AP - 111

EVAPORATION PONDS

NEW MEXICO
ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6313
Phone (505) 476-6000 Fax (505) 476-6030
www.env.nm.gov

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

APR 0 3 2020

John Moore
Environmental Superintendent
Western Refining, Southwest Inc., Gallup Refinery
92 Giant Crossing Road
Gallup, New Mexico 87301

RE: APPROVAL WITH MODIFICATIONS
GEOTECHNICAL ENGINEERING REPORT
WESTERN REFINING SOUTHWEST INC., GALLUP REFINERY
EPA ID # NMD000333211
HWB-WRG-20-001

Dear Mr. Moore:

The New Mexico Environment Department (NMED) has reviewed the *Geotechnical Engineering Report* (Report), dated January 7, 2020, submitted on behalf of Marathon Petroleum Company dba Western Refining Southwest Inc., Gallup Refinery (the Permittee). The Report is generally acceptable; however, several technical deficiencies are identified in the Report. NMED hereby issues this Approval with Modifications with the attached comments.

The Permittee must address all comments in the attachment and submit a response letter, and replacement pages no later than **August 17, 2020**.

This approval is based on the information presented in the document as it relates to the objectives of the work identified by NMED at the time of review. Approval of this document does not constitute agreement with all information or every statement presented in the document.

If you have questions regarding this Approval with Modifications, please contact Michiya Suzuki of my staff at 505-476-6046.

Sincerely,

Kevin Pierard
Chief
Hazardous Waste Bureau

cc: D. Cobrain, NMED HWB
M. Suzuki, NMED HWB
C. Chavez, OCD
L. King, EPA Region 6 (6LCRRC)
B. Moore, WRG

File: Reading File and WRG 2020 File
HWB-WRG-20-001

Attachment

Comment 1
In the Project Description Section, page 1, the Permittee states, "[t]he ponds are apparently lined with a synthetic HDPE or compacted clay liner." Previous information indicates that ponds are lined with compacted clay rather than HDPE. Explain which ponds are lined with a synthetic HDPE, if any, in a response letter.

Comment 2
In the Geotechnical Characterization Section, *Subsurface Profile,* page 4, the Permittee states, "[m]ost pertinent to the geotechnical engineering analyses discussed later in this report, are the results of the consolidated drained triaxial shear tests and unconfined compression strength tests conducted on relatively undisturbed samples obtained from the test borings." The method used to determine the shear strength was not appropriate. Typically, three specimens of the same soil are tested over a range of normal or effective stresses which would be present along potential failure surfaces to define the strength envelope. To bracket this range for a 13-foot-high embankment, an additional confining stress greater than five pounds per square inch (psi) would be necessary. Although the Permittee used conservative strength properties relative to literature values for similar materials, if water levels vary or rise in the piezometers, then stability analyses will need to be rerun, and more accurate strength values will need to be determined. In this case, consolidated undrained triaxial tests with pore water pressure measurements must be run with three specimens of the same soil collected from the same cross-section. This would require the collection of new undisturbed samples. Acknowledge the provision in the response letter. No other action is required.

In addition, NMED does not agree with using unconfined (zero confining stress) compression strength tests to determine effective cohesion (c') because those tests are normally used to determine total stress cohesion – to be used in total stress (short term/end of construction) analyses with friction angle (phi') equal zero. In the event that shear strength needs to be reevaluated, c' must be determined using the consolidated undrained triaxial test with pore water pressure measurements.

Comment 3
In the Geotechnical Characterization Section, *Subsurface Profile,* page 5, the Permittee states, "[u]sing the lowest unconfined compression strength test result, the combined Mohr envelope, and Table 5.1, the following Mohr-Coulomb strength parameters were conservatively developed for use in modeling the subsurface stratigraphy for the stability analyses." The unit weight of 115 pounds per cubic foot (pcf) was used for the "fat clay" in the stability analysis. However, the unit weight must be calculated based on the soil moisture content and dry density in Appendix B, *Laboratory Testing,* Exhibits B-10 through B-23. The unit weight of the soil is averaged as 123 pcf. It is more appropriate to conduct the slop stability analysis using the results acquired from laboratory tests. Rerun the stability analysis using the soil unit weight as determined by the laboratory tests. Provide replacement pages, where applicable.

Comment 4
In the Stability Evaluation Section, *Stability Modeling,* page 7, the Permittee states, "[a]n assumed traffic live load of 150 psf was applied to the crest of each embankment and section to simulate maintenance truck traffic that may be encountered during the lifetime of the structures." It is not clear how the live load value of 150 psf was used. Provide a reference for the value in the response letter.

Comment 5
In Appendix B, *Laboratory Testing,* Exhibits B-10 through B-23 are labeled as both Consolidated Drawing Triaxial Compression Tests and Unconfined Compression Strength. Clarify which test was performed on the samples in the response letter.

Comment 6
In Appendix C, *Piezometer Readings,* Exhibits C-2 and C-3 present water levels in piezometers installed along Ponds 6, 7, and 9. Piezometer readings in Pond 6 increased significantly between September 16, 2019 and December 11, 2019. Issues associated with the increase of the water level in Pond 6 must be addressed. The following sequence of corrective measures must be taken:

a. Pond 6 piezometer reading must continue to be monitored. If piezometer readings continue to rise, it is likely that the minimum factor of safety will no longer be attainable. Therefore, Pond 6 piezometers must continue to be measured until piezometer readings stabilize.
b. If piezometer readings rise, stability analyses must be rerun to determine whether a static factor of safety of 1.5 and a seismic factor of safety of 1.13 are still attained.
c. If stability analyses are rerun and the static factor of safety is calculated to be less than 1.5 or a seismic factor of safety is less than 1.13, embankment soil strength must be evaluated using the method prescribed in Comment 2 above.

Collect piezometer readings quarterly and report them in future annual periodic groundwater reports. In addition, provide a discussion regarding the necessity of conducting the analyses in the reports.

Comment 7
In Appendix D, *Slope Stability Analyses,* Exhibit D-3 indicates that there is minimal freeboard at Pond 7; the pond water level is nearly at the crest elevation. Inadequate freeboard could result in overtopping during a storm event. Breaching and instability caused by erosion may result from overtopping, regardless of the acceptable stability analyses factors of safety. Evaluate whether current water levels provide adequate freeboard and provide a discussion in the response letter.

Comment 8

The Report does not discuss the situation where rapid drawdown is employed during site operations (e.g., pond cleanout). If rapid drawdown is expected to occur, a rapid drawdown analysis must be conducted to evaluate the stability of interior slopes. Under rapid drawdown conditions, the rate of dissipation of pore water pressures in the embankment soils, which have developed under long term, steady state conditions, cannot keep pace with the lowering of the pond level. This results in excess pore pressures in the embankment that are likely to reduce embankment stability below that of long term, steady state conditions. In the response letter, explain whether site operations that employ rapid drawdown are scheduled in near future. If such events are scheduled, rapid drawdown analysis must be conducted prior to executing the operations and the results submitted to NMED for review.

Geotechnical Engineering Report

Marathon Petroleum Company Gallup Refinery
Evaporation Pond Nos. 6, 7 and 9
Gallup, New Mexico
January 7, 2020
Terracon Project No. 66195049

Prepared for:
Marathon Petroleum Corporation
Jamestown, New Mexico

Prepared by:
Terracon Consultants, Inc.
Tempe, Arizona

January 7, 2020

Marathon Petroleum Corporation
92 Giant Crossing Road
Jamestown, New Mexico 87347

Attn: Mr. Brian Moore
P: (505) 299 0942
E: BMoore1@marathonpetroleum.com

Re: **Geotechnical Engineering Report**
Marathon Petroleum Company Gallup Refinery
Evaporation Pond Nos. 6, 7 and 9
92 Giant Crossing Road
Gallup, New Mexico
Terracon Project No. 66195049

Dear Mr. Moore:

Terracon Consultants, Inc. (Terracon) has completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. P66195049 dated March 11, 2019. This report presents the findings of the subsurface exploration and provides geotechnical engineering results and opinions concerning the current configuration and stability of the evaporation pond side slopes for the project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

DONALD R. CLARK REGISTERED 6466 PROFESSIONAL ENGINEER STATE OF NEW MEXICO

Donald R. Clark, P.E.
Sr. Principal / Sr. Consultant

Brittany J. Dalton, P.E.
Project Engineer

Copies to: Addressee (1 via email)

REPORT TOPICS

ATTACHMENTS

Exhibit No.

REPORT SUMMARY

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering evaluation for Evaporation Ponds 6, 7 and 9 at the existing Marathon Petroleum Refinery in Gallup, New Mexico. The geotechnical scope of work included the advancement of 9 test borings and 10 piezometer borings to depths ranging from 7 to 36.5 feet below existing site grade, installation of piezometers, laboratory testing on representative samples of the subsurface materials, numerical slope stability modeling and analyses, and development of engineering opinions concerning the stability of the existing evaporation pond embankment slopes.

Based on the information generated and gathered during the course of this geotechnical engineering evaluation and subject to the limitations and precautions outlined in this report, the following key items have been identified and considered for the project:

- The Marathon Petroleum Company Gallup Refinery is located approximately 18 miles east from the center of the City of Gallup. The entire refinery property is approximately one square mile. Located within the property limits of the refinery are thirteen (13) evaporation ponds designated as Pond 1 through Pond 12B. The embankments forming each pond have heights ranging from approximately 12 to 15 feet with variable side slopes of approximately 3H:1V. The ponds are lined with HDPE or clay. We understand portions of the embankment on Pond 7 experienced a breach in past years.

- The majority of the subsurface soils encountered to the depths of the borings within the existing embankments from within Ponds 6, 7 and 9 consist of fat clays with intermittent layers of sandy/silty lean clay. Laboratory test results indicate the clay soils exhibit high plasticity characteristics.

- The piezometer data indicates that existing water levels at some piezometer locations range from approximately 1.7 feet to 7 feet below the ground surface at the location of the test borings.

- Numerical slope stability modeling and analyses based on the data generated from this geotechnical engineering evaluation indicate the embankment slopes at Evaporation Ponds 6, 7 and 9 are currently stable. Minimum Factors of Safety against slope instability determined from the modeling range from 1.51 to 3.0 under static conditions and from approximately 1.2 to 2.3 under seismic conditions. Detailed discussion concerning these results are provided in the report.

This report summary should be used in conjunction with the entire report for further evaluation purposes. It should be recognized that specific details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled General Comments should be read for an understanding of the report limitations.

Geotechnical Engineering Report

Marathon Petroleum Company Gallup Refinery

92 Giant Crossing Road

Gallup, New Mexico

Terracon Project No. 66195049

January 7, 2020

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering evaluation services performed for the existing Evaporation Pond Nos. 6, 7 & 9 located at the existing Marathon Petroleum Company Gallup Refinery in Gallup, New Mexico. The purpose of our geotechnical engineering services for this project was to assess the existing slope configurations and geotechnical engineering conditions at specific locations along the embankments of the existing Evaporation Pond Nos. 6, 7 & 9. The geotechnical engineering evaluation and the opinions contained in this report have been based on topographic conditions and the results of geotechnical exploration completed at the selected cross sections outlined in the Work Plan Submittal – Updated Slope Stability Modeling Evaporation Ponds prepared by Axis Group dated November, 2018.

The geotechnical engineering Scope of Services for this project included the advancement of nineteen (19) test borings to depths ranging from approximately 7 to 36.5 feet below existing site grades at locations of the selected sections for the project. Piezometers were installed in ten (10) of the nineteen (19) borings.

Maps showing the site and boring locations are included in **Appendix A**. The results of the laboratory testing performed on selected soil samples obtained from the site during the field exploration are summarized in part on the boring logs and are presented in graphical and tabular form in **Appendix B**. Piezometer data is included in **Appendix C**. The results of the numerical modeling and stability analyses conducted as part of our geotechnical engineering evaluation are included in **Appendix D**.

PROJECT DESCRIPTION

The Marathon Petroleum Company Gallup Refinery is located approximately 18 miles east from the center of the City of Gallup. The entire Refinery property is approximately one square mile. There are thirteen (13) evaporation ponds designated as Pond 1 through Pond 12B located within the limits of the refinery property. Each pond has an embankment height ranging from approximately 12 to 15 feet. Existing embankment side slopes are approximately 3H:1V. The ponds are apparently lined with a synthetic HDPE or compacted clay liner. We understand that portions of the embankments forming Pond 7 experienced a breach in the recent past.

In November of 2018, Axis Group prepared a document titled ***Work Plan Submittal – Updated Slope Stability Modeling Evaporation Ponds***, referred to as the Axis Work Plan, which formed the basis for this preparation and completion of this geotechnical engineering report. The Axis Work Plan submittal was in response to a previous letter titled ***Approval with Modifications Revised Letter Report Evaporation Pond Dike Breach and Summary Report Evaporation Ponds Repairs*** prepared by the New Mexico Environmental Department Hazardous Waste Bureau (NMED) on August 22, 2017. It is our understanding that this letter included prior slope stability analyses with data from temporary drive point piezometers that were abandoned during ongoing berm improvement activities. The Axis Work Plan was submitted to outline the proposed updated stability analyses and field investigation activities.

According to the Axis Work Plan, the proposed geotechnical engineering work scope was to include the following:

- Installation of 10 new piezometers;
- Testing of representative soil samples to provide engineering properties and geotechnical parameters for stability modeling and analyses; and,
- Updated numerical slope stability analysis

This geotechnical work by Terracon was completed in direct response to, and in general accordance with the Axis Work plan. This geotechnical engineering report provides the results of the geotechnical engineering evaluation completed by Terracon for this project.

SITE CONDITIONS

The following description of site conditions is derived from our site reconnaissance in association with the field exploration and our review of the provided topographic maps of the project site.

Item	Description
Parcel Information	The refinery property and project site is located at 92 Giant Crossing Road in Gallup, New Mexico.
Existing Improvements	The refinery facility currently has a total of 13 existing evaporation ponds. The focus of the geotechnical valuation and field exploration was at selected location of embankments on Pond Nos. 6, 7 and 9.
Current Ground Cover	The ground surface at the location of the test borings consisted of bare soil with some vegetation.

Item	Description
Existing Topography	The entire refinery site generally slopes down to the west and southwest. At Pond 6 there is an elevation difference of approximately 13 feet from the bottom of the pond to the top of the pond embankment. At Pond 7 there is an elevation difference of approximately 11 feet from the bottom of the pond to the top of the pond embankment. At Pond 9 there is an elevation difference of approximately 5.5 feet from the bottom of the pond to the top of the pond embankment. All embankments are sloped at an approximate slope ratio of 3H:1V (Horizontal:Vertical).

GEOTECHNICAL CHARACTERIZATION

Subsurface Profile

A total of 9 test borings and 10 piezometers were drilled at the locations shown on the **Site Plan and Boring Locations, Exhibit A-1** in **Appendix A**. The test borings and piezometers were specifically located to explore the existing subsurface soil conditions and provide subsurface modeling at select locations on embankments forming Evaporation Pond Nos. 6, 7 and 9. Specific conditions encountered at each boring location are indicated on the individual boring logs presented in **Appendix A**. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual.

For purposes of this report, the borings and subsurface stratigraphy has been summarized for Pond Nos. 6, 7 and 9 and can be generalized as follows:

Description	Boring Nos.	Approximate Depth to Bottom of Stratum (ft)	Material Description	Relative Density / Consistency
Evaporation Pond 9				
Stratum 1	B-01 thru B-03, P-01 & P-02	4 to 9	Lean Clay, Sandy Lean Clay	Stiff
Stratum 2		36.5 (maximum depth explored)	Fat Clay, Fat Clay with Sand	Med. Stiff to Very Stiff
Evaporation Pond 6				
Stratum 1	B-04 thru B-06, P-03 – P-06	8 to 28	Fat Clay, Fat Clay with Sand	Stiff to Hard
Stratum 2		13 to 33	Clayey Sand with Gravel, Silty Sand	Loose to Dense
Stratum 3		36.5 (maximum depth explored)	Lean Clay, Fat Clay	Medium Stiff to Hard
Evaporation Pond 7				

Description	Boring Nos.	Approximate Depth to Bottom of Stratum (ft)	Material Description	Relative Density / Consistency
Stratum 1	B-07 thru B-09, P07 – P10	18 to 28	Lean Clay with Sand, Sandy Lean Clay, Clayey Sand, Silty Sand	Stiff/Medium Dense
Stratum 2		36.5 (maximum depth explored)	Fat Clay, Fat Clay with Sand	Medium Stiff to Stiff/Medium Dense

Laboratory tests were conducted on selected soil samples and the test results are presented in **Appendix B**. Most pertinent to the geotechnical engineering analyses discussed later in this report, are the results of the consolidated drained triaxial shear tests and unconfined compression strength tests conducted on relatively undisturbed samples obtained from the test borings.

Results of the consolidated drained triaxial shear tests and unconfined compression strength testing of the existing pond slopes are summarized as follows:

Location	Boring Nos.	Sample Depth (ft)	Unified Classification	Mohr's Envelope Friction Angle (°) [1]	Unconfined Compression Strength (psi) [2]
Pond 6	B-04	5	CL/CH	---	3
	B-05	5	CH	---	8
	B-06	5	CH	---	20
	P-03	5	CL	36	---
	P-05	2.5	CL	---	20
	P-06	2.5	CH	44	---
Pond 7	B-07	5	CH	35	---
	B-08	5	CH	---	80
	B-09	5	CH	---	30
	P-07	5	CL	---	27
	P-08	2.5	CH	---	75
	P-09	2.5	CL	---	35
	P-10	2.5	CH	---	25
Pond 9	B-01	2.5	CL	---	18
	B-02	5	CL	38	---
	B-03	5	CH	---	23

Location	Boring Nos.	Sample Depth (ft)	Unified Classification	Mohr's Envelope Friction Angle (°) [1]	Unconfined Compression Strength (psi) [2]
	P-01	2.5	CH	---	32
	P-02	5	CH	---	19

Notes:

1. The friction angle was estimated from the laboratory triaxial data. A Mohr strength envelope was developed assuming zero cohesion for each test and the value obtained is depicted in this graph. Visualization can be found in Exhibits B-24 thru B-26.
2. The Unconfined Compression strength as depicted in this table was interpolated from the straight-line portion of the stress/strain test results. The stress was taken at the beginning of strain softening at the break of the straight-line portion of each strength curve.

For purposes of the numerical modeling and stability analyses, the Mohr circles for each triaxial test conducted was combined onto one graph. From this graph, a new Mohr envelope was determined using the least friction angle found by connecting the tangents of the smallest Mohr circles. The interpolated y-axis intercept (cohesion) of this envelope presented was determined to be 3.9 psi (561 psf). Based on Table 5.1 in the ***United States Department of the Interior, Bureau of Reclamation, Design of Small Dams 3rd Edition***, correlated drained shear strength values for fat clay soils include a cohesion intercept in the range of 216 to 3,096 psf, and an angle of internal friction ranging between 4.0° to 27.5°. Using the lowest unconfined compression strength test result, the combined Mohr envelope, and Table 5.1, the following Mohr-Coulomb strength parameters were conservatively developed for use in modeling the subsurface stratigraphy for the stability analyses.

Material	Unit Weight (pcf)	Friction Angle (°) [1]	Cohesion (psf) [2]
Fat Clay (CH)	115	14	150

Notes:

1. The friction angle was estimated from the combined laboratory data. A Mohr's envelope was developed based on the least friction angle achieved from the different Mohr's circles.
2. The cohesion was selected based on least unconfined compressive strength determined from all testing, and then reduced for conservativism in the analyses.

SEISMIC CONSIDERATIONS

The seismic design requirements for the structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average

value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil properties encountered at the site and as described on the exploration logs and results, it is our professional opinion that the **Seismic Site Classification is D**. Subsurface explorations at this site were extended to a maximum depth of 36.5 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

Seismic design parameters were derived from seismicmaps.org, where inputs such as the project coordinates, reference methodology, risk category, and site class are selected. The Peak Ground Acceleration (PGA) obtained from the website and used in the analysis consists of a PGA of 0.108g (% gravity). For Global Stability, it is generally acceptable to select a horizontal pseudo-static earthquake coefficient (K_h) between 0.5 and 0.67 of the PGA. A pseudo-static value of 0.5 of the PGA was selected for the analyses conducted for this project

STABILITY EVALUATION

Stability Modeling

Three cross sections were developed for engineering analyses of the existing evaporation ponds at the project site. One section was taken perpendicular to the west embankment of Pond 6, a second was taken perpendicular to the west embankment of Pond 7, and a final section was taken through the north embankment of Pond 9. The representative cross sections and subsurface stratigraphy modeled through each section are shown graphically on **Exhibits D-1** through **D-6** in **Appendix D**.

Slope stability analyses take into consideration material strength, presence and orientation of weak layers, water (piezometric) pressures, surcharge loads, and the slope geometry. Mathematical computations are performed using computer-assisted simulations to calculate a Factor of Safety (FS) against slope instability.

Strength parameters, used to model the subsurface stratigraphy for the stability analyses, were based upon the boring data obtained during the field exploration and results of the laboratory test data as described in the previous sections of this report. Groundwater was encountered in Boring B-01 at a depth of 17 feet below ground surface. The latest piezometers readings were taken on December 11, 2019 and these readings were used to model the piezometric surface(s) in the analyses. It was noted during the December piezometer readings that the site may have experienced precipitation the week prior to the piezometer readings. This may cause variable or seasonally high phreatic surface readings depending on the amount and duration of precipitation events in the area of the site. The location of the phreatic surface within the particular cross section used in the analyses plays a significant role in the stability of the slopes. The introduction

of water into the subsurface materials has a destabilizing effect of reducing the normal effective stress/strengths on potential failure surfaces through buoyancy, thus reducing shear resistance of slopes, tending to cause slumping movement and failures.

It should be noted that some of the piezometer readings indicated no water was encountered. In the case where no water was observed, the phreatic surface was considered and conservatively modeled in the analyses to be at the base of the piezometer borings. Also, the reading of the piezometer at the lowest point of the toe of each embankment was considered to be the elevation of the phreatic surface for the extent of the modeling conducted beyond the location of the embankment at that point. This approach is considered to be conservative in terms of the stability evaluations.

An assumed traffic live load of 150 psf was applied to the crest of each embankment and section to simulate maintenance truck traffic that may be encountered during the lifetime of the structures.

As previously discussed, review of seismic design maps for the location of this project and the seismic criteria discussed above, a peak ground acceleration (PGA) coefficient of 0.108g was determined for the project area. According to ***Federal Highway Administration Geotechnical Engineering Circular No. 3***, a design value of equal to 0.5*PGA will limit permanent seismic deformation to less than 0.3 meters. For purposes of the analyses, the seismic analyses incorporated a pseudo-static horizontal earthquake coefficient of one-half the peak ground acceleration coefficient (input value of 0.054g) to simulate potential earthquake loading.

Analytical Approach

Stability analyses for the existing slope configurations and sections were performed using the computer program SlopeW developed by GeoSlope, Inc. SlopeW utilizes algorithms for the Morgenstern-Price method of slices for potential slip or failure surfaces. The Morgenstern-Price analysis was performed on each embankment cross section. The Morgenstern-Price method uses force and moment equilibrium to determine a factor of safety against instability. This analysis is based on limit-equilibrium where the forces and moments resisting failure are compared against the forces and moments tending to cause failure. This ratio, termed the factor of safety (FS), is an indication of stability of each postulated failure surface. Reasonable FS values are dependent upon the confidence in the parameters utilized in the analyses performed, among other factors related to the project itself.

Within the program and for each analysis, a search is undertaken on multiple potential slip (or failure) surfaces to determine the lowest factor of safety on a critical failure surface for each model. The lowest factor of safety obtained from the search routine of potential failure surfaces within each cross section is considered as an indicator of the long-term safety of the slope against instability. For each analysis, multiple random failure surfaces for each cross section were analyzed. Graphical results of the stability calculations for each cross section are included in **Appendix D** (**Exhibits D-1** through **D-6**).

Stability Evaluation Results

Based on the analyses, the calculated FS against instability for the critical surface identified by the search routine for each section is summarized in the following table:

Cross Section	Calculated Factor of Safety (FS)		Exhibit Nos.
	Static	Seismic	
Pond 6 West	1.51	1.24	D-1, D- 2
Pond 7 West	1.59	1.35	D-3, D-4
Pond 9 North	2.99	2.26	D-5, D-6

Based upon the results of the stability evaluations, it appears that the embankment slopes at the existing ponds have adequate factors of safety against slope instability under both static and seismic loading. The typically accepted minimum FS for long-term slope stability for man-made slope is 1.5 for static and 1.13 for seismic conditions, respectively. The graphical results of the analyses are included in **Appendix D** (**Exhibits D-1** through **D-6**) of this report.

GEOTECHNICAL OPINIONS AND CONSIDERATIONS

Based on our understanding of the project, review of the ***Work Plan***, field reconnaissance of the area, the results of the field exploration and laboratory testing of soil samples obtained from the site, and numerical slope stability analyses, we have developed the following geotechnical engineering opinions and discussions regarding the stability of the pond embankment slopes at the site:

- Based on the geotechnical engineering analyses completed to date, the existing evaporation pond embankment slopes for Ponds 6, 7 and 9 are considered to be stable under both static and seismic loading conditions at the current existing configurations.

- No water was encountered in the piezometers installed within the embankments at Pond 7 and Pond 9. In the case of Pond Nos. 7 and 9, the phreatic surface was conservatively modeled at the bottom most depth of the piezometer boring.

- Since the location of the phreatic surface within a slope or embankment has a potentially significant impact on the overall FS of the slope, as demonstrated by the analyses conducted for this project, we recommend that the piezometers in all ponds be monitored in the future for fluctuations in the phreatic surface. Any fluctuations determined from the recommended monitoring program should be evaluated for the impact to the stability of the embankments at this location. In this case, any phreatic surfaces encountered within

the installed Pond 7 and 9 piezometers should be considered cause for additional evaluation of the embankment slopes. Depending on the results of additional stability evaluations caused by such a triggering event, the development of a potential remediation plan may become necessary to increase overall stability.

- On the basis of our engineering evaluation as outlined in this report and based on our site reconnaissance, there is no evidence of any type of mass slope instability in the embankments in Ponds 6, 7 and 9 at the locations which were evaluated.

