	1250824.	1597.8599	-.0023854	321.7038	-93.8428
18.000	.227423	1253760.	1421.2949	-.0023782	322.3449	-102.3405
19.800	.223149	1256364.	1229.7756	-.0023711	322.9134	-110.4588
21.600	.218888	1258610.	1023.9833	-.0023639	323.4037	-118.1993
23.400	.214639	1260472.	804.5966	-.0023568	323.8102	-125.5638
25.200	.210403	1261926.	572.2906	-.0023496	324.1277	-132.5540
27.000	.206180	1262951.	327.7373	-.0023424	324.3514	-139.1718
28.800	.201971	1263523.	71.6057	-.0023352	324.4765	-145.4189
30.600	.197774	1263624.	-195.4385	-.0023280	324.4985	-151.2969
32.400	.193590	1263235.	-472.7327	-.0023208	324.4134	-156.8078
34.200	.189419	1262336.	-759.6176	-.0023136	324.2173	-161.9532
36.000	.185261	1260912.	-1055.4368	-.0023064	323.9064	-166.7348
37.800	.181116	1258948.	-1359.5370	-.0022993	323.4775	-171.1544
39.600	.176984	1256428.	-1671.2683	-.0022921	322.9273	-175.2137
41.400	.172864	1253340.	-1989.9837	-.0022849	322.2531	-178.9145
43.200	.168758	1249671.	-2315.0393	-.0022778	321.4522	-182.2584
45.000	.164664	1245411.	-2645.7942	-.0022707	320.5222	-185.2471
46.800	.160583	1240551.	-2981.6107	-.0022636	319.4611	-187.8823
48.600	.156515	1235081.	-3321.8539	-.0022566	318.2669	-190.1657
50.400	.152459	1228994.	-3665.8921	-.0022496	316.9381	-192.0989
52.200	.148417	1222285.	-4013.0963	-.0022426	315.4732	-193.6835
54.000	.144386	1214947.	-4362.8406	-.0022357	313.8712	-194.9212
55.800	.140368	1206977.	-4714.5019	-.0022288	312.1312	-195.8136
57.600	.136363	1198372.	-5067.4600	-.0022219	310.2526	-196.3621
59.400	.132369	1189130.	-5421.0973	-.0022151	308.2349	-196.5683
61.200	.128388	1179250.	-5774.7993	-.0022084	306.0780	-196.4338
63.000	.124419	1168734.	-6127.9538	-.0022017	303.7821	-195.9601
64.800	.120462	1157582.	-6479.9515	-.0021951	301.3474	-195.1485
66.600	.116517	1145797.	-6830.1857	-.0021885	298.7746	-194.0006
68.400	.112583	1133383.	-7178.0520	-.0021820	296.0644	-192.5176
70.200	.108662	1120345.	-7522.9488	-.0021756	293.2179	-190.7011
72.000	.104751	1106689.	-7864.2767	-.0021693	290.2364	-188.5522
73.800	.100852	1092420.	-8201.4388	-.0021630	287.1213	-186.0723
75.600	.096964	1077549.	-8533.8404	-.0021568	283.8746	-183.2627
77.400	.093088	1062083.	-8860.8889	-.0021507	280.4981	-180.1246
79.200	.089222	1046033.	-9181.9942	-.0021447	276.9940	-176.6591
81.000	.085367	1029410.	-9496.5680	-.0021388	273.3649	-172.8674
82.800	.081522	1012226.	-9804.0241	-.0021330	269.6134	-168.7505
84.600	.077688	994496.	-10103.7782	-.0021273	265.7424	-164.3096
86.400	.073864	976232.	-10395.2479	-.0021217	261.7551	-159.5456
88.200	.070050	957451.	-10677.8526	-.0021162	257.6548	-154.4595
90.000	.066245	938169.	-10951.0132	-.0021108	253.4452	-149.0523
91.800	.062451	918403.	-11214.1524	-.0021055	249.1300	-143.3247
93.600	.058666	898173.	-11466.6945	-.0021003	244.7134	-137.2776
95.400	.054890	877497.	-11708.0650	-.0020953	240.1995	-130.9118
97.200	.051123	856397.	-11937.6909	-.0020903	235.5929	-124.2281
99.000	.047364	834894.	-12155.0004	-.0020855	230.8984	-117.2270
100.800	.043615	813011.	-12359.4230	-.0020808	226.1208	-109.9092
102.600	.039873	790771.	-12550.3892	-.0020763	221.2654	-102.2754
104.400	.036140	768199.	-12727.3304	-.0020718	216.3376	-94.3260
106.200	.032415	745322.	-12889.6792	-.0020675	211.3430	-86.0615
108.000	.028697	722165.	-13036.8686	-.0020633	206.2874	-77.4823

