Chevron U.S.A. Inc.
C-147 Registration Application Package
Hayhurst New Mexico T26S R27E

- Section 2 Recycling Containment
- Section 2 Recycling Facility

Jan 17, 2018

Contents

I. INTRODUCTION

Chevron U.S.A. Inc. (Chevron) requests registration under 19.15.34 NMAC of the following recycling containment and recycling facility in the Hayhurst New Mexico development area located in Township 26 South, Range 27 East.

- Section 2 Recycling Containment
- Section 2 Recycling Facility

Appendix 1 contains a survey plat identifying the location of the recycling containment and the recycling facility. Note that the Section 2 recycling containment is identified as "Proposed Frac Pond 4" and the Section 2 recycling facility is identified as "Proposed Recycling Facility", respectively on the plat.

Compliance with the requirements of 19.15.34.11 through 19.15.34.15 is described in this application. Note that Chevron is requesting a total of three variances from these requirements as noted in Section IV and fully described in Section VIII.

A copy of Form C-147 found in Section II has been submitted to the State Land Office, which is the surface land owner, as required under 19.15.34.10.A.

II. NMOCD FORM C-147

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 S. First St., Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources
Department
Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-147
Revised March 31, 2015

Recycling Facility and/or Recycling Containment

Type of Facility: ☒ Recycling Facility ☒ Recycling Containment*

Type of action: ☒ Permit ☒ Registration ☐ Modification ☐ Extension ☐ Closure ☐ Other (explain) _____

*** At the time C-147 is submitted to the division for a Recycling Containment, a copy shall be provided to the surface owner.**

Be advised that approval of this request does not relieve the operator of liability should operations result in pollution of surface water, ground water or the environment. Nor does approval relieve the operator of its responsibility to comply with any other applicable governmental authority's rules, regulations or ordinances.

1.

Operator: Chevron U.S.A. Inc. (For multiple operators attach page with information) OGRID #: 4323

Address: 1400 Smith Street, Houston TX 77002

Facility or well name (include API# if associated with a well): "HH NM Sec 2 Frac Pond and Recycle Facility"

OCD Permit Number: _____ (For new facilities the permit number will be assigned by the district office)

U/L or Qtr/Qtr N Section 2 Township 26 South Range 27 East County: Eddy

Surface Owner: ☐ Federal ☒ State ☐ Private ☐ Tribal Trust or Indian Allotment

2.

☒ **Recycling Facility:** (Location: U/L N, Section 2, T26S, R27E)

Location of recycling facility (if applicable): Latitude 32.065644 Longitude -104.165003 NAD: ☐ 1927 ☒ 1983

Proposed Use: ☐ Drilling* ☒ Completion* ☐ Production* ☐ Plugging *

The re-use of produced water may NOT be used until fresh water zones are cased and cemented

☐ Other, ***requires permit for other uses. Describe use, process, testing, volume of produced water and ensure there will be no adverse impact on groundwater or surface water.***

☒ Fluid Storage

☒ Above ground tanks ☒ Recycling containment ☐ Activity permitted under 19.15.17 NMAC explain type _____

☐ Activity permitted under 19.15.36 NMAC explain type: _____ ☐ Other explain _____

☐ For multiple or additional recycling containments, attach design and location information of each containment **(see Part 3 below for Section 10 recycling containment and bottom of page 3 for Section 9 recycling containment location)**

☐ **Closure Report (required within 60 days of closure completion):** ☐ Recycling Facility Closure Completion Date: _____

3.

☒ **Recycling Containment:**

☐ Annual Extension after initial 5 years (attach summary of monthly leak detection inspections for previous year)

Center of Recycling Containment (if applicable): Latitude 32.071130 Longitude -104.166990 NAD: ☐ 1927 ☒ 1983

☐ For multiple or additional recycling containments, attach design and location information of each containment

☒ Lined ☒ Liner type: Thickness 60 mil ☐ LLDPE ☒ HDPE ☐ PVC ☒ Other _____

☐ String-Reinforced

Liner Seams: ☒ Welded ☐ Factory ☒ Other Field Volume: 587,330 bbl Dimensions: L 796' x W 683' x D 23'

☐ Recycling Containment Closure Completion Date: _____

4.

Bonding:

☒ Covered under bonding pursuant to 19.15.8 NMAC per 19.15.34.15(A)(2) NMAC **(These containments are limited to only the wells owned or operated by the owners of the containment.)**

☐ Bonding in accordance with 19.15.34.15(A)(1). Amount of bond $_____ **(work on these facilities cannot commence until bonding amounts are approved)**

☐ Attach closure cost estimate and documentation on how the closure cost was calculated.

5.

Fencing:

☐ Four foot height, four strands of barbed wire evenly spaced between one and four feet

☒ Alternate. Please specify 8 ft. tall chain link with 3 strand barbed wire on top. Please see attached (Sec. V III.B) regarding proposed fencing for details.

6.

Signs:

☒ 12"x 24", 2" lettering, providing Operator's name, site location, and emergency telephone numbers

☐ Signed in compliance with 19.15.16.8 NMAC

7.

Variances:

Justifications and/or demonstrations that the proposed variance will afford reasonable protection against contamination of fresh water, human health, and the environment.

Check the below box only if a variance is requested:

☒ Variance(s): Requests must be submitted to the appropriate division district for consideration of approval. If a Variance is requested, include the variance information on a separate page and attach it to the C-147 as part of the application.

If a Variance is requested, it must be approved prior to implementation.

8.

Siting Criteria for Recycling Containment

Instructions: The applicant must provide attachments that demonstrate compliance for each siting criteria below as part of the application. Potential examples of the siting attachment source material are provided below under each criteria.

General siting

Ground water is less than 50 feet below the bottom of the Recycling Containment. NM Office of the State Engineer - iWATERS database search; USGS; Data obtained from nearby wells	☐ Yes ☒ No ☐ NA
Within incorporated municipal boundaries or within a defined municipal fresh water well field covered under a municipal ordinance adopted pursuant to NMSA 1978, Section 3-27-3, as amended. - Written confirmation or verification from the municipality; written approval obtained from the municipality	☐ Yes ☒ No ☐ NA
Within the area overlying a subsurface mine. - Written confirmation or verification or map from the NM EMNRD-Mining and Minerals Division	☐ Yes ☒ No
Within an unstable area. - Engineering measures incorporated into the design; NM Bureau of Geology & Mineral Resources; USGS; NM Geological Society; topographic map	☐ Yes ☒ No
Within a 100-year floodplain. FEMA map	☐ Yes ☒ No
Within 300 feet of a continuously flowing watercourse, or 200 feet of any other significant watercourse, or lakebed, sinkhole, or playa lake (measured from the ordinary high-water mark). - Topographic map; visual inspection (certification) of the proposed site	☐ Yes ☒ No
Within 1000 feet from a permanent residence, school, hospital, institution, or church in existence at the time of initial application. - Visual inspection (certification) of the proposed site; aerial photo; satellite image	☐ Yes ☒ No
Within 500 horizontal feet of a spring or a fresh water well used for domestic or stock watering purposes, in existence at the time of initial application. - NM Office of the State Engineer - iWATERS database search; visual inspection (certification) of the proposed site	☐ Yes ☒ No
Within 500 feet of a wetland. - US Fish and Wildlife Wetland Identification map; topographic map; visual inspection (certification) of the proposed site	☐ Yes ☒ No

9.

Recycling Facility and/or Containment Checklist:

Instructions: Each of the following items must be attached to the application. Indicate, by a check mark in the box, that the documents are attached.

- ☒ Design Plan - based upon the appropriate requirements.
- ☒ Operating and Maintenance Plan - based upon the appropriate requirements.
- ☒ Closure Plan - based upon the appropriate requirements.
- ☒ Site Specific Groundwater Data -
- ☒ Siting Criteria Compliance Demonstrations –
- ☒ **Certify that notice of the C-147 (only) has been sent to the surface owner(s)**

10.

Operator Application Certification:

I hereby certify that the information and attachments submitted with this application are true, accurate and complete to the best of my knowledge and belief.

Name (Print): Tony Vallejo Title: HES Support

Signature: Tony Vallejo Date: March 22, 2018

e-mail address: VJUA@chevron.com Telephone: 325-450-1413

11.

OCD Representative Signature: Bradford Billings **Approval Date:** 3/27/2019

Title: Hydrologist **OCD Permit Number:** 2RF-120

☐ OCD Conditions

☐ Additional OCD Conditions on Attachment

III. SITING REQUIREMENTS

A. DISTANCE TO GROUNDWATER

Appendix 2 / Figure 1, Appendix 3, and the discussion below demonstrates that depth to groundwater at the proposed location is greater than 50 feet beneath the bottom of the recycling containment. There were two sets of boring. Borings B-2, B-3, B-6, B-7 and B-8 (the final pond location) show ground water is greater than 50 feet beneath the bottom. Appendix 2 / Figure 1 is a geologic map based on a GIS database of geologic units and structural features in the general location.

The Hobbs Sheet of the Geologic Atlas of Texas locates the project site within sand, silt, and clay deposits (Windblown sand, alluvium, playa, and fluviatile terrace deposits, Qcs, Qp,) underlain by Blackwater Draw (Qbd) Formation consisting of caliche. The caliche and windblown deposits consist of sand and silt in sheets and may sometimes be associated with playa deposits that are generally associated with organics. The windblown cover sands are fine to medium grained, silty, calcareous, and include caliche nodules. Generally, these deposits are 20 to 50 feet thick. The caliche is a conglomerate of various materials such as clay, silt, sand, and gravel that included precipitated calcium carbonate. Often, the calcium carbonate cements the soil grains together. The level of cementation can vary and can be highly cemented to weakly cemented. These deposits can often be soft or loose, especially in the presence of groundwater. Our findings of the exploration are consistent with this within the depths explored.

On Sept 7, 2017, site-specific geotechnical boring was conducted to a depth of 75.5 feet with no detected or observed groundwater presence and the borehole remained dry for a period of at least 24 hours following drilling. The Test Boring Logs may be found in Appendix 3.

B. DISTANCE TO SURFACE WATER

Appendix 2 / Figure 2 illustrates that the recycling containment is not located within 300 feet of a continuously flowing watercourse or 200 feet of any other significant watercourse, lakebed, sinkhole, or playa lake (measured from the ordinary high-water mark).

No continuously flowing watercourses of other significant water features, as defined by NMOCD rules, are.

C. DISTANCE TO PERMANENT RESIDENCE OR INSTITUTIONS

Appendix 2 / Figure 3 illustrates that the recycling containment is not located within 1,000 feet of a permanent residence, school, hospital, institution, or church in existence at the time of this initial registration. The only development and structures in the prescribed setback area is associated with oil and gas production operations.

D. DISTANCE TO DOMESTIC AND STOCK WATER SUPPLIES

Appendix 2 / Figure 4 illustrates that the recycling containment is not located within 500 feet of a spring or fresh water well used for domestic of stock watering purposes at the time of this initial registration. Appendix 2 / Figure 4 identifies that the nearest water well listed in the NMOSE database.

E. DISTANCE TO MUNICIPAL BOUNDARIES AND FRESH WATER FIELDS

Appendix 2 / Figure 5 illustrates that the recycling containment is not within incorporated municipal boundaries or within defined municipal fresh water well fields covered under a municipal ordinance adopted pursuant to Section 3-27-3 NMSA 1978, as amended.

The nearest municipal community to the recycling containment are:

- Village of Malaga, which is not incorporated, located approximately 13 miles northeast;
- Village of Loving, which is incorporated but noes not operate any municipal fresh water well fields, located approximately 16 miles north/northeast; and
- City of Carlsbad, which is incorporated, located approximately 19 miles north/northwest and operates the Sheep Draw Well Field located southwest of the city and approximately 18 miles northwest of the recycling containment.

F. DISTANCE TO WETLANDS

Appendix 2 / Figure 3 illustrates that the recycling containment is not located within 500 feet of any identified wetland. The nearest identified wetland is approximately 5,300 feet southeast of the recycling containment.

G. DISTANCE TO SUBSURFACE MINES

General knowledge based on interaction with the Bureau of Land Management (BLM) Carlsbad Field Office (CFO) staff and a search of the NM EMNRD Mining and Minerals Division database confirms that there are no subsurface mines in proximity of the recycling containment. The only identified facilities in the general vicinity are surface caliche and aggregate pits.

H. DISTANCE TO CAVE / KARST FEATURES

The recycling containment is located within a BLM-identified medium potential karst zone. Appendix 2 / Figure 6, BLM inventory data of existing cave/karst features, and results of site-specific geotechnical studies as detailed in Appendix 6 verify that the recycling containment is not located within an unstable area.

I. DISTANCE TO 100-YEAR FLOODPLAINS

Available information from the Federal Emergency Management Agency indicates that recycling containment location is within the FEMA-identified Zone D, which is an area with possible but undetermined flood hazards where flood hazard analysis has not been conducted and mapped and generally considered to be of minimal flood risk. Field inspection and evaluation of topography in the

general vicinity leads to a determination that the recycling containment is not within any floodplain and has minimal risk for flooding.

IV. DESIGN AND CONSTRUCTION PLAN

Appendix 4 contains the design drawings and details for the recycling containment, which were developed and stamped by a Professional Engineer licensed in the state of New Mexico. Appendix 5 contains the construction specifications to accompany the design drawings and details. These design and construction specifications meet or exceed NMOCD requirements for recycling containments. Appendix 6 contains the Geotechnical Engineering Study Report for the recycling containment site.

A. GENERAL SPECIFICATIONS

The following general specifications have been incorporated into the design and will be met during construction.

- The recycling containment is designed and will be constructed to ensure confinement of produced water, to prevent releases, and to prevent overtopping due to wave action or rainfall.
- The recycling containment, as designed, will be constructed with a proper foundation and interior slopes consisting of a firm, unyielding base, which is smooth and free of rocks, debris, sharp objects, and irregularities. In addition, 8 ounce non-woven geotextile will be installed under the secondary liner to provide additional protection from any protuberances in the foundation and reduction of localized stress-strain.
- The recycling containment will be constructed in a levee with inside and outside grades of three horizontal feet to one vertical foot (3H:1V), which is shallower and provides greater stability than the NMOCD 2H:1V specification for the inside grade.
- The recycling containment will be constructed with a 60 mil HDPE primary and secondary liner and an interstitial leak detection system. Note that the 60 mil HDPE secondary liner exhibits a hydraulic conductivity of less than 1×10^{-12} cm/sec. **Note that this is a variance** from the specified 30 mil LLDPE string reinforced liner or equivalent with a hydraulic conductivity of 1×10^{-9} cm/sec and provides greater protection of fresh water, public health, and the environment. Please refer to Section VIII.A that provides a full description and basis for this variance request.
- The exterior edges of both liners will be anchored in the bottom of a 24-inch deep compacted earth-filled trench, which exceeds the NMOCD 18 inch specification.
- Liner seams will be minimized and oriented vertically rather than across all levee slopes. Factory welded seams will be utilized to the maximum extent possible. Sloped liner panels will extend a minimum of five feet beyond the point of grade change to prevent seams from resting on the grade break.

- All field seams and welds will be subjected to non-destructive field testing by qualified personnel per the appropriate testing standard to ensure proper thermal sealing. Details on liner testing procedures may be found in Section 33 47 13 / Subpart 3.04 of the construction specification (Appendix 5). Field seams will be overlapped a minimum of six inches.
- The primary liner will be protected from excessive hydraulic force or mechanical damage from discharge or suction within the recycling containment. No discharge or suction lines penetrate the liners.
- The recycling containment will be constructed with a leak detection system between the primary and secondary liners comprised of a 200-mil geonet. The system is properly designed to facilitate effective drainage, collection, and removal of liquid above the secondary liner and leakage detection at the earliest possible time.
- The recycling containment is designed to prevent run-on of surface water. The minimal distance from the existing surface elevation to the top of the containment berm will be approximately four feet.

B. STOCKPILING OF TOPSOIL

Where topsoil is present, prior to constructing the recycling containment, it will be stripped and stockpiled on site for use as final cover or fill at time of closure.

C. SIGNS

An upright sign no less than 12 inches by 24 inches with lettering no less than two inches in height will be installed in a conspicuous place on the fence surrounding the containment. The sign will be installed in such a manner and location that a person can easily read the legend. The sign will include the following information:

- The operator's name;
- The location of the site by quarter-quarter or unit letter, section, township, and range;
- Emergency telephone number.

D. FENCING

The recycling containment will be constructed with an eight foot tall chain link fence equipped with three strands of barbed wire on top to deter unauthorized wildlife and human access. **Note that this is a variance** from the minimum required four foot fence with at least four stands of barbed wire evenly spaced in the intervals between one foot and four feet above ground level and provides equivalent or greater wildlife and human deterrence. Please refer to Section VIII.B that provides a full description and basis for this variance request.

The fence will be gated to provide access to Operations personnel and will be closed and locked when access is not required

E. NETTING AND WILDLIFE PROTECTION

The game fence, as described above, surrounding the recycling containment will be effective is excluding terrestrial wildlife. Due to infeasibility of installing netting on a recycling containment system of this size (750 feet by 900 feet), an audible avian deterrence system has been designed and will be installed as an alternative. This type of system is currently used by other recycling containment operators in southeast New Mexico and has been demonstrated as providing effective protection for avian species, including migratory birds. **Note that this is a variance** from the specified screening or netting and will provide equal protection of avian species. Please refer to Section VIII.C that provides a full description and basis for this variance request.

Containment inspections will be conducted at least once per week to include visual determination of any wildlife impacts. If any dead migratory birds or other wildlife is detected, notification to the New Mexico Department of Game and Fish and NMOCD District Office will provided as soon as practicable but no later than 30 days from the date of discovery.

V. OPERATING AND MAINTENANCE PLAN

The recycling containment will be operated in such a manner to contain liquids and solids and the integrity of the liner and leak detection system will be monitored in such a manner to prevent contamination of fresh water and protect public health and the environment as described below. The purpose of the recycling containment is to facilitate recycling of treated produced water from nearby oil and gas wells for new well completions. When treated produced water is not needed for well completion activity, produced water will be properly injected at one of Chevron's or third party's authorized SWDs. The recycling containment will not be used for disposal of produced water or other oilfield wastes.

The recycling containment and associated leak detection system will be inspected at least weekly while it contains any fluid and results of the inspection will be documented on an inspection checklist. These inspections will be performed by a third party contractor, which has been selected by Chevron to operate the recycling facilities and monitor the associated recycling containments. The contractor will continuously staff these facilities while in operation. The completed checklists will be retained and made available for review upon request.

These inspections will address, at a minimum, the following:

- Removal of any visible layer of oil from the liquid surface;
- Verification that a minimum of three foot freeboard is maintained;
- If a liner breach is identified above the liquid surface, the liner will be repaired or liner replacement will be initiated within 48 hours of detection. Alternatively, the NMOCD district office will be contacted within 48 hours to seek and extension for liner repair / replacement.

- If a liner breach is identified below the liquid surface, all liquid above the identified breach will be removed, the NMOCD district office will be notified, and liner repair / replacement shall be initiated within 48 hours of discovery.
- Visual inspection of berm integrity and condition to ensure the prevention of surface water run-on.
- Determination that an oil absorbent boom is present and in proper condition to contain an unanticipated release.

The recycling containment will be equipped with continuous liquid level monitoring and interstitial leak detection systems utilizing pressure transducers connected through a SCADA system to provide immediate notification to Chevron field personnel.

Treated produced water deposits into and withdrawals from the recycling containment will be measured and documented to determine when the system has ceased operations (less than 20% of the total fluid capacity is used during each rolling six month period following the initial withdrawal of produced water). The third party contactor will keep accurate records of total volumes of water received and treated through the recycling facility. Chevron will submit Form C-148 monthly to NMOCD within 30 days of the end of the calendar month listing: volumes of produced water received; volumes of fresh or brackish water received; and total volume of water leaving the recycling facility.

Upon cessation of operation, the NMOCD district office will be notified. Chevron will submit to NMOCD a completed Form C-148 within 30 days following the end of each calendar month. Each submittal will certify that the recycling containment has not ceased operation based on the 20% threshold described above.

VI. CLOSURE PLAN

After operations cease (less than 20% of the total fluid capacity is used every six months following the initial withdrawal of produced water), all fluids will be removed within 60 days and the recycling containment closed within six months.

All removed liquids, solids, and liner materials will be removed and transferred to an NMOCD-approved disposal facility within the six month period.

A five-point composite sample will be collected from beneath the containment and tested for contamination. The composite sample will include stained or wet soil areas, if any, and analyzed for constituents listed in Table I of 19.15.34.14 NMAC.

- If any contaminant concentration exceeds the values listed in Table I (based on depth from bottom of containment to groundwater), the NMOCD district office will be contacted requesting approval before proceeding with closure activity.

- If all contaminant concentrations are less than or equal to the values listed in Table I, closure will proceed by backfilling with non-waste containing, uncontaminated, earthen material.

Within 60 days of completing closure, a Closure Report on NMOCD Form C-147, including required attachments, will be submitted to document all closure activities including sampling results and details of any backfilling, capping, or covering, were applicable. The Closure Report will certify that all information in the report and attachments is correct and that all applicable closure requirements and conditions specified in NMOCD rules and directives have been met.

The recycling containment's locations will be reclaimed to a safe and stable condition that blends with the surrounding undisturbed areas. Topsoils and subsoils will be replaced to their original relative positions and contoured to achieve erosion control, long-term stability, and preservation of surface water flow patterns.

The location will be reseeded in the first favorable growing season following closure with the goal of substantially restoring the impact surface location to the existing condition prior to construction of the recycling containment. Surface reclamation will be deemed complete when: all ground surface disturbing activities have been completed; a uniform vegetative cover with a life-form ratio of plus or minus 50% of pre-disturbance levels has been established; and a total percent plant over of at least 70%, excluding noxious weeds, has been established.

Surface reclamation obligations imposed by the Bureau of Land Management or New Mexico State Trust Land on lands managed by those agencies will supersede these requirements, provided that these other requirements provide equal or greater protection of fresh water, human health, and the environment. NMOCD will be notified when reclamation and re-vegetation are complete.

VII. FINANCIAL ASSURANCE REQUIREMENTS

Chevron U.S.A. Inc. (OGRID 4323) has existing financial assurance in place with NMOCD as required by 19.15.8 NMAC and use of the recycling containment will be limited to support completion of only wells owned and operated by Chevron U.S.A. Inc. Therefore, no additional financial assurance associated with the recycling containment is required.

VIII. VARIANCE REQUESTS

This registration includes requests for three variances from the requirements for each recycling containment as described below.

A. SECONDARY LINER SPECIFICATION

The recycling containment has been designed and will be constructed with a 60 mil HDPE secondary liner rather than the prescribed 30 mil LLDPE secondary liner. Chevron has selected the 60 mil HPDE material for the following reasons:

- The 60 mil HDPE exhibits a maximum hydraulic conductivity of 1×10^{-12} cm/sec, which exceeds the specified performance of 1×10^{-9} cm/sec.
- The US Environmental Protection Agency identifies 60 mil as the recommended minimum thickness for HDPE as detailed in the EPA's Guide for Industrial Waste Management, Part IV, Chapter 7, Section B, page 7B-24 addressing protection of groundwater through proper design and installation of double liner systems.
- HDPE was selected as the preferred secondary liner material based upon weathering/aging characteristics, mechanical properties, and chemical resistance.
- HDPE liner life is expected to exceed twenty years, which is substantially longer than the anticipated age of the recycling containment to support well completion activities in the development area.
- The 60 mil HDPE liner is compliant with internal Chevron Global engineering design and environmental performance standards.

Chevron believes that this variance from the NMOCD prescribed liner specification is warranted and provides greater protection of groundwater resources. Liner hydraulic conductivity and performance specifications are found in Appendix 7.

B. FENCING

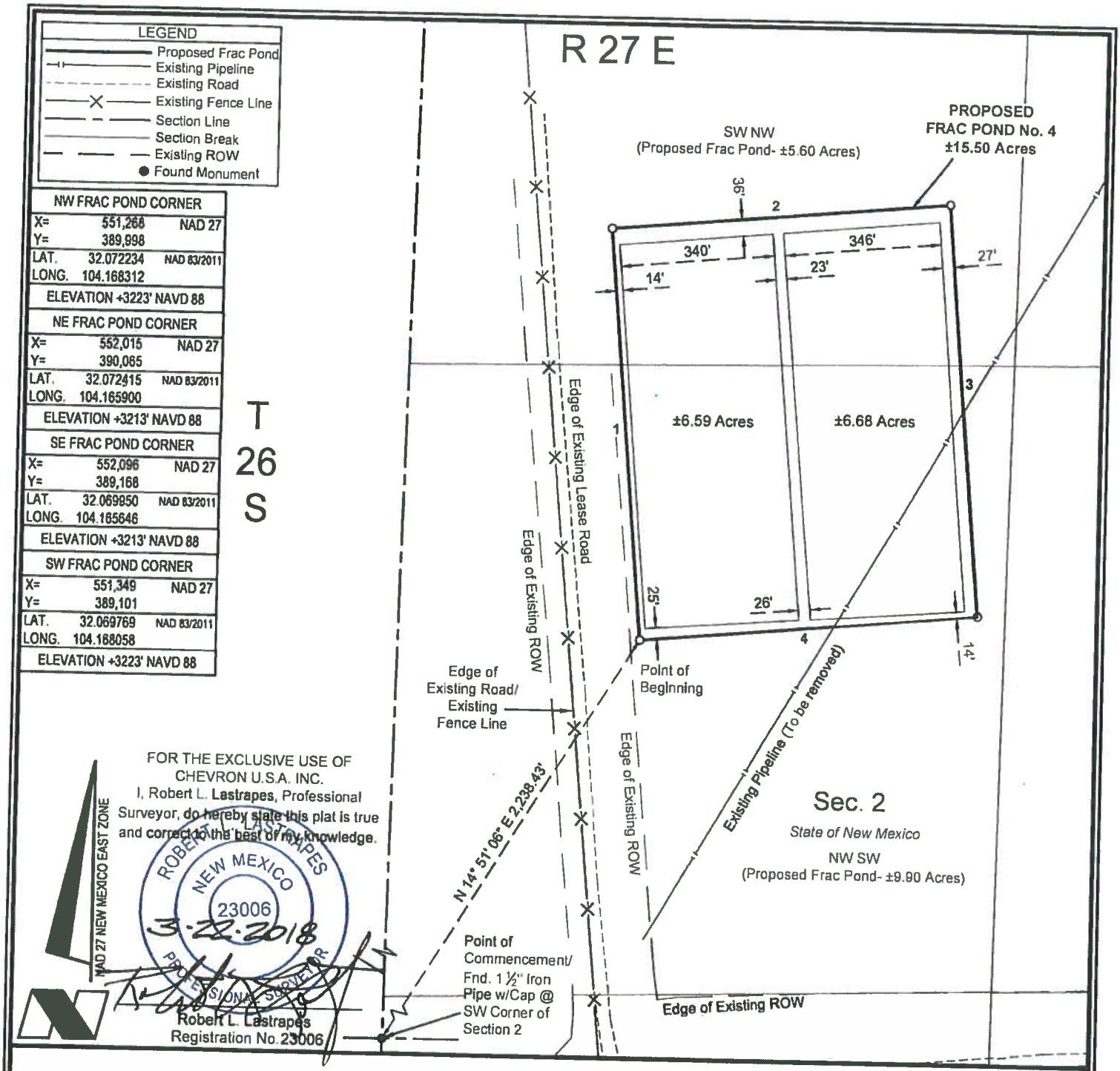
The recycling containment has been designed and will be equipped with an eight foot tall chain link fence equipped with three strands of barbed wire on top. This fence will not be installed with the specified four stands of barbed wire but offers equivalent entry deterrence to wildlife and unauthorized human without introducing the risk of injury resulting from unintended or incidental contact with the barbed wire.