GENERAL COMMENTS

Our analysis and opinions outlined in this report are based upon our understanding of the project, the data obtained from our site exploration and laboratory testing and the results of our engineering analyses. As previously outlined, the most critical geotechnical consequence of this study is considered to be slope stability of the existing slope configurations at discreet locations of the three pond embankments. The stability of a slope is expressed as a factor of safety. It is important to note the concept of factor of safety is a derived value and not an intrinsic property of a particular slope. The accuracy with which the factor of safety for a given slope can be determined is based on a number of factors, the most significant of which are listed below:

- Variability of surface conditions
- Variability and type of subsurface conditions
- Validity of the analytical method
- Validity of simplifying assumptions
- Intensity of study
- Certainty of the design loading conditions occurring.

Depending on how well the above factors can be assessed determines what minimum factor of safety would be required to have a reasonable degree of confidence that a failure will not occur. It is the geotechnical engineers' responsibility to assess these conditions and advise the owner as to a minimum acceptable factor of safety.

Theoretically, a factor of safety of 1.0 indicates that a slope is on the verge of instability. Therefore, any lower factor of safety should result in failure and any higher factor of safety should theoretically represent a safe slope. However, due to the uncertainties associated with any geotechnical investigation and the factors discussed in the preceding paragraph, all slopes, even those with factors of safety greater than 1.0, have some potential for failure. The higher the computed factor of safety is for a given slope, the lower its probability of failure will be.

Natural variations will occur between exploration point locations or due to the modifying effects of or weather. Since the analyses outlined in this report have been conducted at distinct and discreet

locations of the pond embankments, there could be variable soil conditions at other locations. Therefore, the factor of safety against slope instability may vary at other locations on the pond embankments from the results discussed in this report.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

APPENDIX A - FIELD EXPLORATION RESULTS

Field Exploration

Number of Borings	Boring Depth (feet)	Planned Location
9	36.5	Ponds 6, 7, and 9 embankments
10 (piezometers)	7	Ponds 6, 7, and 9 embankments

Boring Layout and Elevations: Unless otherwise noted, Terracon personnel provided the boring layout. Coordinates were interpolated using topographic survey information provided by DePauli Engineering & Surveying LLC.

Subsurface Exploration Procedures: The borings were advanced with a truck-mounted CME-75 drill rig utilizing 8-inch outside diameter hollow-stem augers. At selected intervals, samples of the subsurface materials were taken at each boring location by driving split-spoon (SPT) or ring-lined barrel samplers in general accordance with ASTM Standards. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon is driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. A 3-inch O.D. and 2.5-inch I.D. ring lined sampler was used for sampling in the upper portions of the soil borings. Ring-lined, split-barrel sampling procedures are similar to standard split spoon sampling procedure; however, blow counts are typically recorded for 6-inch intervals for a total of 12 inches of penetration. Bulk samples of subsurface materials were obtained from all the borings. We observed and recorded groundwater levels during drilling and sampling. For safety purposes, all borings were backfilled with auger cuttings after their completion; however, the piezometer borings were completed with monitoring wells consisting of slotted 2” diameter PVC pipe with a gravel filled anulus to the outside of the boring and were completed with a grouted locking well cover at the ground surface.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

SITE LOCATION

Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup Refinery ■ Gallup, NM
January 7, 2020 ■ Terracon Project No. 66195049

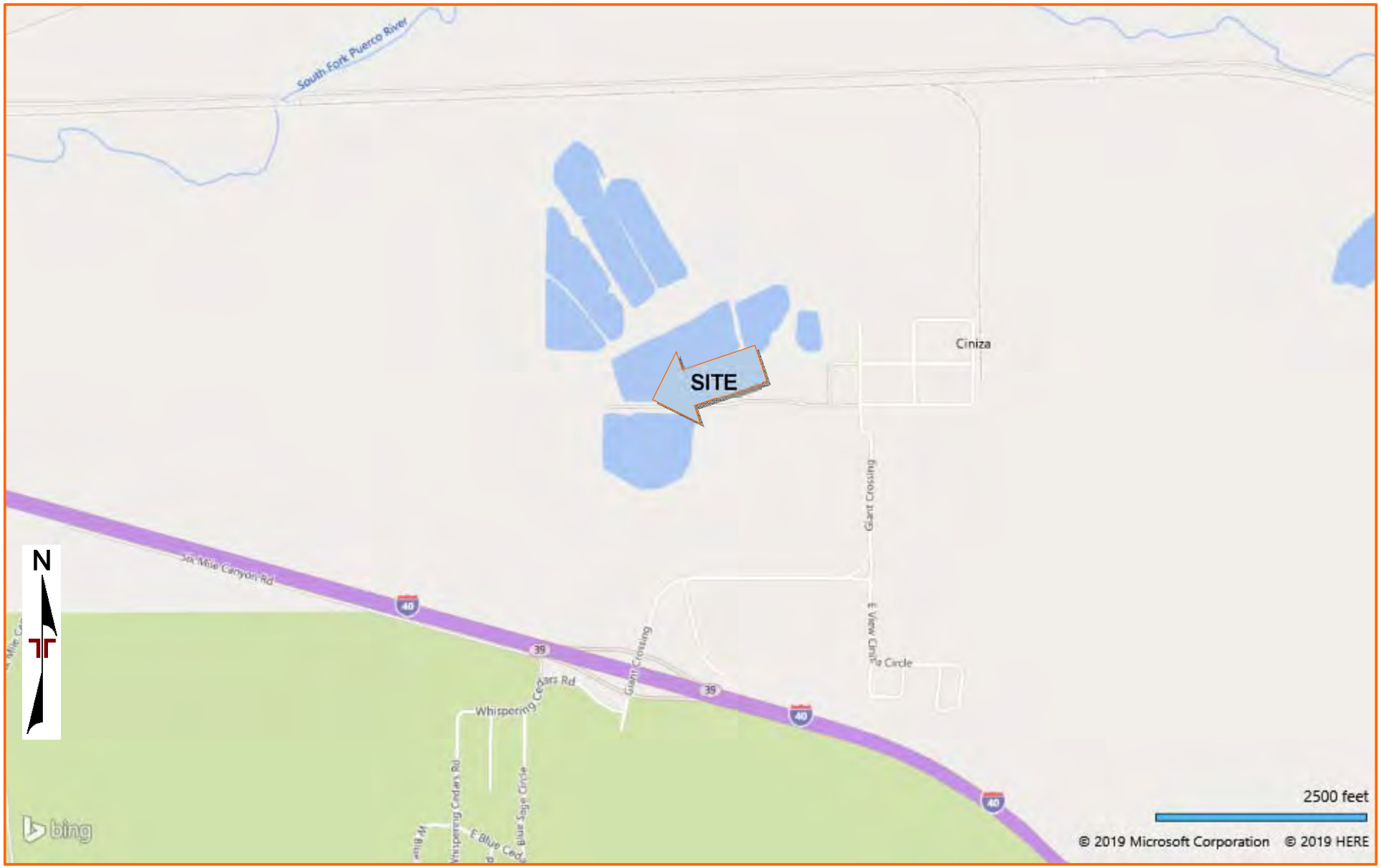


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

Exhibit A-2

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

Exhibit A-3

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup Refinery ■ Gallup, New Mexico
January 7, 2019 ■ Terracon Project No. 66195049

Terracon GeoReport

SAMPLING	WATER LEVEL	FIELD TESTS
Modified Dames & Moore Ring Sampler Standard Penetration Test	**Water Initially Encountered** **Water Level After a Specified Period of Time** **Water Level After a Specified Period of Time** Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	**N** Standard Penetration Test Resistance (Blows/Ft.) **(HP)** Hand Penetrometer **(T)** Torvane **(DCP)** Dynamic Cone Penetrometer **UC** Unconfined Compressive Strength **(PID)** Photo-Ionization Detector **(OVA)** Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (psi)**	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**
Very Loose	0 - 3	0 - 6	Very Soft	less than 3.50	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	3.5 to 7.0	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium Stiff	7.0 to 14.0	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	14.0 to 28.0	8 - 15	10 - 18
Very Dense	> 50	> 99	Very Stiff	28.0 to 55.5	15 - 30	19 - 42
			Hard	> 55.5	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL		RELATIVE PROPORTIONS OF FINES	
Descriptive Term(s) of other constituents	Percent of Dry Weight	**Descriptive Term(s) of other constituents**	**Percent of Dry Weight**
Trace	<15	Trace	<5
With	15-29	With	5-12
Modifier	>30	Modifier	>12

GRAIN SIZE TERMINOLOGY		PLASTICITY DESCRIPTION	
Major Component of Sample	**Particle Size**	**Term**	**Plasticity Index**
Boulders	Over 12 in. (300 mm)	Non-plastic	0
Cobbles	12 in. to 3 in. (300mm to 75mm)	Low	1 - 10
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)	Medium	11 - 30
Sand	#4 to #200 sieve (4.75mm to 0.075mm	High	> 30
Silt or Clay	Passing #200 sieve (0.075mm)		

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or [$Cc<1$ or $Cc>3.0$] [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or [$Cc<1$ or $Cc>3.0$] [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A"		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K, L, M, N]
			Liquid limit - not dried			Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K, L, M]
			PI plots below "A" line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K, L, M, P]
			Liquid limit - not dried			Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

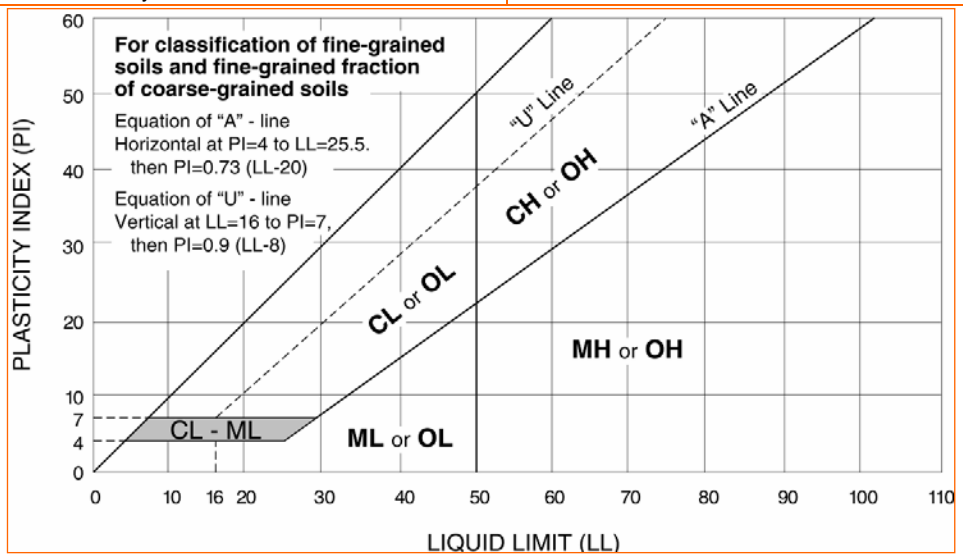
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



BORING LOG NO. B-01

PROJECT: Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup Refinery

CLIENT: Marathon Petroleum Corporation Jamestown, NM

SITE: 92 Giant Crossing Road Gallup, NM

LOCATION See Exploration Plan

Latitude: 35.4888° Longitude: -108.436°

DEPTH	GRAPHIC LOG	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY LEAN CLAY (CL), dark brown, stiff							
				6-4-6/0"				
4.0	**FAT CLAY (CH)**, dark brown, medium stiff to stiff							
5				2-4-6 N=10	27		63-21-42	91
10				2-3-2 N=5	24			
15		▽		3-2-5 N=7	21			
20				2-5-5 N=10	20			
25				2-3-4 N=7	23			
30				2-3-4 N=7	23			
35				3-5-5 N=10				
36.5	***Boring Terminated at 36.5 Feet***							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water encountered at 17' while drilling.*

Terracon
4905 Hawkins St NE
Albuquerque, NM

Boring Started: 07-24-2019 | Boring Completed: 07-24-2019

Drill Rig: 94E CME-55 track ATV | Driller: Terracon

Project No.: 66195049 | Exhibit: A-6

BORING LOG NO. B-02

PROJECT: Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup Refinery

CLIENT: Marathon Petroleum Corporation Jamestown, NM

SITE: 92 Giant Crossing Road Gallup, NM

LOCATION See Exploration Plan

Latitude: 35.4888° Longitude: -108.436°

DEPTH	GRAPHIC LOG	DESCRIPTION	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0		**LEAN CLAY (CL)**, dark brown, stiff							
					2-4-5 N=9	21			
5					14				
9.0		**FAT CLAY WITH SAND (CH)**, dark brown, medium stiff to very stiff							
10					2-3-4 N=7	25		77-26-51	83
15					2-5-7 N=12	29			
20					2-4-7 N=11	27			
25					5-8-10 N=18	21			
30					3-7-10 N=17	23			
35					4-10-13 N=23	17			
36.5		***Boring Terminated at 36.5 Feet***							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
4905 Hawkins St NE
Albuquerque, NM

Boring Started: 07-24-2019 | Boring Completed: 07-24-2019

Drill Rig: 94E CME-55 track ATV | Driller: Terracon

Project No.: 66195049 | Exhibit: A-7

BORING LOG NO. B-03

PROJECT: Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup Refinery

CLIENT: Marathon Petroleum Corporation Jamestown, NM

SITE: 92 Giant Crossing Road Gallup, NM

LOCATION See Exploration Plan

Latitude: 35.4889° Longitude: -108.436°

DEPTH	GRAPHIC LOG	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0	**FAT CLAY (CH)**, dark brown, stiff							
				4-5-5 N=10	22		63-22-41	88
5				13				
10				1-4-6 N=10	28			
15				4-6-7 N=13	29			
18.0	**FAT CLAY WITH SAND (CH)**, dark brown, stiff							
20				4-6-7 N=13	16			
25				5-6-5 N=11	23			
28.0	**FAT CLAY (CH)**, dark brown to white, very stiff							
30				4-7-10 N=17	21			
35				7-10-14 N=24	21			
36.5	***Boring Terminated at 36.5 Feet***							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
4905 Hawkins St NE
Albuquerque, NM

Boring Started: 07-24-2019 | Boring Completed: 07-24-2019

Drill Rig: 94E CME-55 track ATV | Driller: Terracon

Project No.: 66195049 | Exhibit: A-8

BORING LOG NO. B-04

PROJECT: Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup Refinery

CLIENT: Marathon Petroleum Corporation Jamestown, NM

SITE: 92 Giant Crossing Road Gallup, NM

LOCATION See Exploration Plan

Latitude: 35.4898° Longitude: -108.4376°

DEPTH	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	FAT CLAY (CH), dark brown, medium stiff			X	3-2-3 N=5	18			
		5			7				
8.0									
	CLAYEY SAND WITH GRAVEL (SC), dark brown, loose	10		X	3-2-3 N=5	21		43-17-26	38
13.0									
	FAT CLAY (CH), dark brown, medium stiff to hard	15		X	2-3-4 N=7	33			
		20		X	2-6-9 N=15	29			
		25		X	4-6-6 N=12	29			
		30		X	5-9-12 N=21	25			
		35		X	10-17-22 N=39	14			
36.5									
	Boring Terminated at 36.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
4905 Hawkins St NE
Albuquerque, NM

Boring Started: 07-24-2019 | Boring Completed: 07-24-2019

Drill Rig: 94E CME-55 track ATV | Driller: Terracon

Project No.: 66195049 | Exhibit: A-9

BORING LOG NO. B-05

PROJECT: Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup Refinery

CLIENT: Marathon Petroleum Corporation Jamestown, NM

SITE: 92 Giant Crossing Road Gallup, NM

LOCATION See Exploration Plan

Latitude: 35.4897° Longitude: -108.4377°

DEPTH	GRAPHIC LOG	DESCRIPTION	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		FAT CLAY WITH SAND (CH), dark brown, stiff to very stiff							
					4-5-7 N=12	23		62-22-40	85
5					12				
10					2-4-5 N=9	32			
15					2-4-6 N=10	28			
20					3-4-6 N=10	32			
25					5-7-13 N=20	21			
30					8-14-16 N=30	6			
35					12-17-19 N=36	14			
		28.0							
		SILTY SAND (SM), dark brown, dense							
		33.0							
		LEAN CLAY (CL), dark brown to brown, hard							
		36.5							
		Boring Terminated at 36.5 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
4905 Hawkins St NE
Albuquerque, NM

Boring Started: 07-24-2019 | Boring Completed: 07-24-2019

Drill Rig: 94E CME-55 track ATV | Driller: Terracon

Project No.: 66195049 | Exhibit: A-10

BORING LOG NO. B-06

PROJECT: Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup Refinery

CLIENT: Marathon Petroleum Corporation Jamestown, NM

SITE: 92 Giant Crossing Road Gallup, NM

LOCATION See Exploration Plan

Latitude: 35.4897° Longitude: -108.4378°

DEPTH	GRAPHIC LOG	DESCRIPTION	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		FAT CLAY (CH), dark brown, medium stiff to hard							
					1-3-3 N=6	28			
5					12				
10					2-3-4 N=7	25			
15					4-4-6 N=10	28		64-23-41	95
20					8-10-12 N=22	18			
25					7-11-15 N=26	16			
30					4-14-17 N=31	13			
35					10-18-22 N=40	13			
36.5		***Boring Terminated at 36.5 Feet***							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
4905 Hawkins St NE
Albuquerque, NM

Boring Started: 07-24-2019 | Boring Completed: 07-24-2019

Drill Rig: 94E CME-55 track ATV | Driller: Terracon

Project No.: 66195049 | Exhibit: A-11

BORING LOG NO. B-07

PROJECT: Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup Refinery

CLIENT: Marathon Petroleum Corporation Jamestown, NM

SITE: 92 Giant Crossing Road Gallup, NM

LOCATION See Exploration Plan

Latitude: 35.4938° Longitude: -108.4404°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		FAT CLAY (CH), dark brown, medium stiff to stiff								
						3-2-3 N=5	26			
			5			9				
8.0										
		FAT CLAY WITH SAND (CH), dark brown, medium stiff								
			10			1-2-4 N=6	23		56-19-37	78
13.0										
		FAT CLAY (CH), dark brown, stiff								
			15			2-4-6 N=10	27			
			20			2-4-5 N=9	25			
			25			3-5-7 N=12	23			
28.0										
		LEAN CLAY WITH SAND (CL), dark brown, stiff								
			30			2-3-6 N=9	24			
33.0										
		CLAYEY SAND (SC), brown, medium dense								
			35			5-8-8 N=16	13			
36.5										
		Boring Terminated at 36.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
4905 Hawkins St NE
Albuquerque, NM

Boring Started: 07-24-2019 | Boring Completed: 07-24-2019

Drill Rig: 94E CME-55 track ATV | Driller: Terracon

Project No.: 66195049 | Exhibit: A-12

BORING LOG NO. B-08

PROJECT: Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup Refinery

CLIENT: Marathon Petroleum Corporation Jamestown, NM

SITE: 92 Giant Crossing Road Gallup, NM

LOCATION See Exploration Plan

Latitude: 35.4938° Longitude: -108.4405°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	FAT CLAY WITH SAND (CH), dark brown with white streaks, medium stiff to very stiff				6-10-6 N=16	21			
		5			9				
		10			2-3-5 N=8	27		69-23-46	84
		15			2-5-7 N=12	21			
	18.0 **SANDY LEAN CLAY (CL)**, dark brown to brown, very stiff to hard	20			3-9-8 N=17	20			
		25			3-14-17 N=31	13			
	28.0 **SILTY SAND (SM)**, red brown, medium dense	30			3-12-15 N=27	10			
	33.0 **SANDY LEAN CLAY (CL)**, brown, hard	35			9-24-17 N=41	14			
	36.5 ***Boring Terminated at 36.5 Feet***								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
4905 Hawkins St NE
Albuquerque, NM

Boring Started: 07-24-2019 | Boring Completed: 07-24-2019

Drill Rig: 94E CME-55 track ATV | Driller: Terracon

Project No.: 66195049 | Exhibit: A-13

BORING LOG NO. B-09

PROJECT: Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup Refinery

CLIENT: Marathon Petroleum Corporation Jamestown, NM

SITE: 92 Giant Crossing Road Gallup, NM

LOCATION See Exploration Plan

Latitude: 35.4938° Longitude: -108.4405°

DEPTH	GRAPHIC LOG	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0	**FAT CLAY (CH)**, dark brown to brown, stiff to hard							
				2-3-6 N=9	12			
5				18				
10				7-15-21 N=36	16		65-27-38	89
15				15-21-24 N=45	18			
18.0								
20	**SILTY SAND (SM)**, trace clay, light brown, medium dense			8-12-14 N=26	7			
25				12-14-15 N=29	6			
29.0								
30	**SANDY LEAN CLAY (CL)**, brown, hard			8-15-18 N=33	21			
35				16-18-22 N=40	20			
36.5	***Boring Terminated at 36.5 Feet***							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
4905 Hawkins St NE
Albuquerque, NM

Boring Started: 07-24-2019 | Boring Completed: 07-24-2019

Drill Rig: 94E CME-55 track ATV | Driller: Terracon

Project No.: 66195049 | Exhibit: A-14

BORING LOG NO. P-01

PROJECT: Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup Refinery

CLIENT: Marathon Petroleum Corporation Jamestown, NM

SITE: 92 Giant Crossing Road Gallup, NM

LOCATION See Exploration Plan

Latitude: 35.4888° Longitude: -108.436°

Surface Elev.: 6883.38 (Ft.)

DEPTH	ELEVATION (Ft.)	INSTALLATION DETAILS	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0	6883.38	grouted at top with locking well cover						
		2" O.D. hand-slotted PVC pipe slotted at 1" intervals, 6" gravel packed annulus			18			
			5		2-3-4 N=7	23	56-20-36	79
7.0	6876.5	capped at bottom						
		Boring Terminated at 7 Feet						

FAT CLAY WITH SAND (CH), dark brown, medium stiff to very stiff

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
4905 Hawkins St NE
Albuquerque, NM

Boring Started: 07-24-2019 | Boring Completed: 07-24-2019

Drill Rig: 94E CME-55 track ATV | Driller: Terracon

Project No.: 66195049 | Exhibit: A-15

BORING LOG NO. P-02

PROJECT: Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup Refinery

CLIENT: Marathon Petroleum Corporation Jamestown, NM

SITE: 92 Giant Crossing Road Gallup, NM

LOCATION See Exploration Plan

Latitude: 35.4889° Longitude: -108.436°

Surface Elev.: 6680.09 (Ft.)

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0	6680		grouted at top with locking well cover								
			2" O.D. hand-slotted PVC pipe slotted at 1" intervals, 6" gravel packed annulus				5-6-6 N=12	18		61-21-40	81
				5			15				
7.0	6673		capped at bottom								

FAT CLAY WITH SAND (CH), dark brown, stiff

Boring Terminated at 7 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
4905 Hawkins St NE
Albuquerque, NM

Boring Started: 07-24-2019	Boring Completed: 07-24-2019
Drill Rig: 94E CME-55 track ATV	Driller: Terracon
Project No.: 66195049	Exhibit: A-16

BORING LOG NO. P-03

PROJECT: Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup Refinery

CLIENT: Marathon Petroleum Corporation Jamestown, NM

SITE: 92 Giant Crossing Road Gallup, NM

LOCATION See Exploration Plan

Latitude: 35.4898° Longitude: -108.4377°

Surface Elev.: 6888.12 (Ft.)

DEPTH	ELEVATION (Ft.)
0	6888
8.0	6880

LEAN CLAY WITH SAND (CL), trace to with gravel, dark brown, medium stiff to stiff

INSTALLATION DETAILS: grouted at top with locking well cover; 2" O.D. hand-slotted PVC pipe slotted at 1" intervals, 6" gravel packed annulus; capped at bottom

DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
5		4-3-4 N=7	19	44-20-24	74
		10			

Boring Terminated at 8 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method: Hollow Stem Auger

Abandonment Method: Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Water level measured in piezometer on 12/11/19

Terracon
4905 Hawkins St NE
Albuquerque, NM

Boring Started: 07-24-2019 | Boring Completed: 07-24-2019

Drill Rig: 94E CME-55 track ATV | Driller: Terracon

Project No.: 66195049 | Exhibit: A-17

BORING LOG NO. P-04

PROJECT: Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup Refinery

CLIENT: Marathon Petroleum Corporation Jamestown, NM

SITE: 92 Giant Crossing Road Gallup, NM

LOCATION See Exploration Plan

Latitude: 35.4898° Longitude: -108.4377°

Surface Elev.: 6883.67 (Ft.)

DEPTH	ELEVATION (Ft.)
0	6883.67
7.0	6876.5

SANDY FAT CLAY (CH), dark brown with white nodules, soft to stiff

INSTALLATION DETAILS: grouted at top with locking well cover; 2" O.D. hand-slotted PVC pipe slotted at 1" intervals, 6" gravel packed annulus; capped at bottom

DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
5		12	20	95		
		2-2-2 N=4	22		53-20-33	69

Boring Terminated at 7 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method: Hollow Stem Auger

Abandonment Method: Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water level measured in piezometer on 12/11/19*

Terracon
4905 Hawkins St NE
Albuquerque, NM

Boring Started: 07-24-2019 | Boring Completed: 07-24-2019

Drill Rig: 94E CME-55 track ATV | Driller: Terracon

Project No.: 66195049 | Exhibit: A-18

BORING LOG NO. P-05

PROJECT: Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup Refinery

CLIENT: Marathon Petroleum Corporation Jamestown, NM

SITE: 92 Giant Crossing Road Gallup, NM

LOCATION See Exploration Plan

Latitude: 35.4897° Longitude: -108.4378°

Surface Elev.: 6881.45 (Ft.)