109.800	.024987	698757.	-13168.3327	-.0020593	201.1769	-68.5889
111.600	.021284	675126.	-13283.5060	-.0020554	196.0179	-59.3815
113.400	.017587	651303.	-13381.8238	-.0020516	190.8167	-49.8605
115.200	.013898	627317.	-13462.7216	-.0020480	185.5803	-40.0260
117.000	.010215	603202.	-13525.6353	-.0020445	180.3154	-29.8782
118.800	.006538	578989.	-13570.0014	-.0020411	175.0293	-19.4174
120.600	.002867	554713.	-13595.2562	-.0020379	169.7295	-8.6435
122.400	-.000798	530409.	-13600.8362	-.0020348	164.4234	2.4434
124.200	-.004458	506113.	-13586.1782	-.0020318	159.1190	13.8433
126.000	-.008113	481861.	-13550.7187	-.0020290	153.8244	25.5562
127.800	-.011763	457692.	-13493.8940	-.0020263	148.5478	37.5823
129.600	-.015408	433644.	-13415.1404	-.0020238	143.2977	49.9217
131.400	-.019049	409758.	-13313.8939	-.0020214	138.0829	62.5745
133.200	-.022685	386074.	-13189.5900	-.0020191	132.9123	75.5410
135.000	-.026317	362635.	-13041.6638	-.0020170	127.7951	88.8214
136.800	-.029946	339484.	-12869.5502	-.0020150	122.7407	102.4160
138.600	-.033571	316664.	-12672.6831	-.0020131	117.7587	116.3252
140.400	-.037194	294221.	-12450.4962	-.0020114	112.8589	130.5492
142.200	-.040813	272201.	-12202.4223	-.0020098	108.0515	145.0885
144.000	-.044429	250650.	-11927.8935	-.0020083	103.3466	159.9435
145.800	-.048042	229618.	-11626.3413	-.0020069	98.7549	175.1145
147.600	-.051654	209153.	-11297.1963	-.0020057	94.2870	190.6021
149.400	-.055263	189306.	-10939.8883	-.0020045	89.9539	206.4068
151.200	-.058870	170127.	-10553.8462	-.0020035	85.7667	222.5289
153.000	-.062476	151669.	-10138.4981	-.0020026	81.7370	238.9690
154.800	-.066079	133985.	-9693.2713	-.0020018	77.8763	255.7275
156.600	-.069682	117130.	-9217.5919	-.0020011	74.1965	272.8051
158.400	-.073283	101158.	-8710.8854	-.0020005	70.7096	290.2021
160.200	-.076884	86127.0929	-8172.5763	-.0019999	67.4280	307.9191
162.000	-.080483	72093.4561	-7602.0883	-.0019995	64.3642	325.9565
163.800	-.084082	59115.8818	-6998.8440	-.0019991	61.5309	344.3149
165.600	-.087680	47253.8579	-6362.2654	-.0019988	58.9412	362.9946
167.400	-.091277	36567.9126	-5691.7736	-.0019986	56.6082	381.9962
169.200	-.094875	27119.6163	-4986.7892	-.0019984	54.5455	401.3199
171.000	-.098472	18971.5829	-4246.7316	-.0019982	52.7666	420.9662
172.800	-.102068	12187.4703	-3471.0202	-.0019982	51.2855	440.9354
174.600	-.105665	6831.9823	-2659.0734	-.0019981	50.1163	461.2277
176.400	-.109262	2970.8687	-1810.3093	-.0019981	49.2734	481.8435
178.200	-.112858	670.9264	-924.1456	-.0019981	48.7712	502.7828
180.000	-.116455	0.0000	0.0000	-.0019981	48.6248	524.0457