C. NETTING

The recycling containment has been designed and will be equipped with an audible avian species protection system, which effectively deters birds from approaching the area. Due to the size of the proposed recycling containment structure (750 feet by 900 feet), design, construction, and maintenance of netting is not practicable. Chevron has evaluated multiple alternatives, determined that an audible system is the most effective and viable option, and selected the Bird-X Mega Blaster PRO for use. This particular product has been used by other operators with registered recycling containments in southeast New Mexico and proven effective.

IX. APPENDICES

Appendix 1 – Survey Plat



PAGE 1 OF 2

FRAC POND PLAT

Scale: 1" = 300'

300' 0 150' 300'

CHEVRON U.S.A. INC.

PROPOSED FRAC POND
FRAC POND NO. 4
SECTION 2, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER

C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No. 3	DATE: 03/16/2018	REVISED BY: DMB
DATE: APRIL 07, 2017	No. 4	DATE: 03/21/2018	REVISED BY: GDG
FILENAME: T:\2017\2175724\DWG\FRAC POND #4 SUP.dwg			

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Professional Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

R 27 E

LEGEND

- Section Line
- Existing Road & Pad
- Existing Fence Line
- Existing Frac Pond
- Surface Location
- Found Occupation

Whites City Road

Existing Access Road

Sec. 2

State of New Mexico

SE/SW
(±3.22 Acres- Proposed Pad)
Acres-Proposed Facility)

Water Recycle
350' x 200'

Existing Cattle Pen

T 26 S

S 56° 53' 25" W 1,658.52'
To Fnd. 1 ½" Iron Pipe W/Cap @
the SW Corner of Section 2

PROPOSED
SWD FACILITY
±2.41 Acres

350'

300'

Existing Fence Line

PROPOSED PAD
±3.22 Acres

Existing
Skeen 2 SWD
No. 1 Pad

Existing Frac
Pond to be
Removed

330'

Gravitas 2 State SWD
No. 2 Well
400' FSL
1,560' FWL

425'

Existing Fence Line

NAD 27 NEW MEXICO EAST ZONE

Scale: 1" = 200'

200' 0 100' 200'

GRAVITAS 2 STATE SWD NO. 2 WELL	
X= 552,344	NAD 27
Y= 387,394	
LAT. 32.064948	
LONG. 104.164359	
X= 593,528	NAD83
Y= 387,451	
LAT. 32.065070	
LONG. 104.164850	
ELEVATION +3211' NAVD 88	

NW SWD FACILITY PAD CORNER (1)	NE SWD FACILITY PAD CORNER (2)
X= 552,164 NAD 27 Y= 387,844	X= 552,514 NAD 27 Y= 387,844
ELEVATION +3217' NAVD 88	ELEVATION +3217' NAVD 88
SE SWD FACILITY PAD CORNER (3)	**SW SWD FACILITY PAD CORNER (4)**
X= 552,514 NAD 27 Y= 387,544	X= 552,164 NAD 27 Y= 387,544
ELEVATION +3212' NAVD 88	ELEVATION +3217' NAVD 88
NW SWD PAD CORNER (5)	**NE SWD PAD CORNER (6)**
X= 552,124 NAD 27 Y= 387,544	X= 552,549 NAD 27 Y= 387,543
ELEVATION +3217' NAVD 88	ELEVATION +3212' NAVD 88
SE SWD PAD CORNER (7)	**SW SWD PAD CORNER (8)**
X= 552,549 NAD 27 Y= 387,213	X= 552,124 NAD 27 Y= 387,214
ELEVATION +3216' NAVD 88	ELEVATION +3218' NAVD 88

SURFACE USE PLAT **PAGE 1 OF 2**

CHEVRON U.S.A. INC.

PROPOSED PADS
GRAVITAS 2 STATE SWD NO. 2 WELL
SECTION 2, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: TBD	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 1/28/2016	REVISED BY: GDG
DATE: 12/17/2015	No. 2	DATE: 06/03/2016	REVISED BY: BOR
FILENAME: T\2015\2153364\DWG\GRAVITAS 2 STATE SWD 2 and FACILITY SUP.dwg			

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

DISCLAIMER: At this time, C. H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:
Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

NOTE:
Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, a few states with such programs are listed below: New Mexico One Call - www.nmonecall.org.

METES AND BOUNDS DESCRIPTION OF A PROPOSED FRAC POND LOCATED IN SECTION 2 OF TOWNSHIP 26 SOUTH-RANGE 27 EAST EDDY COUNTY, NEW MEXICO

Survey of a Proposed Frac Pond containing 15.50 acres, more or less, located on State of New Mexico property located in Section 2 of Township 26 South, Range 27 East, Eddy County, New Mexico and described as follows:

Commencing at the Southwest corner of said Section 2, Township 26 South Range 27 East at a Found 1 1/2" Iron Pipe with cap; **Thence** North 14 degrees 51 minutes 06 seconds East 2,238.43 feet to the **Point of Beginning**. Said **Point of Beginning** having the following coordinates: X = 551,348.50 and Y = 389,101.47 (New Mexico State Plane Coordinate System, East Zone, NAD 27).

Thence North 05 degrees 06 minutes 39 seconds West 900.00 feet to a point;
Thence North 84 degrees 53 minutes 21 seconds East 750.00 feet to a point;
Thence South 05 degrees 06 minutes 39 seconds East 900.00 feet to a point;
Thence South 84 degrees 53 minutes 21 seconds West 750.00 feet back to the said **Point of Beginning.**

The bearings recited hereon are oriented to New Mexico State Plane Coordinate System, East Zone, NAD 27.

This description represents a survey made on the ground for a proposed frac pond and intended solely for that purpose. This description does not represent a boundary survey.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Professional Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

ROBERT L. LASTRAPES
NEW MEXICO
23006
3-22-2018
PROFESSIONAL SURVEYOR

Robert L. Lastrapes
Registration No. 23006

PROPOSED FRAC POND		
COURSE	BEARING	DISTANCE
1	N 05° 06' 39" W	900.00'
2	N 84° 53' 21" E	750.00'
3	S 05° 06' 39" E	900.00'
4	S 84° 53' 21" W	750.00'

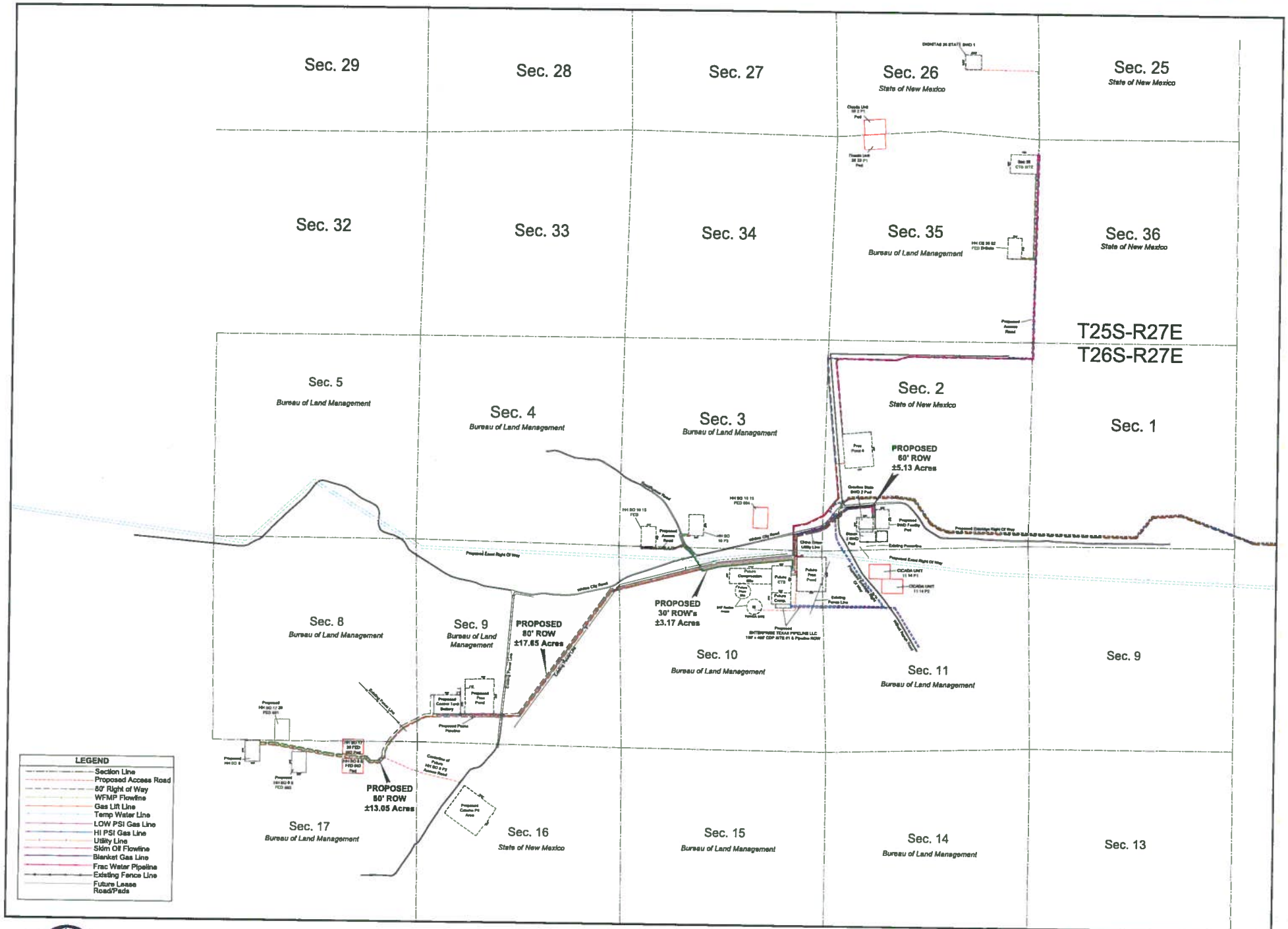
FRAC POND PLAT

CHEVRON U.S.A. INC.

PROPOSED FRAC POND
FRAC POND NO. 4
SECTION 2, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No. 3	DATE: 03/16/2018	REVISED BY: BOR
DATE: APRIL 07, 2017	No. 4	DATE: 03/21/2018	REVISED BY: GDG
FILENAME: T:\2017\2175724\DWG\FRAC POND #4 SUP.dwg			



FENSTERMAKER

C. H. Fenstermaker & Associates, LLC

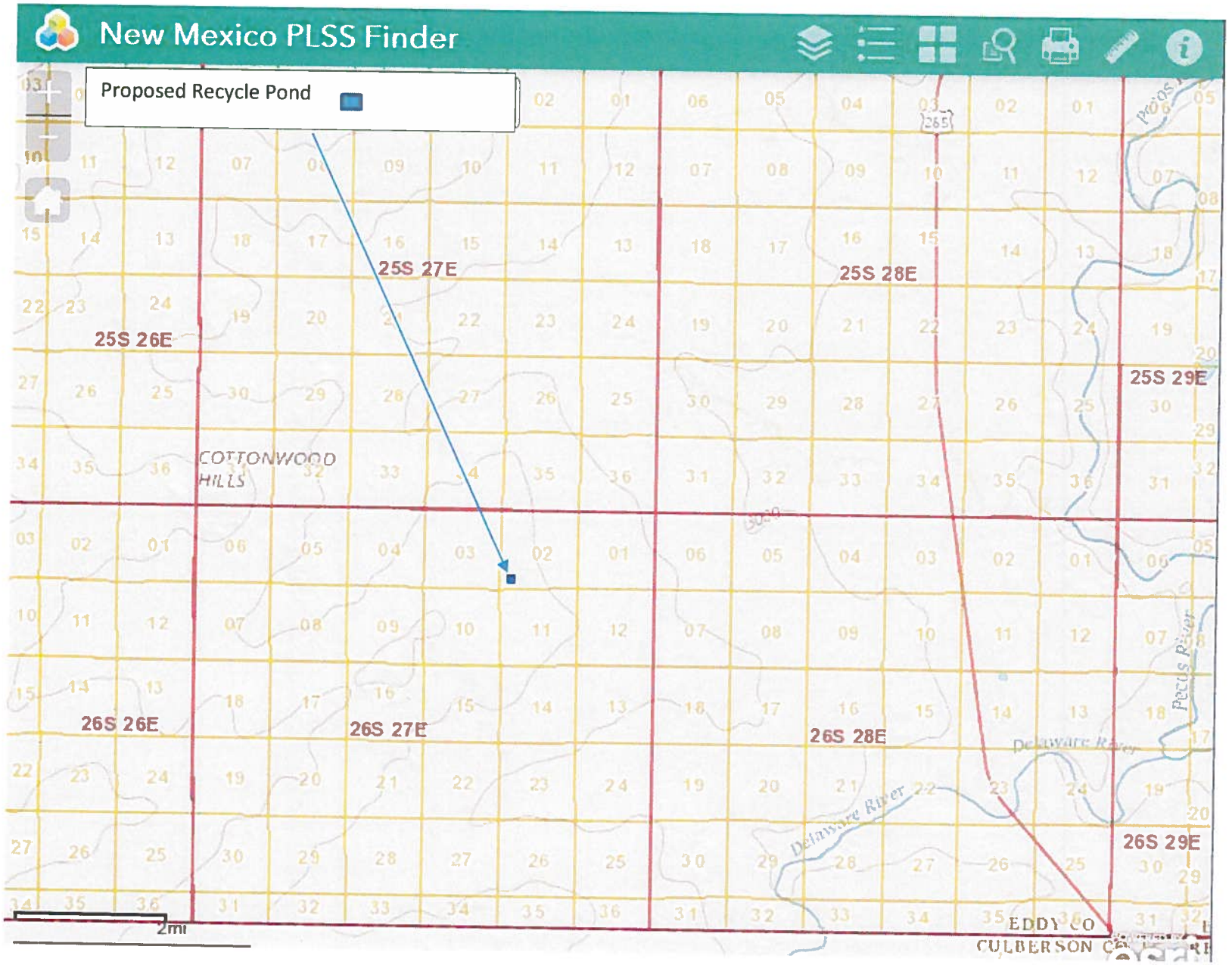
N
W
E
S

TOTAL ACREGE	
Pipeline ROW's	41.79 Acres
Road ROW's	8.03 Acres
Pads/Facilities	134.74 Acres

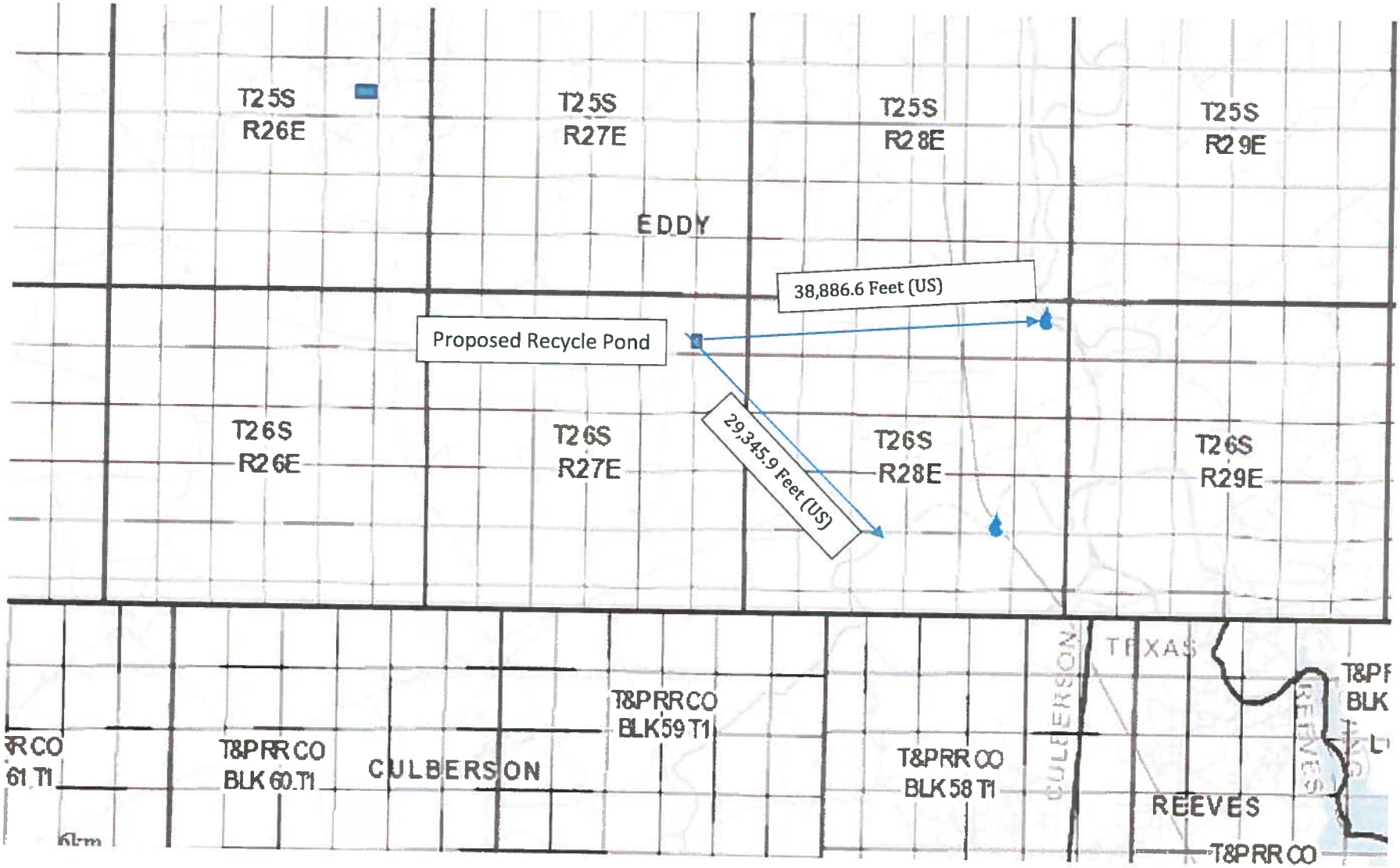
CHEVRON U.S.A. INC.

DETAIL
HAYHURST WORK AREA
SEC. 35,36 & 26, T25S-R27E & SEC. 2,3,4,9,10,11,14 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

Chevron USA Inc. T26SR27 Section 2 Recycle Containment / Appendix 2/ Figure 1 : Geologic Map

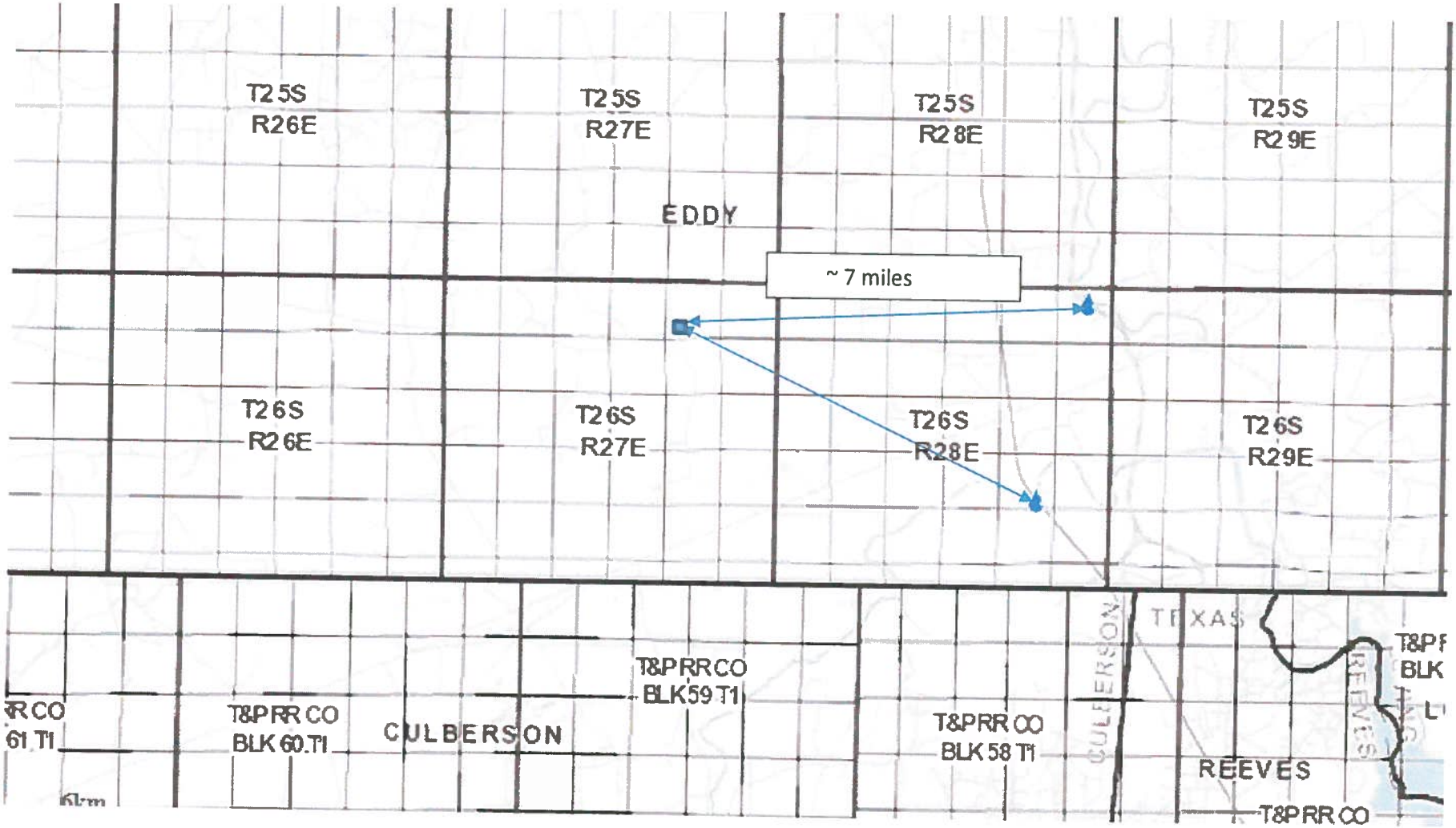


Chevron USA Inc. 26S R27E Section 2 Proposed Recycling Containment / Proposed Recycling Facility
Appendix 2 / Figure 2 – Surface Water Features and Water Courses