DEPTH	ELEVATION (Ft.)
0	6881.5
4.0	6877.5
7.0	6874.5

LEAN CLAY (CL), dark brown with white nodules, stiff

CLAYEY SAND WITH GRAVEL (SC), dark brown, loose

Boring Terminated at 7 Feet

INSTALLATION DETAILS: grouted at top with locking well cover; 2" O.D. hand-slotted PVC pipe slotted at 1" intervals, 6" gravel packed annulus; capped at bottom

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
5	▽		17				
			2-3-3 N=6	15		37-18-19	47

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method: Hollow Stem Auger

Abandonment Method: Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water level measured in piezometer on 12/11/19*

Terracon

4905 Hawkins St NE
Albuquerque, NM

Boring Started: 07-24-2019	Boring Completed: 07-24-2019
Drill Rig: 94E CME-55 track ATV	Driller: Terracon
Project No.: 66195049	Exhibit: A-19

BORING LOG NO. P-06

PROJECT: Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup Refinery

CLIENT: Marathon Petroleum Corporation Jamestown, NM

SITE: 92 Giant Crossing Road Gallup, NM

LOCATION See Exploration Plan

Latitude: 35.4897° Longitude: -108.4378°

Surface Elev.: 6876.95 (Ft.)

DEPTH	ELEVATION (Ft.)
0	6876.95
7.0	6870

GRAPHIC LOG	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
FAT CLAY (CH), dark brown, medium stiff	grouted at top with locking well cover								
	2" O.D. hand-slotted PVC pipe slotted at 1" intervals, 6" gravel packed annulus				6				
		5			2-2-3 N=5	33		65-24-41	92
	capped at bottom								
Boring Terminated at 7 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
4905 Hawkins St NE
Albuquerque, NM

Boring Started: 07-24-2019 | Boring Completed: 07-24-2019

Drill Rig: 94E CME-55 track ATV | Driller: Terracon

Project No.: 66195049 | Exhibit: A-20

BORING LOG NO. P-07

PROJECT: Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup Refinery

CLIENT: Marathon Petroleum Corporation Jamestown, NM

SITE: 92 Giant Crossing Road Gallup, NM

LOCATION See Exploration Plan

Latitude: 35.4938° Longitude: -108.4404°

Surface Elev.: 6885.37 (Ft.)

DEPTH	ELEVATION (Ft.)
0	6885.37
7.0	6878.5

SANDY LEAN CLAY (CL), dark brown, medium stiff to stiff

INSTALLATION DETAILS: grouted at top with locking well cover; 2" O.D. hand-slotted PVC pipe slotted at 1" intervals, 6" gravel packed annulus; capped at bottom

Boring Terminated at 7 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
5	▽		17				
			3-4-4 N=8	20		39-18-21	60

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method: Hollow Stem Auger

Abandonment Method: Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water level measured in piezometer on 12/11/19*

Terracon
4905 Hawkins St NE
Albuquerque, NM

Boring Started: 07-24-2019 | Boring Completed: 07-24-2019

Drill Rig: 94E CME-55 track ATV | Driller: Terracon

Project No.: 66195049 | Exhibit: A-21

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL 66195049 EVAPORATION POND .GPJ TERRACON_DATATEMPLATE.GDT 1/2/20

BORING LOG NO. P-08

PROJECT: Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup Refinery

CLIENT: Marathon Petroleum Corporation Jamestown, NM

SITE: 92 Giant Crossing Road Gallup, NM

LOCATION See Exploration Plan

Latitude: 35.4938° Longitude: -108.4404°

Surface Elev.: 6882.33 (Ft.)

DEPTH	ELEVATION (Ft.)
0	6882.33
7.0	6875.5

GRAPHIC LOG	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
FAT CLAY (CH), dark brown, stiif to hard	grouted at top with locking well cover								
	2" O.D. hand-slotted PVC pipe slotted at 1" intervals, 6" gravel packed annulus				37				
		5			3-5-6 N=11	24		78-29-49	89
	capped at bottom								
Boring Terminated at 7 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
4905 Hawkins St NE
Albuquerque, NM

Boring Started: 07-24-2019	Boring Completed: 07-24-2019
Drill Rig: 94E CME-55 track ATV	Driller: Terracon
Project No.: 66195049	Exhibit: A-22

BORING LOG NO. P-09

PROJECT: Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup Refinery

CLIENT: Marathon Petroleum Corporation Jamestown, NM

SITE: 92 Giant Crossing Road Gallup, NM

LOCATION See Exploration Plan

Latitude: 35.4938° Longitude: -108.4405°

Surface Elev.: 6878.71 (Ft.)

DEPTH	ELEVATION (Ft.)
0	6878.71
7.0	6871.5

LEAN CLAY (CL), dark brown with white nodules, stiff to very stiff

INSTALLATION DETAILS: grouted at top with locking well cover; 2" O.D. hand-slotted PVC pipe slotted at 1" intervals, 6" gravel packed annulus; capped at bottom

Boring Terminated at 7 Feet

DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
5		26				
		3-5-4 N=9	22		49-19-30	86

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method: Hollow Stem Auger

Abandonment Method: Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

4905 Hawkins St NE
Albuquerque, NM

Boring Started: 07-24-2019 | Boring Completed: 07-24-2019

Drill Rig: 94E CME-55 track ATV | Driller: Terracon

Project No.: 66195049 | Exhibit: A-23

BORING LOG NO. P-10

PROJECT: Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup Refinery

CLIENT: Marathon Petroleum Corporation Jamestown, NM

SITE: 92 Giant Crossing Road Gallup, NM

LOCATION See Exploration Plan

Latitude: 35.4938° Longitude: -108.4405°

Surface Elev.: 6872.87 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	0	6873	grouted at top with locking well cover								
			2" O.D. hand-slotted PVC pipe slotted at 1" intervals, 6" gravel packed annulus				16				
				5			3-5-3 N=8	22		76-25-51	91
	7.0	6866	capped at bottom								

FAT CLAY (CH), dark brown to brown, medium stiff to stiff

Boring Terminated at 7 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
4905 Hawkins St NE
Albuquerque, NM

Boring Started: 07-24-2019	Boring Completed: 07-24-2019
Drill Rig: 94E CME-55 track ATV	Driller: Terracon
Project No.: 66195049	Exhibit: A-24

APPENDIX B – LABORATORY TESTING

Laboratory Testing

Samples retrieved during the field exploration were taken to the laboratory for further observation by the project geotechnical engineer and were classified in accordance with the Unified Soil Classification System (USCS) described in Appendix A. At that time, the field descriptions were confirmed or modified as necessary and an applicable laboratory testing program was formulated to determine engineering properties of the subsurface materials.

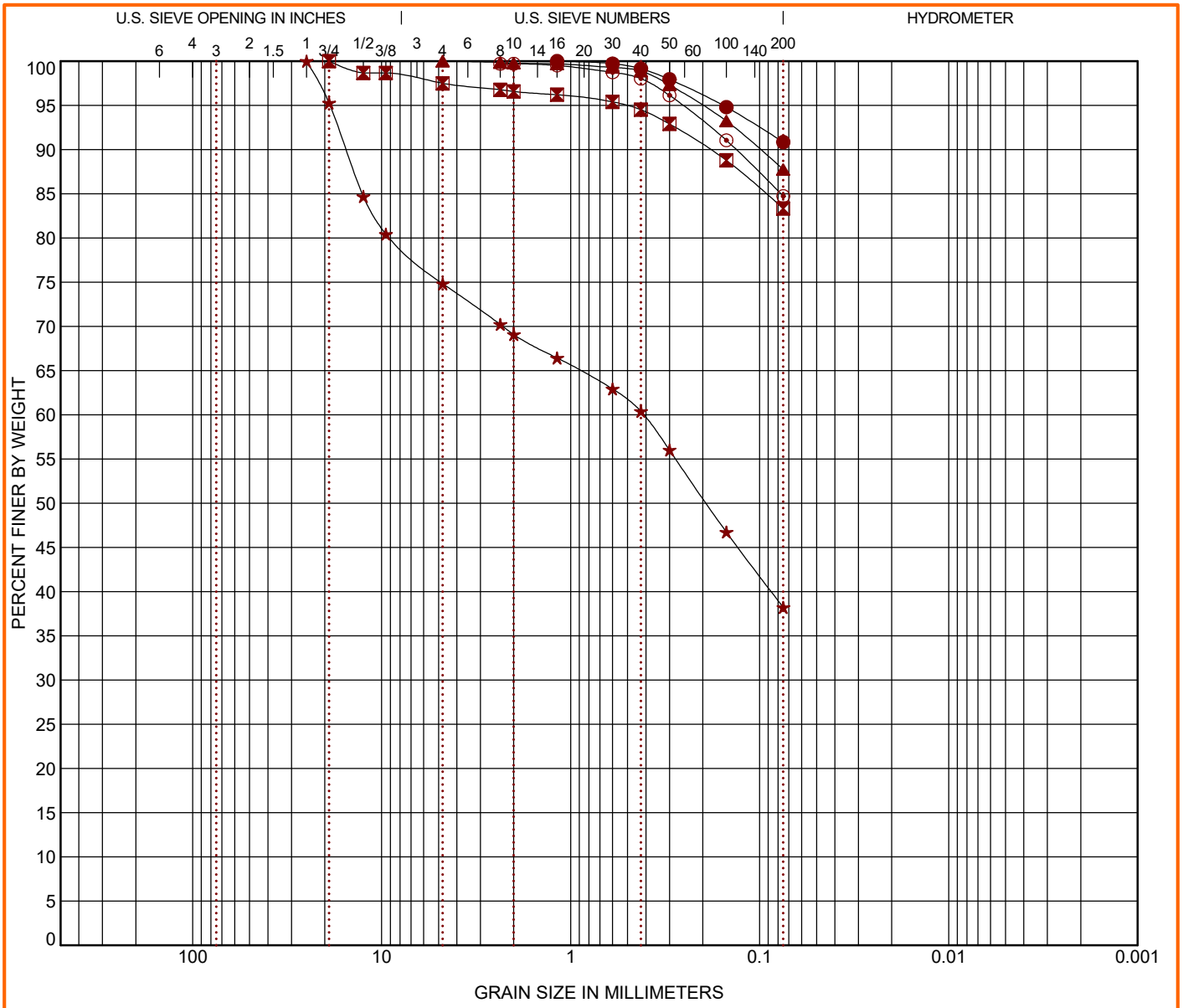
Laboratory tests were conducted on selected soil samples and the test results are presented in this appendix. The laboratory test results were used for the geotechnical engineering analyses, and the development of the geotechnical engineering opinions. Laboratory tests were performed in general accordance with the applicable ASTM, local or other accepted standards.

Selected soil samples obtained from the site were tested for the following engineering properties:

- Sieve Analysis
- Atterberg Limits
- Consolidated-Drained Triaxial Shear
- In-situ Water Content
- In-situ Dry Density
- Unconfined Compressive Strength

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-01	5 - 6.5	FAT CLAY (CH)	27	63	21	42		
⊠	B-02	10 - 11.5	FAT CLAY with SAND (CH)	25	77	26	51		
▲	B-03	2.5 - 4	FAT CLAY (CH)	22	63	22	41		
★	B-04	10 - 11.5	CLAYEY SAND with GRAVEL (SC)	21	43	17	26		
⊙	B-05	2.5 - 4	FAT CLAY with SAND (CH)	23	62	22	40		

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-01	5 - 6.5	1.18				0.0	0.0	9.2		90.8	
⊠	B-02	10 - 11.5	19				0.0	2.5	14.2		83.3	
▲	B-03	2.5 - 4	4.75				0.0	0.0	12.3		87.7	
★	B-04	10 - 11.5	25	0.412			0.0	25.2	36.6		38.2	
⊙	B-05	2.5 - 4	2.36						15.0		84.7	

PROJECT: Evaporation Pond Nos. 6, 7 and 9
Marathon Petroleum Company
Gallup Refinery

SITE: 92 Giant Crossing Road
Gallup, NM

Terracon
4905 Hawkins St NE
Albuquerque, NM

PROJECT NUMBER: 66195049

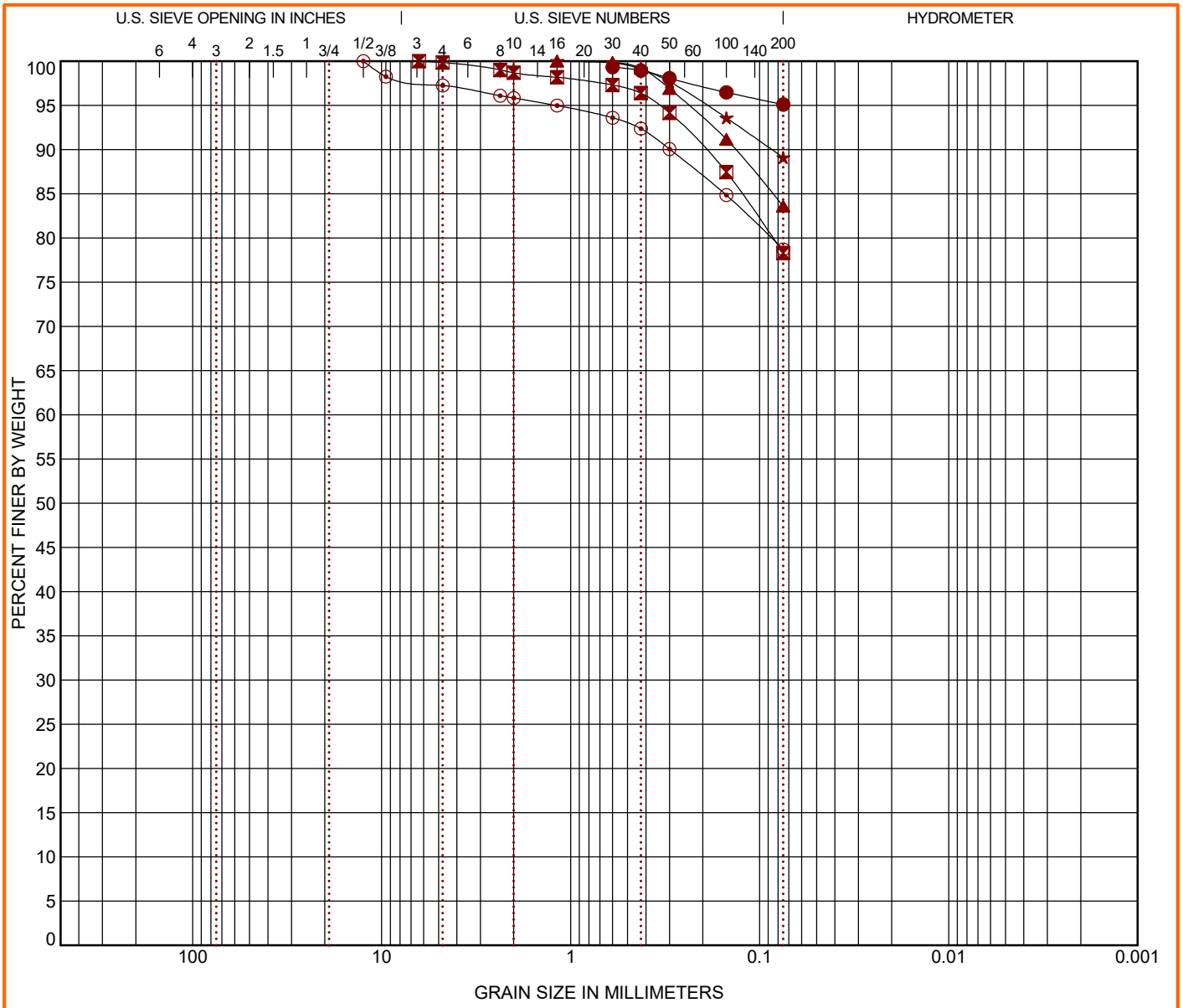
CLIENT: Marathon Petroleum Corporation
Jamestown, NM

Exhibit: B-2

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 66195049 EVAPORATION POND .GPJ TERRACON_DATATEMPLATE.GDT 9/11/19

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-06	15 - 16.5	FAT CLAY (CH)	28	64	23	41		
⊠	B-07	10 - 11.5	FAT CLAY with SAND (CH)	23	56	19	37		
▲	B-08	10 - 11.5	FAT CLAY with SAND (CH)	27	69	23	46		
★	B-09	10 - 11.5	FAT CLAY (CH)	16	65	27	38		
⊙	P-01	5 - 6.5	FAT CLAY with SAND (CH)	23	56	20	36		

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-06	15 - 16.5	0.6						4.2		95.1	
⊠	B-07	10 - 11.5	6.35				0.0	0.2	21.6		78.3	
▲	B-08	10 - 11.5	1.18				0.0	0.0	16.4		83.6	
★	B-09	10 - 11.5	1.18				0.0	0.0	10.9		89.1	
⊙	P-01	5 - 6.5	12.5				0.0	2.8	18.5		78.7	

PROJECT: Evaporation Pond Nos. 6, 7 and 9
Marathon Petroleum Company
Gallup Refinery

SITE: 92 Giant Crossing Road
Gallup, NM

Terracon
4905 Hawkins St NE
Albuquerque, NM

PROJECT NUMBER: 66195049

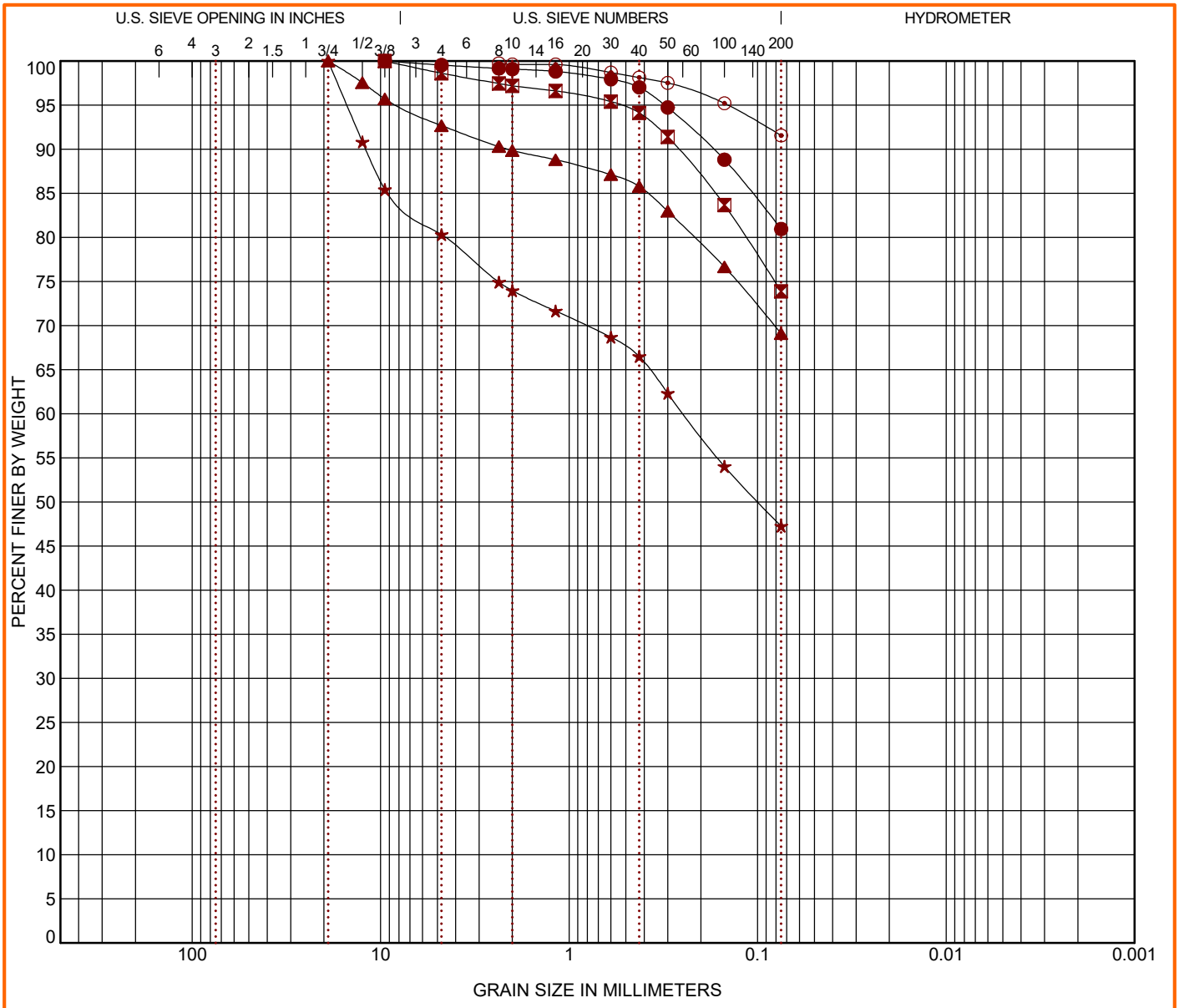
CLIENT: Marathon Petroleum Corporation
Jamestown, NM

Exhibit: B-3

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 66195049 EVAPORATION POND .GPJ TERRACON_DATATEMPLATE.GDT 9/11/19

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	P-02	2.5 - 4	FAT CLAY with SAND (CH)	18	61	21	40		
⊠	P-03	2.5 - 4	LEAN CLAY with SAND (CL)	19	44	20	24		
▲	P-04	5 - 6.5	SANDY FAT CLAY (CH)	22	53	20	33		
★	P-05	5 - 6.5	CLAYEY SAND with GRAVEL (SC)	15	37	18	19		
⊙	P-06	5 - 6.5	FAT CLAY (CH)	33	65	24	41		

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	P-02	2.5 - 4	9.5				0.0	0.5	18.6		80.9	
⊠	P-03	2.5 - 4	9.5				0.0	1.4	24.7		73.9	
▲	P-04	5 - 6.5	19				0.0	7.3	23.6		69.1	
★	P-05	5 - 6.5	19	0.247			0.0	19.7	33.1		47.3	
⊙	P-06	5 - 6.5	2.36						8.2		91.6	

PROJECT: Evaporation Pond Nos. 6, 7 and 9
Marathon Petroleum Company
Gallup Refinery

SITE: 92 Giant Crossing Road
Gallup, NM

Terracon
4905 Hawkins St NE
Albuquerque, NM

PROJECT NUMBER: 66195049

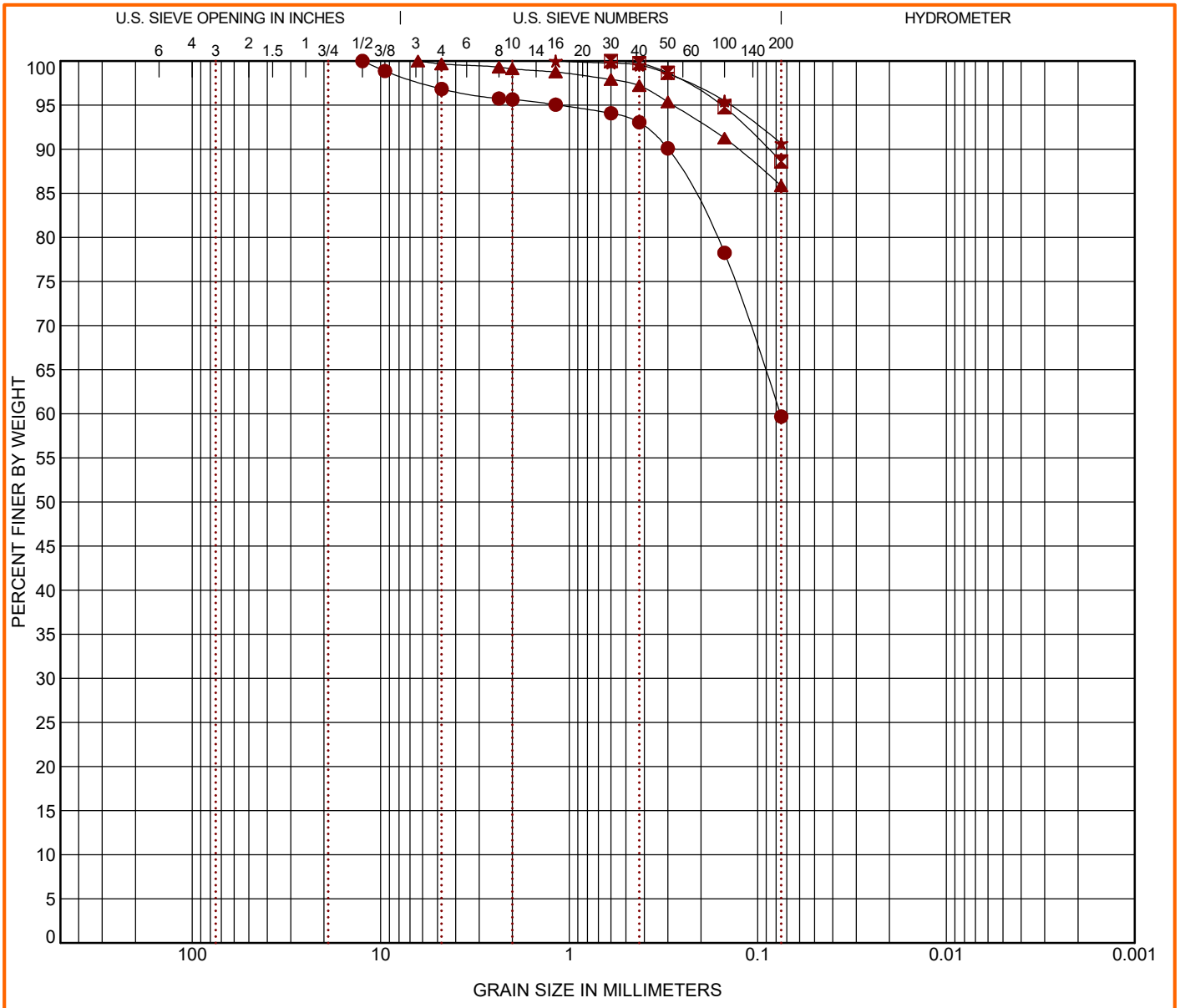
CLIENT: Marathon Petroleum Corporation
Jamestown, NM

Exhibit: B-4

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 66195049 EVAPORATION POND .GPJ TERRACON_DATATEMPLATE.GDT 9/11/19

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	P-07	5 - 6.5	SANDY LEAN CLAY (CL)	20	39	18	21		
⊠	P-08	5 - 6.5	FAT CLAY (CH)	24	78	29	49		
▲	P-09	5 - 6.5	LEAN CLAY (CL)	22	49	19	30		
★	P-10	5 - 6.5	FAT CLAY (CH)	22	76	25	51		

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	P-07	5 - 6.5	12.5	0.076			0.0	3.2	37.1		59.7	
⊠	P-08	5 - 6.5	0.6				0.0	0.0	11.4		88.6	
▲	P-09	5 - 6.5	6.35				0.0	0.3	13.8		85.9	
★	P-10	5 - 6.5	1.18				0.0	0.0	9.3		90.7	