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection	=	.27086817	in
Computed slope at pile head	=	-.00244858	
Maximum bending moment	=	1263624.	lbs-in
Maximum shear force	=	-13600.83624	lbs
Depth of maximum bending moment	=	30.60000000	in
Depth of maximum shear force	=	122.40000	in
Number of iterations	=	5	
Number of zero deflection points	=	1	

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment, y = pile-head displacment in
Type 2 = Shear and Slope, M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness, V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment, S = Pile-head Slope, radians
Type 5 = Deflection and Slope, R = Rot. Stiffness of Pile-head in-lbs/rad

Load Type	Boundary Condition 1	Boundary Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
1	V= 2400.000	M= 1.21E+06	49500.0000	.2708682	1263624.	-13600.8362

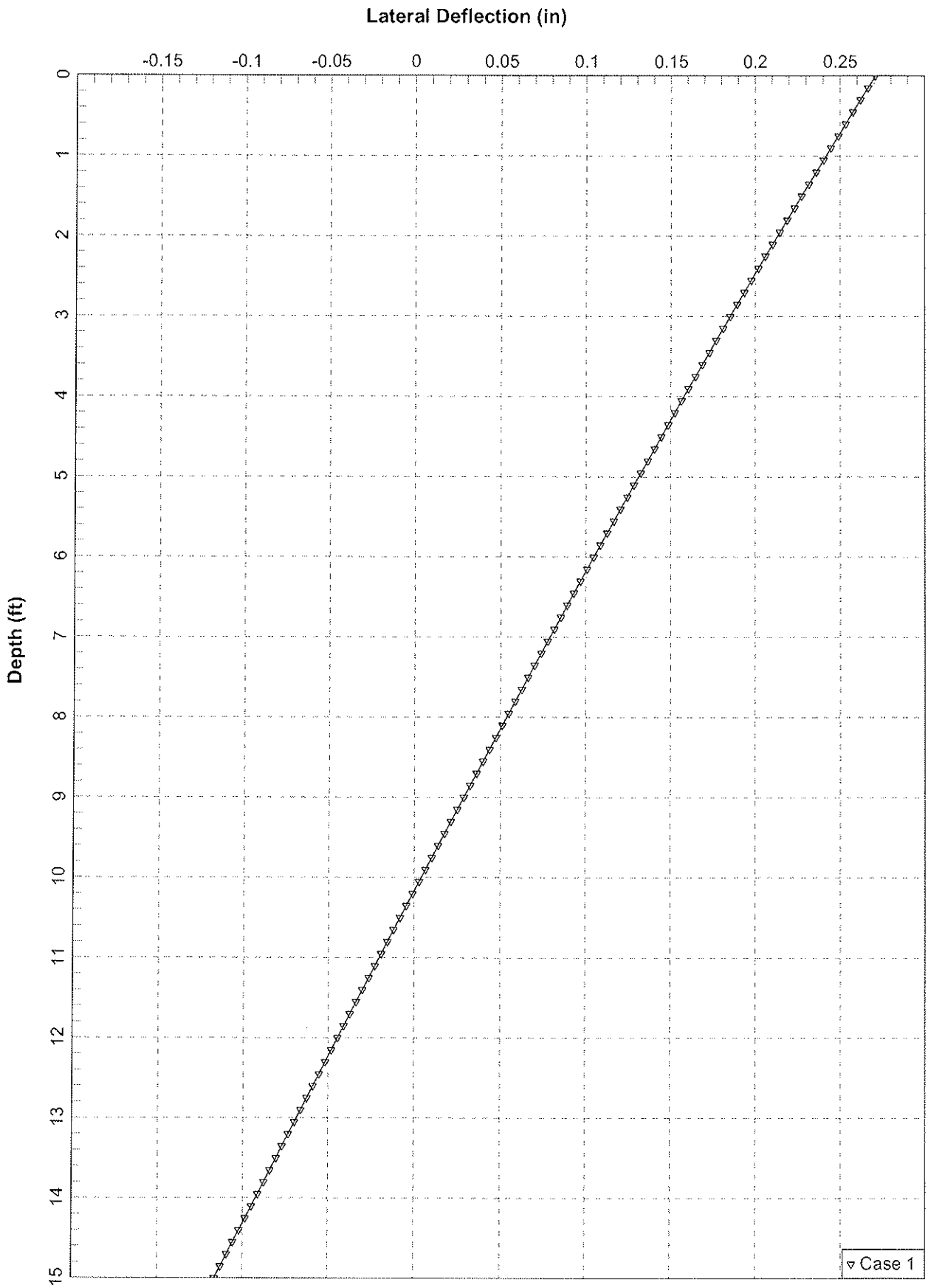
Pile-head Deflection vs. Pile Length

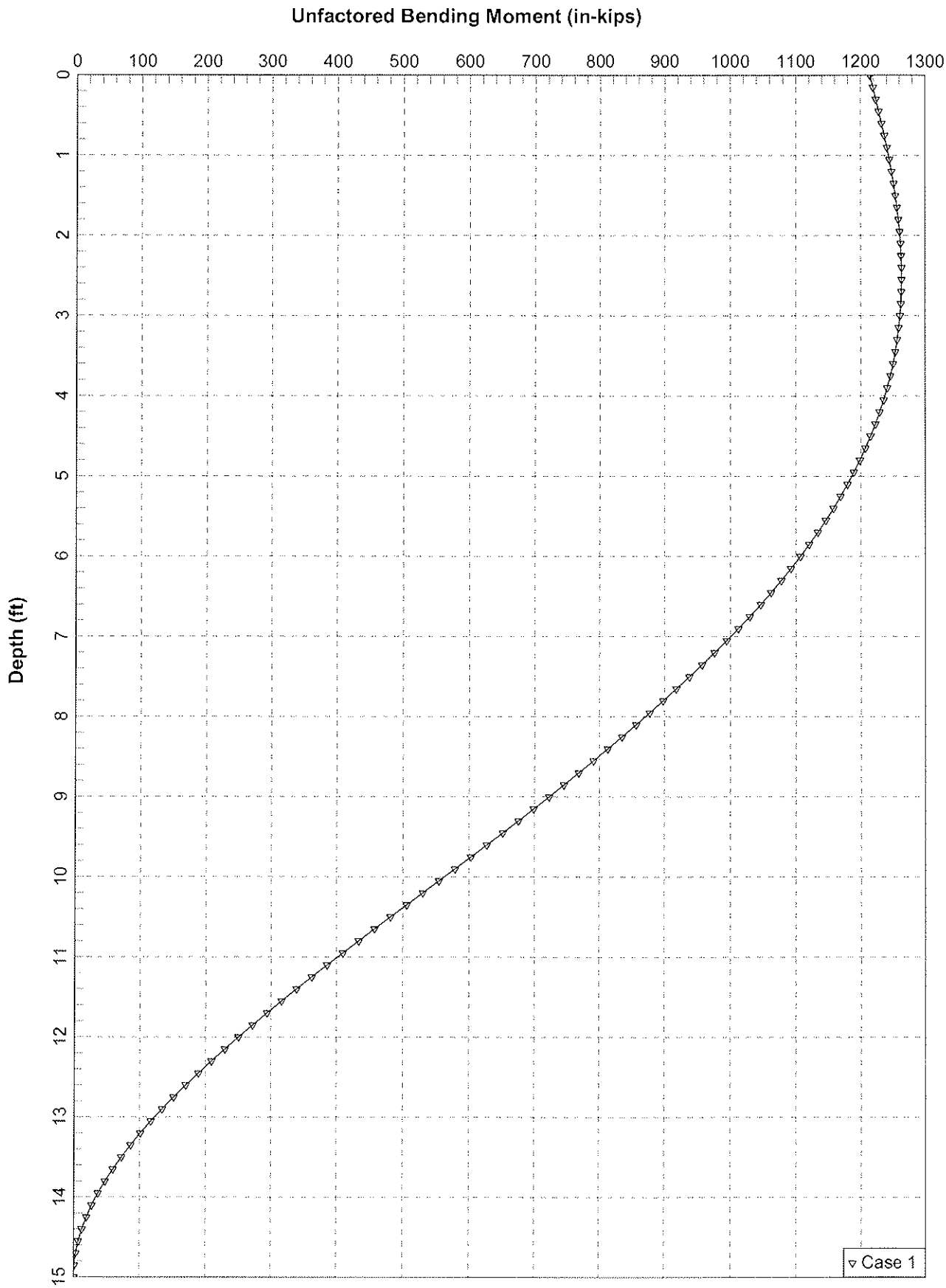
Boundary Condition Type 1, Shear and Moment