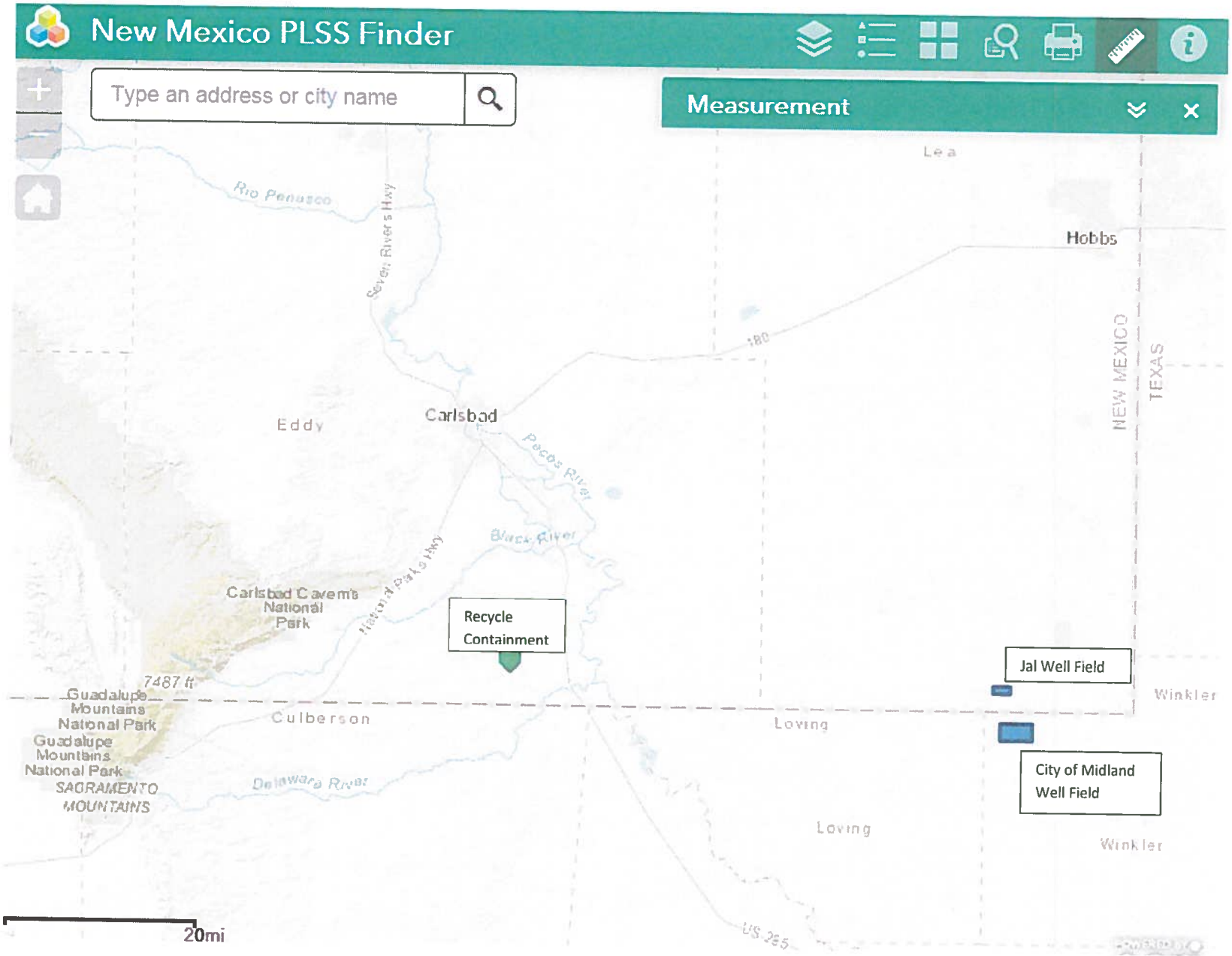


Chevron USA Inc. 26S R27E Section 2 Proposed Recycling Containment / Proposed Recycling Facility
Appendix 2 / Figure 3 – Permanent Residences and Institutions, Wetlands

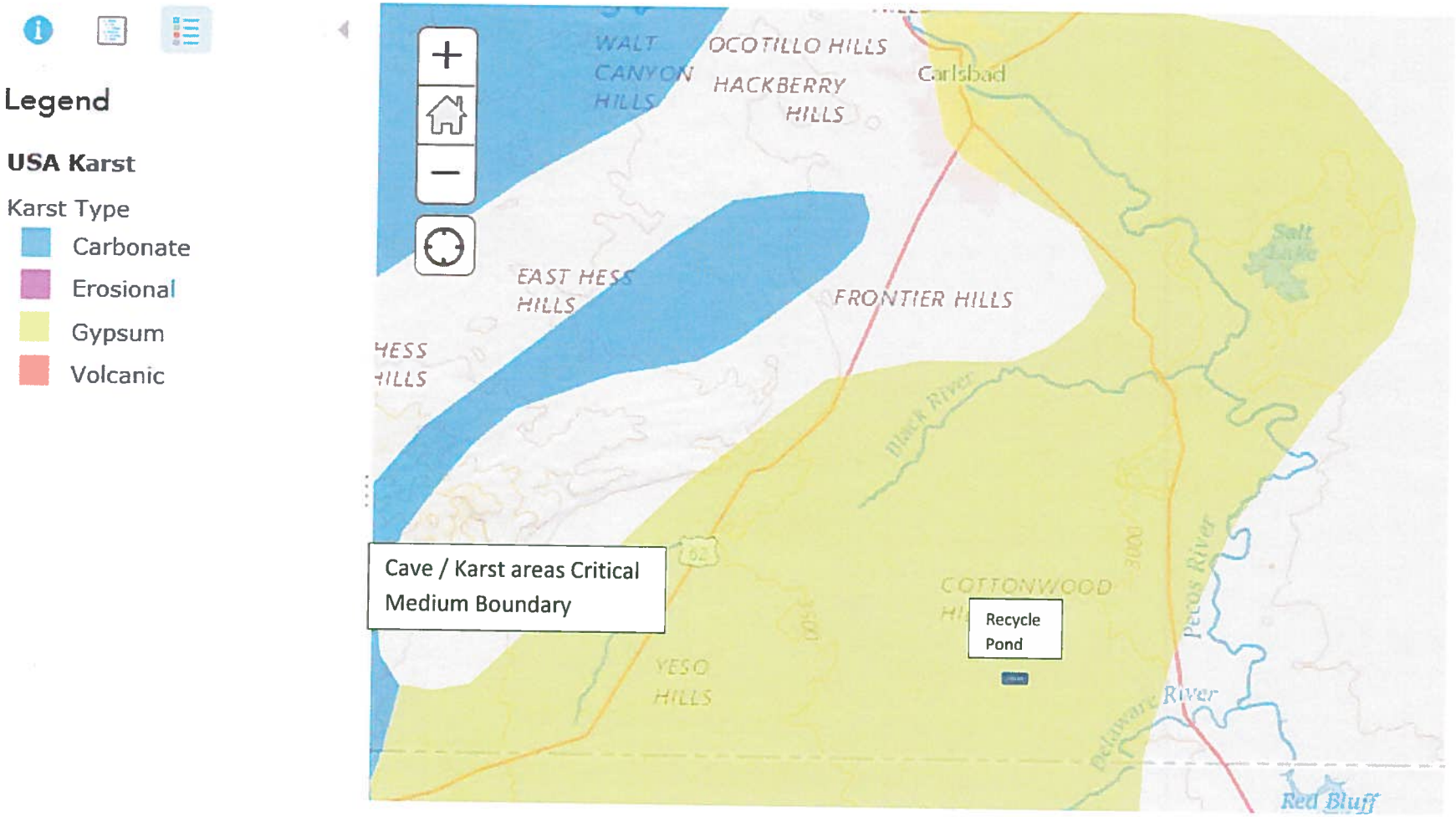
Chevron USA Inc. T26SR27 Section 2 Proposed Recycle Containment / Appendix 2/ Figure 4 : Domestic Stock Water Supply



Chevron USA Inc. T26S R27E Sect 2 Recycle Containment, Appendix 2 / Figure 5 : Municipal Boundaries and Fresh Water Fields



Chevron USA Inc. T26S R27E Sec. 2 Recycling Containment, Appendix 2 / Figure 6 : Cave Karst Features



Appendix 2 – Recycling Containment Figures

TETRA TECH

Hayhurst Section 2 Hydraulic Fracturing Ponds

Eddy County, New Mexico

August 2017

complex world

CLEAR SOLUTIONS™

Report of Geotechnical Study Hayhurst Section 2 Hydraulic Fracturing Ponds

Eddy County, New Mexico

Prepared for:
Mr. Ruben Kopara
Chevron North America Exploration and Production Company
6301 Deauville Blvd, Midland, Texas 79706
Phone: (432) 687-7215

Prepared by:

Tetra Tech

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Texas Registered Engineering Firm 3924

Tetra Tech Project No. 212C-MD-02848

THOMAS A. CHAPEL
NEW MEXICO
18861
8/2/17
PROFESSIONAL ENGINEER

Thomas A. Chapel
Principal Engineer

Reviewed by: Don Grahlherr, P. E
Vice President

August 2, 2017

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Chevron North America Exploration and Production Company (Chevron) plans to construct hydraulic fracturing ponds at the Hayhurst, New Mexico, Section 2 property located in Eddy County, New Mexico. Chevron will construct two separate ponds, with a capacity of approximately 350,000 barrels (bbl) each to service well drilling operations. The ponds will be designed with a double liner and a leak detection system. The floor of each pond will be sloped to a sump where fluids can be collected, sampled, and pumped if needed.

The purposes of this study were to obtain information on subsurface conditions, and to provide geotechnical design criteria for the construction of the proposed ponds. The general site location is shown on the Site Location Map, Figure 1 and Topographic Map (Figure 2).

Between May 16th and 19th, 2017, Tetra Tech and a subcontractor mobilized to the site with a truck-mounted drilling rig to drill five (5) exploratory soil borings to identify subsurface conditions and collect samples. Borings B-1 and B-4 were drilled to a depth of approximately 45 feet below the existing ground surface (bgs). Borings B-2 and B-3 were drilled to a depth of approximately 40 feet bgs. Boring B-5 was drilled to a depth of approximately 73 feet. Water was encountered at approximate depths of 31, 28, and 31 feet (bgs) in B-1, B-4, and B-5 respectively, and rose to depths of 26, 26, and 29 feet when checked prior to backfilling the boreholes one to two days following the initial drilling. New Mexico Oil Conservation Division Rules published in the New Mexico Administrative Code (NMAC) have specific siting requirements for "pits" (ponds), associated with oil and gas exploration and production, which are within specified proximities to groundwater. A hydrogeological study to meet the requirements of the NMAC should be performed to determine whether the groundwater encountered is a perched layer or a continuous water bearing feature. Approximate locations of the borings are shown on Figure 4.

The borings encountered 3½ to 8½ feet of loose to very dense sand and silt over naturally cemented soil. The cemented soil extended to the maximum depth drilled of 40 feet in boreholes B-2 and B-3.Relatively less cemented soil was encountered starting at depths of 23.5, 28, and 33 feet, and continued to depths of 38.5, 40, and 60 feet respectively in B-1, B-4, and B-5 (located in the southern and central portions of the site). The poorly cemented layer continued to the maximum depth drilled of 45 feet in B-1. Strongly cemented soil was encountered in B-4 and B-5 to the maximum depths drilled of 45 and 73 feet respectively.

Review of mapping by the U.S. Geological Survey (Figure 3) indicates that the Rustler Formation, which is a carbonate based sedimentary rock with evaporates present, underlies the site, and can be prone to karst formation and dissolution leaving voids. No voids were encountered during our investigation, however this does not ensure that voids do not exist beneath the proposed site. Tetra Tech recommends that Chevron consider additional investigation to determine more conclusively if voids exist beneath the site.

Additional investigation and construction recommendations for development of the site are provided in the body of this report.

We have prepared this executive summary solely to provide a general overview, and it should not be used for any purpose except that for which it was intended. We recommend detailed review of the entire report for information about our findings, recommendations and other concerns related to geotechnical conditions for the site.

1.0 PURPOSE AND SCOPE OF STUDY

Chevron plans to construct hydraulic fracturing ponds at the Hayhurst New Mexico, Section 2 property located in Eddy County, New Mexico. Chevron will construct two ponds at the site. Each pond will have an approximate operational capacity of 350,000 barrels (bbls) and will service well drilling operations. We understand the hydraulic fracturing ponds will be designed with a double liner and a leak detection system. The bottom of the pond will be sloped and equipped with a sump and access port/riser at the low point of the floor of the pond.

The scope of the study for this project included the following.

1) New Mexico 811 Utility locate request;

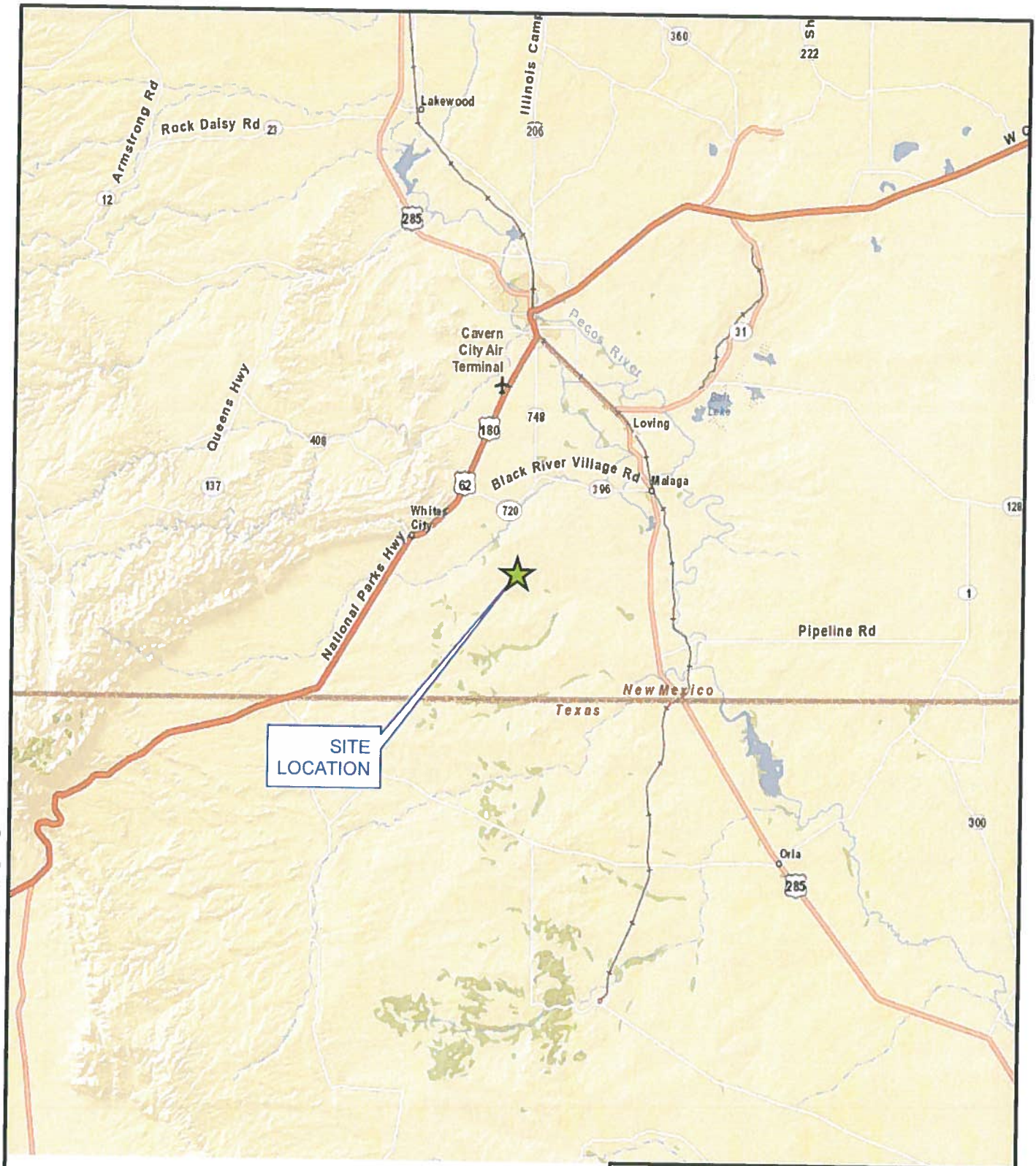
2) Mobilize a CME 75 drilling rig to drill four (4) borings to a depth of 40 or 45 feet and one (1) boring to a depth of 73 feet to look for evidence of groundwater;

3) Perform Standard Penetration Tests (SPT) at every 5 or 10-foot interval to evaluate soil consistency and collect soil samples for evaluation;

4) Backfill borings with soil cuttings after completion of drilling and 24-hour measurements, as required; and

5) Provide geotechnical engineering design criteria and recommendations and prepare a geotechnical report.

The general location of the site is shown on the Site Location Map, Figure 1 and Topographic Map, Figure 2.



SOURCE: MODIFIED FROM ESRI STREETMAP, 2017.

CHEVRON
HAYHURST
SEC. 2 FRAC POND
EDDY COUNTY, NEW MEXICO

FIGURE 1
SITE LOCATION MAP

TETRA TECH

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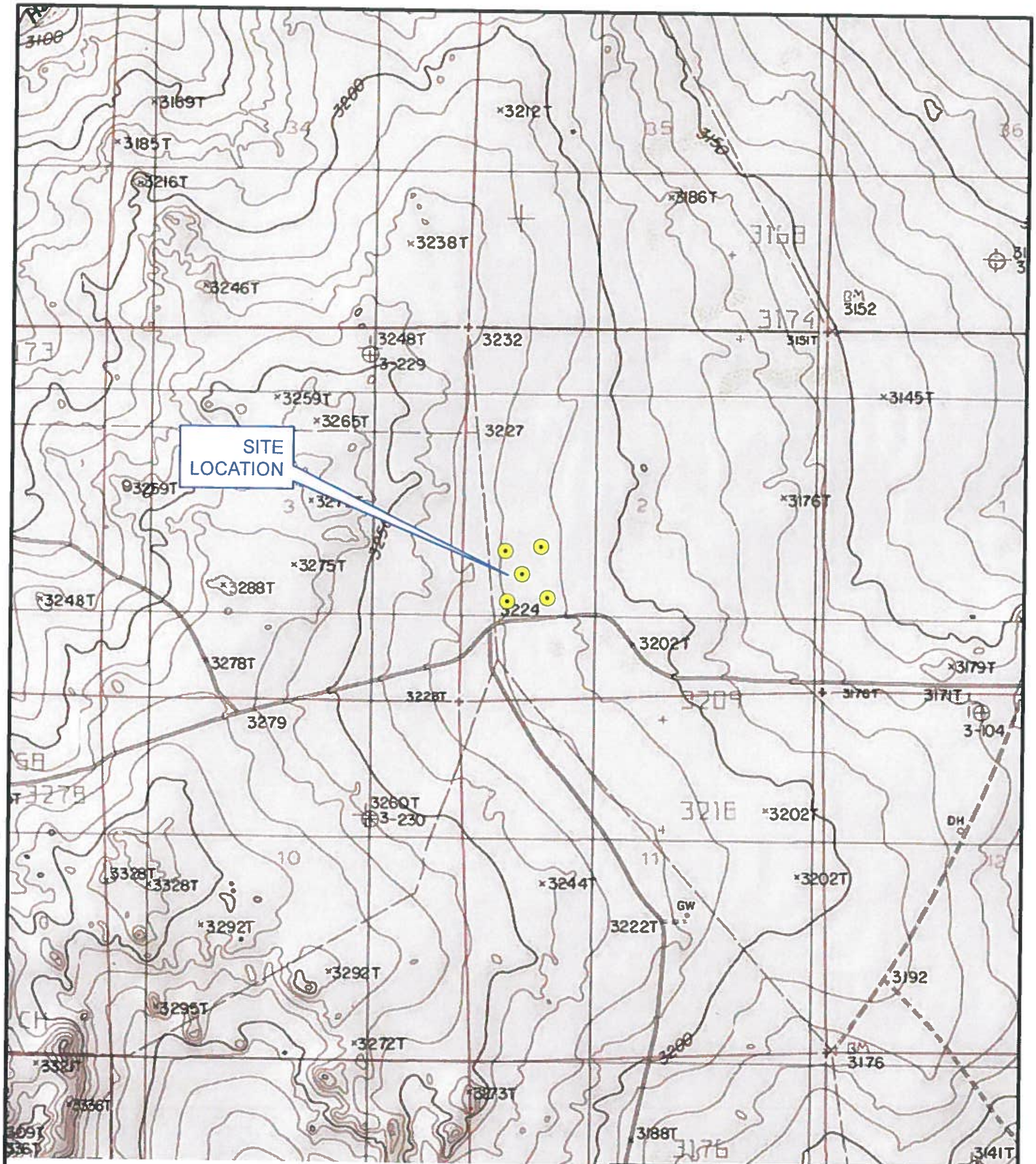


Legend

⊙ Boring Location

N W E S

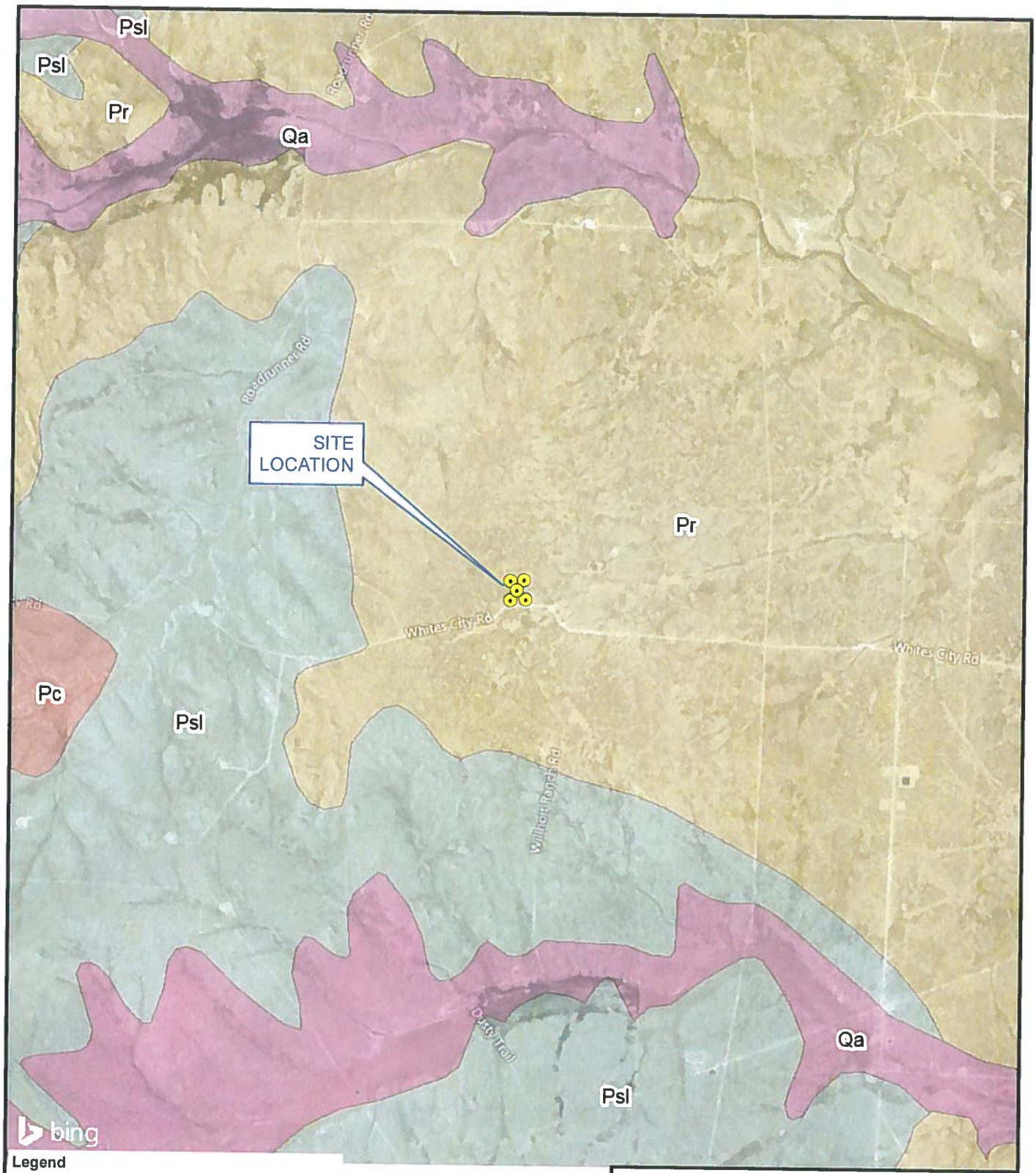
0 1,000 2,000
Feet

SOURCE: MODIFIED USGS, COTTONWOOD HILLS, NM-TX 1985 QUADRANGLE.

CHEVRON
HAYHURST
SEC. 2 FRAC POND
EDDY COUNTY, NEW MEXICO

FIGURE 2
TOPOGRAPHIC MAP

TETRA TECH



Legend

Boring Location

Rock Unit

- Pc - Castile Formation
- Pr - Rustler Formation
- Psl - Salado Formation
- Qa - Alluvium

N
W E
S

0 0.5 1
Miles

SOURCE: MODIFIED FROM USGS, PRELIMINARY INTEGRATED GEOLOGIC MAP FOR THE UNITED STATES CENTRAL STATES, 2005, AND BING MAPS HYBRID IMAGERY, 2011.