PROJECT: Evaporation Pond Nos. 6, 7 and 9
Marathon Petroleum Company
Gallup Refinery

SITE: 92 Giant Crossing Road
Gallup, NM

Terracon
4905 Hawkins St NE
Albuquerque, NM

PROJECT NUMBER: 66195049

CLIENT: Marathon Petroleum Corporation
Jamestown, NM

Exhibit: B-5

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 66195049 EVAPORATION POND .GPJ TERRACON_DATATEMPLATE.GDT 9/11/19

Consolidated Drained Triaxial Compression Test

Report Number: 66195049
Service Date:
Report Date: 10/08/19
Task:

Terracon
4685 S. Ash Avenue
Tempe, Arizona 85282
(480) 897-8200

Client

Marathon Petroleum Corporation
Jamestown, New Mexico

Project

Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup
92 Giant Crossing Road
Gallup, New Mexico

Project No. 66195049

Sample Identification and Properties

Sample ID	B-2@5
Material	Sandy Silty Clay
Specimen Condition	In-Situ Rings
Plastic Limit	--
Liquid Limit	--
Specific Gravity	2.7
SG Determination	Assumed

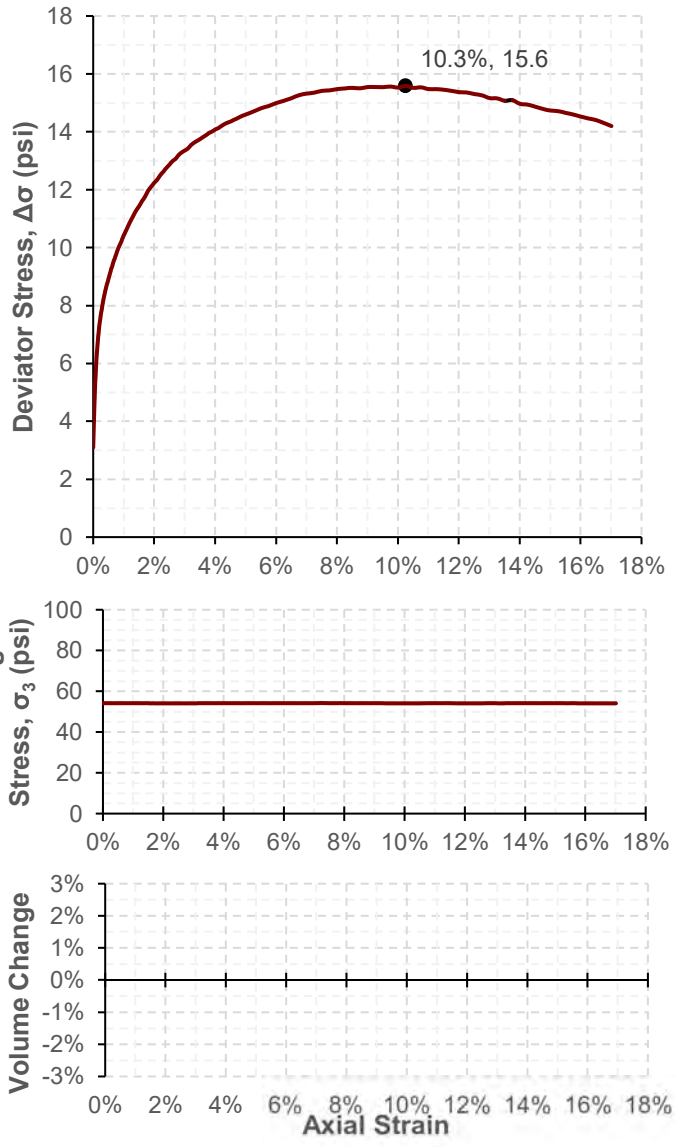
Specimen Properties	Initial	Final
Dry Unit Weight (pcf)	110.1	106.5
Void Ratio	0.53	0.58
Water Content	16.7%	18.9%
Saturation	86%	88.1%
Source of Water Content	Entire Sample	Entire Sample
Height (in)	5.031	5.006
Diameter (in)	2.31	--

Triaxial Test Parameters

Method for specimen Saturation (wet or dry)?	Dry
Total back pressure (psi)	50
Effective consolidation stress (psi)	5
Rate of strain (%/hour)	1.0
Failure criterion	15% or Max
B Value	0.98

Triaxial Test Results

Deviator stress at failure (psi)	15.6
Minor principal stress at failure (psi)	54.1
Major principal stress at failure (psi)	69.7
Axial strain at failure	10.3%



Services:
Terracon Rep:
Reported To:
Contractor:

Report Distribution

Reviewed By: Kirk Jackson
Kirk D. Jackson, P.E.
Project Engineer

Consolidated Drained Triaxial Compression Test

Report Number: 66195049
Service Date:
Report Date: 10/08/19
Task:

Terracon
4685 S. Ash Avenue
Tempe, Arizona 85282
(480) 897-8200

Client

Marathon Petroleum Corporation
Jamestown, New Mexico

Project

Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup
92 Giant Crossing Road
Gallup, New Mexico

Project No. 66195049

Sample Identification and Properties

Sample ID	B-7@5
Material	Sandy Silty Clay
Specimen Condition	In-Situ Rings
Plastic Limit	--
Liquid Limit	--
Specific Gravity	2.651
SG Determination	Assumed

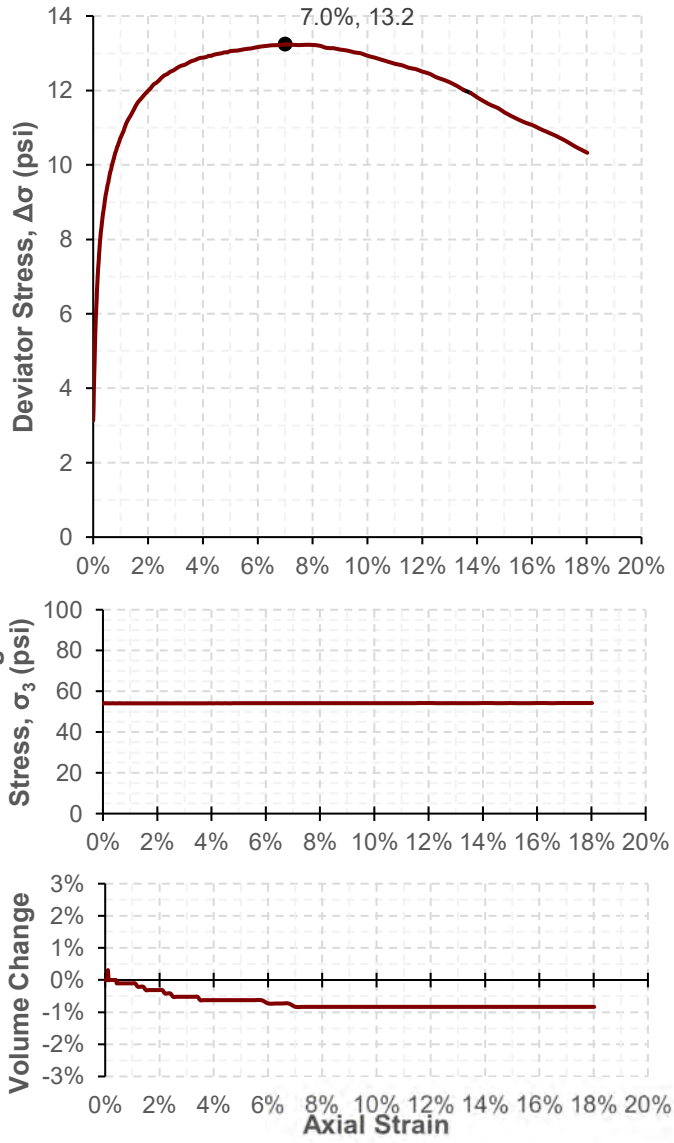
Specimen Properties	Initial	Final
Dry Unit Weight (pcf)	96.7	94.2
Void Ratio	0.71	0.75
Water Content	26.2%	28.2%
Saturation	98%	99.0%
Source of Water Content	Entire Sample	Entire Sample
Height (in)	4.997	4.981
Diameter (in)	2.356	--

Triaxial Test Parameters

Method for specimen Saturation (wet or dry)?	Dry
Total back pressure (psi)	50
Effective consolidation stress (psi)	5
Rate of strain (%/hour)	1.0
Failure criterion	15% or Max
B Value	0.99

Triaxial Test Results

Deviator stress at failure (psi)	13.2
Minor principal stress at failure (psi)	54.1
Major principal stress at failure (psi)	67.4
Axial strain at failure	7.0%



Services:
Terracon Rep:
Reported To:
Contractor:

Report Distribution

Reviewed By: Kirk Jackson
Kirk D. Jackson, P.E.
Project Engineer

Consolidated Drained Triaxial Compression Test

Report Number: 66195049
Service Date:
Report Date: 10/08/19
Task:

Terracon
4685 S. Ash Avenue
Tempe, Arizona 85282
(480) 897-8200

Client

Marathon Petroleum Corporation
Jamestown, New Mexico

Project

Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup
92 Giant Crossing Road
Gallup, New Mexico

Project No. 66195049

Sample Identification and Properties

Sample ID	P-3@5
Material	Sandy Silty Clay
Specimen Condition	In-Situ Rings
Plastic Limit	--
Liquid Limit	--
Specific Gravity	2.651
SG Determination	Assumed

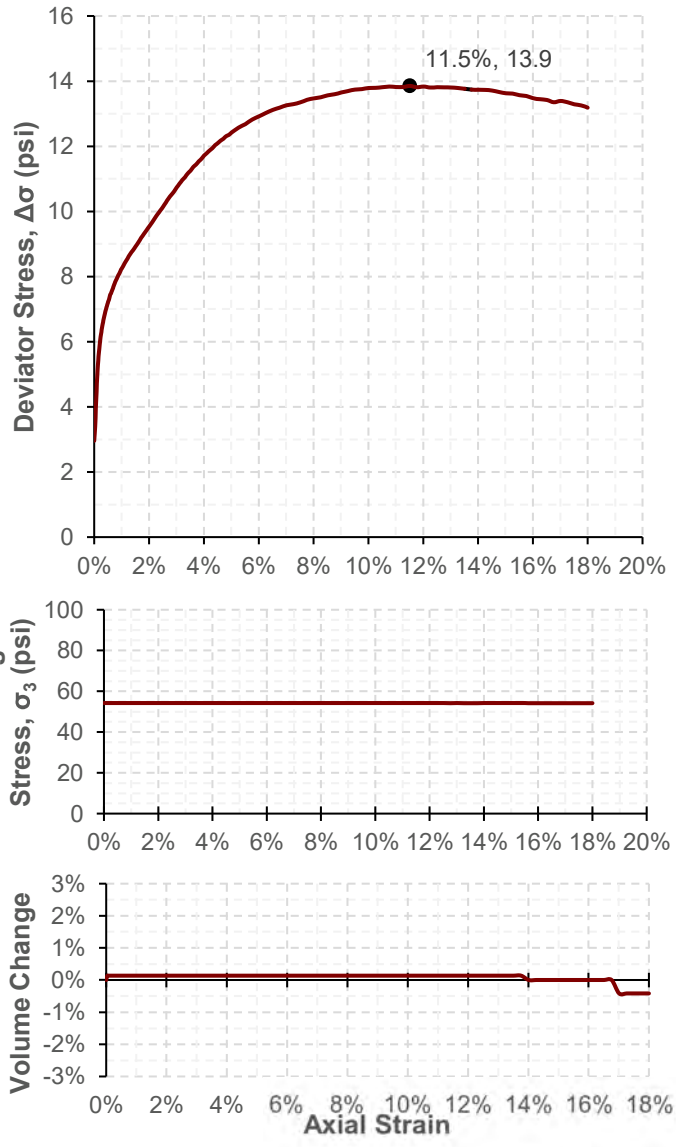
Specimen Properties	Initial	Final
Dry Unit Weight (pcf)	109.2	108.9
Void Ratio	0.51	0.52
Water Content	17.0%	20.5%
Saturation	88%	105.1%
Source of Water Content	Entire Sample	Entire Sample
Height (in)	5.024	5.004
Diameter (in)	2.396	--

Triaxial Test Parameters

Method for specimen Saturation (wet or dry)?	Dry
Total back pressure (psi)	50
Effective consolidation stress (psi)	5
Rate of strain (%/hour)	1.0
Failure criterion	15% or Max
B Value	0.97

Triaxial Test Results

Deviator stress at failure (psi)	13.9
Minor principal stress at failure (psi)	54.2
Major principal stress at failure (psi)	68.1
Axial strain at failure	11.5%



Services:
Terracon Rep:
Reported To:
Contractor:

Report Distribution

Reviewed By: Kirk D. Jackson, P.E.
Project Engineer

Consolidated Drained Triaxial Compression Test

Report Number: 66195049
Service Date:
Report Date: 10/08/19
Task:

Terracon
4685 S. Ash Avenue
Tempe, Arizona 85282
(480) 897-8200

Client

Marathon Petroleum Corporation
Jamestown, New Mexico

Project

Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup
92 Giant Crossing Road
Gallup, New Mexico

Project No. 66195049

Sample Identification and Properties

Sample ID	P-6@2.5
Material	Sandy Silty Clay
Specimen Condition	In-Situ Rings
Plastic Limit	--
Liquid Limit	--
Specific Gravity	2.651
SG Determination	Assumed

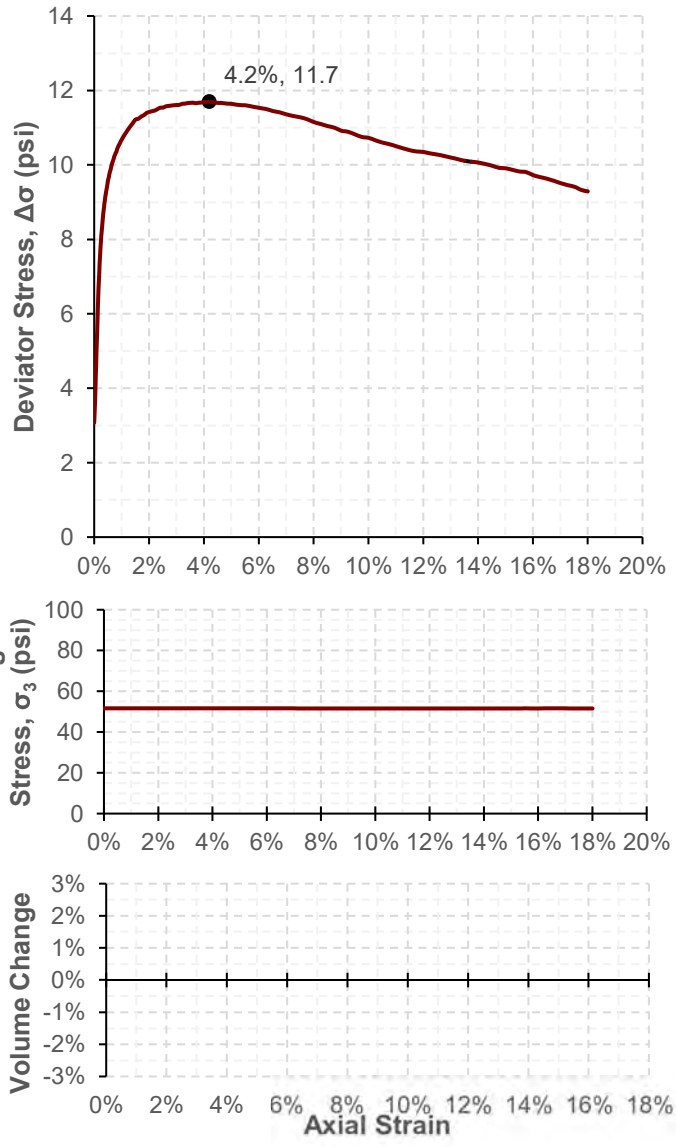
Specimen Properties	Initial	Final
Dry Unit Weight (pcf)	91.1	92.0
Void Ratio	0.81	0.79
Water Content	27.8%	31.0%
Saturation	91%	103.3%
Source of Water Content	Entire Sample	Entire Sample
Height (in)	5.765	5.759
Diameter (in)	2.387	--

Triaxial Test Parameters

Method for specimen Saturation (wet or dry)?	Dry
Total back pressure (psi)	53
Effective consolidation stress (psi)	3
Rate of strain (%/hour)	1.0
Failure criterion	15% or Max
B Value	0.98

Triaxial Test Results

Deviator stress at failure (psi)	11.7
Minor principal stress at failure (psi)	51.6
Major principal stress at failure (psi)	63.3
Axial strain at failure	4.2%



Services:
Terracon Rep:
Reported To:
Contractor:

Report Distribution

Reviewed By: Kirk Jackson
Kirk D. Jackson, P.E.
Project Engineer

Consolidated Drained Triaxial Compression Test

Report Number: 66195049.0000
Service Date:
Report Date: 10/08/19
Task:

Terracon
4685 S. Ash Avenue
Tempe, Arizona 85282
(480) 897-8200

Client

Marathon Petroleum Corporation
Jamestown, New Mexico

Project

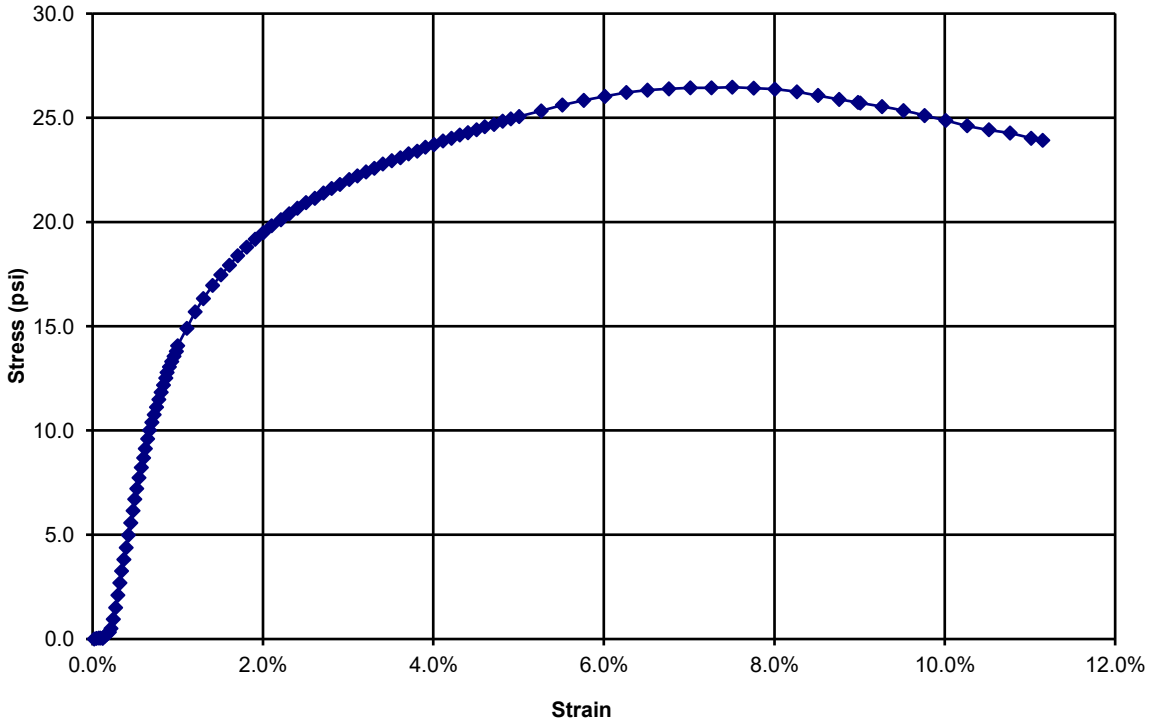
Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup
92 Giant Crossing Road
Gallup, New Mexico

Project No. 66195049

UNCONFINED COMPRESSION STRENGTH OF COHESIVE SOIL (ASTM D 2166)

SAMPLE ID: B-01 @ 2.5'
DIAMETER [in.]: 2.385
HEIGHT [in.]: 5.537
STRAIN RATE: 1%
MOISTURE CONTENT: 19.5%
DRY DENSITY [pcf]: 103.1

MAXIMUM STRESS [psi]: 26.5
AT STRAIN: 7.5%
AT TIME: 0:07:31



Services:
Terracon Rep:
Reported To:
Contractor:

Report Distribution

Reviewed By: Kirk Jackson
Kirk D. Jackson, P.E.
Project Engineer

Exhibit: B-10

Consolidated Drained Triaxial Compression Test

Report Number: 66195049.0000
Service Date:
Report Date: 10/08/19
Task:

Terracon
4685 S. Ash Avenue
Tempe, Arizona 85282
(480) 897-8200

Client

Marathon Petroleum Corporation
Jamestown, New Mexico

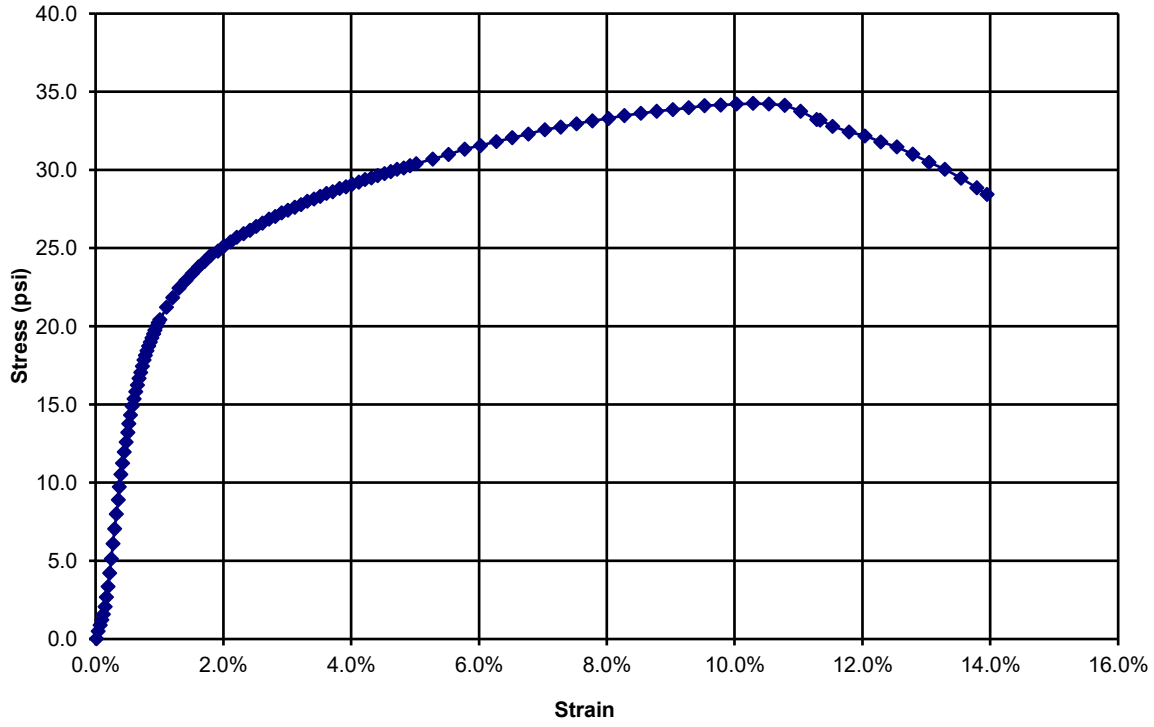
Project

Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup
92 Giant Crossing Road
Gallup, New Mexico

Project No. 66195049

UNCONFINED COMPRESSION STRENGTH OF COHESIVE SOIL (ASTM D 2166)

SAMPLE ID:	B-03 @ 5'	MAXIMUM STRESS [psi]:	34.3
DIAMETER [in.]:	2.375	AT STRAIN:	10.3%
HEIGHT [in.]:	5.564	AT TIME:	0:10:17
STRAIN RATE:	1%		
MOISTURE CONTENT:	17.7%		
DRY DENSITY [pcf]:	106.6		



Services:
Terracon Rep:
Reported To:
Contractor:

Report Distribution

Reviewed By: Kirk Jackson
Kirk D. Jackson, P.E.
Project Engineer

Exhibit: B-11

Consolidated Drained Triaxial Compression Test

Report Number: 66195049.0000
Service Date:
Report Date: 10/08/19
Task:

Terracon
4685 S. Ash Avenue
Tempe, Arizona 85282
(480) 897-8200

Client

Marathon Petroleum Corporation
Jamestown, New Mexico

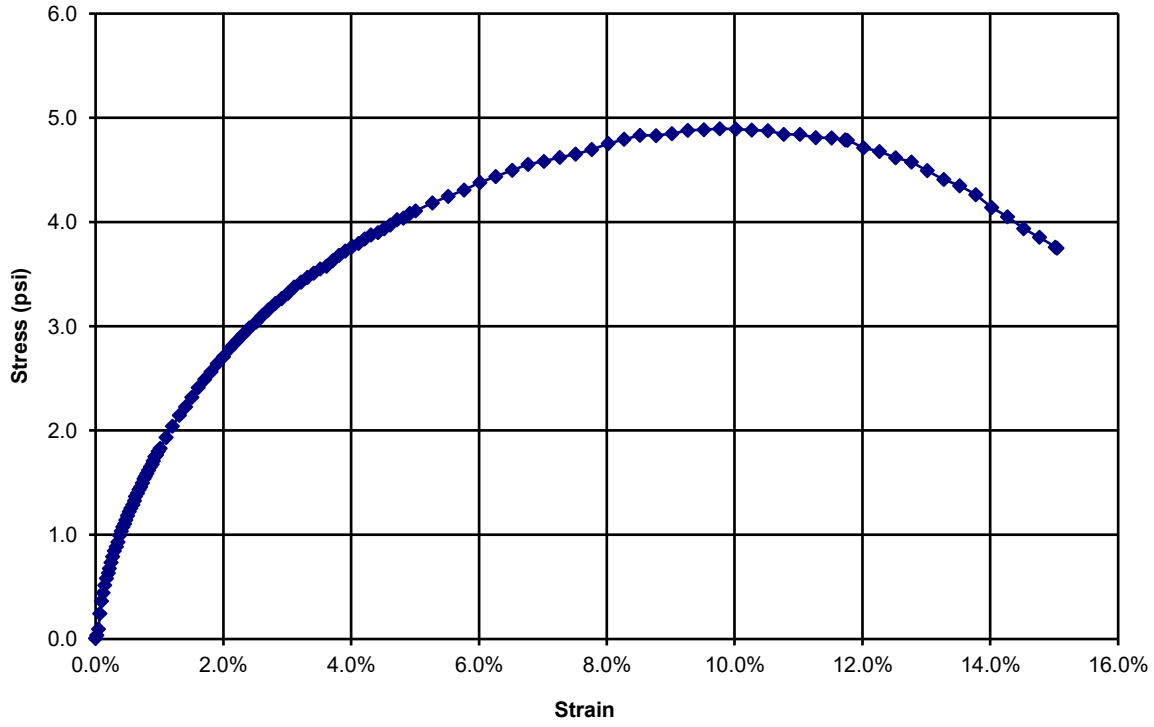
Project

Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup
92 Giant Crossing Road
Gallup, New Mexico