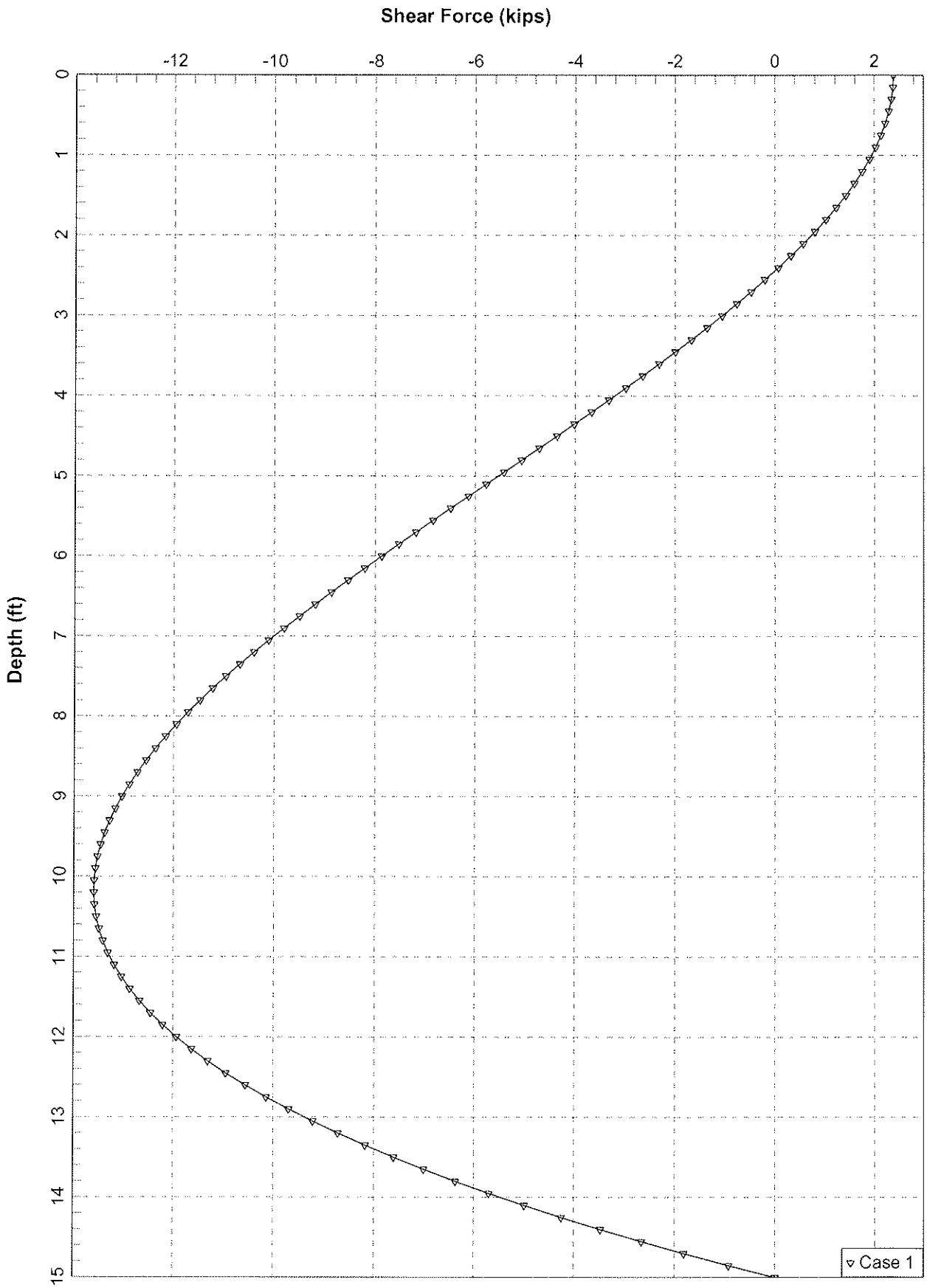
Shear = 2400. lbs
Moment = 1214400. in-lbs
Axial Load = 49500. lbs