CHEVRON
HAYHURST
SEC. 2 FRAC POND
EDDY COUNTY, NEW MEXICO

FIGURE 3
SOIL TEST BORING LOCATION MAP
AND AREA GEOLOGY

TETRA TECH

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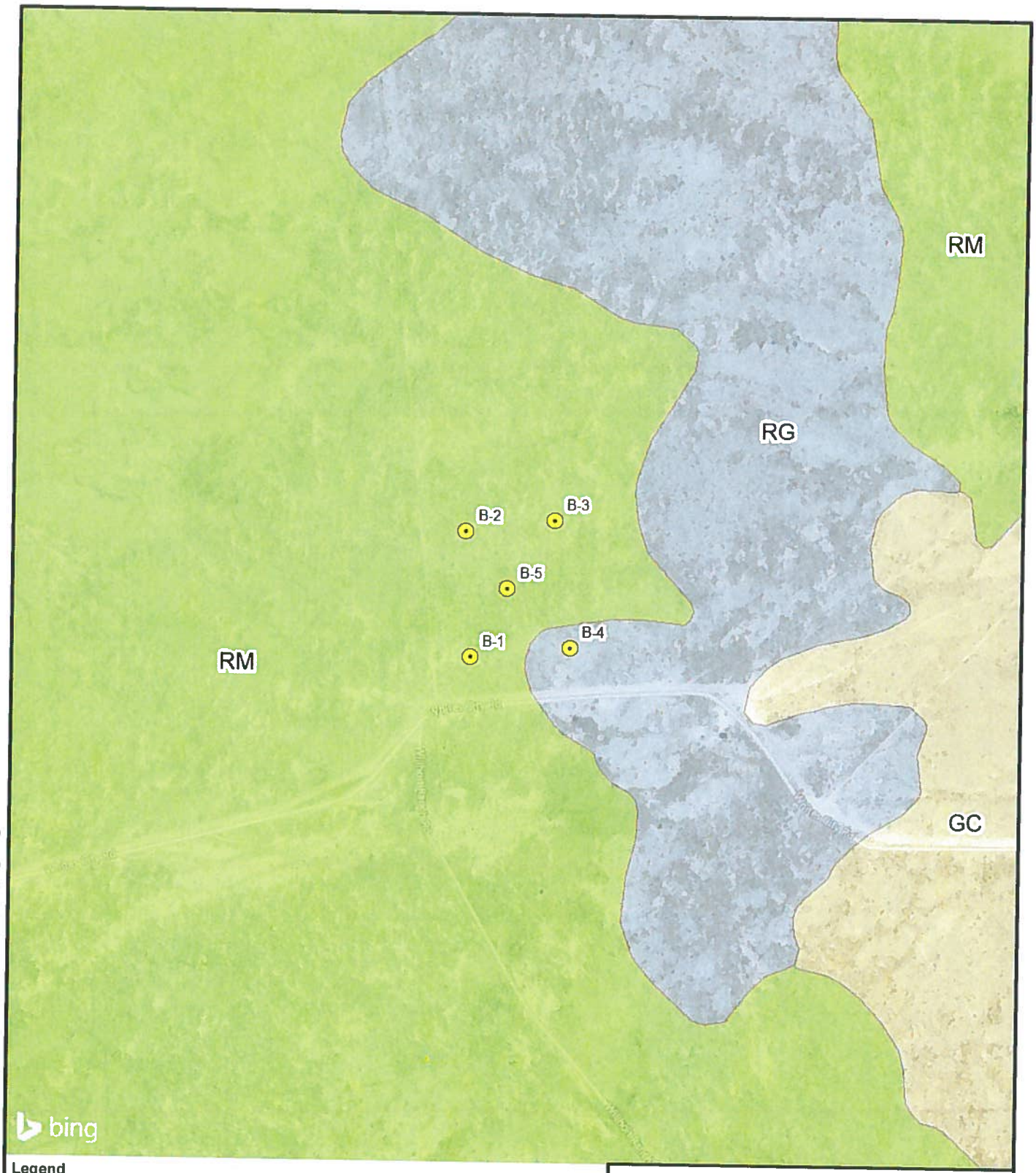

Legend

Boring Location

Soil Type

GC - Gypsum land-Cottonwood complex, 0 to 3 percent slopes

RG - Reeves-Gypsum land complex, 0 to 3 percent slopes

RM - Reeves-Reagan loams, 0 to 3 percent slopes

SOURCE: MODIFIED FROM USDA, NRCS SOIL SURVEY GEOGRAPHIC DATABASE FOR EDDY AREA, NEW MEXICO, 2016, AND BING MAPS HYBRID IMAGERY, 2011.

N
W
E
S

0 400 800
Feet

CHEVRON
HAYHURST
SEC. 2 FRAC POND
EDDY COUNTY, NEW MEXICO

FIGURE 4
NRCS SOIL TYPES

TETRA TECH

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2.0 SITE CONDITIONS

The site for the proposed hydraulic fracturing pond is identified as the Hayhurst Section 2 site. It is located adjacent to unpaved roads, 12½ miles southwest of Malaga, New Mexico in Eddy County at the intersection of County Road 775 and Whites City Road. GPS coordinates recorded at the site are 32.067930N and 104.167640W.

The site was wooded with mesquite trees and wild shrubs; clearing with a bulldozer was necessary to access the boring locations at the central and north ends of the site. The site appeared to be relatively flat. Surface utilities, fences, and access roads (on the site) were not observed to be present at the time of drilling, however two underground pipeline right-of-ways were observed at the west and south ends of the site adjacent to the south and west lease roads. In addition, an abandoned underground pipeline running from the southwest to northeast direction was noted. Care was taken to ensure the borings were not located near these underground lines. Drainage streams, swales, playa, or other potential issues were not observed. The existing ground surface appeared to be loose but it adequately supported the drilling rig during drilling. The immediate surrounding property was undeveloped.

3.0 PROPOSED DEVELOPMENT

Based on the information provided by Chevron via electronic mail, the proposed development will consist of two hydraulic fracturing ponds, constructed adjacent to each other, in accordance with the standards outlined in the Chevron Mid-Continent Business Unit General Standards for Brackish and Produced Water Containment Structures (MCBU General Standards) and New Mexico Oil Conservation Division (NMOCD), to service well drilling operations. Each pond will have an operational storage capacity of approximately 350,000 bbl and will be partially below ground. We understand Chevron prefers to balance cut and fill volumes using onsite soil for fill to construct the earthen berms. The ponds will be double lined and equipped with a leak detection system. The bottom of the ponds will be sloped to drain to an installed liquid leak detection sump.

4.0 GEOLOGIC CONDITIONS

Geologic mapping by the U.S. Geological Survey (USGS, 2005 and 2014) indicates the Rustler Formation is the foundation bedrock at the site (Figure 3). This sedimentary rock is primarily composed of carbonate from the Permian Period with evaporites also present. The contact with sediments of the underlying Permian Salado Formation is mapped about one mile west of the subject site.

Mapping by the Natural Resources Conservation Service (NRCS, 2017) identifies the site soils as the Reeves-Gypsum and Reeves-Reagan mapping units (Figure 4). These soils are both described as loam or clay loam derived as residuum weathered from gypsum.

The bedrock and soils described above can often be prone to karst formation and dissolution leaving voids, especially in the presence of groundwater. The size, orientation, extent and such voids is difficult to predict using conventional exploratory geotechnical drilling. Geophysical methods often provide a more effective means to identify potential karst features which can then be verified or ruled out using exploratory drilling.

Our findings of the geotechnical study are consistent with this characterization within the depths explored. No voids in the subsurface were encountered in our borings.

5.0 EXPLORATORY SOIL BORINGS

Tetra Tech drilled five (5) exploratory soil borings (B-1 through B-5) to identify subsurface conditions at the site between May 16 and 18, 2017. The boring locations were selected by a representative from Tetra Tech using a satellite image provided by Chevron. The proposed pond footprint was overlaid on the satellite image and GPS coordinates were obtained for each boring location. The boring locations were marked in the field by Tetra Tech using these GPS coordinates and a commercially available hand held GPS unit. The boring locations were cleared for drilling by comparing the proposed locations to buried utility locations marked by New Mexico 811 utility locating services. In addition, Chevron subcontractors cleared the boring locations using hand-held pipeline locating instruments.

The borings were drilled by Enviro-Drill Company from Albuquerque, New Mexico using a truck mounted CME 75 drilling rig. After the necessary vegetation clearing, the ground surface was stable for the drilling rig to access the boring locations and no access issues were noted. Tetra Tech's representative was on site to observe site conditions and the drilling.

Hollow stem auger (HSA) drilling equipment was used to complete the borings. Borings B-1 and B-4 were drilled to a depth of approximately 40 feet below the existing ground surface (bgs) and borings B-2 and B-3 were drilled to a depth of approximately 45 feet bgs. Boring B-5 was drilled to an approximate depth of 73 feet bgs to investigate the presence or absence of groundwater. All borings were left open for a period of approximately 24 to 48 hours to let groundwater levels stabilize. Final water level measurements were taken in each boring after 24 or 48 hours (as applicable) and groundwater was sampled in B-5 and delivered to a commercial laboratory for purposes of analyzing for TPH, Chlorides and RCRA metals, as requested by Chevron.

Soil samples were collected using a split-spoon sampler in borings B-1 through B-4 at 5-foot intervals. In boring B-5 samples were collected at 5-foot intervals to a depth of 30 feet bgs, then the spacing interval was increased to 10-feet. Standard Penetration Tests (SPT) were performed during sampling in accordance with ASTM D 1586 where a 140-pound automatic hammer is repeatedly dropped from a height of 30 inches. The number of blows for each 6-inch increment was recorded on the logs to categorize the consistency of the soil. After drilling and sampling activities were complete the borings were backfilled with soil cuttings. The soil boring logs are presented in Appendix A, and approximate locations of the borings are shown on Figure 4.

6.0 SUBSURFACE CONDITIONS

The information from the borings indicate the subsurface conditions were relatively consistent within the area where the borings were drilled. Beneath minimal vegetation and topsoil, all five (5) borings encountered 3½ to 8½ feet of unconsolidated soil over naturally cemented soil. The cemented soil extended to the maximum depth drilled of 40 feet in boreholes B-2 and B-3 (located on the north side of the proposed site). Relatively less cemented soil was encountered starting at depths of 23.5, 28, and 33 feet, and continued to depths of 38.5, 40, and 60 feet in B-1, B-4, and B-5 (located in the southern and central portions of the site) respectively. The poorly cemented layer continued to the maximum depth drilled of 45 feet in B-1. Strongly cemented soil was encountered in B-4 and B-5 to the maximum depths drilled of 45 and 73 feet respectively. Free water appears to coincide with the relatively less cemented layers in B-1, B-4, and B-5 as described below.

A moisture content of 23.5% was measured on a sample recovered from B-4 at 3.5 feet that had a fines content (percent silt and clay sized particles) of 54.8% by mass. Standard Penetration Test (SPT) N-values in this stratum ranged from 25 bpf in B-4 at 3.5 feet to 62 blows per foot (bpf) in B-1 at 3.5 feet and 50 blows for 3 inches in B-5 at 3.5 feet. Cemented layers had in-situ moisture contents at ranged from 9.8 to 20.4% for 19 samples tested at depths of up to 45 feet. Deeper samples from B-5 at 48.5 and 58.5 feet had moisture contents of 33.1 and 28.8% respectively. In-situ dry densities ranged from 82.3 to 122.6 pounds per cubic foot (pcf). Eleven of the 22 cemented soils samples had a fines content less than 50% and were therefore classified as sand soils in accordance the Unified Soil Classification System (USCS). No consistent layering was observed among the cemented soils in relation to the fines content. Atterberg limits testing of the cemented soils indicated a liquid limit ranging from 33 to 83 and plasticity index ranging from 6 to 61. The sample from B-5 at 48.5 feet was anomalous with a much higher liquid limit of 83 and plasticity index of 61 than the rest of the cemented soils where the liquid limit ranged from 33 to 42 and the plasticity index ranged from 6 to 15. Based on these index properties three of the samples were classified as silty sand (SM) and three were classified as clayey sand (SC). The fines content of the cemented soils with 50% or more fines ranged from 50 to 92%. Atterberg limits testing of these samples indicated a liquid limit ranging from 29 to 62 and plasticity index ranging from 12 to 37. Five of the fine grained cemented soil samples were classified as low plasticity clay (CL) and two were classified as high plasticity clay (CH). N-values within this stratum ranged from 13 bpf to greater than 100 bpf with the lower N-values corresponding to clayey samples or zones where free water was prevalent.

Free water was encountered in three of the five borings at the time of drilling. Water was not encountered in borings B-2 and B-3 (both located on the northern side of the site). Depths to water at the time of drilling were 31, 28 and 31 feet in borings B-1, B-4, and B-5, respectively. Water levels rose to depths of 26, 26, and 29 feet when checked prior to backfilling the boreholes one to two days following the initial drilling. Our observations are only indicative of conditions at the time and boring locations indicated. Water levels can vary due to many factors, including seasonal changes, site topography, surface runoff, post development conditions, the layering and permeability of subsurface strata, water levels in waterways, utilities, and other factors that may not have been evident at the time this study. Long-term observations would be necessary to more accurately evaluate the groundwater behavior and fluctuations.

7.0 ENGINEERING ANALYSES AND RECOMMENDATIONS

7.1 Primary Geotechnical Considerations

The two primary concerns that could impact the proposed development are the presence of strongly cemented soil within the proposed depths of excavation and the possibility of voids due to karst/evaporite subsurface conditions.

Excavation of strongly cemented soil will be difficult for construction due to the high energy required to excavate and eventually pulverize the cemented soil into fragments small enough to use as fill as described below.

While no voids due to karst/evaporite soil and bedrock were encountered during our borehole exploration, they could exist beneath the construction site and could become evident as a result of additional loading or changes to groundwater conditions as a result of construction or through natural progression. Settlement of pond floors or sidewalls due to undetected voids could cause distress or failure of liner systems and discharge of the pond contents to the subgrade. We recommend a geophysical exploration program be considered to search for voids that may not have been identified by the exploratory drilling. Such a program was beyond the scope of the current investigation; however should Chevron decide to undertake a geophysical investigation, Tetra Tech is available to assist.

7.2 Site Preparation

To prepare the site for pond construction, an area larger than the proposed footprint by at least 10 feet in plan dimension on all sides should be stripped of vegetation, roots, organic material, existing construction materials, debris, and other unsuitable materials. A typical stripping depth is approximately 6 inches; however, the actual depth will vary and should be based on field conditions and observations. After stripping, we anticipate a moderately stable surface for support of construction equipment. Unsuitable areas (such as those with loose, wet, soft, yielding, and/or pumping subgrade) should be corrected before construction proceeds.

Obstructions that could hinder preparation of the site should also be removed, with special attention given to unknown or un-documented below ground appurtenances and any existing above and below ground flow lines. Care should be taken not to damage any existing buried utilities located within the footprint of the proposed construction. Any resulting utility trenches/excavations due to replacement or relocation of utilities should be backfilled as discussed in the Fill Placement and Compaction section of this report.

7.3 Excavation and Embankment Slopes

Based on the subsurface data, sandy soil is present to depths of 3½ to 8½ feet below the existing grade and then cemented soils were encountered. Conventional construction equipment can be used to excavate the soil, however excavation into the cemented soils will be more difficult and additional effort to excavate may be necessary. Heavy duty rock ripping equipment like a ripper mounted on a Caterpillar D8 bulldozer or equivalent may be necessary.

The earthwork contractor should review the subsurface conditions and appropriately select excavation equipment and initial slope of the excavation to minimize potential sloughing and to remain in compliance with OSHA Regulations 1926.651 and 1926.652 on excavation safety. Wetting of the exposed excavation sides to a moisture content near or slightly above optimum may be necessary to stabilize and maintain the slopes during construction.

During construction the excavation slopes should be inspected and kept under observation for safety purposes. Excavation slopes specified by OSHA are dependent on types of soil and groundwater conditions encountered. Based on our investigation the on-site soil is classified as Type C and the cemented soil can be considered to be Type B according to OSHA 1926, Subpart P, Appendix A. The contractor's "competent person" should identify the soils encountered in the excavation and refer to OSHA 1926.651 and 1926.652 to verify the conditions and classifications from our investigation and determine appropriate slopes. If deemed unstable, the excavation sides should be flattened or benched to remain in compliance. Stockpiles of soils and equipment should not be placed within a horizontal distance equal to one-half the excavation depth, from the edge of excavation. Excavations deeper than 20 feet should be designed by a Professional Engineer as recommended by OSHA.

Embankment slopes must be constructed slopes flat enough to prevent slope failures. For soil and embankment fill design parameters, an angle of internal friction of 30 degrees with no cohesion is recommended in lieu of design parameters based on shear strength testing. A compacted/improved subgrade soil unit weight of 120 pcf is appropriate. The pond will be lined and we have assumed the liner system will function to prevent development of a phreatic surface within the embankment. We understand that side slopes will be designed at 3 horizontal to 1 vertical (3H:1V), which is consistent with the New Mexico Administrate Code (NMAC) requirements for design of "pits" (or ponds) associated with oil and gas exploration and production operations and not considered temporary, which states that the maximum allowed pond embankment slope is 3H:1V for exterior slopes and 2H:1V for interior slopes. Although steeper slopes may be shown to be stable and acceptable per regulations, we recommend 3H:1V based on consideration of potential constructability issues, liner stability, seepage, and slope stability. We understand the MCBU General Standards have similar slope requirements. If Chevron would like to consider construction of slopes steeper than the 3H:1V recommended above Tetra Tech is available to conduct slope stability analysis to evaluate the feasibility of steeper slopes and liner system performance on those slopes. This analysis would be supported by slope stability modeling and hand calculations to present to the NMOCD in a variance request.

7.4 Fill Placement and Compaction

On-site soils free of rocks greater than 1-inch in diameter, organics, and debris are suitable for use as structural fill or backfill. The cemented soils will likely require additional processing beyond ripping to achieve a soil consistency and meet the maximum particle size dimension in the construction specifications. Fill and backfill should not be placed on organics or other deleterious materials such as soil or rock with soluble components such as gypsum. If additional fill is needed for construction of the embankment, imported fill should be a well-graded clayey sand (SC) or low plasticity clay (CL), or imported soils with engineering properties that are similar to on-site soils (depending on the intended use of the fill). For structural support, a uniform, granular material having 100% passing the 1-inch sieve, 30% to 70% passing the No. 4 sieve, and 3% to 15% passing the number 200 sieve is recommended. Prior to importation, samples of soils being considered as fill should be examined and evaluated by a geotechnical engineer for engineering properties to determine suitability of the material for its intended use.

The bases of fills in soil should be scarified at least 8 inches deep, moisture-conditioned or dried to within 2% of optimum moisture content, processed to a uniform condition, and then compacted to at least 95 percent of maximum dry density determined by standard Proctor (ASTM D698). For on-site and imported fill and backfill, moisture should be adjusted to within minus 1 to 3 percent above optimum moisture content as determined by standard Proctor and the soils thoroughly mixed prior to placement and compaction to provide uniform water content throughout the fill. Fill and backfill should be placed in uniform lifts of 8 inches or less in loose thickness and compacted to at least 95% of standard Proctor maximum dry density (ASTM D 698). Fill should be compacted using heavy vibratory equipment. In areas with limited space for heavy equipment, appropriate compaction equipment, such as a jumping jack or other hand tools should be used. Where smaller compacting equipment or hand tools are used, the fill lifts should be 6 inches or less in loose thickness. The contractor should select the equipment type based upon the fill soil conditions.

Placement and compaction of fill should be observed and tested by a qualified geotechnical engineer or their qualified representative during construction. Each vertical foot of compacted fill placed should be tested for compaction comparison to standard Proctor results. A minimum of one moisture/density verification test should be performed for every 5,000-square-feet of compacted area, or for every 150-lineal feet of utility trench backfill. For smaller areas, a minimum of three (3) verification tests should be conducted for every lift. Subsequent lifts should not be placed until the exposed lift has been tested to confirm compliance with the specified moisture and density. Lifts failing to meet the moisture and density requirements should be reworked to meet the required specifications prior to subsequent lifts being placed. Density and moisture verification testing is recommended to provide an indication that adequate earthwork is being performed. However, the quality of the fill and compaction is the sole responsibility of the contractor. Satisfactory verification testing is not a guarantee of the quality of the contractor's earthwork operations.

The specified moisture content must be maintained until compaction of the overlying lift, or until the cushioning sand layer or geotextile fabric and geomembrane liner are installed. Failure to maintain the specified moisture content could result in excessive soil movement resulting in embankment failure. The contractor must provide some means of controlling the moisture content (such as water hoses, water trucks, etc.). Maintaining subgrade moisture is always critical, but will require the most effort during warm, windy and/or sunny conditions.

7.5 Proof Rolling

Proof rolling of the subgrade prior to fill placement and liner installation should be used to detect areas of soft and/or pumping soil. Proof rolling should be conducted using a heavy, rubber-tired vehicle weighing at least 25 tons, with the tires inflated to the manufacturer's specified operating pressure. The entire area should be proof rolled, with each succeeding pass offset by not greater than one tire width. The geotechnical engineer or an experienced soils technician should be present during proof rolling activities to assist with the identification of unsuitable soil. Unsuitable soil should be undercut and reworked, or otherwise improved in a manner that is suitable to the design and approved by the geotechnical engineer.

7.6 Geomembrane Liner Protection

Where the exposed surface is rough, rock protrusions and sharp edges can potentially damage the geomembrane liner. Additionally an irregular foundation with voids can create localized stress points on the geomembrane liner. The subsurface conditions at this site indicate sandy soils to a depth of 3½ to 8½ feet deep which should suffice for geomembrane liner foundation, however, the pond bottom will likely be in the underlying cemented soil with rock-like protrusions and surface irregularities. If the protrusions are greater than ¼-inch or if voids greater than 2 inches deep will exist below the liner, a cushion, such as a fine grained sand layer, approximately 6 inches thick or a properly designed cushion geotextile should be used to reduce the risk of damage to the liner. Liner requirements must meet those presented in the New Mexico Administrative Code (NMAC).

7.8 Freeboard

An important aspect of embankment stability and performance is maintaining the appropriate freeboard (the vertical distance from the water surface to the crest of the embankment). If the freeboard is insufficient, the embankment could overtop, leading to excessive erosion and possible failure. The NMAC requirements for operation of "pits" (or ponds) associated with oil and gas exploration and production and MCBU General Standards require a minimum freeboard of three feet which must be maintained at all times.

7.9 Settlement of Subgrade and Embankment Materials

Settlement of embankment material is another important aspect of embankment stability and total fluid storage potential over time. It is anticipated that the embankments will be constructed of fill consisting of on-site material or imported fill. The on-site sandy soils have a relatively low potential for post-construction settlement. Construction recommendations from above for subgrade proof rolling, subgrade improvements, and fill placement will reduce the amount of settlement. Due to the sandy nature of the soils, most of the anticipated or potential settlement within the embankments and under the embankments should occur during construction.

7.10 Permitting

If applicable, a permit application should be filed with the NMOCD in accordance with NMAC regulations prior to construction. Construction and installation in accordance with NMOCD regulations found in the NMAC and the design drawings and construction specifications is recommended. The NMOCD may require notification prior to construction and prior to operation of the pond.

8.0 CONCLUSIONS

The Tetra Tech investigation identified two potential issues that should be addressed prior to development of the proposed hydraulic fracturing ponds at the Hayhurst Section 2 site. The first is that water in the boreholes stabilized at depths of 26, 26, and 29 feet in borings 1, 4, and 5, respectively (when measured one to two days following the initial drilling). New Mexico Oil Conservation Division rules in the NMAC have specific siting requirements for "pits" (ponds), associated with oil and gas exploration and production, which are within specified proximities to groundwater. A hydrogeological study to meet the requirements of the NMAC should be performed to determine whether the water encountered is a perched layer or a continuous water bearing feature.

Another potential issue is based on review of mapped geology at the site which indicated a bedrock formation that is susceptible to formation of voids, especially in the presence of groundwater, where dissolution of the carbonate and evaporite minerals can occur. Voids can be exacerbated by loading or changes in hydrology that could occur as a result of the pond construction. Collapse of soils overlying such voids could damage the ponds or liner system and result in release of stored fluids to the environment.

Geophysical methods can be an effective means to identify potential voids that may exist at depth but are not readily identifiable by exploratory drilling. If geophysical methods suggest that voids may exist, additional exploratory drilling might be needed to confirm the presence of voids.

Tetra Tech can assist Chevron with further analyses of the Hayhurst Section 2 site should it be of interest. We can prepare a scope of work and cost estimate for Chevron review prior to authorization of these tasks.

Following further understanding of the groundwater and presence of subsurface voids, the proposed hydraulic fracturing ponds can be constructed in accordance with MCBU General Standards and NMOCD regulations, as described herein. Construction should be conducted in accordance with MCBU General Standards, NMOCD regulations, the engineering drawings and specifications prepared by Tetra Tech, and this report.

9.0 REFERENCES

Chevron Mid-Continent Business Unit MCBU General Standards for Brackish and Produced Water Containment Structures, DRAFT version (MCBU General Standards)

U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS, 2017). Web Soil Survey. http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx. Accessed July 10, 2017.

United States Geological Survey (USGS, 2005). Preliminary Integrated Geologic Map for the United States Central States. Open-File Report 2005-1351

United States Geological Survey (USGS, 2014). Karst in the United States: A Digital Map Compilation and Database. Open-File Report 2014-1156. Weary, D.J., and Doctor, D.H.

10.0 LIMITATIONS

This report was prepared from data developed during our field exploration, laboratory testing, and engineering judgment. Our design recommendations were based on subsurface data and our experience with similar projects and subsurface conditions. Our borings were located to obtain a reasonable interpretation of subsurface conditions. It should be noted that the borings were widely spaced and variation in the subsoils between borings is likely.

A qualified, experienced geotechnical engineer or their designated representative should observe the construction to look for evidence that would indicate differences in subsurface conditions from those described in this report. If any information becomes available that would alter our assumptions, conclusions or recommendations, the opinions presented in this report should be considered invalid until we have been contacted to review our recommendations based on the new information. The geotechnical engineer should review plans and specifications during the design. Placement and compaction of engineered fill, backfill, subgrade and other fills should be observed and tested by a representative of a Construction Materials Testing (CMT) firm during construction, and Tetra Tech should be retained to review these data.

We believe this study was conducted in a manner consistent with that level of skill and care ordinarily used by members of the profession currently practicing under similar conditions in the locality of this project. No warranty, express or implied, is made. If we can be of further service in discussing the contents of this report or in the analysis of the planned project from the geotechnical point of view, please contact us.