Project No. 66195049

UNCONFINED COMPRESSION STRENGTH OF COHESIVE SOIL (ASTM D 2166)

SAMPLE ID:	B-04 @ 5.0'	MAXIMUM STRESS [psi]:	4.9
DIAMETER [in.]:	2.386	AT STRAIN:	9.8%
HEIGHT [in.]:	5.541	AT TIME:	0:09:46
STRAIN RATE:	1%		
MOISTURE CONTENT:	17.6%		
DRY DENSITY [pcf]:	108.5		



Services:
Terracon Rep:
Reported To:
Contractor:

Report Distribution

Reviewed By: Kirk Jackson
Kirk D. Jackson, P.E.
Project Engineer

Exhibit: B-12

Consolidated Drained Triaxial Compression Test

Report Number: 66195049.0000
Service Date:
Report Date: 10/08/19
Task:

Terracon
4685 S. Ash Avenue
Tempe, Arizona 85282
(480) 897-8200

Client

Marathon Petroleum Corporation
Jamestown, New Mexico

Project

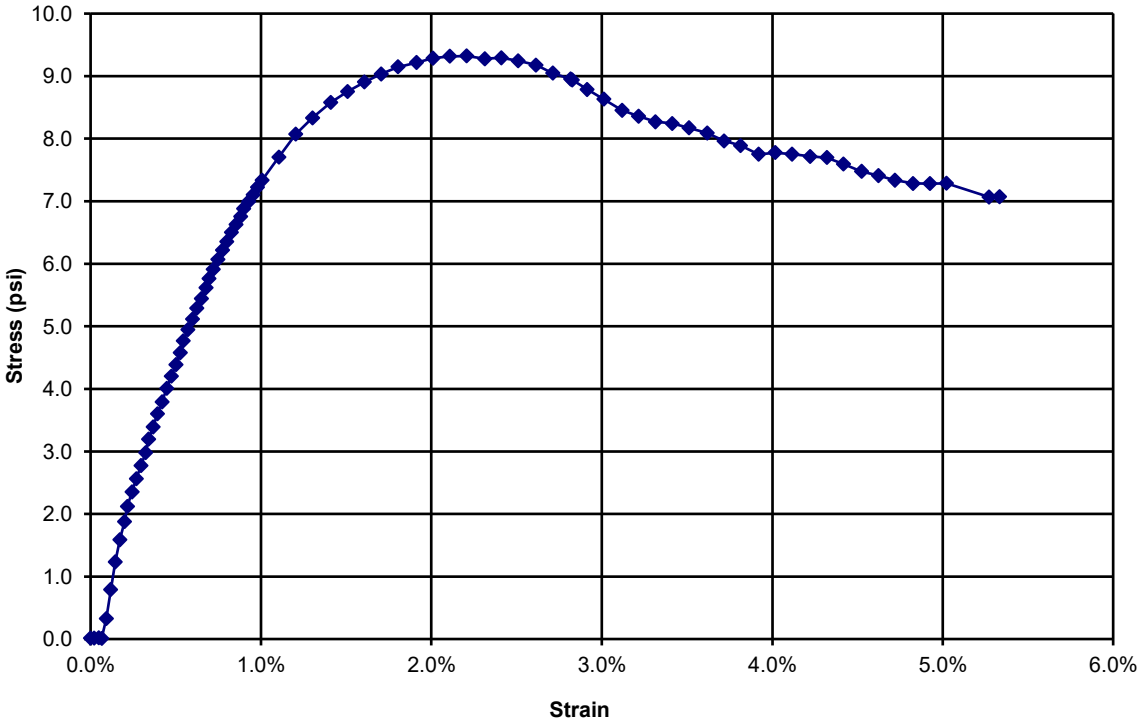
Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup
92 Giant Crossing Road
Gallup, New Mexico

Project No. 66195049

UNCONFINED COMPRESSION STRENGTH OF COHESIVE SOIL (ASTM D 2166)

SAMPLE ID: B-05 @ 5'
DIAMETER [in.]: 2.411
HEIGHT [in.]: 4.898
STRAIN RATE: 1%
MOISTURE CONTENT: 11.1%
DRY DENSITY [pcf]: 115.5

MAXIMUM STRESS [psi]: 9.3
AT STRAIN: 2.2%
AT TIME: 0:02:13



Services:
Terracon Rep:
Reported To:
Contractor:

Report Distribution

Reviewed By: Kirk Jackson
Kirk D. Jackson, P.E.
Project Engineer

Exhibit: B-13

Consolidated Drained Triaxial Compression Test

Report Number: 66195049.0000
Service Date:
Report Date: 10/08/19
Task:

Terracon
4685 S. Ash Avenue
Tempe, Arizona 85282
(480) 897-8200

Client

Marathon Petroleum Corporation
Jamestown, New Mexico

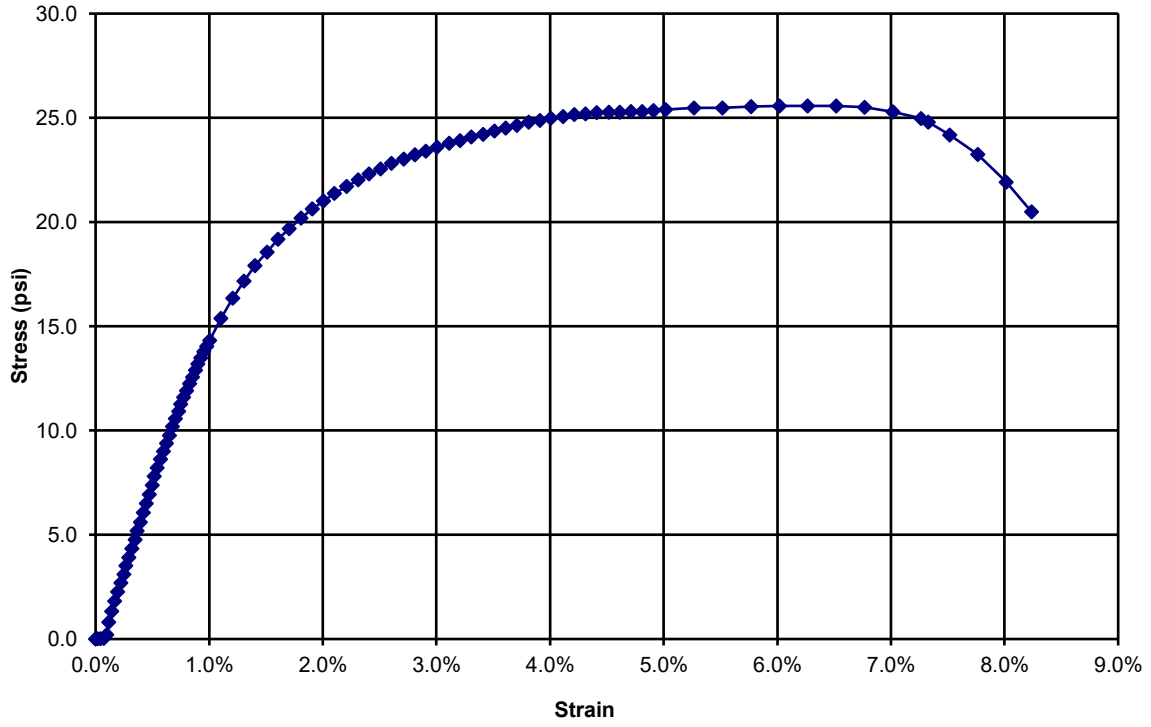
Project

Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup
92 Giant Crossing Road
Gallup, New Mexico

Project No. 66195049

UNCONFINED COMPRESSION STRENGTH OF COHESIVE SOIL (ASTM D 2166)

SAMPLE ID:	B-06 @ 5.0'	MAXIMUM STRESS [psi]:	25.6
DIAMETER [in.]:	2.404	AT STRAIN:	6.3%
HEIGHT [in.]:	5.746	AT TIME:	0:06:16
STRAIN RATE:	1%		
MOISTURE CONTENT:	26.4%		
DRY DENSITY [pcf]:	91.8		



Services:
Terracon Rep:
Reported To:
Contractor:

Report Distribution

Reviewed By: Kirk Jackson
Kirk D. Jackson, P.E.
Project Engineer

Exhibit: B-14

Consolidated Drained Triaxial Compression Test

Report Number: 66195049.0000
Service Date:
Report Date: 10/08/19
Task:

Terracon
4685 S. Ash Avenue
Tempe, Arizona 85282
(480) 897-8200

Client

Marathon Petroleum Corporation
Jamestown, New Mexico

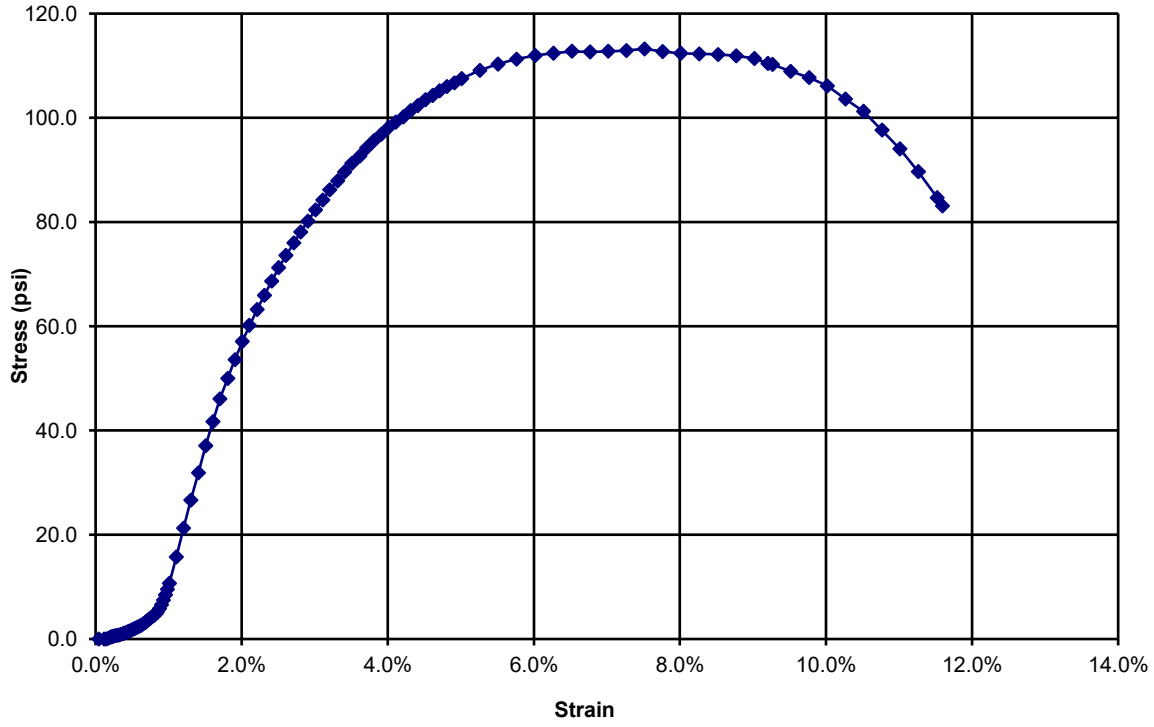
Project

Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup
92 Giant Crossing Road
Gallup, New Mexico

Project No. 66195049

UNCONFINED COMPRESSION STRENGTH OF COHESIVE SOIL (ASTM D 2166)

SAMPLE ID:	B-08 @ 5.0'	MAXIMUM STRESS [psi]:	113.2
DIAMETER [in.]:	2.373	AT STRAIN:	7.5%
HEIGHT [in.]:	3.92	AT TIME:	0:07:31
STRAIN RATE:	1%		
MOISTURE CONTENT:	16.2%		
DRY DENSITY [pcf]:	101.3		



Services:
Terracon Rep:
Reported To:
Contractor:

Report Distribution

Reviewed By: Kirk Jackson
Kirk D. Jackson, P.E.
Project Engineer

Exhibit: B-15

Consolidated Drained Triaxial Compression Test

Report Number: 66195049.0000
Service Date:
Report Date: 10/08/19
Task:

Terracon
4685 S. Ash Avenue
Tempe, Arizona 85282
(480) 897-8200

Client

Marathon Petroleum Corporation
Jamestown, New Mexico

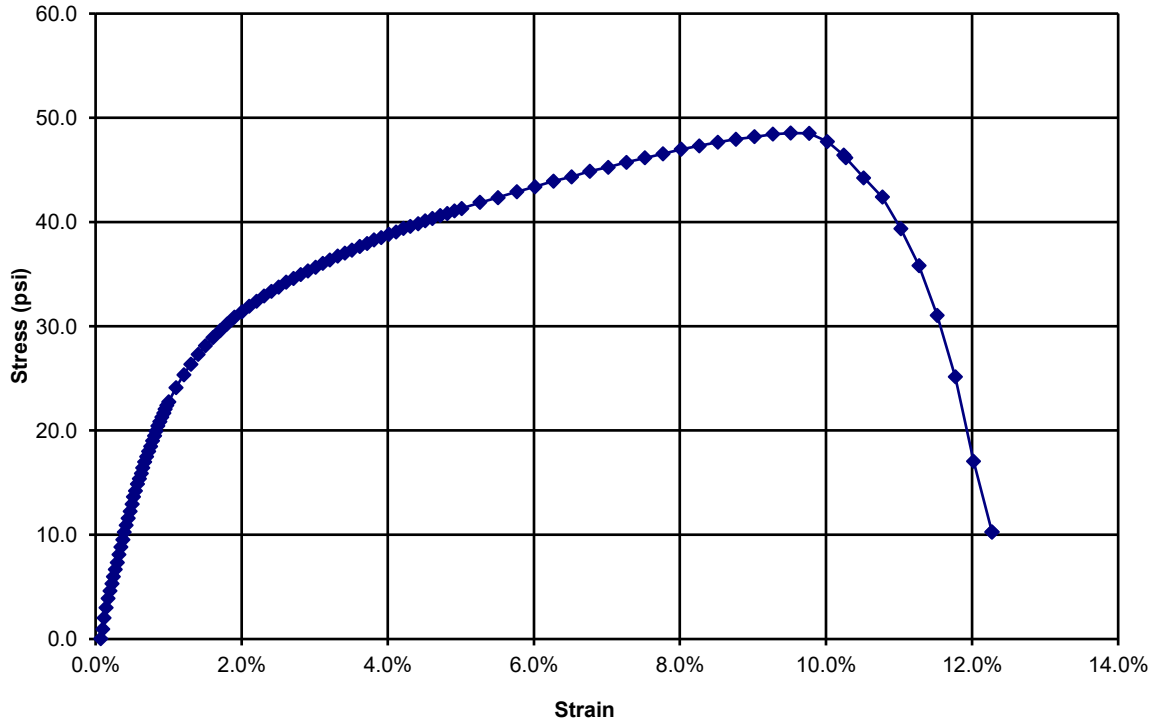
Project

Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup
92 Giant Crossing Road
Gallup, New Mexico

Project No. 66195049

UNCONFINED COMPRESSION STRENGTH OF COHESIVE SOIL (ASTM D 2166)

SAMPLE ID:	B-09 @ 5.0'	MAXIMUM STRESS [psi]:	48.5
DIAMETER [in.]:	2.383	AT STRAIN:	9.5%
HEIGHT [in.]:	5.725	AT TIME:	0:09:32
STRAIN RATE:	1%		
MOISTURE CONTENT:	23.1%		
DRY DENSITY [pcf]:	97.2		



Services:
Terracon Rep:
Reported To:
Contractor:

Report Distribution

Reviewed By: Kirk Jackson
Kirk D. Jackson, P.E.
Project Engineer

Exhibit: B-16

Consolidated Drained Triaxial Compression Test

Report Number: 66195049.0000
Service Date:
Report Date: 10/08/19
Task:

Terracon
4685 S. Ash Avenue
Tempe, Arizona 85282
(480) 897-8200

Client

Marathon Petroleum Corporation
Jamestown, New Mexico

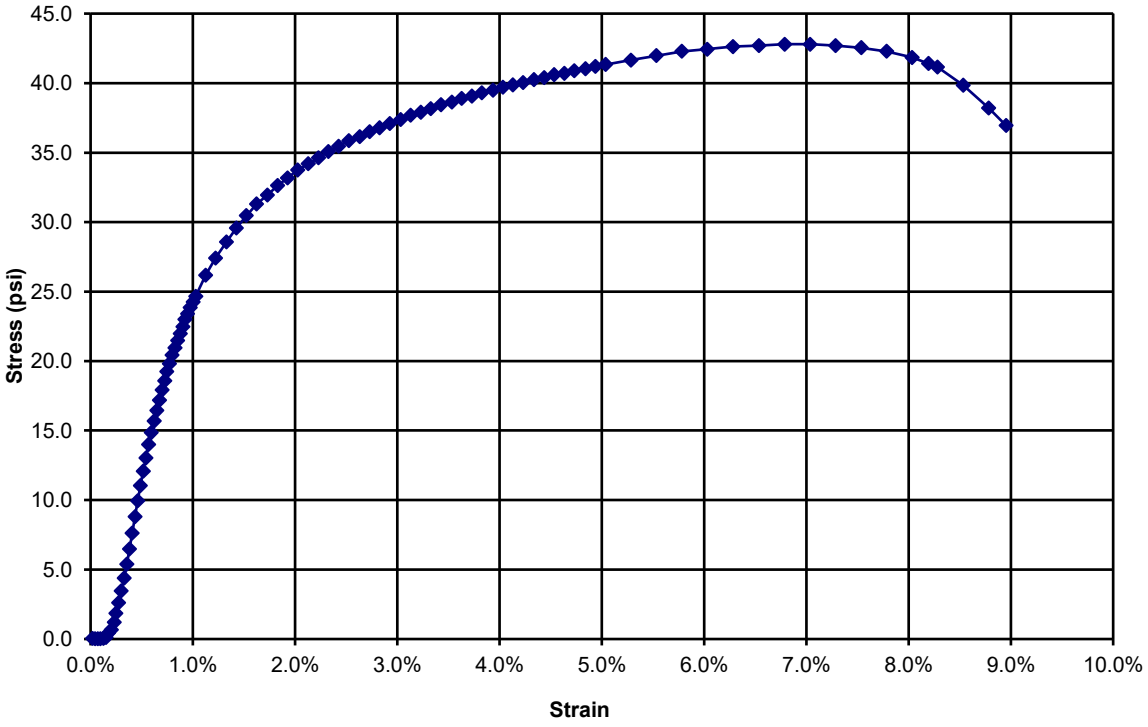
Project

Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup
92 Giant Crossing Road
Gallup, New Mexico

Project No. 66195049

UNCONFINED COMPRESSION STRENGTH OF COHESIVE SOIL (ASTM D 2166)

SAMPLE ID:	P-01 @ 2.5'	MAXIMUM STRESS [psi]:	42.8
DIAMETER [in.]:	2.393	AT STRAIN:	7.0%
HEIGHT [in.]:	5.546	AT TIME:	0:07:03
STRAIN RATE:	1%		
MOISTURE CONTENT:	19.9%		
DRY DENSITY [pcf]:	102.5		



Services:
Terracon Rep:
Reported To:
Contractor:

Report Distribution

Reviewed By: Kirk Jackson
Kirk D. Jackson, P.E.
Project Engineer

Exhibit: B-17

Consolidated Drained Triaxial Compression Test

Report Number: 66195049.0000
Service Date:
Report Date: 10/08/19
Task:

Terracon
4685 S. Ash Avenue
Tempe, Arizona 85282
(480) 897-8200

Client

Marathon Petroleum Corporation
Jamestown, New Mexico

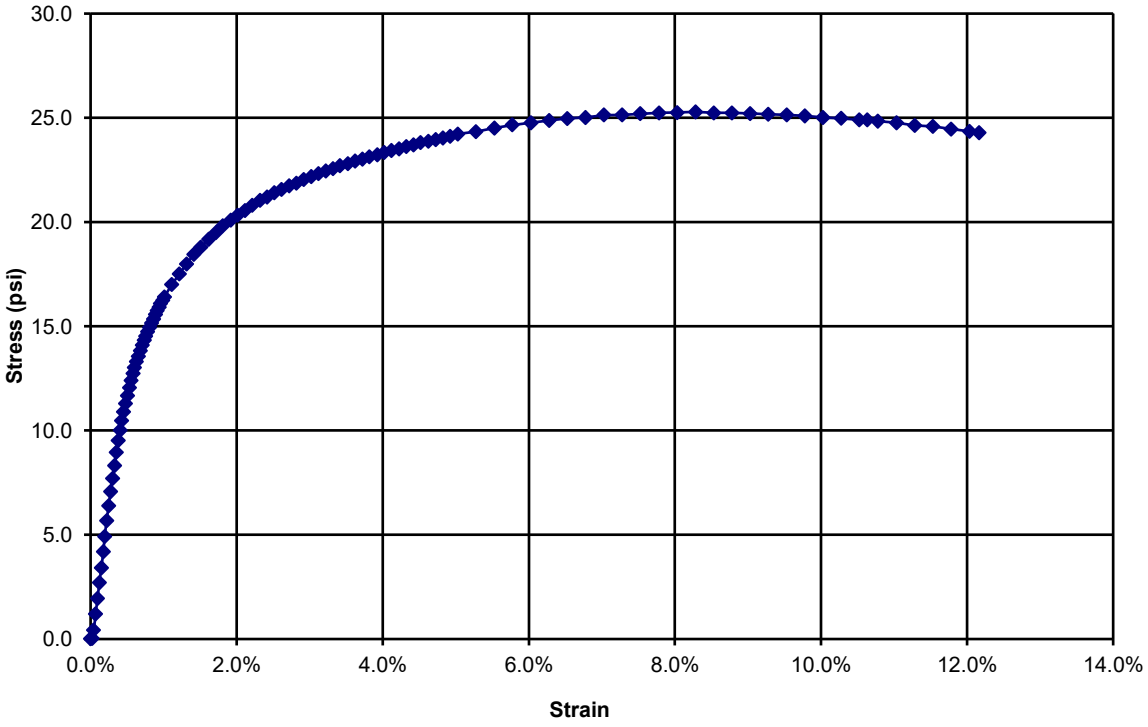
Project

Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup
92 Giant Crossing Road
Gallup, New Mexico

Project No. 66195049

UNCONFINED COMPRESSION STRENGTH OF COHESIVE SOIL (ASTM D 2166)

SAMPLE ID:	P-02 @ 5'	MAXIMUM STRESS [psi]:	25.3
DIAMETER [in.]:	2.384	AT STRAIN:	8.3%
HEIGHT [in.]:	5.536	AT TIME:	0:08:17
STRAIN RATE:	1%		
MOISTURE CONTENT:	26.4%		
DRY DENSITY [pcf]:	96.1		



Services:
Terracon Rep:
Reported To:
Contractor:

Report Distribution

Reviewed By: Kirk Jackson
Kirk D. Jackson, P.E.
Project Engineer

Exhibit: B-18

Consolidated Drained Triaxial Compression Test

Report Number: 66195049.0000
Service Date:
Report Date: 10/08/19
Task:

Terracon
4685 S. Ash Avenue
Tempe, Arizona 85282
(480) 897-8200

Client

Marathon Petroleum Corporation
Jamestown, New Mexico

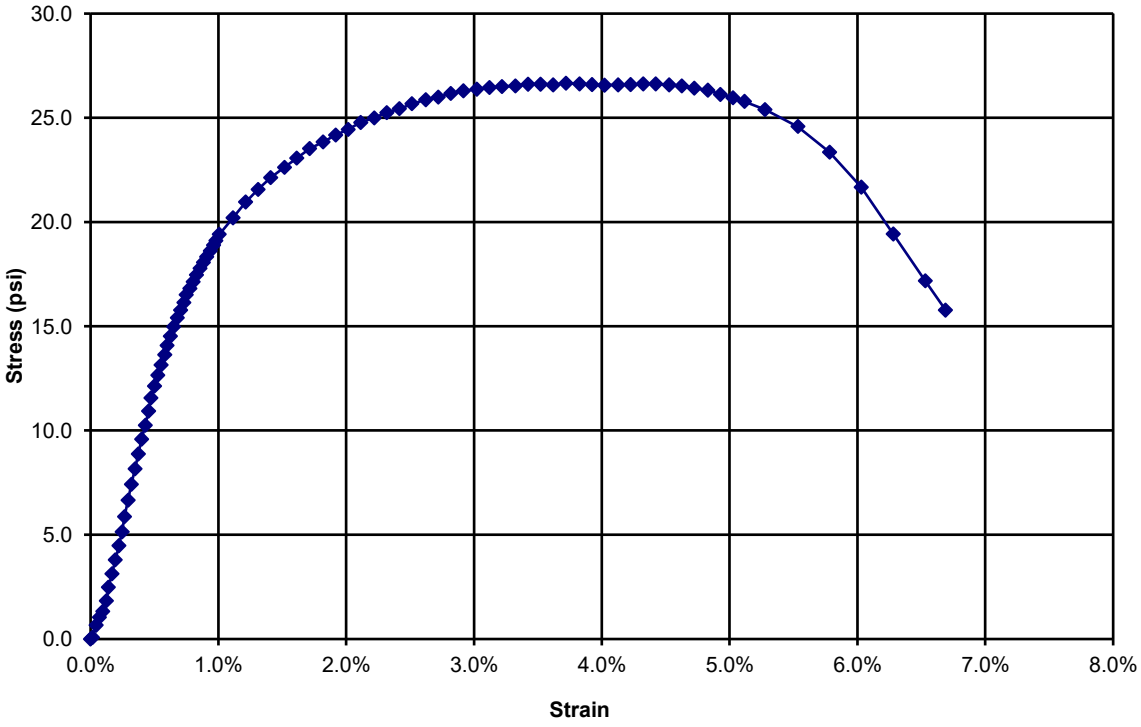
Project

Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup
92 Giant Crossing Road
Gallup, New Mexico