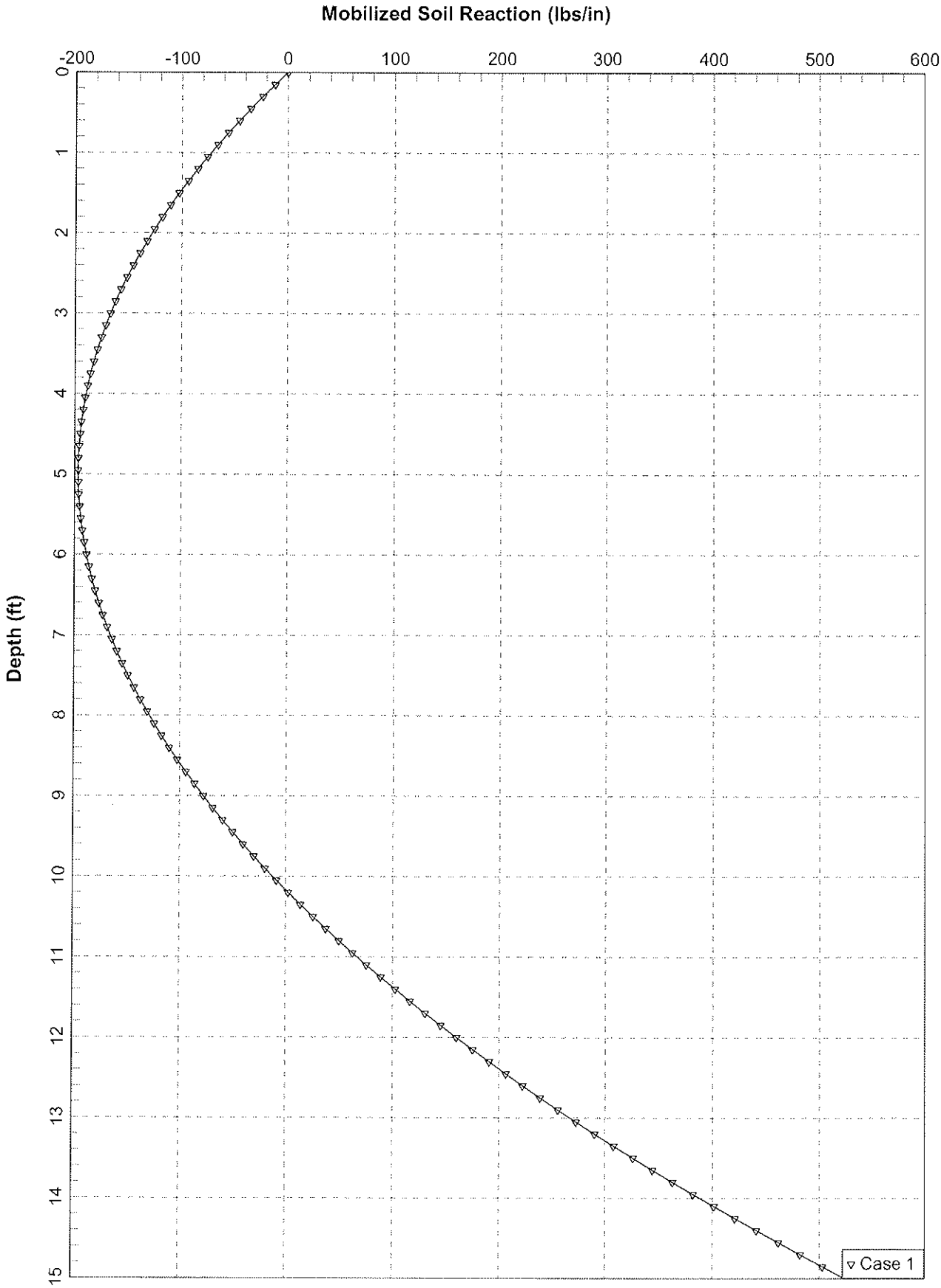
Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
180.000	.27086817	1263624.	-13600.83624
171.000	.30950992	1260909.	-14292.79532
162.000	.35749154	1258353.	-15063.46329
153.000	.41773839	1255893.	-15930.12739
144.000	.49438854	1253581.	-16915.40367
135.000	.59344007	1251503.	-18049.64379
126.000	.72383794	1249817.	-19374.83276
117.000	.89937989	1248578.	-20951.20683
108.000	1.14223819	1248013.	-22869.14509
99.000	1.65940188	1252073.	-26404.63865