APPENDIX A

EXPLORATORY BORING LOGS

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-1

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/16/2017
GROUND ELEVATION: NA
METHOD: HSA
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.067930 N
LOGGED BY: Clint Merritt and Raj Meruva
DRILLING CONTRACTOR: Enviro Drill
LONGITUDE: 104.167640 W
DRILLED BY: Juan Uribe
Notes: Not Recorded

DEPTH (ft)	SAMPLE TYPE	N Value	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
5	SS	62				3.5 Very Dense, Pink, Fine Grained **SAND**
10	SS	50/5"	MC = 19.8% Fines = 36.1%			8.5 Very Dense, Pink, Weakly Cemented Fine Grained **SAND**, with < 20% Fine Gravel, Calcareous, Moist
15	SS	50/4"				
20	SS	50/1"				
25	SS	50/3"	MC = 13.2% DD = 106.1 pcf LL = 37 Fines = 49.5%	SM		23.5 Very Dense to Medium Dense, Dark Brown, Moderately Cemented Fine Silty and Clayey **SAND**, Increasing Plasticity with Depth, Moist to Wet
30	SS	13				▼ Water depth 48 hours after drilling ▼ Water depth at the end of drilling
35	SS	15	MC = 18.8% DD = 102.3 pcf LL = 33 Fines = 47.4%	SC		▽ Water depth during drilling
40	SS	13				

BOREHOLE/TP/WELL - VECTOR HAYHURST.GPJ LAB SUMMARY.GDT 7/13/17

(Continued Next Page)

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-1

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	N Value	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
						Stiff to Very Stiff, Dark Brown, Low Plasticity **CLAY** with Sand, Moist
45	SS	46	MC = 17.7% DD = 122.6 pcf LL = 29 Fines = 57.7%	CL		45.0
						Borehole terminated at 45.0

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-2

CLIENT Chevron **PROJECT NAME** Hayhurst NM, Sec.2 Frac Pond

PROJECT NUMBER 212C-MD-00848 **PROJECT LOCATION** Eddy County, New Mexico

DATE(S) OF DRILLING: 05/18/2017 **GROUND ELEVATION: NA** **METHOD: HSA**

CONSULTANT: Tetra Tech, Inc. **LATITUDE: 32.069966 N** **LOGGED BY: Clint Merritt and Raj Meruva**

DRILLING CONTRACTOR: Enviro Drill **LONGITUDE: 104.167700 W** **DRILLED BY: Juan Uribe**

Notes: Not Recorded

DEPTH (ft)	SAMPLE TYPE	N Value	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						
						Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
	SS	50/5"	MC = 14.1% Fines = 41.9%			3.5
5						Very Dense, Pink, Strongly Cemented Medium Grained **SAND**, with <50% Quartz Fragments, Moist
						5.0
						Hard, Red, **SILT TO CLAY** Fines and Plasticity Increasing with Depth, with Sand, with <50% Quartz Fragments, Calcareous, Moist
10	SS	50/2"				
15	SS	50/3"	MC = 15.6% DD = 96 0 pcf LL = 44 Fines = 50.3%	ML		
20	SS	50/4"				
25	SS	50/3"				
30	SS	50/4"	MC = 20.4% DD = 93.1 pcf LL = 53 Fines = 59.2%	CH		30.0
						Very Dense, Pink, Strongly Cemented Medium Grained **SILTY SAND**, with >50% Quartz Fragments, Calcareous, Moist
35	SS	50/2"				
40	SS	50/4"	MC = 19.5% LL = 42 Fines = 38.8%	SM		40.0
						Borehole terminated at 40.0

BOREHOLE/TP/WELL - VECTOR HAYHURST.GPJ LAB SUMMARY.GDT 7/13/17

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-3

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/18/2017
GROUND ELEVATION: NA
METHOD: HSA
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.070140 N
LOGGED BY: Clint Merritt and Raj Meruva
DRILLING CONTRACTOR: Enviro Drill
LONGITUDE: 104.165980 W
DRILLED BY: Juan Uribe
Notes: Not Recorded

DEPTH (ft)	SAMPLE TYPE	N Value	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0					
					Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
					3.5
5	SS	50/5"	MC = 13.8% Fines = 52.9%		Very Dense, Pale Red, Weakly Cemented Medium Grained Sandy Silty **CLAY** with <10% Small Angular Limestone Fragments, Moist
10	SS	50/5"			
					13.0
15	SS	50/3"			Hard, Yellowish Brown, Strongly Cemented **SILTY CLAY**, with < 20% Small Angular Limestone Fragments, Slight odor, Calcareous, Slightly Moist
20	SS	50/4"	MC = 9.8% Fines = 85.6%		
25					
30					
35					
40					
					40.0
					Borehole terminated at 40.0

BOREHOLE/TP/WELL - VECTOR HAYHURST.GPJ LAB SUMMARY.GDT 7/13/17

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-4

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/17/2017
GROUND ELEVATION: NA
METHOD: HSA
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.068070 N
LOGGED BY: Clint Merritt and Raj Meruva
DRILLING CONTRACTOR: Enviro Drill
LONGITUDE: 104.165660 W
DRILLED BY: Juan Uribe
Notes: Not Recorded

DEPTH (ft)	SAMPLE TYPE	N Value	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
3.5						
5	SS	25	MC = 23.5% Fines = 54.8%			Medium Dense, Pink, Weakly Cemented Medium Grained **SILT**, Calcareous, Moist
8.5						
10	SS	50/2"				Hard, Red, Strongly Cemented Low Plasticity **CLAY**, with Sand, Calcareous, Moist
15	SS	50/2"	MC = 16.5% DD = 96.1 pcf LL = 37 Fines = 61.9%	CL		
20	SS	50/2"				
20.0						
25	SS	50/4"	MC = 10.0% Fines = 43.2%			Very Dense, Red, Moderately Cemented Medium Grained Silty Clayey **SAND**, with < 20% Gypsum Fragments, Moist to Wet
						▼ Water depth 48 hours after drilling
28.0						▽ Water depth during drilling
30	SS	20				Very Stiff to Hard, Red, Low Plasticity **CLAY**, with Sand, Moist
35	SS	26	MC = 15.5% DD = 113.9 pcf LL = 29 Fines = 92.1%	CL		
40	SS	35				Freestanding water

BOREHOLE/TP/WELL - VECTOR HAYHURST.GPJ LAB SUMMARY.GDT 7/13/17

(Continued Next Page)

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-4

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	N Value	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
						Very Stiff to Hard, Red, Low Plasticity **CLAY**, with Sand, Moist *(continued)*
45	SS	*50/1"*	MC = 15.1% LL = 30 Fines = 88.6%	CL		45.0
						Borehole terminated at 45.0

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-5

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/17/2017
GROUND ELEVATION: NA
METHOD: HSA
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.069030 N
LOGGED BY: Clint Merritt and Raj Meruva
DRILLING CONTRACTOR: Enviro Drill
LONGITUDE: 104.166890 W
DRILLED BY: Juan Uribe
Notes: Not Recorded

DEPTH (ft)	SAMPLE TYPE	N Value	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
3.5						
5	SS	50/3"	MC = 17.0% Fines = 19.3%			Very Dense, Pink, Strongly Cemented Medium Grained **SAND**, Calcareous, Moist
8.5						
10	SS	50/4"	MC = 15.8% DD = 99 8 pcf LL = 42 Fines = 44.4%	SM		Very Dense, Pale Red, Strongly Cemented Medium Grained, Silty to Clayey **SAND** with > 40% Gypsum/Quartz Fragments, Calcareous, Moist
15	SS	50/4"				
20	SS	50/5"	MC = 15.9% DD = 114.2 pcf LL = 46 Fines = 49.7%	SC		
25	SS	50/4"	MC = 16.5% Fines = 25.9%			
25.0						
30	SS	50/3"	MC = 20.3% DD = 96.6 pcf LL = 62 Fines = 51.5%	CH		Hard, Pink, High Plasticity **CLAY** with Sand, Calcareous, Wet Water depth 22.5 hours after drilling Water depth during drilling
33.0						
35	SS	49				Very Dense to Medium Dense, Reddish Brown, Moderately Cemented Medium Grained **CLAYEY SAND** with > 30% Quartz Fragments, with Lenses of Clay, High Plasticity, Slightly Wet
40	SS	49				

BOREHOLE/TP/WELL - VECTOR HAYHURST.GPJ LAB SUMMARY.GDT 7/13/17

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TETRA TECH
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Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-5

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	N Value	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
45						Very Dense to Medium Dense, Reddish Brown, Moderately Cemented Medium Grained **CLAYEY SAND** with > 30% Quartz Fragments, with Lenses of Clay, High Plasticity, Slightly Wet *(continued)*
50	SS	25	MC = 33.1% DD = 82.3 pcf LL = 83 Fines = 39.2%	SC		
55						
60	SS	50/3"	MC = 28.8% LL = 45 Fines = 56.3%	CL		60.0
65						Very Dense, Reddish brown, Clayey, Strongly Cemented Medium Grained **SAND**, with > 40% Quartz, Wet and Muddy
70	SS	50/1"				73.0
						Borehole terminated at 73.0

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Professional Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

R 27 E

LEGEND

- Section Line
- Existing Road & Pad
- Existing Fence Line
- Existing Frac Pond
- Surface Location
- Found Occupation

Whites City Road

Existing Access Road

Sec. 2

State of New Mexico

SE/SW
(±3.22 Acres- Proposed Pad)
Acres-Proposed Facility)

Water Recycle
350' x 200'

Existing Cattle Pen

T
26
S

S 56° 53' 25" W 1,658.52'
To Fnd. 1 ½" Iron Pipe W/Cap @
the SW Corner of Section 2

1 2 3 4 5 6 7 8

350'

300'

PROPOSED SWD FACILITY ±2.41 Acres

Existing Fence Line

PROPOSED PAD ±3.22 Acres

Existing Skeen 2 SWD No. 1 Pad

Existing Frac Pond to be Removed

330'

425'

Existing Fence Line

Gravitas 2 State SWD No. 2 Well 400' FSL 1,560' FWL

NAD 27 NEW MEXICO EAST ZONE

Scale: 1" = 200'

200' 0 100' 200'

GRAVITAS 2 STATE SWD NO. 2 WELL	
X= 552,344	NAD 27
Y= 387,394	
LAT. 32.064948	
LONG. 104.164359	
X= 593,528	NAD83
Y= 387,451	
LAT. 32.065070	
LONG. 104.164850	
ELEVATION +3211' NAVD 88	

NW SWD FACILITY PAD CORNER (1)	NE SWD FACILITY PAD CORNER (2)
X= 552,164 NAD 27	X= 552,514 NAD 27
Y= 387,844	Y= 387,844
ELEVATION +3217' NAVD 88	ELEVATION +3217' NAVD 88
SE SWD FACILITY PAD CORNER (3)	SW SWD FACILITY PAD CORNER (4)
X= 552,514 NAD 27	X= 552,164 NAD 27
Y= 387,544	Y= 387,544
ELEVATION +3212' NAVD 88	ELEVATION +3217' NAVD 88
NW SWD PAD CORNER (5)	NE SWD PAD CORNER (6)
X= 552,124 NAD 27	X= 552,549 NAD 27
Y= 387,544	Y= 387,543
ELEVATION +3217' NAVD 88	ELEVATION +3212' NAVD 88
SE SWD PAD CORNER (7)	SW SWD PAD CORNER (8)
X= 552,549 NAD 27	X= 552,124 NAD 27
Y= 387,213	Y= 387,214
ELEVATION +3216' NAVD 88	ELEVATION +3218' NAVD 88

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT **PAGE 1 OF 2**

CHEVRON U.S.A. INC.

PROPOSED PADS
GRAVITAS 2 STATE SWD NO. 2 WELL
SECTION 2, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: TBD	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 1/28/2016	REVISED BY: GDG
DATE: 12/17/2015	No. 2	DATE: 06/03/2016	REVISED BY: BOR
FILENAME: T\2015\2153364\DWG\GRAVITAS 2 STATE SWD 2 and FACILITY SUP.dwg			

DISCLAIMER: At this time, C. H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:
Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

NOTE:
Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance: New Mexico One Call System - www.nmonecall.org.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Professional Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

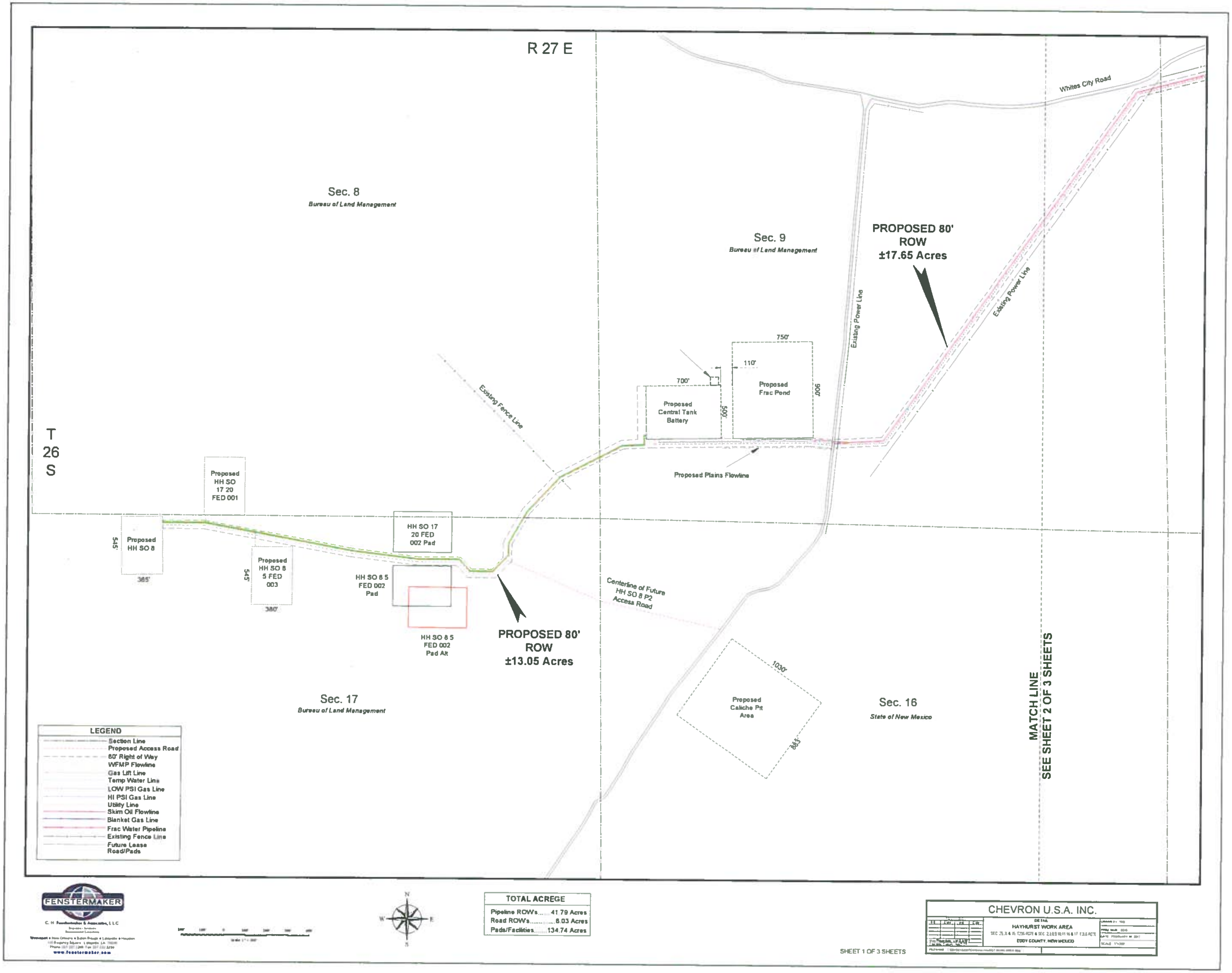
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED PADS
GRAVITAS 2 STATE SWD NO. 2 WELL
SECTION 2, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: TBD	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 1/28/2016	REVISED BY: GDG
DATE: 12/17/2015	No. 2	DATE: 06/03/2016	REVISED BY: BOR
FILENAME: T:\2015\2153364\DWG\GRAVITAS 2 STATE SWD 2 and FACILITY SUP.dwg			


R 27 E
T
26
S
Sec. 8
Bureau of Land Management
Sec. 9
Bureau of Land Management
Sec. 16
State of New Mexico
Sec. 17
Bureau of Land Management
Whites City Road
Existing Power Line
Existing Power Line
PROPOSED 80'
ROW
±17.65 Acres
PROPOSED 80'
ROW
±13.05 Acres
750'
110'
900'
700'
500'
Proposed
Frac Pond
Proposed
Central Tank
Battery
Proposed Plains Flowline
Existing Fence Line
Proposed
HH SO
17 20
FED 001
Proposed
HH SO 8
545'
385'
Proposed
HH SO 8
5 FED
003
545'
380'
HH SO 17
20 FED
002 Pad
HH SO 8 5
FED 002
Pad
HH SO 8 5
FED 002
Pad Alt
Centerline of Future
HH SO 8 P2
Access Road
1030'
883'
Proposed
Caliche Pit
Area
MATCH LINE
SEE SHEET 2 OF 3 SHEETS
LEGEND
Section Line
Proposed Access Road
80' Right of Way
WFMP Flowline
Gas Lift Line
Temp Water Line
LOW PSI Gas Line
HI PSI Gas Line
Utility Line
Skim Oil Flowline
Blanket Gas Line
Frac Water Pipeline
Existing Fence Line
Future Lease
Road/Pads
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
www.fenstermaker.com
N
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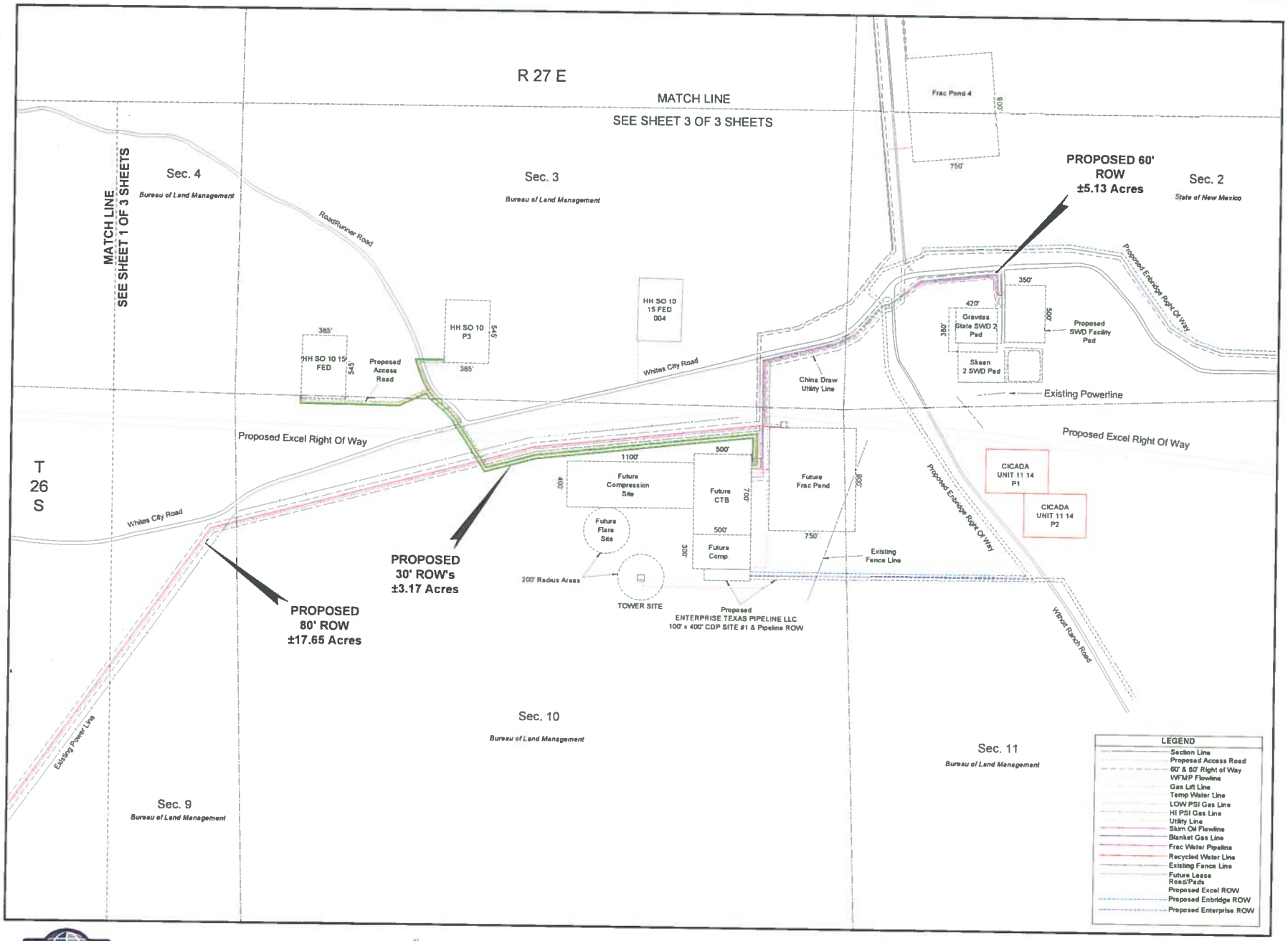
TOTAL ACREGE
Pipeline ROW's......41.79 Acres
Road ROW's..........8.03 Acres
Pads/Facilities......134.74 Acres
CHEVRON U.S.A. INC.
DETAIL
HAYHURST WORK AREA
EDDY COUNTY, NEW MEXICO
SHEET 1 OF 3 SHEETS



FENSTERMAKER

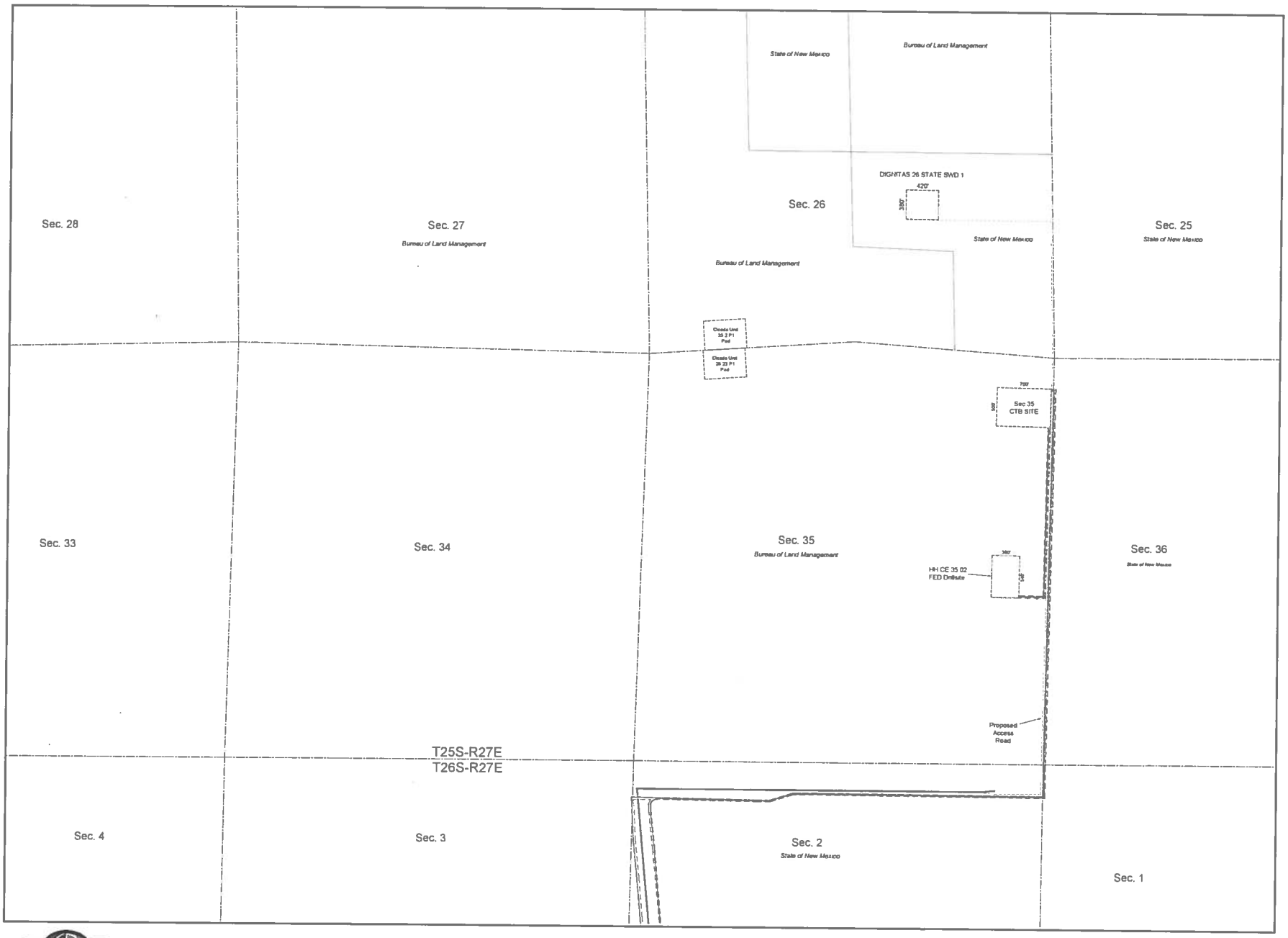
C H Fenstermaker & Associates, LLC

CHEVRON U.S.A. INC.

HAYHURST WORK AREA

EDDY COUNTY, NEW MEXICO

SHEET 2 OF 3 SHEETS



FENSTERMAKER

C. H. Fenstermaker & Associates, L.L.C.

135 Regency Square | Lafayette, LA 70508
Phone 337.237.2200 | Fax 337.232.3299
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SHEET 3 OF 3 SHEETS

CHEVRON U.S.A. INC.