Project No. 66195049

UNCONFINED COMPRESSION STRENGTH OF COHESIVE SOIL (ASTM D 2166)

SAMPLE ID:	P-05 @ 2.5'	MAXIMUM STRESS [psi]:	26.7
DIAMETER [in.]:	2.379	AT STRAIN:	3.7%
HEIGHT [in.]:	5.541	AT TIME:	0:03:44
STRAIN RATE:	1%		
MOISTURE CONTENT:	12.6%		
DRY DENSITY [pcf]:	113.1		



Services:
Terracon Rep:
Reported To:
Contractor:

Report Distribution

Reviewed By: Kirk Jackson
Kirk D. Jackson, P.E.
Project Engineer

Exhibit: B-19

Consolidated Drained Triaxial Compression Test

Report Number: 66195049.0000
Service Date:
Report Date: 10/08/19
Task:

Terracon
4685 S. Ash Avenue
Tempe, Arizona 85282
(480) 897-8200

Client

Marathon Petroleum Corporation
Jamestown, New Mexico

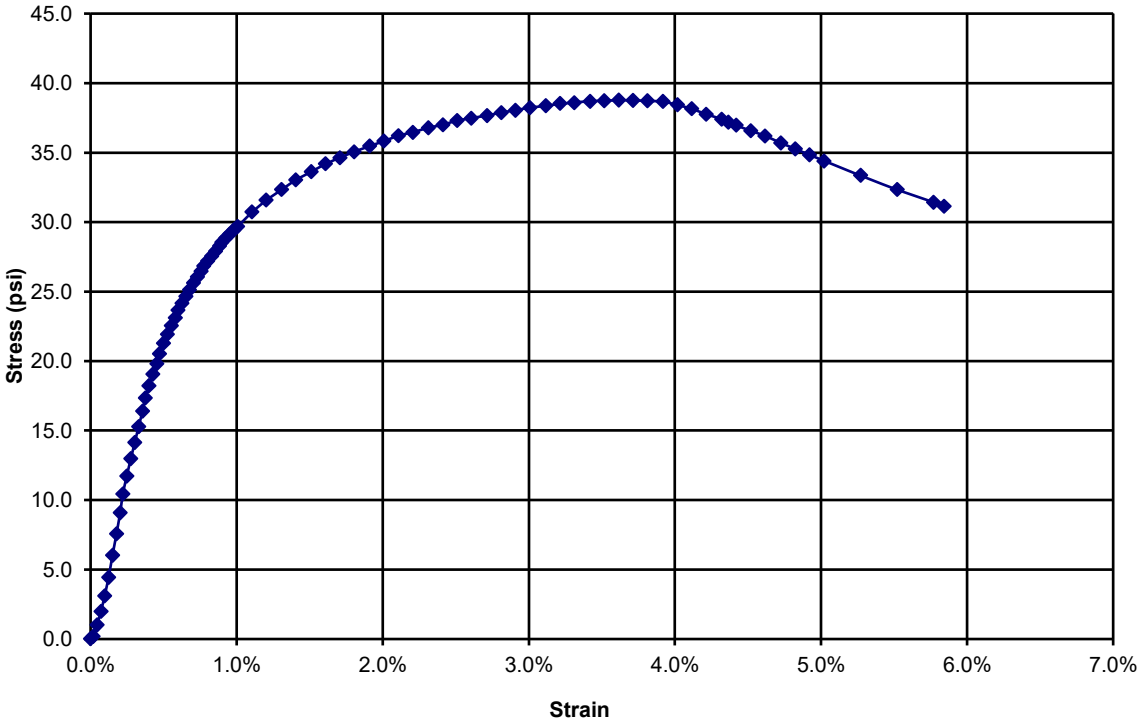
Project

Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup
92 Giant Crossing Road
Gallup, New Mexico

Project No. 66195049

UNCONFINED COMPRESSION STRENGTH OF COHESIVE SOIL (ASTM D 2166)

SAMPLE ID:	P-07 @ 5'
DIAMETER [in.]:	2.404
HEIGHT [in.]:	5.555
STRAIN RATE:	1%
MOISTURE CONTENT:	20.7%
DRY DENSITY [pcf]:	104.1
MAXIMUM STRESS [psi]:	38.8
AT STRAIN:	3.6%
AT TIME:	0:03:38



Services:
Terracon Rep:
Reported To:
Contractor:

Report Distribution

Reviewed By: Kirk Jackson
Kirk D. Jackson, P.E.
Project Engineer

Exhibit: B-20

Consolidated Drained Triaxial Compression Test

Report Number: 66195049.0000
Service Date:
Report Date: 10/08/19
Task:

Terracon
4685 S. Ash Avenue
Tempe, Arizona 85282
(480) 897-8200

Client

Marathon Petroleum Corporation
Jamestown, New Mexico

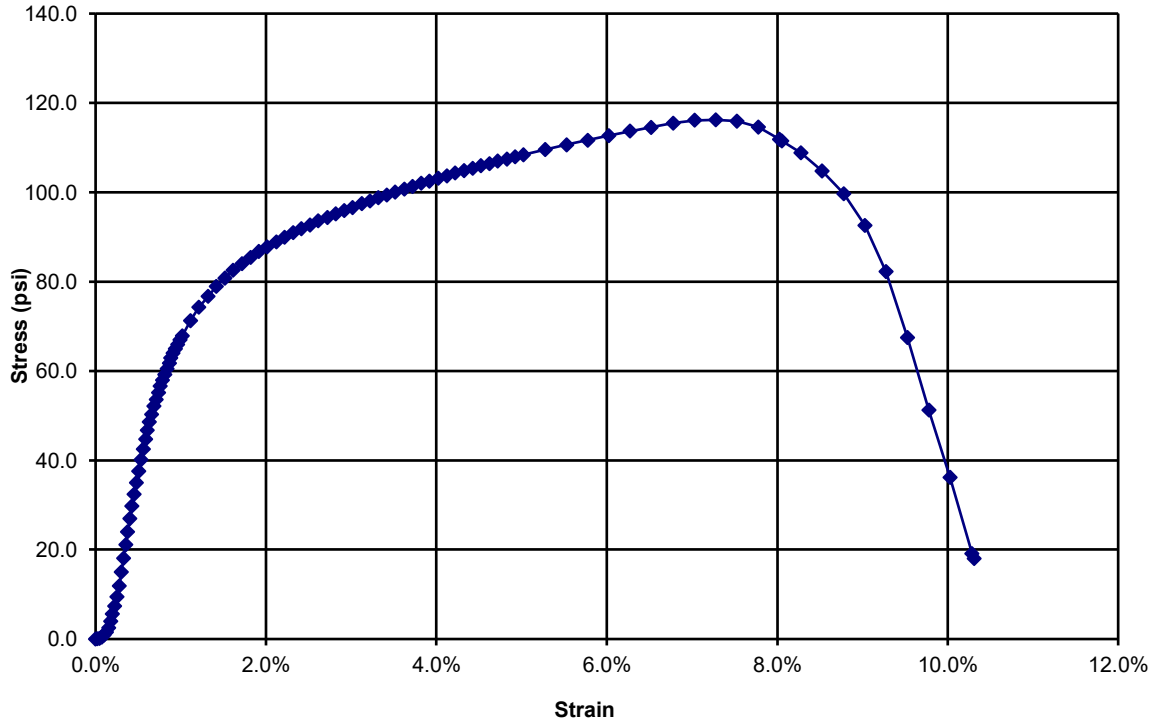
Project

Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup
92 Giant Crossing Road
Gallup, New Mexico

Project No. 66195049

UNCONFINED COMPRESSION STRENGTH OF COHESIVE SOIL (ASTM D 2166)

SAMPLE ID:	P-08 @ 2.5'	MAXIMUM STRESS [psi]:	116.2
DIAMETER [in.]:	2.389	AT STRAIN:	7.3%
HEIGHT [in.]:	5.715	AT TIME:	0:07:17
STRAIN RATE:	1%		
MOISTURE CONTENT:	18.7%		
DRY DENSITY [pcf]:	108.8		



Services:
Terracon Rep:
Reported To:
Contractor:

Report Distribution

Reviewed By: Kirk Jackson
Kirk D. Jackson, P.E.
Project Engineer

Exhibit: B-21

Consolidated Drained Triaxial Compression Test

Report Number: 66195049.0000
Service Date:
Report Date: 10/08/19
Task:

Terracon
4685 S. Ash Avenue
Tempe, Arizona 85282
(480) 897-8200

Client

Marathon Petroleum Corporation
Jamestown, New Mexico

Project

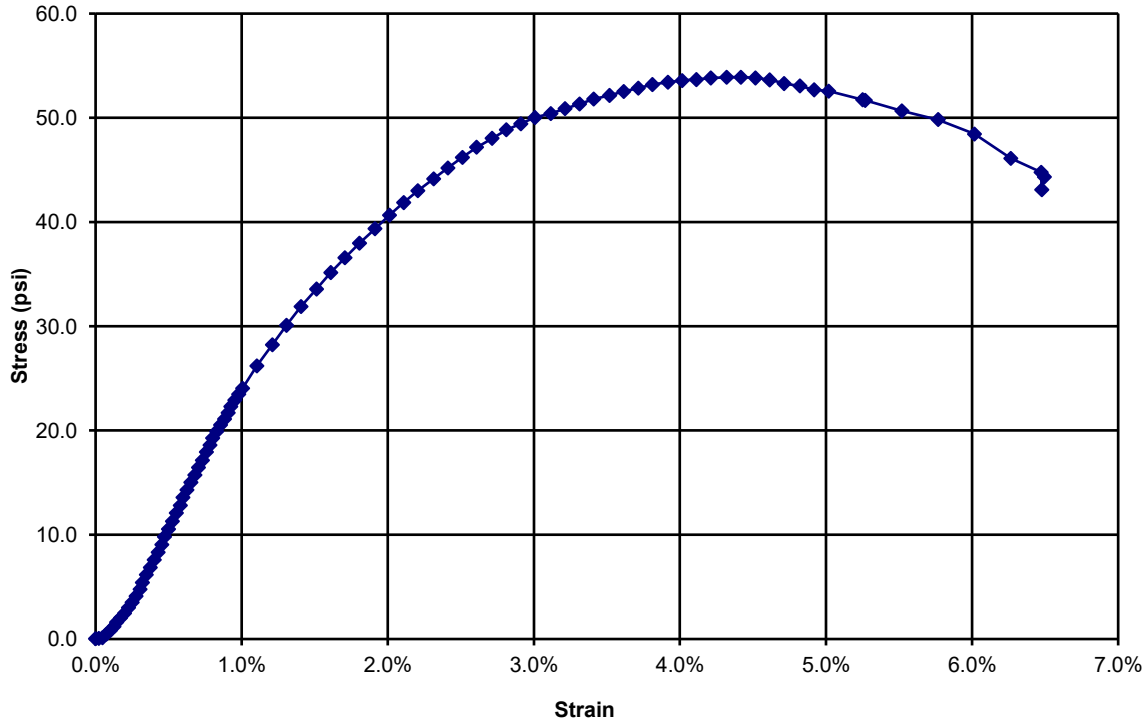
Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup
92 Giant Crossing Road
Gallup, New Mexico

Project No. 66195049

UNCONFINED COMPRESSION STRENGTH OF COHESIVE SOIL (ASTM D 2166)

SAMPLE ID: P-09 @ 2.5'
DIAMETER [in.]: 2.366
HEIGHT [in.]: 4.925
STRAIN RATE: 1%
MOISTURE CONTENT: 16.1%
DRY DENSITY [pcf]: 100.4

MAXIMUM STRESS [psi]: 53.9
AT STRAIN: 4.4%
AT TIME: 0:04:25



Services:
Terracon Rep:
Reported To:
Contractor:

Report Distribution

Reviewed By: Kirk Jackson
Kirk D. Jackson, P.E.
Project Engineer

Exhibit: B-22

Consolidated Drained Triaxial Compression Test

Report Number: 66195049.0000
Service Date:
Report Date: 10/08/19
Task:

Terracon
4685 S. Ash Avenue
Tempe, Arizona 85282
(480) 897-8200

Client

Marathon Petroleum Corporation
Jamestown, New Mexico

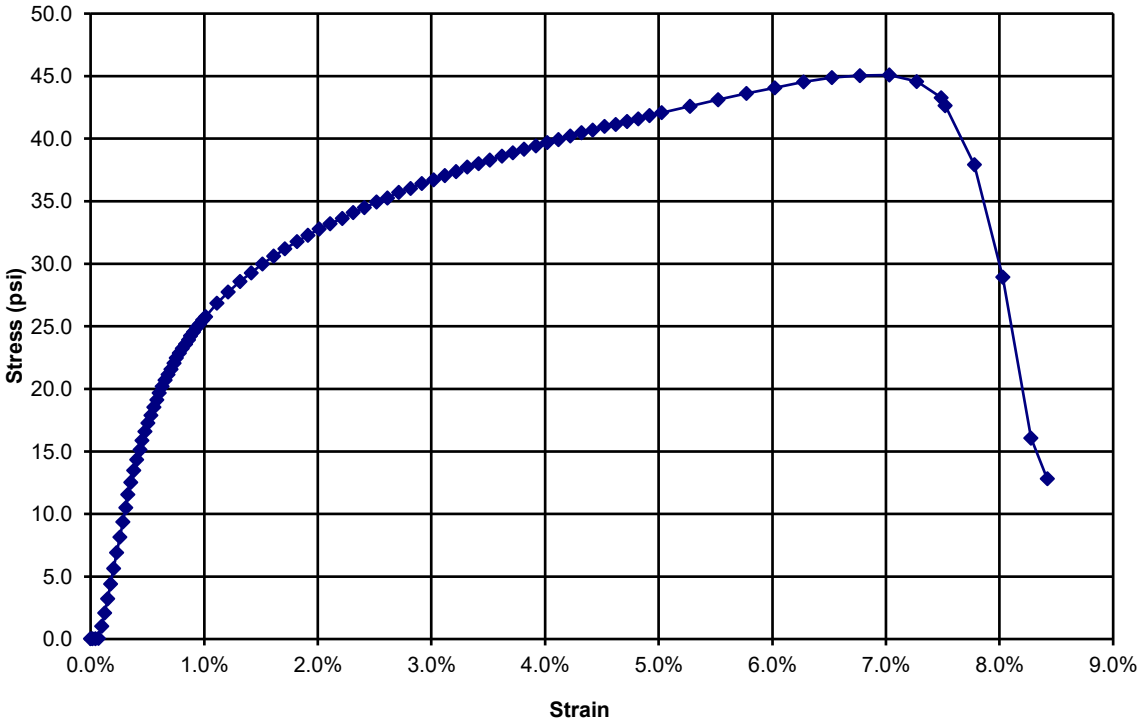
Project

Evaporation Pond Nos. 6, 7 and 9 Marathon Petroleum Company Gallup
92 Giant Crossing Road
Gallup, New Mexico

Project No. 66195049

UNCONFINED COMPRESSION STRENGTH OF COHESIVE SOIL (ASTM D 2166)

SAMPLE ID:	P-10 @ 2.5'	MAXIMUM STRESS [psi]:	45.1
DIAMETER [in.]:	2.379	AT STRAIN:	7.0%
HEIGHT [in.]:	5.569	AT TIME:	0:07:02
STRAIN RATE:	1%		
MOISTURE CONTENT:	21.1%		
DRY DENSITY [pcf]:	99.5		



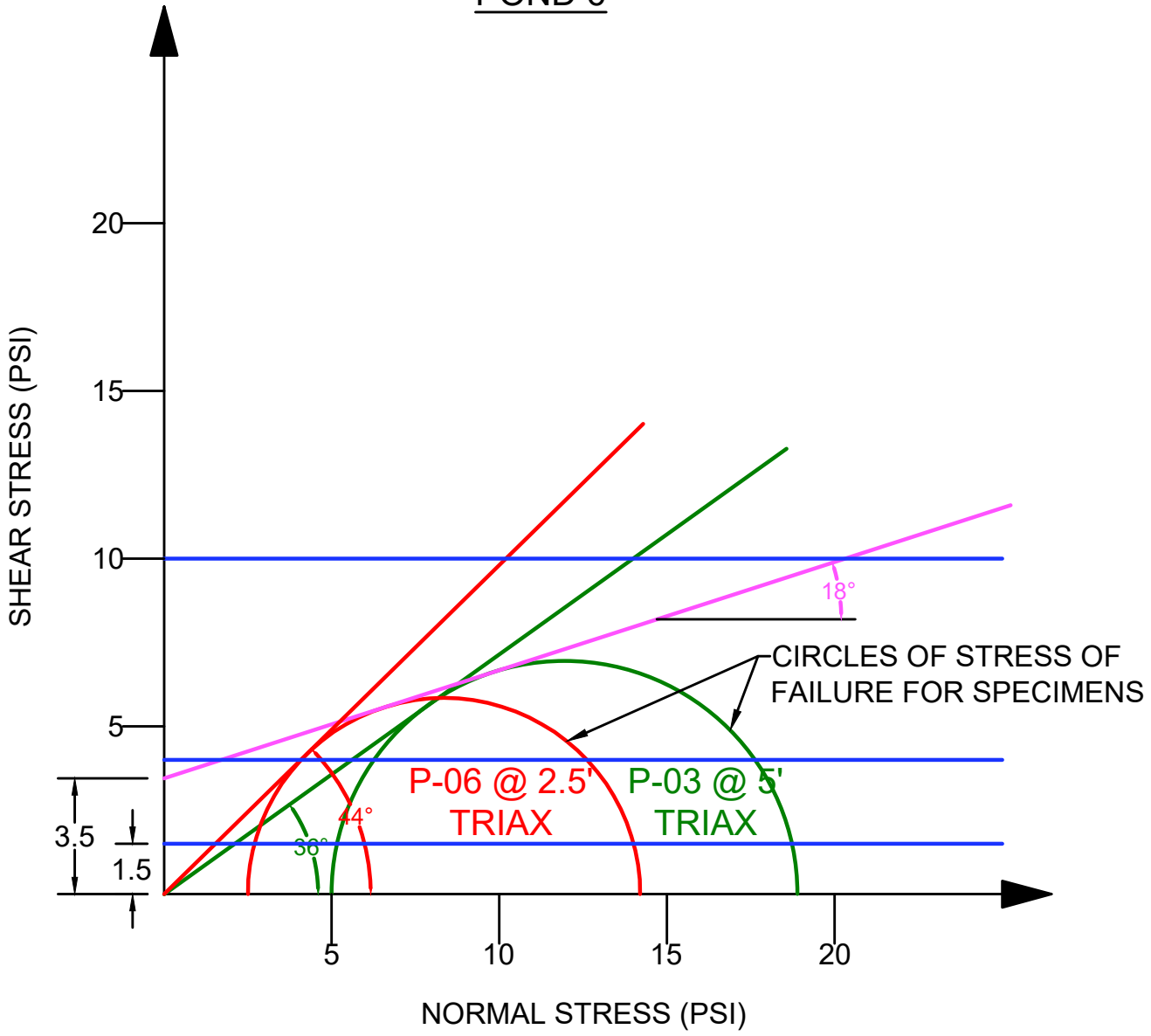
Services:
Terracon Rep:
Reported To:
Contractor:

Report Distribution

Reviewed By: Kirk Jackson
Kirk D. Jackson, P.E.
Project Engineer

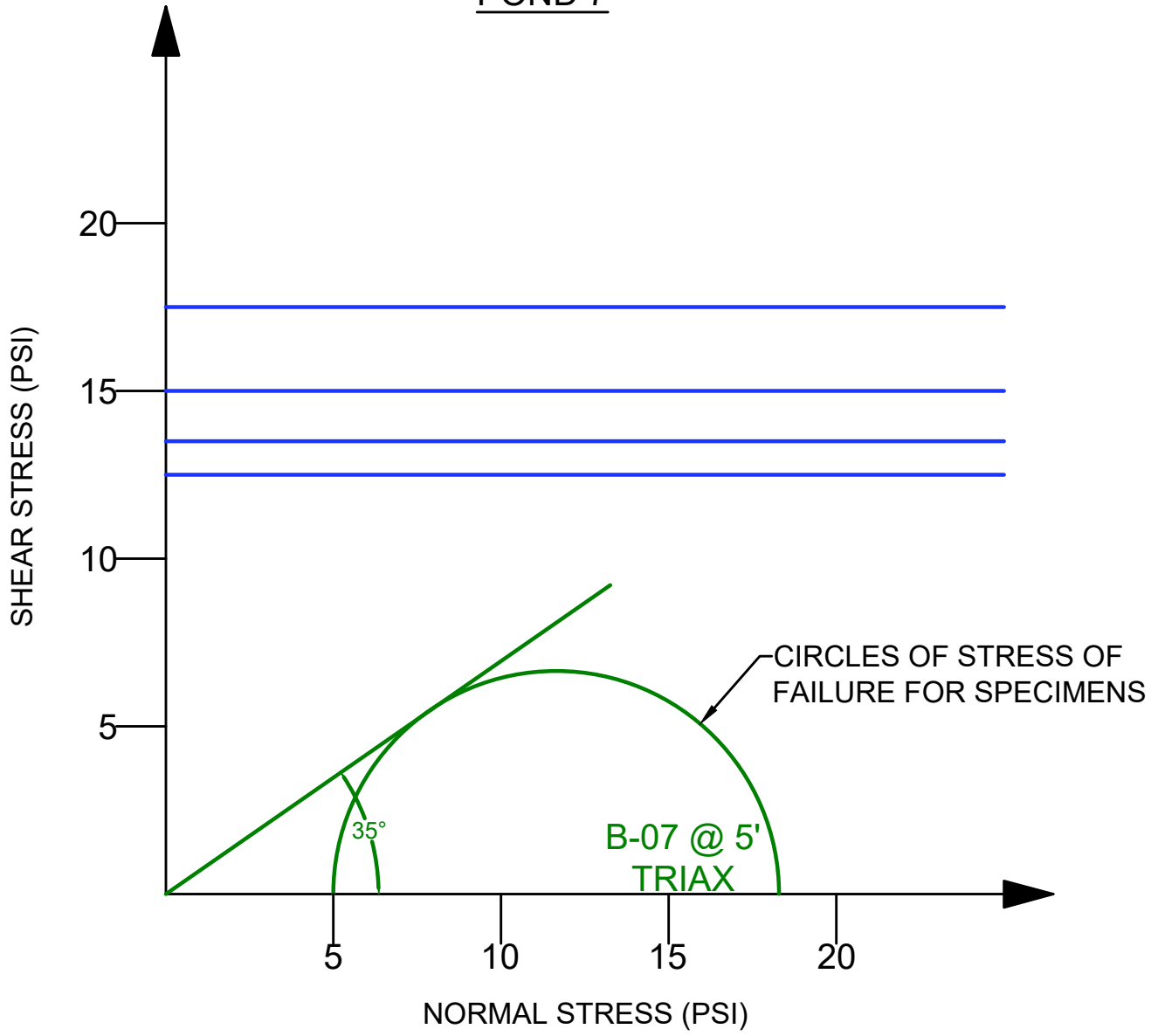
Exhibit: B-23

POND 6



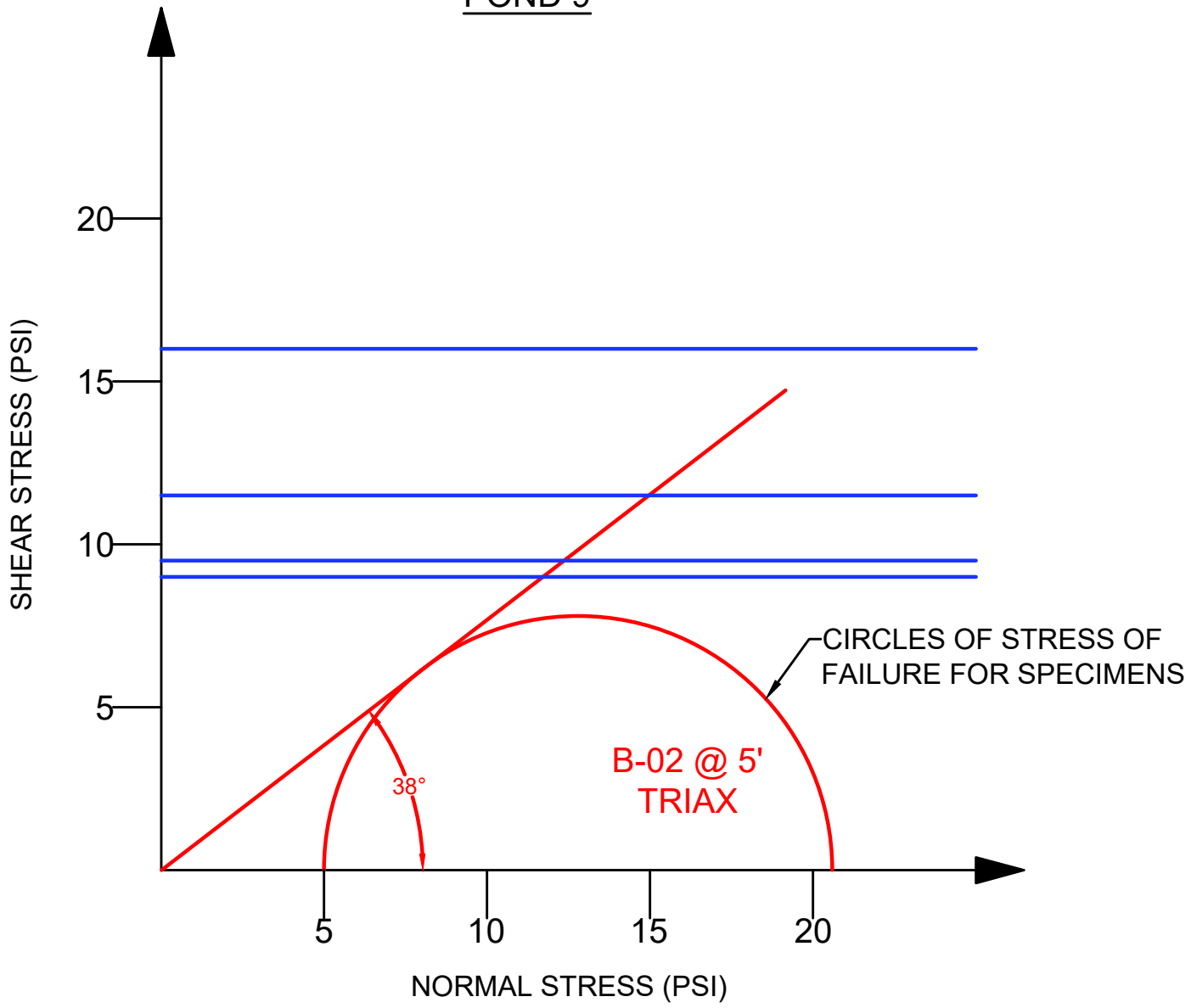
Project Mngr: BJD	Project No. 66195049	Terracon Consulting Engineers and Scientists	MOHR STRENGTH ENVELOPE - P-06 @ 2.5' AND P-03 @ 5'
Drawn By: BJD	Scale: AS SHOWN	4685 South Ash Avenue, Suite H-4 Tempe, AZ 85282	MARATHON PETROLEUM COMPANY GALLUP
Checked By: DRC	File No. POND 6 PARAMETERS.DWG	PH. (480) 897-8200 FAX. (480) 897-1133	EVAPORATION POND NOS. 6 &7 GALLUP, NEW MEXICO
Approved By: DRC	Date: 01/02/2020		EXHIBIT B-24