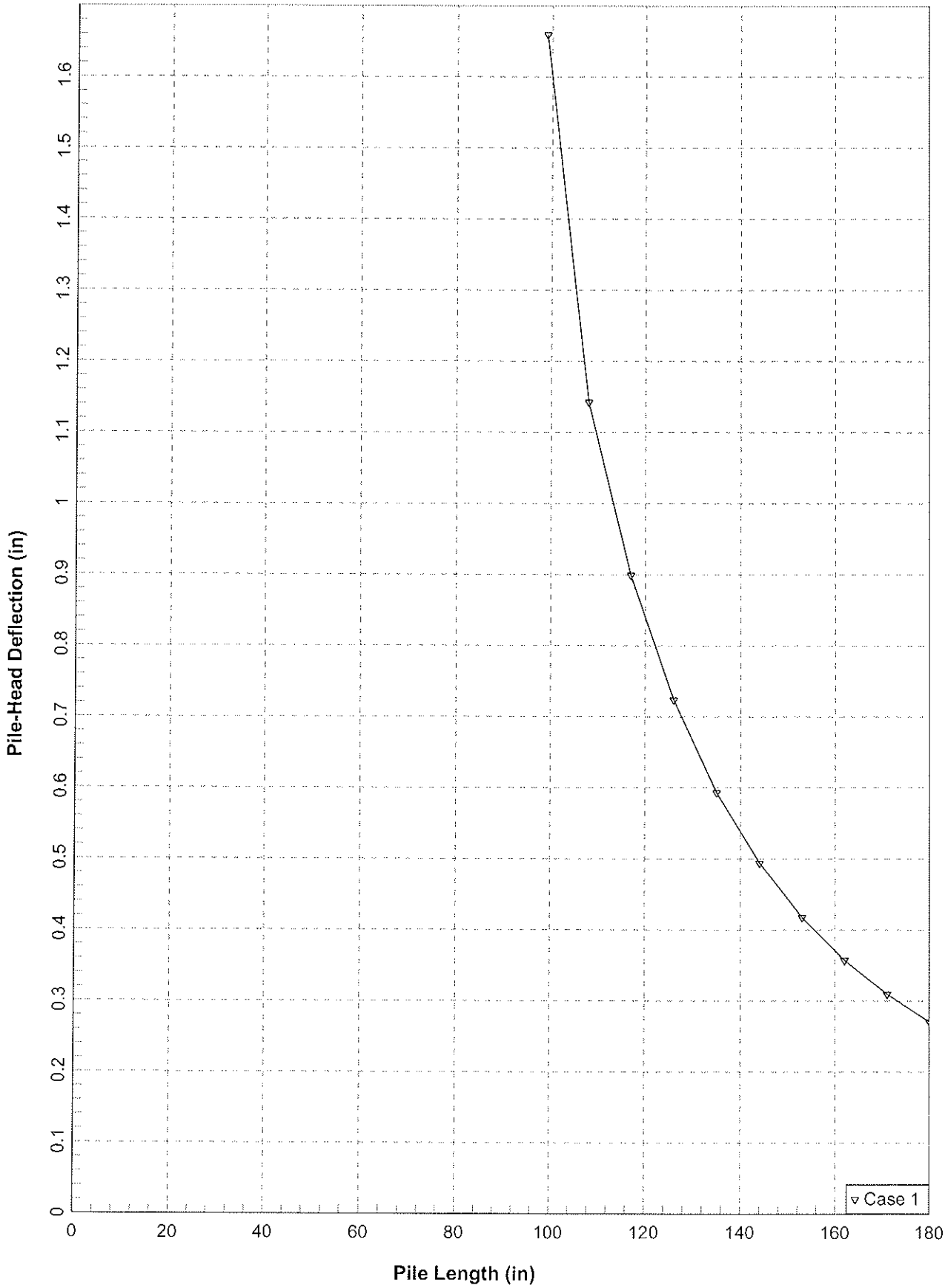
The analysis ended normally.


Lateral Deflection (in)
-0.15
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Case 1


Unfactored Bending Moment (in-kips)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Case 1


Shear Force (kips)
-12
-10
-8
-6
-4
-2
0
2
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Case 1


Mobilized Soil Reaction (lbs/in)
-200
-100
0
100
200
300
400
500
600
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Case 1


Pile-Head Deflection (in)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
0
20
40
60
80
100
120
140
160
180
Pile Length (in)
Case 1