DETAIL
HAYHURST WORK AREA
SEC 25 & 26, T25S R27E & SEC 30 & 31, T25S R28E & SEC 35 & 36, T25S R27E & SEC 1, T26S R27E
EDDY COUNTY, NEW MEXICO

Appendix 3 – Recycling Containment Groundwater Boring Log

TETRA TECH

September 7, 2017

Mr. Ruben Kopara
Chevron North America Exploration and Production Company
6301 Deauville Blvd,
Midland, Texas 79706

Subject: **Addendum to Geotechnical Investigation Report**
Hayhurst Section 2 Hydraulic
Fracturing Ponds
Eddy County, New Mexico

Dear Mr. Kopara:

On August 2, 2017, Tetra Tech published a report of our geotechnical study for the referenced site where Chevron intends to construct two earthen impoundments with capacities of approximately 350,000 bbl each to service well drilling operations. Subsequent to that investigation and report, Chevron moved the location of the proposed pits to an adjacent area immediately north of the previous site. On August 17 and 18, 2017, Tetra Tech returned to the site and drilled three additional borings in the new area to investigate subsurface conditions. The locations of the borings are shown on the attached Figure 1. Previous borings are labeled B-1 through B-5; the more recent borings are labeled B-6 through B-8.

Borings B-6 through B-8 encountered 21 to 30 feet of medium dense to dense sand over hard clay with cemented lenses. Standard Penetration Tests (SPT) in the sand had values or blow counts (N) ranging from 23 blows per foot to 50 blows for 2 inches; blow counts in the clay ranged from 9 blows per foot (in B-8 at the contact with the overlying sand) to 50 blows for 2 inches. In general, the density of the soils increases with depth based on the SPT values. Free water was not encountered in the borings.

The additional borings indicate that the subsurface conditions on the northern part of the site are consistent with those encountered to the south. The soils to the south have a higher silt and clay content, but blow counts are similar. The borings to the north have a lesser degree of cementation at shallow depth, which may simplify earthwork. No voids or carbonate rocks or deposits were encountered.

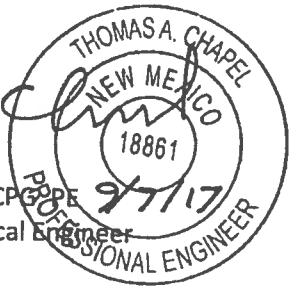
Recommendations made in our geotechnical report for the original site remain valid for the revised pit location. Our report: *Hayhurst, Section 2 Hydraulic Fracturing Ponds, Eddy County New Mexico*, dated August 2, 2017, should be carefully reviewed in its entirety during design and construction of the pits at the proposed revised location. In particular, we reiterate that although evidence of voids or karst terrain were not encountered, the site is located in a karst-prone geologic area and voids that were not observed in our widely spaced borings could exist under portions of the site. We recommend Chevron consider geophysical investigation to more conclusively determine if voids could exist below portions of the site.

Tetra Tech
3801 Automation Way, Suite 100, Fort Collins, CO 80525
Tel 970.223.9600 Fax 970.223.7171 www. tetratech.com

Please contact the undersigned with any questions or comments you may have regarding this addendum letter or our recommendations for these sites.

Sincerely,

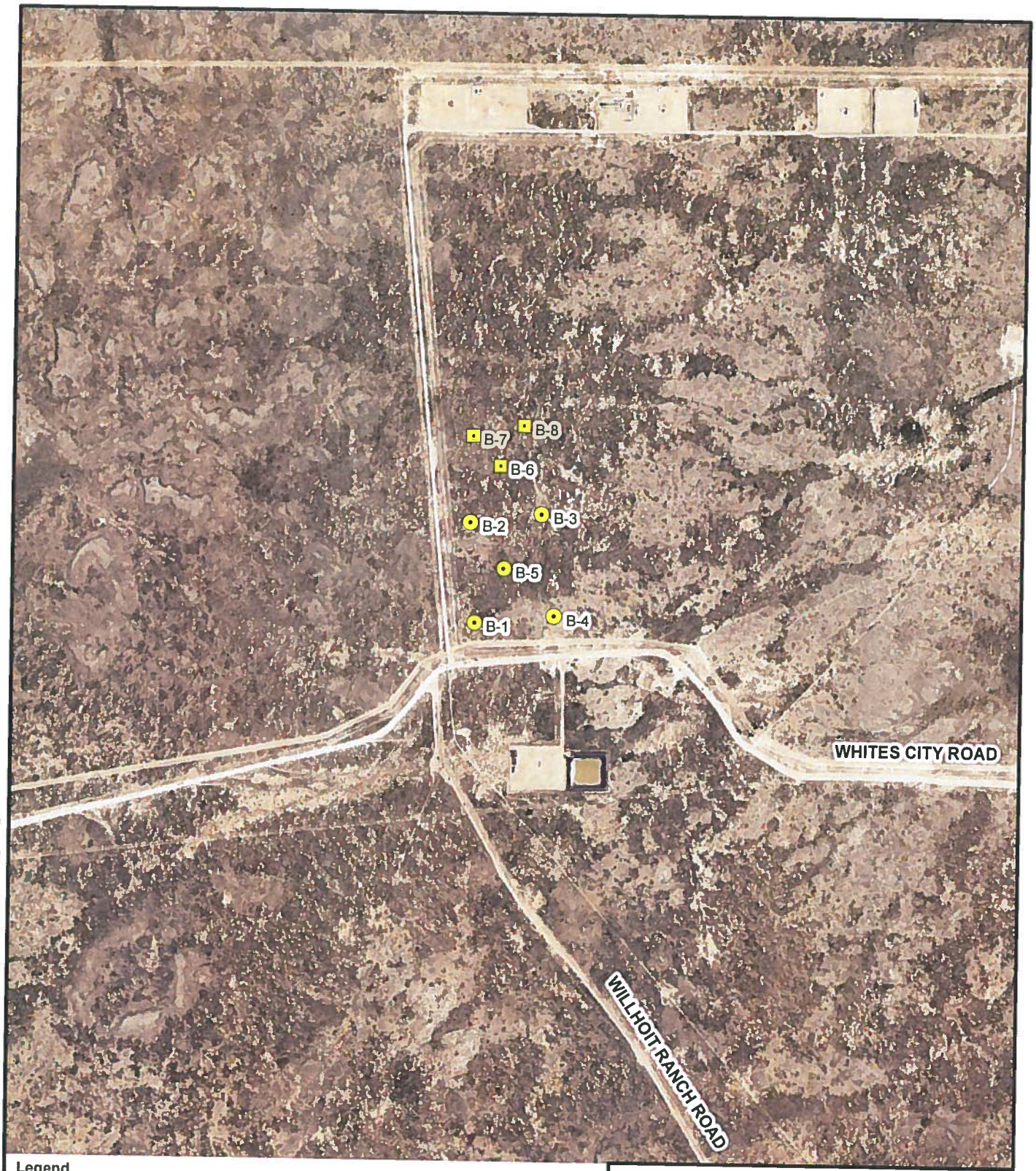
TETRA TECH, INC.



Thomas A. Chapel, CPG, PE
Principal Geotechnical Engineer

Reviewed by

Don Grahlherr, PE
Vice President



Legend

- Boring Location
- Additional Boring Location

N
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S

0 500 1,000
Feet

SOURCE: MODIFIED FROM USDA NAIP IMAGERY, 2016.

CHEVRON
HAYHURST
SEC. 2 FRAC POND
EDDY COUNTY, NEW MEXICO

FIGURE 1
AERIAL MAP

TETRA TECH

Date Saved: 9/5/2017 5:51:37 PM User: joel.peters Path: L:\CADD\P212C-MD\00848\1600\Chevron_Hayhurst_212C_MD_00848_2A.mxd

ATTACHMENT A

BORING LOGS

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-1

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/16/2017
GROUND ELEVATION: NA
METHOD:
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.067930 N
LOGGED BY: Clint Merritt and Raj Meruva
DRILLING CONTRACTOR: Enviro Drill
LONGITUDE: 104.167640 W
DRILLED BY: Juan Uribe
Notes: Not Recorded

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
5	SS	62			3.5	Very Dense, Pink, Fine Grained **SAND**
10	SS	50/5"	MC = 19.8% Fines = 36.1%		8.5	Very Dense, Pink, Weakly Cemented Fine Grained **SAND**, with < 20% Fine Gravel, Calcareous, Moist
15	SS	50/4"				
20	SS	50/1"				
25	SS	50/3"	MC = 13.2% DD = 106.1 pcf LL = 37 Fines = 49.5%	SM	23.5	Very Dense to Medium Dense, Dark Brown, Moderately Cemented Fine Silty and Clayey **SAND**, Increasing Plasticity with Depth, Moist to Wet
30	SS	13				▼ Water depth 48 hours after drilling ▼ Water depth at the end of drilling
35	SS	15	MC = 18.8% DD = 102.3 pcf LL = 33 Fines = 47.4%	SC		▽ Water depth during drilling
40	SS	13				

BOREHOLE/TP/WELL - TT HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

(Continued Next Page)

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-1

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
						Very Dense to Medium Dense, Dark Brown, Moderately Cemented Fine Silty and Clayey **SAND**, Increasing Plasticity with Depth, Moist to Wet *(continued)*
45	SS	46	MC = 17.7% DD = 122.6 pcf LL = 29 Fines = 57.7%	CL		Stiff to Very Stiff, Dark Brown, Low Plasticity **CLAY** with Sand, Moist Stiff to Very Stiff, Dark Brown, Low Plasticity **CLAY** with Sand, Moist *(continued)*
						45.0 Borehole terminated at 45.0

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-2

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/18/2017
GROUND ELEVATION: NA
METHOD:
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.069966 N
LOGGED BY: Clint Merritt and Raj Meruva
DRILLING CONTRACTOR: Enviro Drill
LONGITUDE: 104.167700 W
DRILLED BY: Juan Uribe
Notes: Not Recorded

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
5	SS	50/5"	MC = 14.1% Fines = 41.9%			3.5 Very Dense, Pink, Strongly Cemented Medium Grained **SAND**, with <50% Quartz Fragments, Moist
10	SS	50/2"				5.0 Hard, Red, **SILT TO CLAY** Fines and Plasticity Increasing with Depth, with Sand, with <50% Quartz Fragments, Calcareous, Moist
15	SS	50/3"	MC = 15.6% DD = 96.0 pcf LL = 44 Fines = 50.3%	ML		
20	SS	50/4"				
25	SS	50/3"				
30	SS	50/4"	MC = 20.4% DD = 93.1 pcf LL = 53 Fines = 59.2%	CH		30.0 Very Dense, Pink, Strongly Cemented Medium Grained **SILTY SAND**, with >50% Quartz Fragments, Calcareous, Moist
35	SS	50/2"				
40	SS	50/4"	MC = 19.5% LL = 42 Fines = 38.8%	SM		40.0 Borehole terminated at 40.0

BOREHOLE/TPWELL - TT HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-3

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/18/2017
CONSULTANT: Tetra Tech, Inc.
DRILLING CONTRACTOR: Enviro Drill
Notes: Not Recorded

GROUND ELEVATION: NA
LATITUDE: 32.070140 N
LONGITUDE: 104.165980 W

METHOD:
LOGGED BY: Clint Merritt and Raj Meruva
DRILLED BY: Juan Uribe

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0					Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
3.5					
5	SS	50/5"	MC = 13.8% Fines = 52.9%		Very Dense, Pale Red, Weakly Cemented Medium Grained Sandy Silty **CLAY** with <10% Small Angular Limestone Fragments, Moist
10	SS	50/5"			
13.0					
15	SS	50/3"			Hard, Yellowish Brown, Strongly Cemented **SILTY CLAY**, with < 20% Small Angular Limestone Fragments, Slight odor, Calcareous, Slightly Moist
20	SS	50/4"	MC = 9.8% Fines = 85.6%		
25					
30					
35					
40					
40.0					Borehole terminated at 40.0

BOREHOLE/TP/WELL - TT HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-4

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/17/2017
GROUND ELEVATION: NA
METHOD:
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.068070 N
LOGGED BY: Clint Merritt and Raj Meruva
DRILLING CONTRACTOR: Enviro Drill
LONGITUDE: 104.165660 W
DRILLED BY: Juan Uribe
Notes: Not Recorded

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						
						Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
						3.5
5	SS	25	MC = 23.5% Fines = 54.8%			Medium Dense, Pink, Weakly Cemented Medium Grained **SILT**, Calcareous, Moist
						8.5
10	SS	50/2"				Hard, Red, Strongly Cemented Low Plasticity **CLAY**, with Sand, Calcareous, Moist
15	SS	50/2"	MC = 16.5% DD = 96.1 pcf LL = 37 Fines = 61.9%	CL		
20	SS	50/2"				
						20.0
						Very Dense, Red, Moderately Cemented Medium Grained Silty Clayey **SAND**, with < 20% Gypsum Fragments, Moist to Wet
25	SS	50/4"	MC = 10.0% Fines = 43.2%			
						▼ Water depth 48 hours after drilling
						28.0 ▽ Water depth during drilling
30	SS	20				Very Stiff to Hard, Red, Low Plasticity **CLAY**, with Sand, Moist
35	SS	26	MC = 15.5% DD = 113.9 pcf LL = 29 Fines = 92.1%	CL		
40	SS	35				Freestanding water

(Continued Next Page)

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-4

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
						Very Stiff to Hard, Red, Low Plasticity CLAY, with Sand, Moist *(continued)*
45	SS	50/1"	MC = 15.1% LL = 30 Fines = 88.6%	CL		45.0
						Borehole terminated at 45.0

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-5

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/17/2017
GROUND ELEVATION: NA
METHOD:
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.069030 N
LOGGED BY: Clint Merritt and Raj Meruva
DRILLING CONTRACTOR: Enviro Drill
LONGITUDE: 104.166890 W
DRILLED BY: Juan Uribe
Notes: Not Recorded

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
3.5						
5	SS	50/3"	MC = 17.0% Fines = 19.3%			Very Dense, Pink, Strongly Cemented Medium Grained **SAND**, Calcareous, Moist
8.5						
10	SS	50/4"	MC = 15.8% DD = 99.8 pcf LL = 42 Fines = 44.4%	SM		Very Dense, Pale Red, Strongly Cemented Medium Grained, Silty to Clayey **SAND** with > 40% Gypsum/Quartz Fragments, Calcareous, Moist
15	SS	50/4"				
20	SS	50/5"	MC = 15.9% DD = 114.2 pcf LL = 46 Fines = 49.7%	SC		
25	SS	50/4"	MC = 16.5% Fines = 25.9%			
25.0						
30	SS	50/3"	MC = 20.3% DD = 96.6 pcf LL = 62 Fines = 51.5%	CH		Hard, Pink, High Plasticity **CLAY** with Sand, Calcareous, Wet ▽ Water depth 22.5 hours after drilling ▽ Water depth during drilling
33.0						
35	SS	49				Very Dense to Medium Dense, Reddish Brown, Moderately Cemented Medium Grained **CLAYEY SAND** with > 30% Quartz Fragments, with Lenses of Clay, High Plasticity, Slightly Wet
40	SS	49				

BOREHOLE/TP/WELL - TT_HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

(Continued Next Page)

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-5

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
45						Very Dense to Medium Dense, Reddish Brown, Moderately Cemented Medium Grained **CLAYEY SAND** with > 30% Quartz Fragments, with Lenses of Clay, High Plasticity, Slightly Wet *(continued)*
50	SS	25	MC = 33.1% DD = 82.3 pcf LL = 83 Fines = 39.2%	SC		
55						
60	SS	50/3"	MC = 28.8% LL = 45 Fines = 56.3%	CL		60.0
65						Very Dense, Reddish brown, Clayey, Strongly Cemented Medium Grained **SAND**, with > 40% Quartz, Wet and Muddy
70	SS	50/1"				73.0
						Borehole terminated at 73.0

BOREHOLE/TP/WELL - TT HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-6

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 08/17/2017
GROUND ELEVATION: NA
METHOD:
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.071130 N
LOGGED BY: Not Recorded
DRILLING CONTRACTOR: Not Recorded
LONGITUDE: 104.166990 W
DRILLED BY: Not Recorded

Notes: No groundwater encountered. N values have been corrected for sampler diameter.

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0				Medium Dense, Brown, **SAND**, some Organics, No Odor, Dry
	CA	29		
3.0				Very Dense, Reddish Yellow, **SAND** with about 40% Small, Fine, Moderately Cemented Gravel Sandstone Fragments, No Organics, No Odor, Dry
5	CA	49		
	CA	50/5"		
7.0				Very Dense, Yellowish Brown, Fine **SAND**, with about 50%, Coarse Strongly Cemented Sandstone, Gravel, with Fine Moderately Cemented Quartz Gravel, No Odor, No Organics, Dry
10	ST			
15	CA	50/1"		
20	CA	50/3"		
25	CA	72		~ 10% Coarse Strongly Cemented Chert Gravel
30				
30.0	CA	19		Hard, Pale Red, **CLAY**, with about 20% Quartz, No Organics, No Odor, Dry
35				
40	ST			
	CA	50/1"		

BOREHOLE/TP/WELL - TT_HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

(Continued Next Page)

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-6

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION
45				Hard, Pale Red, **CLAY**, with about 20% Quartz, No Organics, No Odor, Dry *(continued)*
50	ST			50.0
55				
60	CA	50/2"		
65				
70	CA	50/3"		
75				Borehole terminated at 76.5

BOREHOLE/TP/WELL - TT HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-7

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 08/18/2017
GROUND ELEVATION: NA
METHOD:
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.071740 N
LOGGED BY: Not Recorded
DRILLING CONTRACTOR: Not Recorded
LONGITUDE: 104.167650 W
DRILLED BY: Not Recorded

Notes: No groundwater encountered. N values have been corrected for sampler diameter.

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0				Dense to Very Dense, Reddish Brown **SAND**, No Organics, No Odor, Dry
	CA	27		
5	CA	50/5"		
	CA	50/3"		
	CA	50/2"		
7.0				Very Dense, Pink, **SAND**, with about 20% Weakly Cemented Quartz, No Odor, No Organics, Calcareous, Dry
10	CA	50/4"		
15	CA	50/3"		
20	CA	50/4"		
21.0				Hard, **CLAY**, with about 60% Moderately Cemented Quartz, No Odor, No Organics, Dry
25	ST			
30	CA	63		
35	CA	43		
40	ST			

BOREHOLE/TP/WELL - TT_HAYHURST.GPJ_LAB SUMMARY.GDT 8/24/17

(Continued Next Page)

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-7

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION
			41.5	Borehole terminated at 41.5

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-8

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 08/18/2017
GROUND ELEVATION: NA
METHOD:
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.071940 N
LOGGED BY: Not Recorded
DRILLING CONTRACTOR: Not Recorded
LONGITUDE: 104.166430 W
DRILLED BY: Not Recorded

Notes: No groundwater encountered. N values have been corrected for sampler diameter.

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0				Medium Dense to Very Dense, Reddish Brown, **SAND**, some Organics, No Odor, Dry
	CA	23		
5	CA	50/5"		
	CA	50/4"		
	CA	50/5"		
10	CA	50/5"		
15	CA	50/5"		
20	CA	50/6"		
25				7.0 Very Dense, Red, **SAND**, some Organics, No Odor, Dry
	CA	9		25.0 Stiff, Red, **CLAY**, with 30% Quartz, No Odor, No Organics, Dry
30	ST			30.0 Very Stiff to Hard, Red, **CLAY**, with 30% Quartz, No Odor, No Organics, Moist
	CA	16		
35	ST			
40	CA	50/4"		

(Continued Next Page)

TETRA TECH
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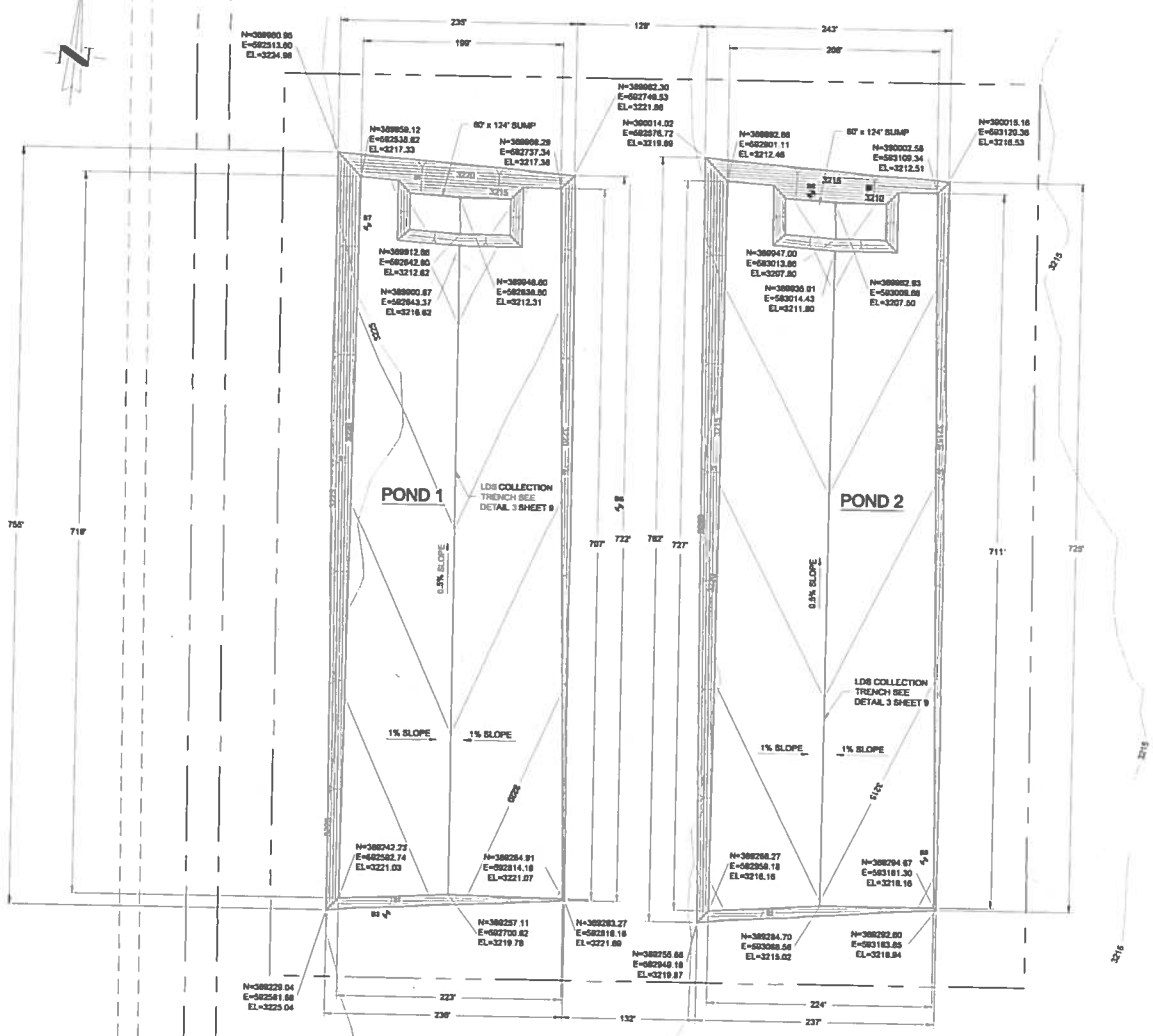
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-8

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION
41.5				Borehole terminated at 41.5

Appendix 4 – Recycling Containment Engineering Drawings



POND 1 EXCAVATION CALCULATION
TOTAL AREA = 4.02 ACRES
EXCAVATION VOLUME = 30,427 CU.YDS

POND 2 EXCAVATION CALCULATION
TOTAL AREA = 4.11 ACRES
EXCAVATION VOLUME = 29,375 CU.YDS

POND 1 AND POND 2 COLLECTION SUMP EXCAVATION PLAN COORDINATES

LOCATION	NORTHING	EASTING	ELEVATION
POND 1 NE TOP	389965.31	582699.86	3218.94
POND 1 NE BOTTOM	389952.44	582686.86	3212.94
POND 1 NW TOP	389956.53	582575.89	3218.91
POND 1 NW BOTTOM	389947.75	582586.98	3212.91
POND 1 SW TOP	389880.91	582581.22	3217.31
POND 1 SW BOTTOM	389911.80	582582.18	3213.21
POND 1 SE TOP	389906.54	582706.18	3217.24
POND 1 SE BOTTOM	389916.55	582692.15	3213.24
POND 2 NE TOP	389989.64	583070.83	3212.12
POND 2 NE BOTTOM	389998.78	583060.83	3208.12
POND 2 NW TOP	389983.88	582946.95	3212.10
POND 2 NW BOTTOM	389972.06	582960.06	3208.10
POND 2 SW TOP	389933.84	582952.28	3212.40
POND 2 SW BOTTOM	389948.13	582983.25	3208.40
POND 2 SE TOP	389939.86	583076.25	3212.42
POND 2 SE BOTTOM	389950.88	583063.22	3208.42

LEGEND

- EXISTING 5' CONTOUR INTERVAL (FEET, MSL)
- EXISTING 1' CONTOUR INTERVAL
- PROPOSED 5' CONTOUR INTERVAL (FEET, MSL)
- PROPOSED 1' CONTOUR INTERVAL
- BURIED PIPELINE
- PERMIT BOUNDARY
- CUT SYMBOL AND SLOPE
- SOIL BORING LOCATION AND NUMBER
- UNIMPROVED ROAD

HAYHURST A. LANGFORD — NEW MEXICO — 24389 — PROFESSIONAL ENGINEER

REVISIONS NO.	DATE	DESCRIPTION

DESIGNED NL
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CHECKED SDD
DATE 9/17

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CHEVRON N.A. E&P, MCBU
EDDY COUNTY, NEW MEXICO
GPS (WGS84)
32.068884°N, -104.166851°W