POND 7



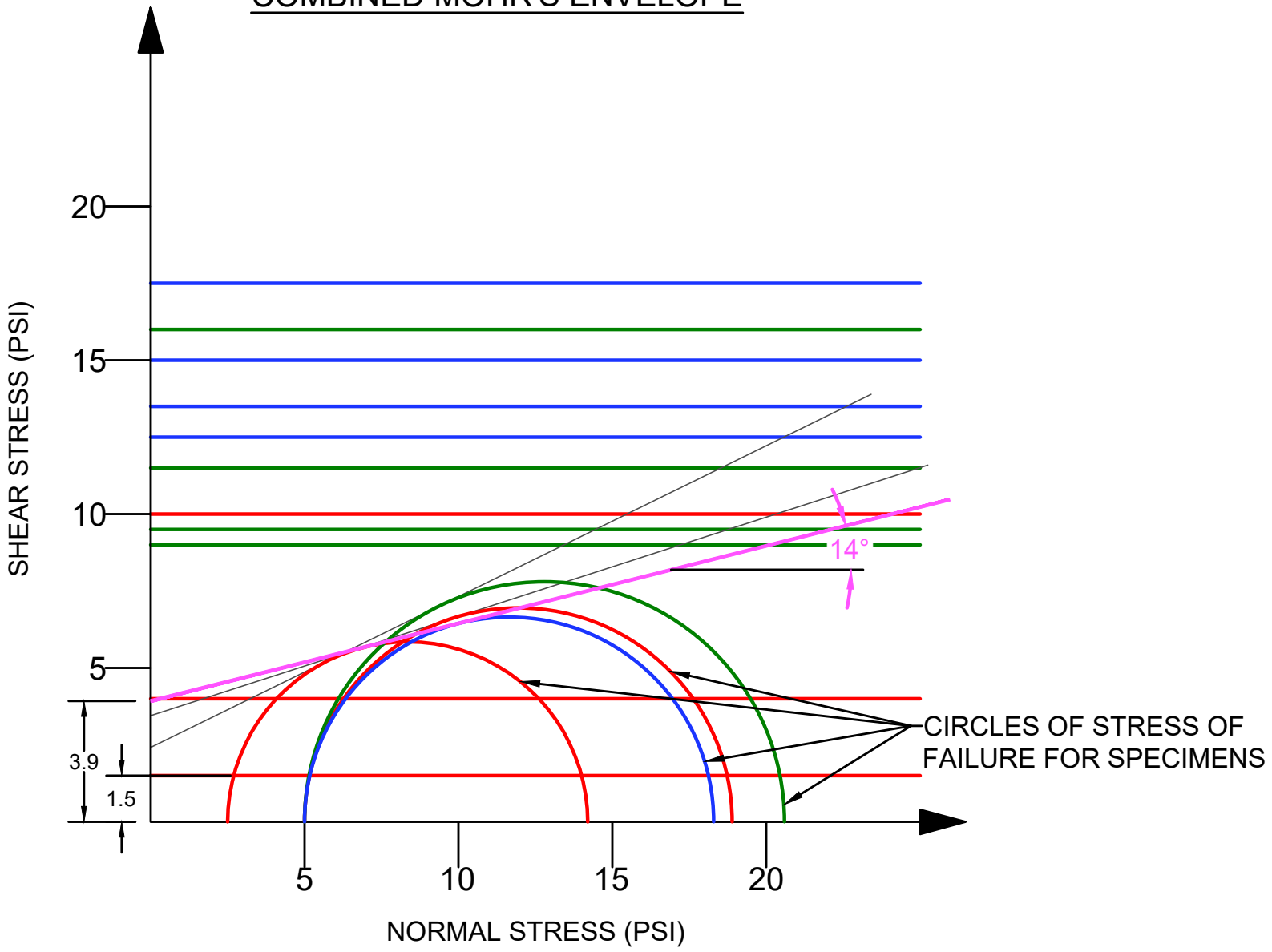
Project Mngr: BJD	Project No. 66195049	Terracon Consulting Engineers and Scientists	MOHR STRENGTH ENVELOPE - B-07 @ 5'
Drawn By: BJD	Scale: AS SHOWN	4685 South Ash Avenue, Suite H-4 Tempe, AZ 85282	MARATHON PETROLEUM COMPANY GALLUP
Checked By: DRC	File No. POND 7 PARAMETERS.DWG	PH. (480) 897-8200 FAX. (480) 897-1133	EVAPORATION POND NOS. 6 &7 GALLUP, NEW MEXICO
Approved By: DRC	Date: 01/02/2020		EXHIBIT B-25

POND 9



Project Mngr: BJD	Project No. 66195049	Terracon Consulting Engineers and Scientists	MOHR STRENGTH ENVELOPE - B-02 @ 5'
Drawn By: BJD	Scale: AS SHOWN	4685 South Ash Avenue, Suite H-4 Tempe, AZ 85282	MARATHON PETROLEUM COMPANY GALLUP
Checked By: DRC	File No. POND 9 PARAMETERS.DWG	PH. (480) 897-8200 FAX. (480) 897-1133	EVAPORATION POND NOS. 6 &7 GALLUP, NEW MEXICO
Approved By: DRC	Date: 01/02/2020		EXHIBIT B-26

COMBINED MOHR'S ENVELOPE



LEGEND:

- POND 6 TEST DATA
- POND 7 TEST DATA
- POND 9 TEST DATA

Project Mngr: BJD	Project No. 66195049
Drawn By: BJD	Scale: AS SHOWN
Checked By: DRC	File No. COMBINED PARAMETERS.DWG
Approved By: DRC	Date: 01/02/2020

Terracon
Consulting Engineers and Scientists
4685 South Ash Avenue, Suite H-4 Tempe, AZ 85282
PH. (480) 897-8200 FAX. (480) 897-1133

MOHR STRENGTH ENVELOPE - COMBINED

MARATHON PETROLEUM COMPANY GALLUP

EVAPORATION POND NOS. 6 &7
GALLUP, NEW MEXICO

EXHIBIT

B-27

APPENDIX C – PIEZOMETER READINGS

Project Number: 66195049

Project Name: Marathon Petroleum Company Gallup Refinery
Evaporation Ponds 6, 7 & 9

Summary of Piezometer Data		
	Depth From Top of boring (ft)	
Piezometer No.	9/16/2019	12/11/2019
P-01	No Water	No Water
P-02	No Water	No Water
P-03	3.6	1.92
P-04	4	1.67
P-05	4.2	6
P-06	No Water	No Water
P-07	5.7	6.92
P-08	No Water	No Water
P-09	No Water	No Water
P-10	No Water	No Water

No Water (9/16)
No Water (9/16)
No Water (9/16)
1.3' Water (9/16)

POND 7 (West to East)
(4 - TOTAL)

POND 12B
POND 12A
POND 11
POND 7
UPPER STORM WATER BASIN
POND 8
POND 2
SMWU-1
POND 3
POND 4
POND 5
POND 6

No Water (9/16)
2.8' Water (9/16)
3' Water (9/16)
3.4' Water (9/16)

POND 6 (West to East)
(4 - TOTAL)

No Water (9/16)
No Water (9/16)

POND 9
(2 - TOTAL)

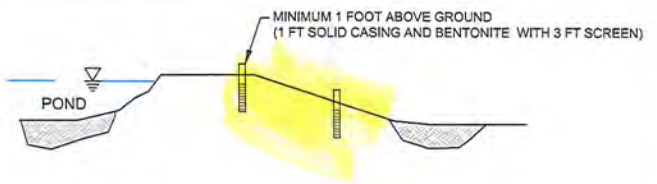
POND 9

N

0 175 350
SCALE IN FEET

LEGEND:
PROPOSED STABILITY ANALYSIS LOCATION
PROPOSED PIEZOMETER LOCATION

TYPICAL POND 9
PIEZOMETER SECTION



AXIS GROUP Inc.
1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

PROJ. NO.: 15-010-04	DATE: 10/30/2018	DRAWN BY: JAY	CHECKED BY: JWB

MARATHON- GALLUP REFINERY, NEW MEXICO

PROPOSED PIEZOMETER LOCATIONS AND
NUMERICAL SLOPE STABILITY SECTION LOCATIONS

Exhibit No.

C-2

C:\Users\ELundborg\Desktop\Revised Slope Stability\FIGURE 6a-6b - X-Sections and Peizometer Locs.dwg ELundborg Plotted: Oct 30, 2018 - 1:38pm

No Water
No Water
No Water
0' 1"

POND 7 (West to East)
(4 - TOTAL)

POND 7

POND 8

POND 11

POND 12B

POND 12A

UPPER STORM
WATER BASIN

POND 2

SMWU-1

POND 3

POND 4

POND 5

No Water
1'0"
5'4"
5'1"

POND 6

POND 6 (West to East)
(4 - TOTAL)

Measurements observed
on 12/11/19 @ 9:30am
Measurements are from the
bottom of the manitor to
the surface of the water

No Water
No Water

POND 9
(2 - TOTAL)

POND 9

N

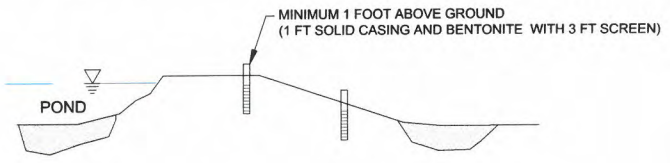
0 175 350
SCALE IN FEET

LEGEND:

PROPOSED STABILITY ANALYSIS LOCATION

PROPOSED PIEZOMETER LOCATION

TYPICAL POND 9
PIEZOMETER SECTION



AXIS GROUP Inc.
1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

PROJ. NO.: 15-010-04	DATE: 10/30/2018	DRAWN BY: JAY	CHECKED BY: JWB

MARATHON- GALLUP REFINERY, NEW MEXICO

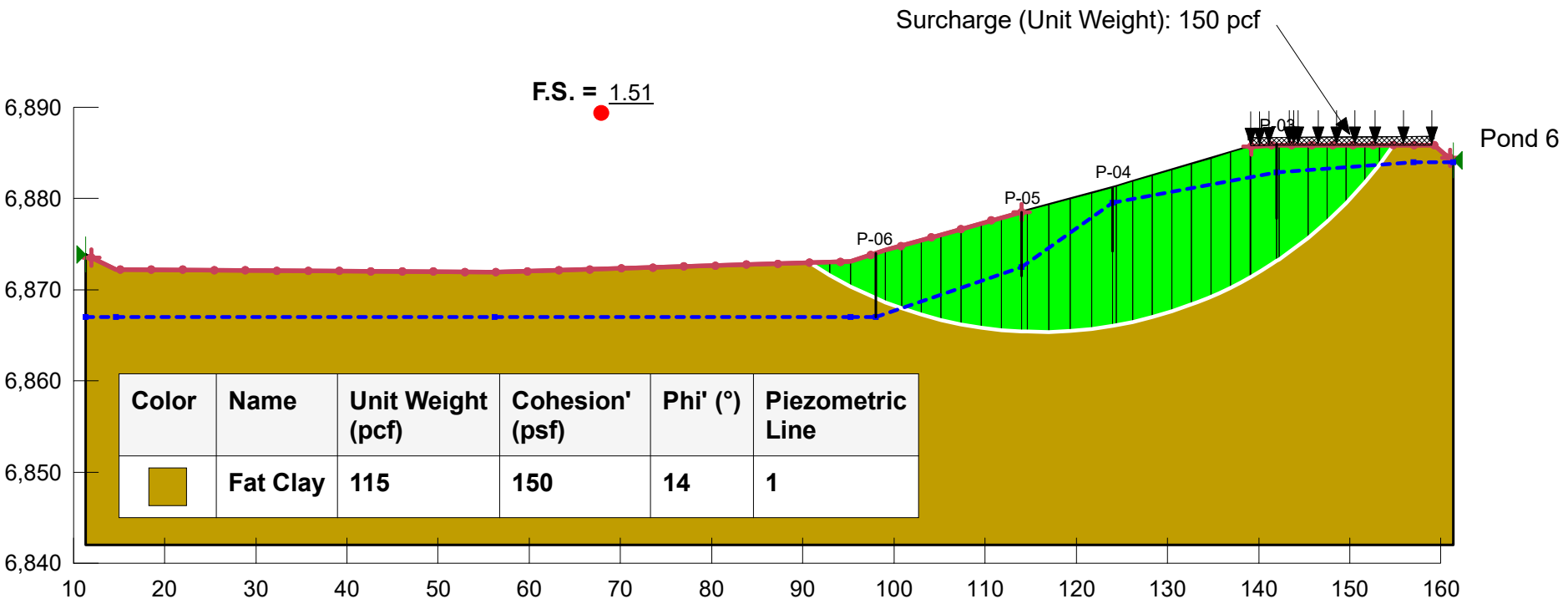
PROPOSED PIEZOMETER LOCATIONS AND
NUMERICAL SLOPE STABILITY SECTION LOCATIONS

Exhibit No.

C-3

APPENDIX D – SLOPE STABILITY ANALYSES

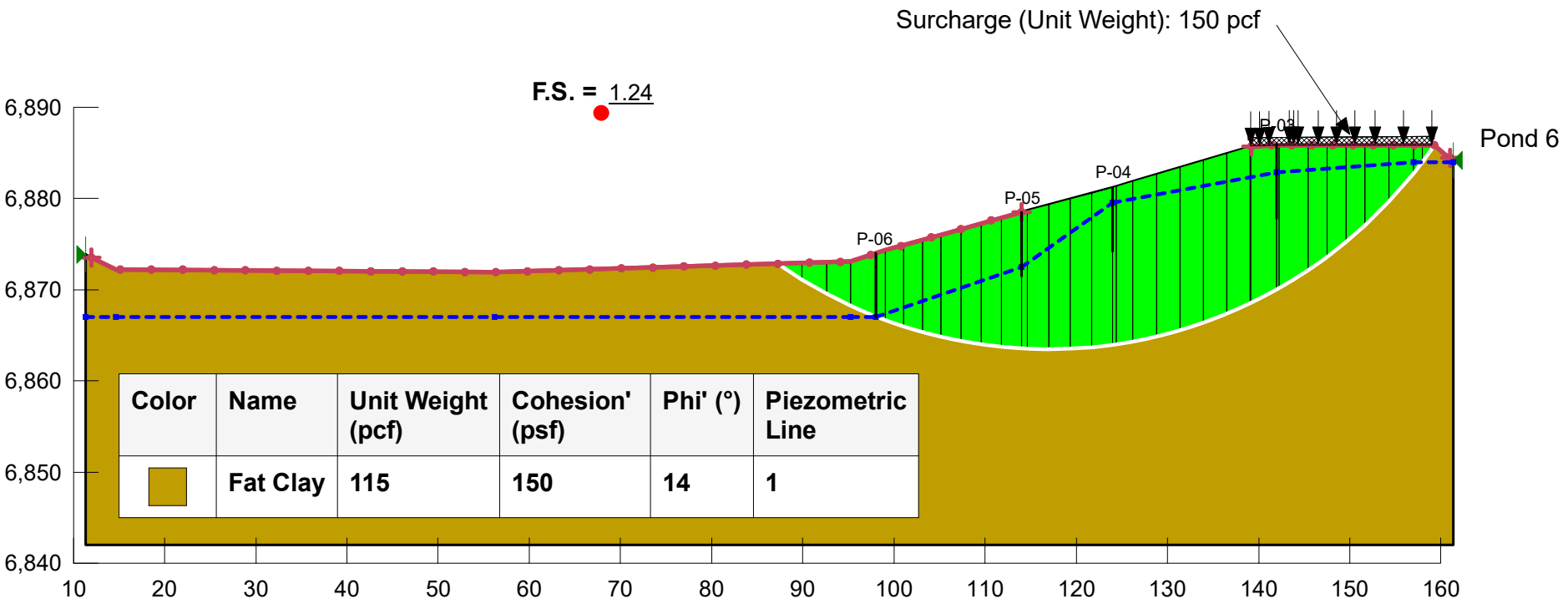
Marathon Patroleum Company Gallup Refinery
Pond 6 - Slope Stability Analysis
Morgenstern Price Limit-Equilibrium
Water Level: Updated Piezometer Readings dated 12/11/19
Static Conditions



Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Fat Clay	115	150	14	1

Exhibit D-1

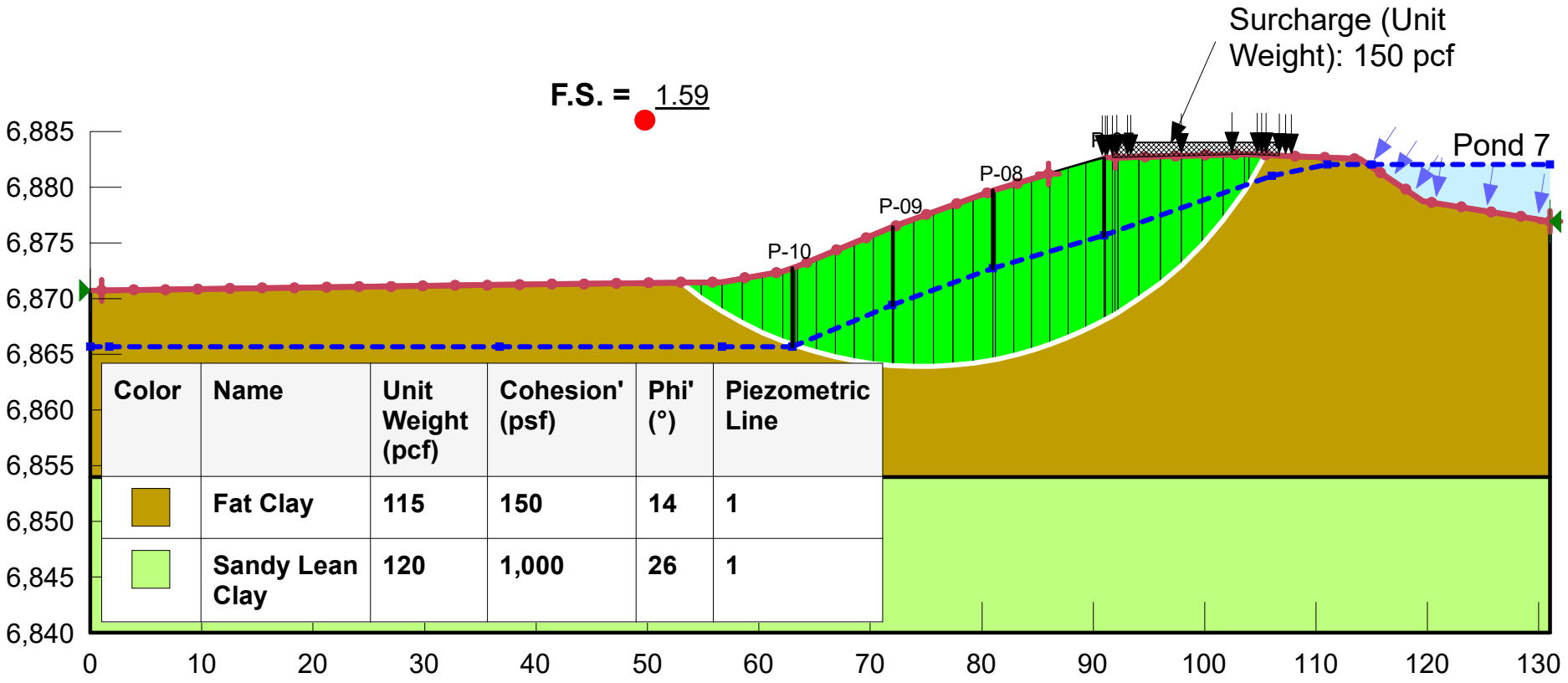
Marathon Patroleum Company Gallup Refinery
Pond 6 - Slope Stability Analysis
Morgenstern Price Limit-Equilibrium
Water Level: Updated Piezometer Readings dated 12/11/19
Seismic Conditions



Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Fat Clay	115	150	14	1

Exhibit D-2

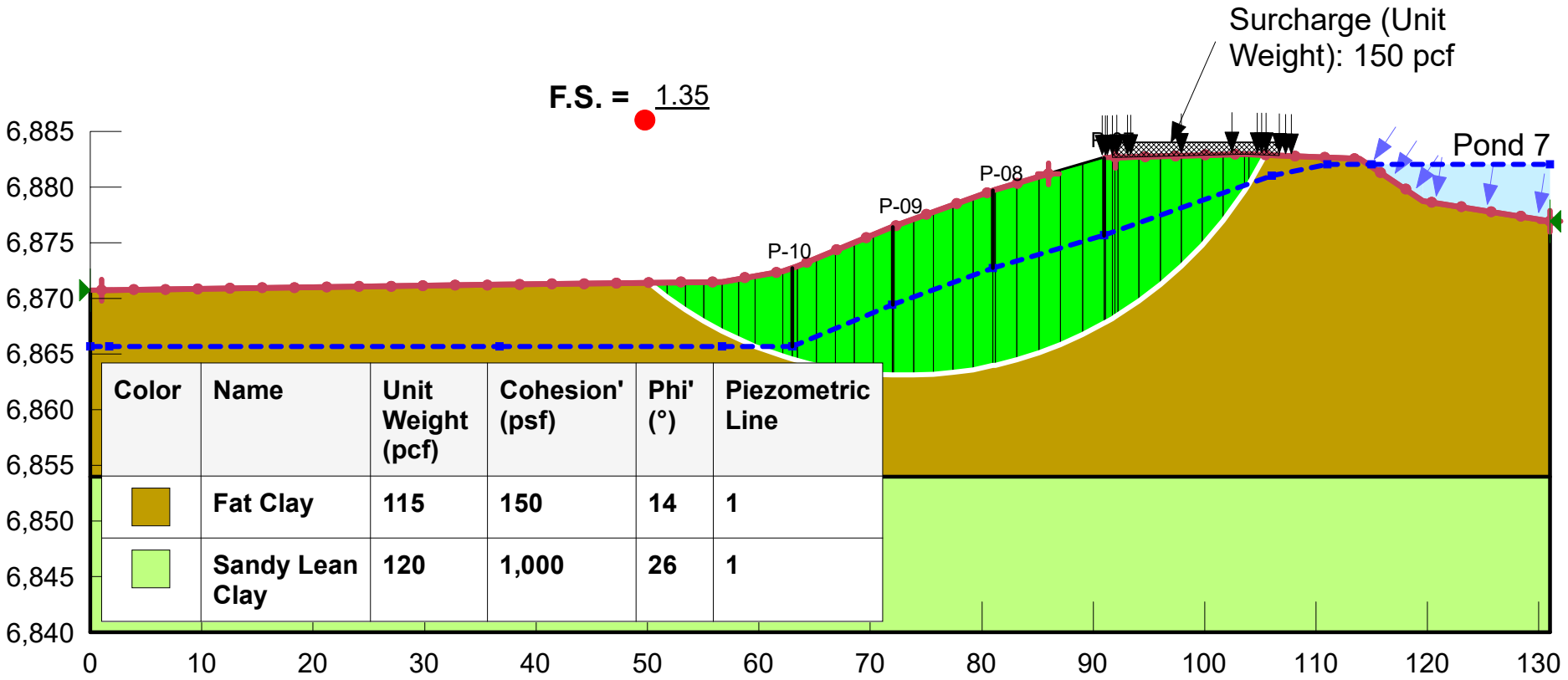
Marathon Patroleum Company Gallup Refinery
Pond 7 - Slope Stability Analysis
Morgenstern Price Limit-Equilibrium
Water Level: Updated Piezometer Readings dated 12/11/19
Static Conditions



Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Fat Clay	115	150	14	1
	Sandy Lean Clay	120	1,000	26	1

Exhibit D-3

Marathon Patroleum Company Gallup Refinery
Pond 7 - Slope Stability Analysis
Morgenstern Price Limit-Equilibrium
Water Level: Updated Piezometer Readings dated 12/11/19
Seismic Conditions



Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Fat Clay	115	150	14	1
	Sandy Lean Clay	120	1,000	26	1

Exhibit D-4

Marathon Patroleum Company Gallup Refinery
Pond 9 - Slope Stability Analysis
Morgenstern Price Limit-Equilibrium
Water Level: Updated Piezometer Readings dated 12/11/19
Static Conditions