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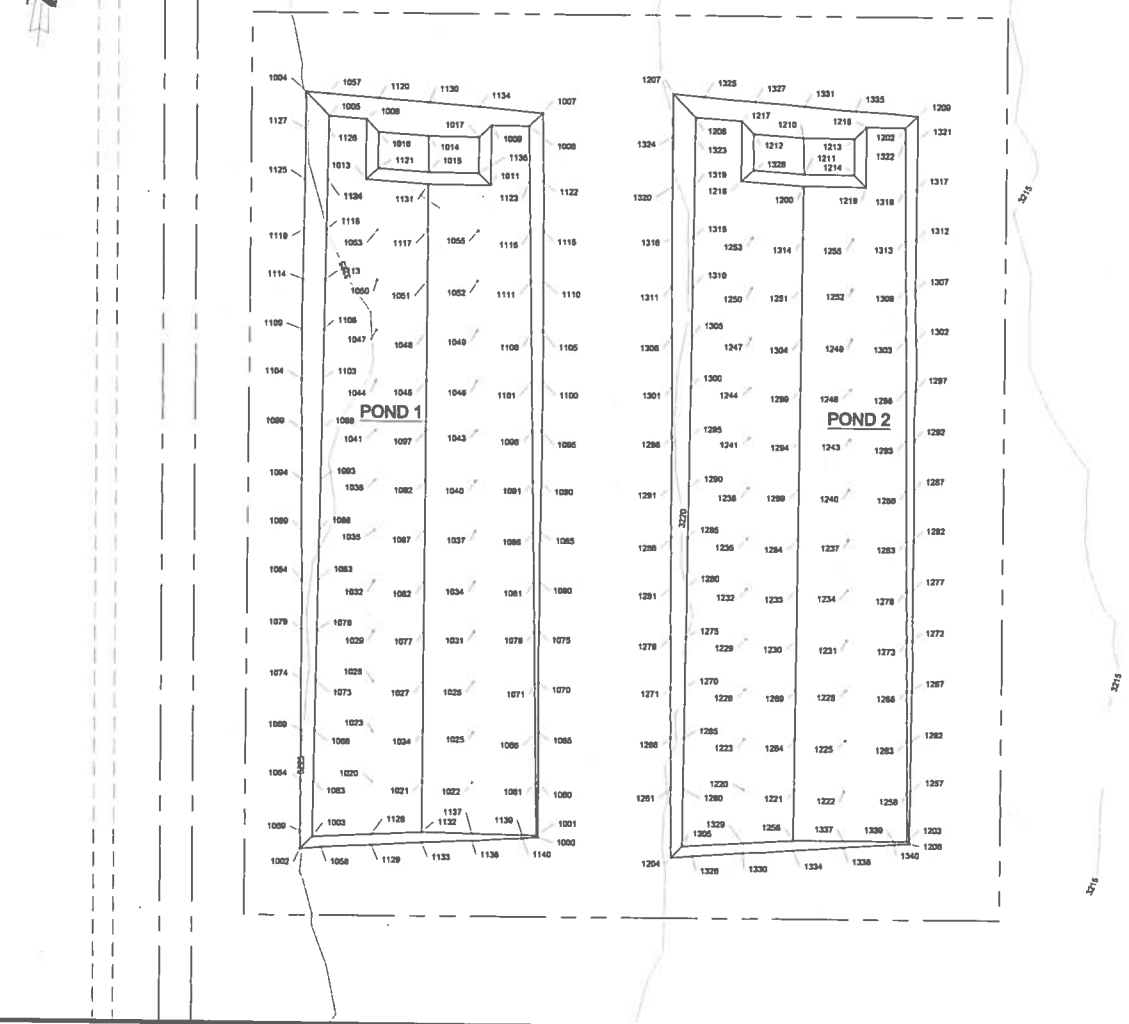
BAR IS ONE (1) INCH ON ORIGINAL DRAWING.
0 — 1"
IF NOT ONE (1) INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

SCALES:
HORIZONTAL SCALE: 1" = 80'
VERTICAL SCALE: NA

POND 1 AND POND 2 EXCAVATION PLAN HAYHURST SECTION 2 EDDY COUNTY, NEW MEXICO

PROJECT NO. 212C-MD-00648
DRAWING NO. C-3
SHEET NO. 3 OF 18



POND 1 EXCAVATION CALCULATION
TOTAL AREA = 4.02 ACRES
EXCAVATION VOLUME = 30,427 CU.YDS

POND 2 EXCAVATION CALCULATION
TOTAL AREA = 4.11 ACRES
EXCAVATION VOLUME = 29,375 CU.YDS

NOTES

1. POND 1 BELOW GRADE STAKING POINTS ARE FROM 1000 THRU 1140 REFERENCE ASCII FILE - POND1 BELOW GRADE STAKING.TXT
2. POND 2 BELOW GRADE STAKING POINTS ARE FROM 1200 THRU 1280 REFERENCE ASCII FILE - POND2 BELOW GRADE STAKING.TXT
3. STAKING POINT FILE IS A COMMA DELINEATED FILE WITH CORRESPONDING POINT NUMBER, NORTHING, EASTING AND ELEVATION

LEGEND

- EXISTING 5' CONTOUR INTERVAL (FEET, MSL)
- EXISTING 1' CONTOUR INTERVAL
- BURIED PIPELINE
- PERMIT BOUNDARY
- UNIMPROVED ROAD

REVISIONS NO.	DATE	DESCRIPTION

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EDDY COUNTY, NEW MEXICO
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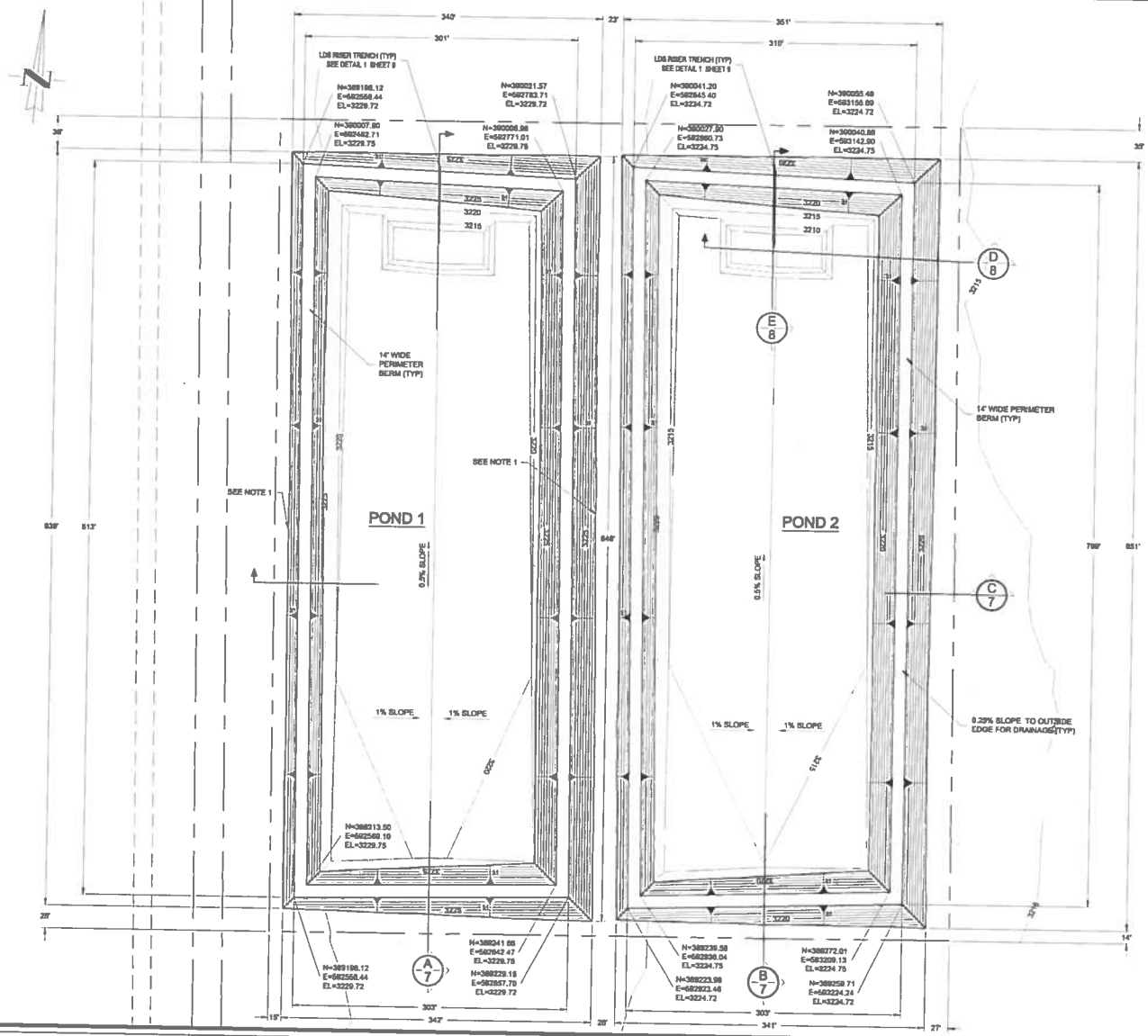
IF NOT ONE (1) INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALES:
HORIZONTAL SCALE: 1" = 60'
VERTICAL SCALE: NA

POND 1 AND POND 2 BELOW GRADE STAKING PLAN HAYHURST SECTION 2 EDDY COUNTY, NEW MEXICO

PROJECT NO. 212C-MD-00848
DRAWING NO. C-4
SHEET NO. 4 OF 18



POND 1 CAPACITY CALCULATIONS (GROSS)
TOTAL AREA (EL 3229.75') = 4.88 ACRES
VOLUME = 74,606 CU.YDS
CAPACITY = 358,773 BBLS

POND 1 CAPACITY CALCULATIONS (NET)
TOTAL AREA (EL 3226.75') = 4.46 ACRES
VOLUME = 52,012 CU.YDS
CAPACITY = 250,120 BBLS

POND 1 BREECH VOLUME CALCULATION
TOTAL AREA (EL 3221.0') = 4.88 ACRES
VOLUME = 60,287 CU.YDS
CAPACITY = 289,914 BBLS

POND 1 SOIL BALANCE CALCULATION
TOTAL AREA = 6.57 ACRES
FILL VOLUME (1.6x) = 27,399 CU.YDS
EXCAVATION VOLUME = 30,427 CU.YDS
EXCESS VOLUME = 3,028 CU.YDS

POND 2 CAPACITY CALCULATIONS (GROSS)
TOTAL AREA (EL 3224.75') = 5.00 ACRES
VOLUME = 75,652 CU.YDS
CAPACITY = 363,803 BBLS

POND 2 CAPACITY CALCULATIONS (NET)
TOTAL AREA (EL 3221.75') = 4.57 ACRES
VOLUME = 52,504 CU.YDS
CAPACITY = 252,486 BBLS

POND 2 BREECH VOLUME CALCULATION
TOTAL AREA (EL 3216.0') = 5.00 ACRES
VOLUME = 61,847 CU.YDS
CAPACITY = 297,416 BBLS

POND 2 SOIL BALANCE CALCULATION
TOTAL AREA = 6.73 ACRES
FILL VOLUME (1.6x) = 28,655 CU.YDS
EXCAVATION VOLUME = 29,375 CU.YDS
EXCESS VOLUME = 720 CU.YDS

LEGEND

- EXISTING 5' CONTOUR INTERVAL (FEET, MSL)
- EXISTING 1' CONTOUR INTERVAL
- PROPOSED 5' CONTOUR INTERVAL (FEET, MSL)
- PROPOSED 1' CONTOUR INTERVAL
- BURIED PIPELINE
- PERMIT BOUNDARY
- FILL SYMBOL AND SLOPE
- UNIMPROVED ROAD

NOTE:

1. GRADE 0.5 % TO THE NORTH AND SOUTH - GRADE AT TOE 0.25% AWAY FROM EACH POND TOE WHERE EROSION CONTROL IS INSTALLED

NATHAN A. LANGFORD, NEW MEXICO, 24399, PROFESSIONAL ENGINEER

REVISIONS NO.	DATE	DESCRIPTION

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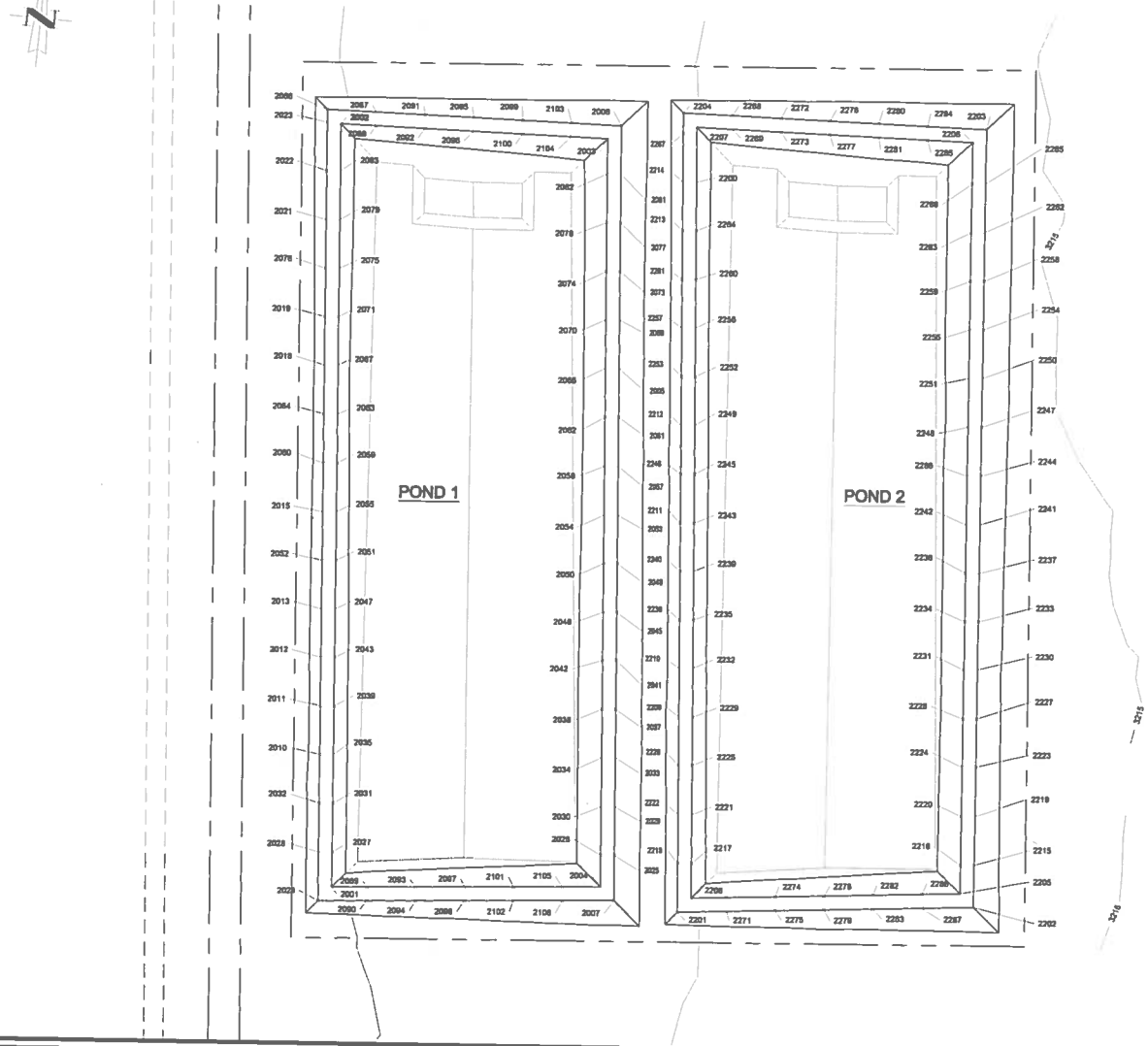
SCALES:
HORIZONTAL SCALE: 1" = 60'
VERTICAL SCALE: NA

POND 1 AND POND 2 COMPLETION PLAN HAYHURST SECTION 2 EDDY COUNTY, NEW MEXICO

PROJECT NO. 212C-MD-00848
DRAWING NO. C-5
SHEET NO. 5 OF 18



NOTES

1. POND 1 ABOVE GRADE STAKING POINTS ARE FROM 2000 THRU 2099 REFERENCE ASCII FILE - POND1 ABOVE GRADE STAKING.TXT
2. POND 2 ABOVE GRADE STAKING POINTS ARE FROM 2200 THRU 2299 REFERENCE ASCII FILE - POND2 ABOVE GRADE STAKING.TXT
3. STAKING POINT FILE IS A COMMA DELINEATED FILE WITH CORRESPONDING POINT NUMBER, NORTHING, EASTING AND ELEVATION

LEGEND

- 3235 — EXISTING 5' CONTOUR INTERVAL (FEET, MSL)
- EXISTING 1' CONTOUR INTERVAL
- BURIED PIPELINE
- PERMIT BOUNDARY
- UNIMPROVED ROAD

NATHAN A. LANGFORD — NEW MEXICO — 34999 — PROFESSIONAL ENGINEER

REVISIONS		
NO.	DATE	DESCRIPTION

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CHECKED	SDD
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EDDY COUNTY, NEW MEXICO
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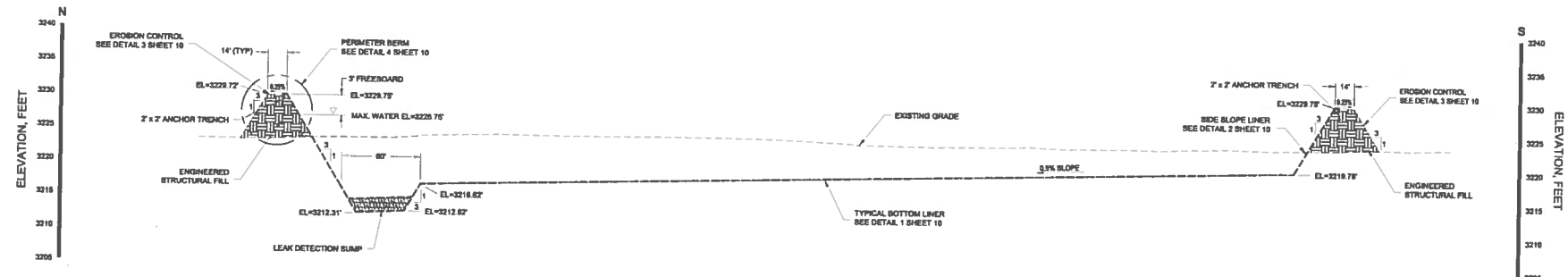
SCALES:
HORIZONTAL SCALE: 1" = 60'
VERTICAL SCALE: n/a

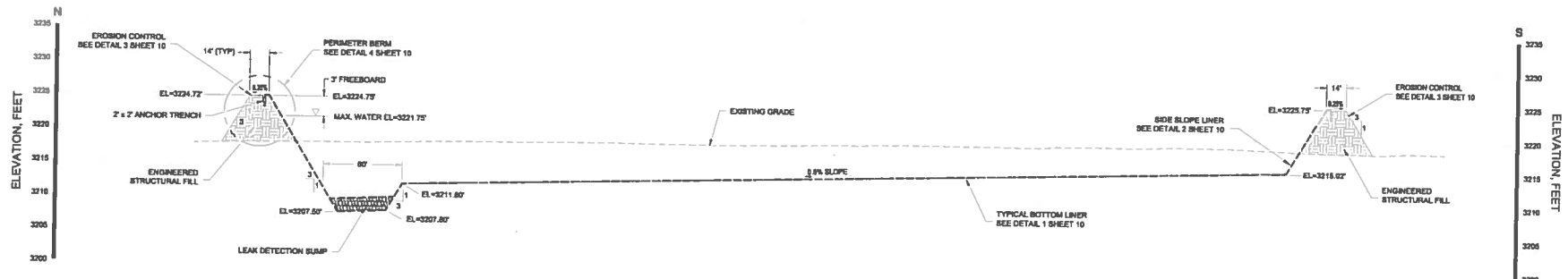
POND 1 AND POND 2 ABOVE GRADE STAKING PLAN HAYHURST SECTION 2 EDDY COUNTY, NEW MEXICO

PROJECT NO.	212C-MD-00848
DRAWING NO.	C-6
SHEET NO.	6 OF 18



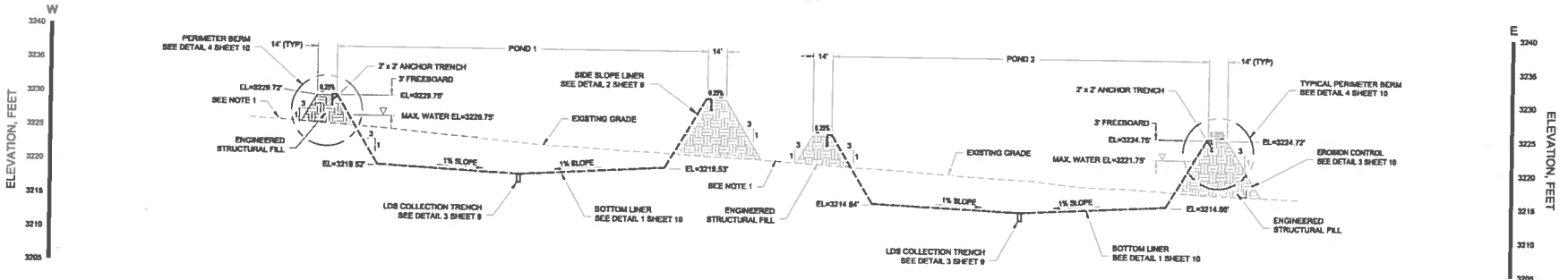
Section A

VERTICAL SCALE EXAGGERATED 5X



Section B

VERTICAL SCALE EXAGGERATED 5X



Section C

VERTICAL SCALE EXAGGERATED 5X

NOTE:

1. GRADE 0.5 % TO THE NORTH AND SOUTH - GRADE AT TOE 0.25% AWAY FROM EACH POND TOE WHERE EROSION CONTROL IS INSTALLED .

NATHAN A. LANGFORD NEW MEXICO 24388 PROFESSIONAL ENGINEER

REVISIONS

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SCALES:
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VERTICAL SCALE: n/a

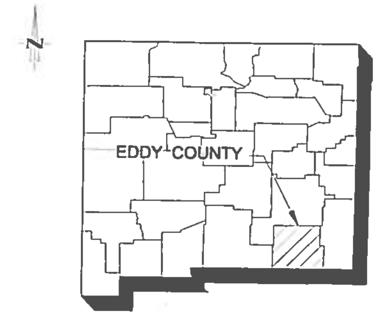
POND 1 AND POND 2 CROSS-SECTIONS HAYHURST SECTION 2 EDDY COUNTY, NEW MEXICO

PROJECT NO. 212C-MD-00848
DRAWING NO. C-7
SHEET NO. 7 OF 18

Appendix 5 – Recycling Containment Construction Specifications

CHEVRON N.A. E&P, MCBU
HAYHURST SECTION 2
HYDRAULIC FRACTURING
POND 1 AND POND 2
CONSTRUCTION PROJECT

EDDY COUNTY, NEW MEXICO



INDEX OF DRAWINGS

GENERAL NOTES

1. ALL TOPOGRAPHIC, UTILITY AND CONTROL POINT LOCATION INFORMATION IS BASED ON SURVEY INFORMATION FURNISHED BY THE OWNER, THE CONTRACTOR HAS THE SOLE RESPONSIBILITY FOR FIELD VERIFICATION.
2. COORDINATE INFORMATION IS BASED ON AND ARE BASED ON STATE PLANES COORDINATE NEW MEXICO EAST ZONE (4726) NAD83, THE CONTRACTOR SHALL IDENTIFY ANY DISCREPANCIES PRIOR TO PROCEEDING WITH CONSTRUCTION.
3. CONTROL POINT "OPTIMA" LOCATION IS AT
NORTHING 389137.882
EASTING 682576.868
ELEVATION 3221.4'
4. THE CONTRACTOR SHALL IDENTIFY AND LOCATE UTILITY LINES, MONITOR WELLS, SURVEY MONUMENTS, AND OTHER NEARBY STRUCTURES PRIOR TO PERFORMING WORK. UTILITIES, MONITOR WELLS, SURVEY MONUMENTS AND OTHER NEARBY STRUCTURES SHALL BE PROTECTED FROM DAMAGE DURING THIS WORK. ANY DAMAGE TO UTILITY LINES, MONITOR WELLS, SURVEY MONUMENTS, AND OTHER NEARBY STRUCTURES DURING THE WORK SHALL BE REPAIRED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER. COSTS ASSOCIATED WITH THESE REPAIRS SHALL INCLUDE THE ACTUAL REPAIR COSTS AND ALL ENGINEERING COSTS REQUIRED BY THE ENGINEER TO COORDINATE AND OBTAIN REGULATORY APPROVAL OF THE REPAIRS IF REQUIRED.
5. THE CONTRACTOR SHALL REFER TO THE HAYHURST SECTION 2 HYDRAULIC FRACTURING POND 1 AND POND 2 TECHNICAL SPECIFICATIONS IN ADDITON TO THE DRAWINGS FOR THE CONSTRUCTION.