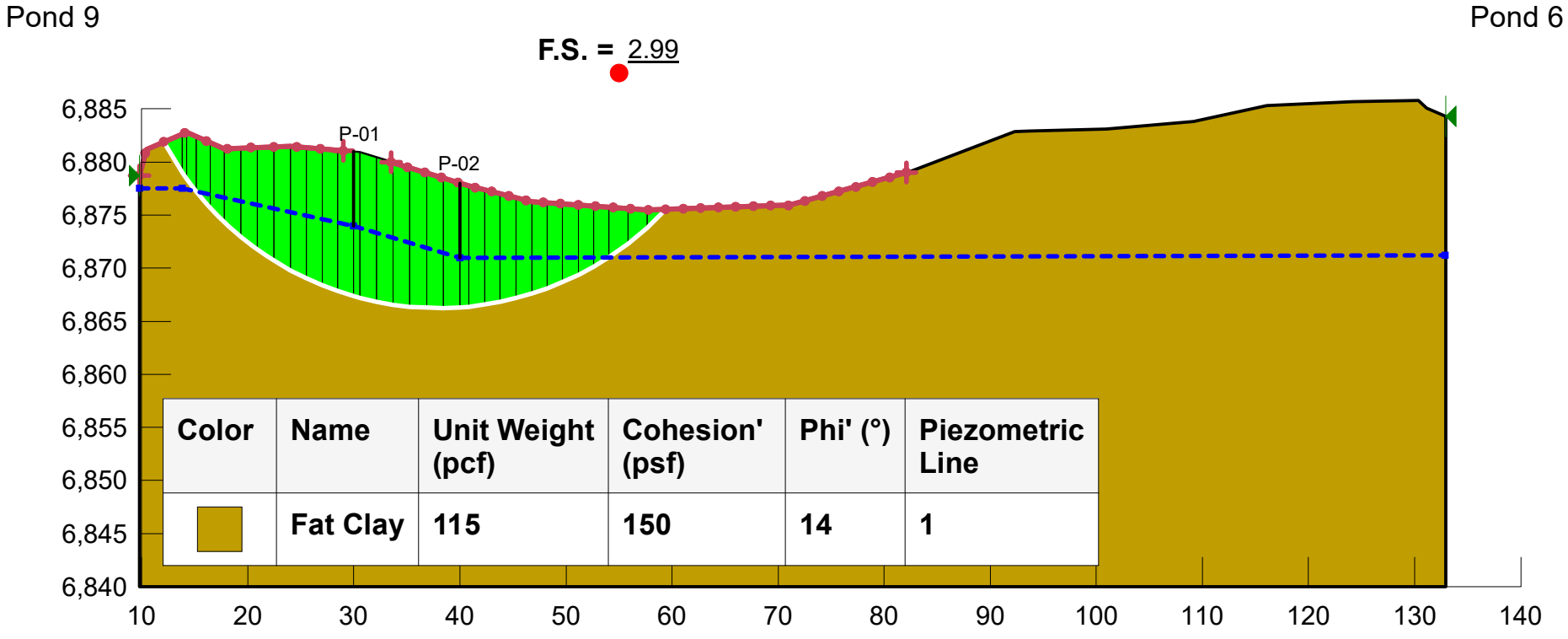


Exhibit D-5

Marathon Patroleum Company Gallup Refinery
Pond 9 - Slope Stability Analysis
Morgenstern Price Limit-Equilibrium
Water Level: Updated Piezometer Readings dated 12/11/19
Seismic Conditions

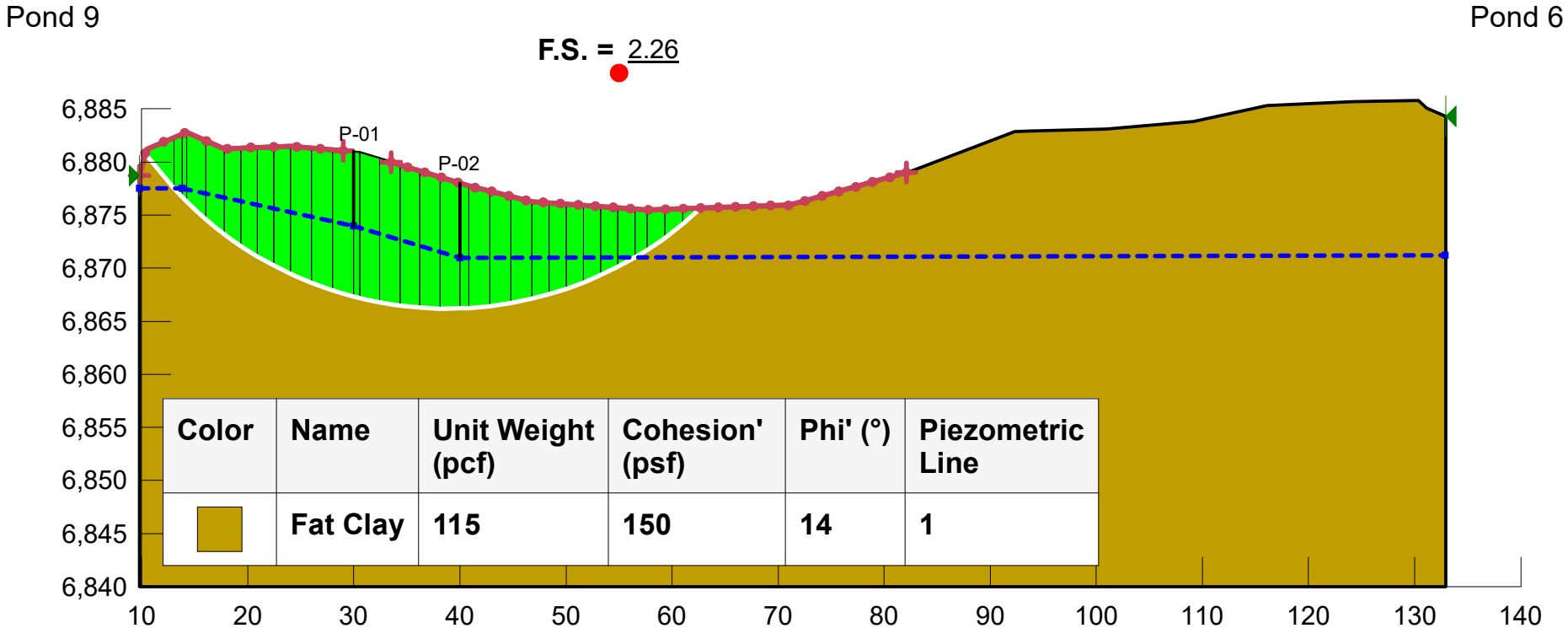


Exhibit D-6

NEW MEXICO
ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6313
Phone (505) 476-6000 Fax (505) 476-6030
www.env.nm.gov

Michelle Lujan Grisham
Governor

Howie C. Morales
Lt. Governor

James C. Kenney
Cabinet Secretary

Jennifer J. Pruett
Deputy Secretary

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

May 22, 2019

John Moore
Environmental Superintendent
Western Refining Southwest Inc., Gallup Refinery
92 Giant Crossing Road
Gallup, New Mexico 87301

RE: APPROVAL
RESPONSE TO APPROVAL WITH MODIFICATIONS
EVAPORATION POND BERM TESTING
WESTERN REFINING SOUTHWEST INC., GALLUP REFINERY
EPA ID # NMD000333211
HWB-WRG-19-004

Dear Mr. Moore:

The New Mexico Environment Department (NMED) is in receipt of the Marathon Petroleum Company LP dba Western Refining Southwest, Inc. Gallup Refinery (the Permittee) *Response to Approval with Modifications Evaporation Pond Berm Testing* (Response) dated May 9, 2019. The Permittee's responses to NMED's comments were adequately addressed and NMED hereby issues this Approval.

The Permittee must submit a report documenting the results of the evaporation pond berm testing to NMED no later than **November 22, 2019.**

This approval is based on the information presented in the document as it relates to the objectives of the work identified by NMED at the time of review. Approval of this document does not constitute agreement with all information or every statement presented in the document.

If you have questions regarding this correspondence, please contact Kristen Van Horn of my staff at 505-476-6046.

Sincerely,

John E. Kieling
Chief
Hazardous Waste Bureau

cc: D. Cobrain, NMED HWB
K. Van Horn, NMED HWB
C. Chavez, EMNRD OCD
B. Moore, MPC
L. King, EPA

File: Reading File and WRG 2019 File
WRG-19-004

Marathon Petroleum Company LP

May 9, 2019

Mr. John E. Kieling, Chief
New Mexico Environmental Department 2905
Rodeo Park Drive East, Bldg. 1
Santa Fe, NM 87505-6303

Re: Response to Approval With Modifications
Evaporation Pond Berm Testing
Marathon Petroleum Company LP, Gallup Refinery
(dba Western Refining Southwest, Inc.)
EPA ID# NMD000333211
HWB-WRG-19-004

Dear Mr. Kieling:

The Marathon Petroleum Company (MPC), Gallup Refinery is submitting the enclosed responses to New Mexico Environmental Department (NMED) comments dated April 12, 2019 on the referenced Work Plan for Evaporation Pond Berm Testing. Responses to each of the comments contained in the Approval with Modifications letter are provided in the attached pages.

If you have any questions or comments, please call Brian Moore at 505-726-9745.

Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Sincerely,
Marathon Petroleum Company LP

Robert S. Hanks

Robert S. Hanks
Refinery General Manager

Enclosure

cc K. Van Horn NMED
C. Chavez NMOCD
L. King EPA Region VI
B. Moore Marathon Gallup Refinery

92 Giant Crossing Road
Gallup, NM 87301

May 9, 2019

New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6313

Attn: Mr. John E. Kieling - Chief
Hazardous Waste Bureau

Re: Response to NMED Review Comments
Evaporation Pond Berm Testing (Work Plan)
Marathon Petroleum Company LP, Gallup Refinery
(dba western Refining Southwest, Inc.)
EPA ID # NMD000333211
HWB-WRG-19-004
92 Giant Crossing Road
Gallup, New Mexico
Terracon Proposal Reference No. P66195049

Dear Mr. Kieling:

At your request, Terracon Consultants, Inc. (Terracon) is submitting this letter in response to review comments provided by the New Mexico Environment Department (NMED) in a letter dated April 12, 2019 for the referenced Work Plan. Our responses to each of the review comments are outlined below:

Comment 1
Under the heading "Updated Numerical Slope Stability Analysis", page 1, the Permittee states that "[f]ield investigation activities will begin with installing 10 new piezometers that will be used to complete the updated numerical slope stability analysis." Provide the rationale for the locations selected for the permanent piezometers. The locations correspond to the previous locations of temporary piezometers at Pond 7, Pond 6 (West to East), and Pond 9A. In the report, discuss whether the piezometers are located along berms that have been repaired or upgraded. Additionally, piezometers are proposed for the Pond 7/8 west berm; NMED recommends installing additional piezometers closer to Pond 8 due to concerns of pond water leaching into groundwater at the western end of the evaporation ponds.

Response **– The borings will be located at both repaired and upgraded berms. Pond 7 was repaired due to a breach. Pond 9 was upgraded with the placement of additional fill. It is our professional opinion that the proposed number and location of borings are adequate to address the concerns of NMED and perform the necessary analysis. Several borings**

and piezometers (Pond 7/8 designation) are proposed along the west berm of Pond 7 near the boundary with Pond 8. We assume that the berms for Pond 7 and Pond 8 were constructed at the same time and are adjoining ponds. It is our opinion that the borings located near Pond 7 and Pond 8 should accurately represent the subsurface conditions along the west berm including Pond 7 and Pond 8. Annual groundwater monitoring reports do not indicate leaching of pond water into the groundwater. Therefore, it is our opinion that additional piezometers closer to Pond 8 would not be warranted or required. The report will discuss the location of borings/piezometers in relation to repaired or upgraded berm locations.

Comment 2
Under the heading "Updated Numerical Slope Stability Analysis", page 2, first paragraph, the Permittee states, "[p]revious slope stability analyses conducted at the evaporation pond berms were completed using data from temporary drive point piezometers that were abandoned during ongoing berm improvement activities. The ten new piezometers shown on Figure 1 will be installed as permanent structures with bentonite seals above the screen interval to prevent surface water intrusion and interference." Provide the diameter of the piezometers.

***Response** – The diameter of the piezometers will be a minimum of 2 inches.*

Comment 3
Under the heading "Updated Numerical Slope Stability Analysis", page 2, second paragraph, the Permittee states, "[r]epresentative soil samples will be collected during piezometer installation and submitted to Advanced Terra Testing laboratories in Lakewood, CO for geotechnical analysis including: Soil characterization; Wet and dry unit weights with moisture content; Atterberg limits; Sieve analysis; Effective stress parameters (c' and Ø') from a consolidated-drained triaxial sheer test." Describe the method proposed to collect the soil samples and whether the samples will be disturbed or undisturbed.

***Response** – Both disturbed and undisturbed soil samples will be collected. Undisturbed soil samples will be collected using the Dames and Moore Ring Barreled Sampler (2.42" I.D., 3" O.D.) or thin-walled Shelby Tubes (2" O.D.). Disturbed soil samples will be obtained using standard Split-spoon samplers (1-3/8 I.D., 2" O.D.). Undisturbed soil samples will be used for unit weight/dry density, unconfined compressive strength, direct shear and consolidated-Drained triaxial shear. Disturbed or undisturbed soil samples will be used for moisture content, Atterberg Limits, and sieve analysis.*

Comment 4
Under the heading "Updated Numerical Slope Stability Analysis", page 2, third paragraph, the Permittee states, "[t]o determine the phreatic surface level within the berms, water levels will be recorded from the new piezometers on a monthly basis until stable (about three months). " Describe how the water levels will be measured and recorded.

Response* – *The water levels will be measured using a Solinst Interface Meter Model 122. The water level meter has light and audible warning indicators when water has been encountered in the piezometers. The depth to groundwater (in feet) will be referenced in accordance with top of the surveyed piezometer casing.

Comment 5
Ensure that the soil boring logs contain detailed enough descriptions of the soils encountered and note any discontinuities.

Response* - *Acknowledged

Comment 6
Under the heading "Updated Numerical Slope Stability Analysis", page 2, the Permittee states, "[a]s requested by NMED, results of the slope stability analysis investigation described in this work plan will be submitted to NMED in an Updated Slope Stability Report." The work conducted under this Work Plan must be submitted as a separate report.

Response* - *Acknowledged

We trust that the responses to your review comments have been adequately addressed. If you have any questions concerning this letter, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Michael E. Anderson, P.E.
Principal

Copies to: Addressee (1 via email, 3 via mail)

Marathon Petroleum Company LP

February 8, 2019

Mr. John E. Kieling, Chief
New Mexico Environmental Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

RE: Evaporation Pond Berm Testing
Marathon Petroleum Company LP, Gallup Refinery
(Formerly Western Refining Southwest, Inc.)
EPA ID# NMD000333211

Dear Mr. Kieling:

Attached please find a Work Plan for Containment Berm Slope Stability Modeling for the Evaporation Ponds at the Marathon Petroleum Company (MPC) refinery in Gallup, New Mexico.

If you have any questions or comments regarding the information contained herein, please do not hesitate to contact Mr. Brian Moore at 505-726-9745.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Sincerely,

Robert S. Hanks

Robert S. Hanks
Refinery General Manager
Marathon Petroleum Company – Gallup Refinery

Cc: C. Chavez (OCD)

92 Giant Crossing Road
Jamestown, NM 87347

1101 West Mineral Avenue
Suite 102
Littleton, CO 80120
303.332.5757

November 5, 2018

John Moore, P.E.
Environmental Superintendent
Gallup Refinery
Marathon Petroleum Company
92 Giant Crossing Road
Gallup, NM 87301

Re: Work Plan Submittal - Updated Slope Stability Modeling Evaporation Ponds
Gallup Refinery
HWB-WRG-15-006
EPA ID# NMD000333211
Gallup, New Mexico

Dear John:

Axis Group Inc. (Axis) prepared this work plan to describe the upcoming slope stability investigation efforts planned for the evaporation ponds located at the Gallup Refining facility in Gallup, New Mexico (Facility). The slope stability investigation work described in this work plan responds to the August 22, 2017 New Mexico Environmental Department Hazardous Waste Bureau (NMED) letter Re: *Approval with Modifications Revised Letter Report Evaporation Pond Dike Breach and Summary Report Evaporation Pond Repairs*. Upon approval by Marathon, Axis intends to proceed with the work described herein upon submittal of this work plan to NMED.

Updated Numerical Slope Stability Analysis

Field investigation activities described in this work plan will be used to complete an updated numerical slope stability analysis using data that represents the most current conditions within the evaporation pond berms.

Figure 1 is a plan view showing the current configuration of the evaporation ponds and surrounding berms. Field investigation activities will begin with installing 10 new piezometers that will be used to complete the updated numerical slope stability analysis. As shown on **Figure 1**, these piezometers will be installed at the selected cross-sections within the outer slopes of the following evaporation pond earth berms:

- Pond 7/8 west berm
- Pond 6 west berm
- Pond 9 north berm

Previous slope stability analyses conducted at the evaporation pond berms were completed using data from temporary drive point piezometers that were abandoned during ongoing berm improvement activities. The 10 new piezometers shown on **Figure 1** will be installed as permanent structures with bentonite seals above the screen interval to prevent surface water intrusion and interference.

Representative soil samples will be collected during piezometer installation and submitted to Advanced Terra Testing laboratories in Lakewood, CO for geotechnical analysis including:

- Soil characterization
- Wet and dry unit weights with moisture content
- Atterberg limits
- Sieve analysis
- Effective stress parameters (c' and Ø') from a consolidated-drained triaxial sheer test.

The completed piezometers will be surveyed in the field for location and top of casing measurements. To determine the phreatic surface level within the berms, water levels will be recorded from the new piezometers on a monthly basis until stable (about three months).

The following information will be incorporated into the updated slope stability analysis:

- Morgenstern Price limit-equilibrium analysis via GeoStudio 2012
- Updated berm topography survey data at slope stability cross-section locations
- Updated phreatic surface based on data from new piezometers
- Updated geotechnical soil data collected during installation of new piezometers
- Effective stress soil strength parameters cohesion (c') and angle of internal friction, phi' (Ø')

As requested by NMED, results of the slope stability analysis investigation described in this work plan will be submitted to NMED in an Updated Slope Stability Report. This report will include but not be limited to the following:

- Description of slope stability work
- Description of updated geotechnical parameters from soil sampling
- Figures, boring logs and cross sections showing:
    - New piezometer locations
    - Soil sampling locations/depths
    - Piezometer depths and screened intervals
    - Water level gauging results and phreatic surface
- Discussion of phreatic surface and its potential effect on slope stability
- Graphical output from the slope stability program
- Tabulated factor of safety for each critical cross-section

Seismic Analysis and Liquefaction Potential

Axis reviewed the NMED recommendation to conduct a seismic analysis as part of the updated numerical slope stability modeling of the Gallup evaporation ponds (Comment 4, NMED letter dated August 22, 2017). Per the United States Geological Survey (USGS), the probability and risk level of an earthquake in the Gallup area is very low. Since the probability for an earthquake is low and the risk level is low, the potential for liquefaction is also very low. Accordingly, Axis does not intend to conduct a seismic analysis of the evaporation pond berms. A discussion and USGS data describing the lack of need for a seismic and liquefaction analysis will be provided in the updated slope stability report.

Schedule – Updated Slope Stability Investigation

Figure 2 is a schedule showing the estimated duration times to complete the slope stability work described in this work plan. As stated previously, the work will be initiated upon submittal of this work plan to NMED. Assuming the field investigation work is initiated by mid-November 2018, the Updated Slope Stability Report will be completed by May 30, 2019 as shown in **Figure 2**.

Note that this schedule indicates an extension-of-time request to the NMED will be needed in order to complete the anticipated field and technical work. Per the most recent email from NMED (Kristen Van Horn email dated October 4, 2018, Evaporation Ponds section), this work plan should be sufficient to request an extension of time to complete the work (Figure 2, schedule).

Closing Remarks:

Axis Group Inc. appreciates the opportunity to continue working with Marathon Petroleum Company (MPC) on this important project. Please call me at 303-332-5757 with questions.

Regards,

John W. Billiard, P.E.
Technical Services Director

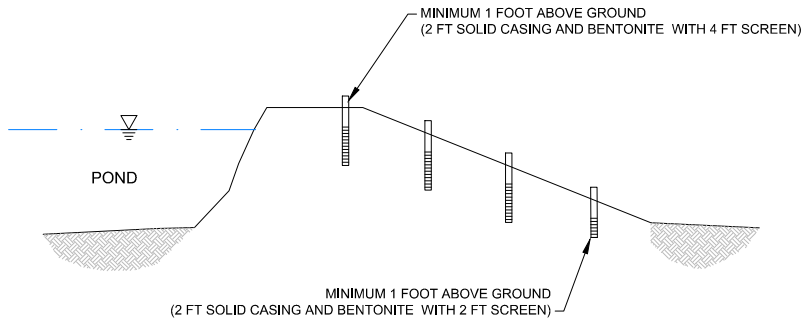
FIGURES

1. PLAN VIEW OF THE EVAPORATION PONDS WITH PROPOSED PIEZOMETER LOCATIONS AND NUMERICAL SLOPE STABILITY SECTION LOCATIONS

2. ANTICIPATED FIELD WORK AND REPORT SCHEDULE

Section	Pond	Direction	Crest Height	Length of Piezometer at Crest	Length of Piezometer 1/3 down slope	Length of Piezometer 1/2 down slope	Length of Piezometer at toe
1	7	West	12	6	6	6	4
3	6	North	10.8	6	6	6	4
5	9	North	7.2	4	-	-	4

TYPICAL POND 6 AND POND 7
PIEZOMETER SECTION

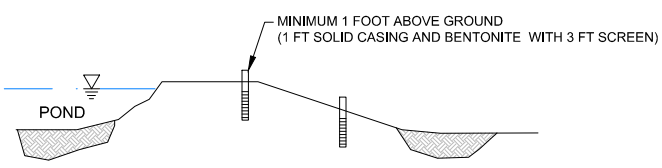


POND 12B
POND 12A
POND 7 (West to East)
(4 - TOTAL)
POND 11
POND 7
UPPER STORM
WATER BASIN
POND 8
POND 2
SMWU-1
POND 3
POND 4
POND 5
POND 6
POND 6 (West to East)
(4 - TOTAL)
POND 9
(2 - TOTAL)
POND 9

N

0 175 350
SCALE IN FEET

TYPICAL POND 9
PIEZOMETER SECTION



LEGEND:

PROPOSED STABILITY ANALYSIS LOCATION

PROPOSED PIEZOMETER LOCATION

1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

MARATHON- GALLUP REFINERY, NEW MEXICO

DRAWING NO.: 1

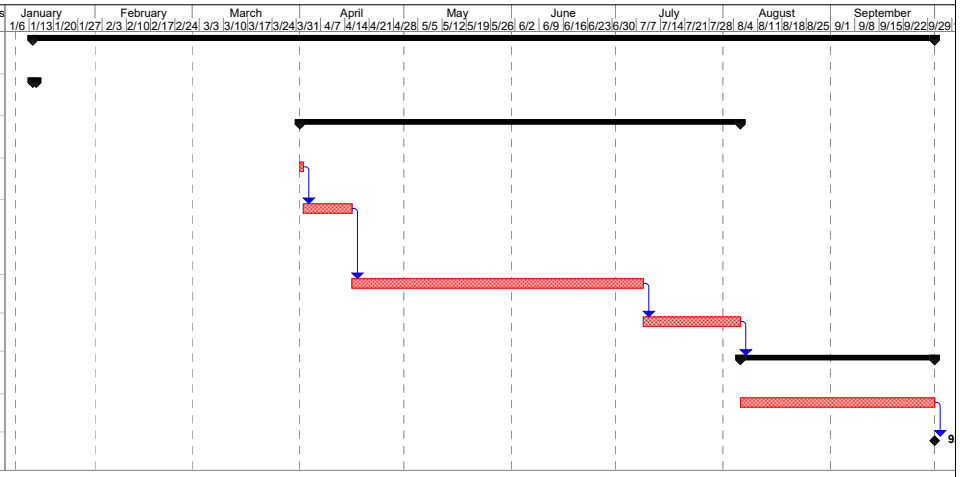
PROPOSED PIEZOMETER LOCATIONS AND
NUMERICAL SLOPE STABILITY SECTION LOCATIONS

PROJ. NO.: 15-010-04	DATE: 10/30/2018	DRAWN BY: JAY	CHECKED BY: JWB

C:\Users\ELundborg\Desktop\Revised Slope Stability\FIGURE 6a-6b - X-Sections and Peizometer Locs.dwg ELundborg Plotted: Oct 30, 2018 - 1:38pm

Proposed Schedule for Field Work Related to NMED Comments and Prepare Revised Report

ID	Task Name	Duration	Start	Finish	Predecess
1	**UPDATED SLOPE STABILITY - EVAPORATION PONDS**	**37.2 wks**	**Mon 1/14/19**	**Mon 9/30/19**	
2	**WORK PLAN to NMED**	1 day	Mon 1/14/19	Mon 1/14/19	
3	**FIELD WORK**	**18.2 wks**	**Mon 4/1/19**	**Mon 8/5/19**	
4	MOBILIZATION	1 day	Mon 4/1/19	Mon 4/1/19	
5	FIELD WORK TO INSTALL PIEZOMETERS AND COLLECT GEOTECHNICAL DATA	2 wks	Tue 4/2/19	Mon 4/15/19	4
6	ANALYZE SOIL SAMPLES AT LABORATORY	12 wks	Tue 4/16/19	Mon 7/8/19	5
7	SLOPE STABILITY ANALYSES	4 wks	Tue 7/9/19	Mon 8/5/19	6
8	**UPDATED SLOPE STABILITY REPORT**	**8 wks**	**Tue 8/6/19**	**Mon 9/30/19**	**7**
9	PREPARE UPDATED REPORT	8 wks	Tue 8/6/19	Mon 9/30/19	
10	SUBMIT UPDATED REPORT	0 wks	Mon 9/30/19	Mon 9/30/19	9



Project: 17-112 Field work based on NMED Comments
Date: Wed 1/9/19

Task | Summary | Construction Task

1. START DATE ASSUMED AS APRIL 1, 2019. START DATE DEPENDS ON CLIENT AND AGENCY APPROVALS

Figure 2
Anticipated Field Work and Report Schedule