REVISIONS		
NO	DATE	DESCRIPTION

DESIGNED NL
DRAWN DKK
CHECKED BDD
DATE 9/17

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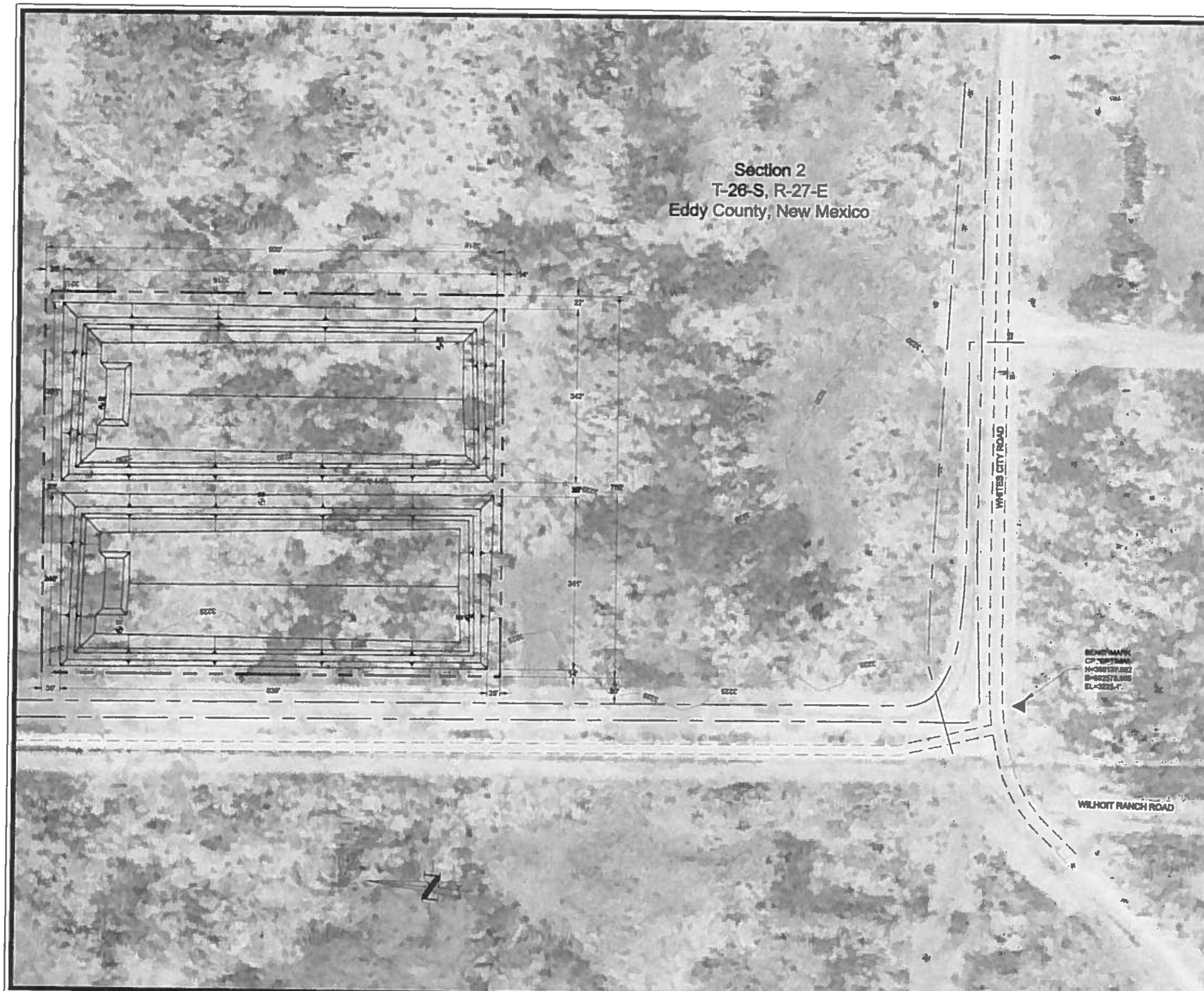
SCALES:
HORIZONTAL SCALE: NA
VERTICAL SCALE: NA

COVER SHEET
HAYHURST SECTION 2
EDDY COUNTY, NEW MEXICO

NATHAN A. LANGFORD
NEW MEXICO
24309
PROFESSIONAL ENGINEER

PROJECT NO. 212C-MD-00848
DRAWING NO. C-1
SHEET NO. 1 OF 18



POND 1 CAPACITY CALCULATIONS (NET)
TOTAL AREA (EL 3227.25') = 4.46 ACRES
VOLUME = 74,009 CU.YDS
CAPACITY = 355,902 BBLS

POND 1 BREECH VOLUME CALCULATION
TOTAL AREA (EL 3219.0') = 4.88 ACRES
VOLUME = 74,479 CU.YDS
CAPACITY = 358,162 BBLS

POND 1 STRAPPING TABLE

ELEVATION RANGE (ft)	cu. yds.	bbls	Total (bbls)
3,212.31 > 3,213.00	33.40	160.62	160.62
3,213.00 > 3,214.00	152.40	732.88	893.49
3,214.00 > 3,215.00	186.70	897.82	1,791.32
3,215.00 > 3,216.00	222.50	1,069.98	2,861.30
3,216.00 > 3,217.00	275.20	1,323.41	4,184.70
3,217.00 > 3,218.00	1,032.70	4,966.15	9,150.86
3,218.00 > 3,219.00	2,576.10	12,388.21	21,539.06
3,219.00 > 3,220.00	4,238.70	20,383.49	41,922.55
3,220.00 > 3,221.00	5,600.90	26,934.17	68,856.72
3,221.00 > 3,222.00	6,042.10	29,055.85	97,912.57
3,222.00 > 3,223.00	6,256.00	30,079.67	127,992.24
3,223.00 > 3,224.00	6,470.40	31,115.51	159,107.75
3,224.00 > 3,225.00	6,688.50	32,164.33	191,272.07
3,225.00 > 3,226.00	6,909.30	33,226.13	224,498.21
3' FREEBOARD → 3,226.00 > 3,226.75	5,328.50	25,624.22	250,122.43
3,226.75 > 3,227.00	1,804.20	8,676.22	258,798.65
3,227.00 > 3,228.00	7,358.90	35,388.21	294,186.86
3,228.00 > 3,229.00	7,587.60	36,488.01	330,674.87
3,229.00 > 3,229.75	5,842.50	28,096.00	358,770.87

POND 2 CAPACITY CALCULATIONS (NET)
TOTAL AREA (EL 3222.75') = 4.57 ACRES
VOLUME = 73,807 CU.YDS
CAPACITY = 354,930 BBLS

POND 2 BREECH VOLUME CALCULATION
TOTAL AREA (EL 3215.0') = 5.00 ACRES
VOLUME = 75,394 CU.YDS
CAPACITY = 362,562 BBLS

POND 2 STRAPPING TABLE

ELEVATION RANGE (ft)	cu. yds.	bbls	Total (bbls)
3,207.50 > 3,208.00	14.9	71.65	71.65
3,208.00 > 3,209.00	140.4	675.17	746.82
3,209.00 > 3,210.00	180.4	867.53	1614.35
3,210.00 > 3,211.00	215.7	1037.28	2651.63
3,211.00 > 3,212.00	256	1231.08	3882.71
3,212.00 > 3,213.00	835.1	4015.91	7898.62
3,213.00 > 3,214.00	2,409.20	11585.60	19484.22
3,214.00 > 3,215.00	4,106.70	19748.71	39232.93
3,215.00 > 3,216.00	5,646.40	27152.97	66385.90
3,216.00 > 3,217.00	6,211.00	29868.08	96253.98
3,217.00 > 3,218.00	6,427.00	30906.80	127160.78
3,218.00 > 3,219.00	6,644.60	31953.22	159114.00
3,219.00 > 3,220.00	6,864.90	33012.62	192126.62
3,220.00 > 3,221.00	7,087.90	34085.00	226211.62
3' FREEBOARD → 3,221.00 > 3,221.75	5,463.90	26275.35	252486.97
3,221.75 > 3,222.00	1,848.70	8895.02	261381.99
3,222.00 > 3,223.00	7,542.00	36268.72	297650.71
3,223.00 > 3,224.00	7,773.00	37379.58	335030.29
3,224.00 > 3,224.75	5,962.80	28771.17	363801.46

LEGEND

- EXISTING 5' CONTOUR INTERVAL (FEET, MSL)
- EXISTING 1' CONTOUR INTERVAL
- PROPOSED POND DESIGN
- BURIED PIPELINE
- PERMIT BOUNDARY
- UNIMPROVED ROAD
- SOIL BORING LOCATION AND NUMBER

NO.	DATE	REVISIONS DESCRIPTION

DESIGNED: NL
DRAWN: DKK
CHECKED: SDD
DATE: 9/17

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Tetra Tech Inc.
Texas Registered Engineering Firm F-3924
4000 N. BIG SPRING, Suite 401
MIDLAND, TEXAS 79705
(432) 682-4559

CHEVRON N.A. E&P, MCBU
EDDY COUNTY, NEW MEXICO
GPS (WGS84)
32.068884°N, -104.166851°W

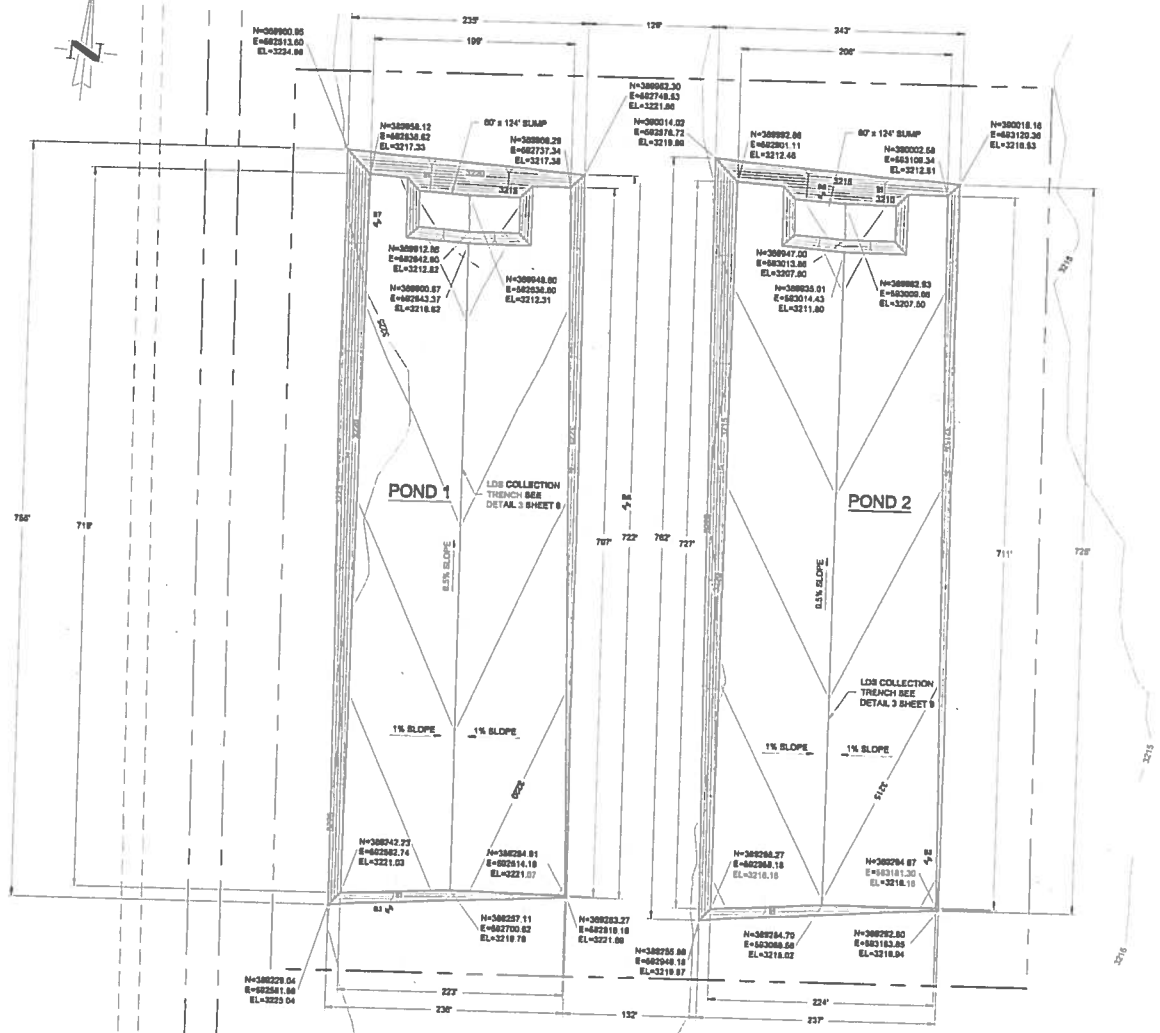
VERIFY SCALE
BAR IS ONE (1) INCH ON ORIGINAL DRAWING.
0 ——— 1"
IF NOT ONE (1) INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALES:
HORIZONTAL SCALE: 1" = 160'
VERTICAL SCALE: NA

EXISTING SITE CONDITIONS
HAYHURST SECTION 2
EDDY COUNTY, NEW MEXICO

PROJECT NO. 212C-MD-00848
DRAWING NO. C-2
SHEET NO. 2 OF 18

NATHAN A. LANGFORD
NEW MEXICO
24389
PROFESSIONAL ENGINEER



POND 1 EXCAVATION CALCULATION
TOTAL AREA = 4.02 ACRES
EXCAVATION VOLUME = 30,427 CU.YDS

POND 2 EXCAVATION CALCULATION
TOTAL AREA = 4.11 ACRES
EXCAVATION VOLUME = 29,375 CU.YDS

POND 1 AND POND 2 COLLECTION SUMP EXCAVATION PLAN COORDINATES

LOCATION	NORTHING	EASTING	ELEVATION
POND 1 NE TOP	388965.31	682699.86	3218.84
POND 1 NE BOTTOM	388952.44	682686.96	3212.84
POND 1 NW TOP	388958.83	682678.69	3218.91
POND 1 NW BOTTOM	388947.78	682686.88	3212.91
POND 1 SW TOP	388899.81	682681.22	3217.21
POND 1 SW BOTTOM	388911.80	682682.18	3213.21
POND 1 SE TOP	388905.84	682706.18	3217.24
POND 1 SE BOTTOM	388918.83	682682.18	3213.24
POND 2 NE TOP	388999.64	683070.93	3212.12
POND 2 NE BOTTOM	388986.78	683060.03	3208.12
POND 2 NW TOP	388993.86	683048.84	3212.10
POND 2 NW BOTTOM	388982.08	683060.05	3208.10
POND 2 SW TOP	388933.84	683063.26	3212.40
POND 2 SW BOTTOM	388948.15	683063.26	3208.40
POND 2 SE TOP	388930.86	683078.25	3212.42
POND 2 SE BOTTOM	388950.86	683063.22	3208.42

LEGEND

- 3255 — EXISTING 5' CONTOUR INTERVAL (FEET, MSL)
- EXISTING 1' CONTOUR INTERVAL
- 3260 — PROPOSED 5' CONTOUR INTERVAL (FEET, MSL)
- PROPOSED 1' CONTOUR INTERVAL
- BURIED PIPELINE
- PERMIT BOUNDARY
- CUT SYMBOL AND SLOPE
- B4 — SOIL BORING LOCATION AND NUMBER
- UNIMPROVED ROAD

NOAH A. LANGFORD NEW MEXICO 24389 PROFESSIONAL ENGINEER

REVISIONS		
NO.	DATE	DESCRIPTION

DESIGNED NL
DRAWN DKK
CHECKED EDO
DATE 9/17

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MIDLAND, TEXAS 79705
(432) 682-4559

CHEVRON N.A. E&P, MCBU
EDDY COUNTY, NEW MEXICO
GPS (WGS84)
32.088884°N, -104.168851°W

VERIFY SCALE
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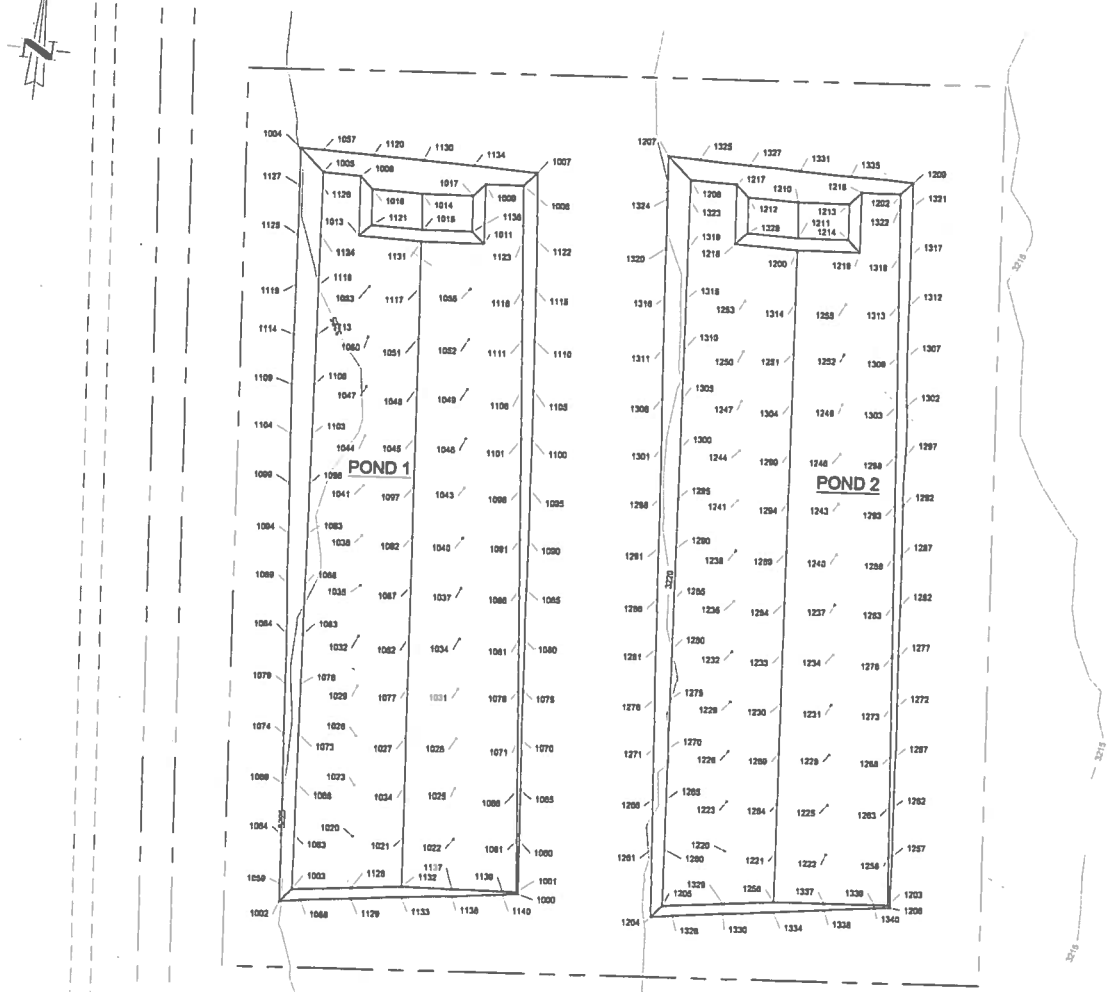
0 1"
IF NOT ONE (1) INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALES:
HORIZONTAL SCALE: 1" = 60'
VERTICAL SCALE: NA

POND 1 AND POND 2 EXCAVATION PLAN HAYHURST SECTION 2 EDDY COUNTY, NEW MEXICO

PROJECT NO. 212C-MD-00848
DRAWING NO. C-3
SHEET NO. 3 OF 18



POND 1 EXCAVATION CALCULATION
TOTAL AREA = 4.02 ACRES
EXCAVATION VOLUME = 30,427 CU.YDS

POND 2 EXCAVATION CALCULATION
TOTAL AREA = 4.11 ACRES
EXCAVATION VOLUME = 29,375 CU.YDS

NOTES

1. POND 1 BELOW GRADE STAKING POINTS ARE FROM 1000 THRU 1140
   REFERENCE ASCII FILE - POND1 BELOW GRADE STAKING.TXT
2. POND 2 BELOW GRADE STAKING POINTS ARE FROM 1200 THRU 1260
   REFERENCE ASCII FILE - POND2 BELOW GRADE STAKING.TXT
3. STAKING POINT FILE IS A COMMA DELINEATED FILE WITH CORRESPONDING POINT NUMBER, NORTHING, EASTING AND ELEVATION

LEGEND

- 3295 — EXISTING 5' CONTOUR INTERVAL (FEET, MSL)
- EXISTING 1' CONTOUR INTERVAL
- BURIED PIPELINE
- PERMIT BOUNDARY
- UNIMPROVED ROAD

NATHAN A. LANGFORD — NEW MEXICO — 21009 — PROFESSIONAL ENGINEER

REVISIONS		
NO.	DATE	DESCRIPTION

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DATE 9/17

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EDDY COUNTY, NEW MEXICO
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32.088884°N, -104.168851°W

VERIFY SCALE
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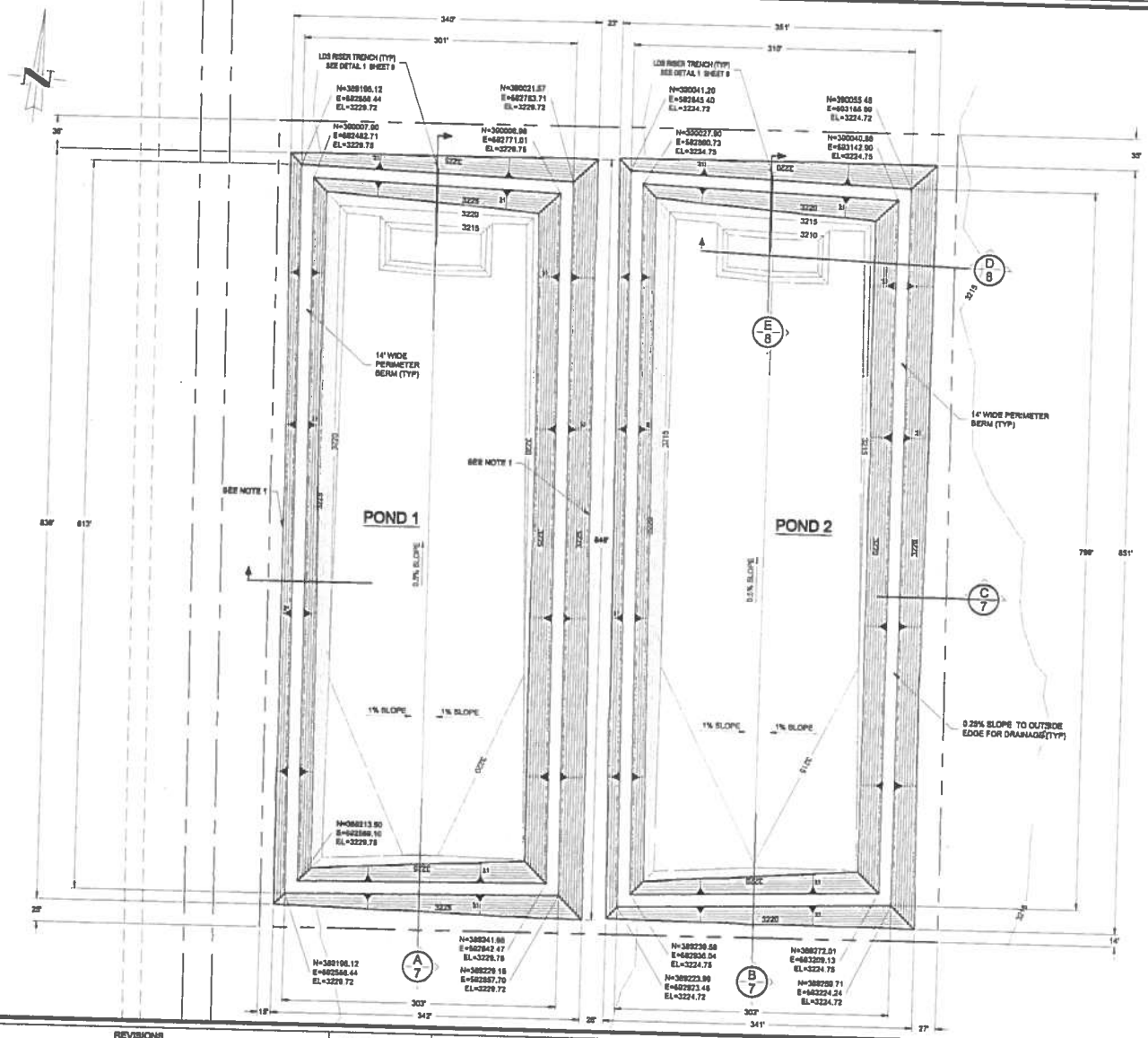
IF NOT ONE (1) INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

SCALES:
HORIZONTAL SCALE: 1" = 80'
VERTICAL SCALES: NA

POND 1 AND POND 2 BELOW GRADE STAKING PLAN HAYHURST SECTION 2 EDDY COUNTY, NEW MEXICO

PROJECT NO. 212C-MD-00648
DRAWING NO. C-4
SHEET NO. 4 OF 18



POND 1 CAPACITY CALCULATIONS (GROSS)
TOTAL AREA (EL 3229.75') = 4.88 ACRES
VOLUME = 74,606 CU.YDS
CAPACITY = 358,773 BBLS

POND 1 CAPACITY CALCULATIONS (NET)
TOTAL AREA (EL 3226.75') = 4.46 ACRES
VOLUME = 52,012 CU.YDS
CAPACITY = 250,120 BBLS

POND 1 BREECH VOLUME CALCULATION
TOTAL AREA (EL 3221.0') = 4.88 ACRES
VOLUME = 60,267 CU.YDS
CAPACITY = 289,914 BBLS

POND 1 SOIL BALANCE CALCULATION
TOTAL AREA = 6.57 ACRES
FILL VOLUME (1.6x) = 27,399 CU.YDS
EXCAVATION VOLUME = 30,427 CU.YDS
EXCESS VOLUME = 3,028 CU.YDS

POND 2 CAPACITY CALCULATIONS (GROSS)
TOTAL AREA (EL 3224.75') = 5.00 ACRES
VOLUME = 75,652 CU.YDS
CAPACITY = 363,803 BBLS

POND 2 CAPACITY CALCULATIONS (NET)
TOTAL AREA (EL 3221.75') = 4.57 ACRES
VOLUME = 52,504 CU.YDS
CAPACITY = 252,486 BBLS

POND 2 BREECH VOLUME CALCULATION
TOTAL AREA (EL 3218.0') = 5.00 ACRES
VOLUME = 61,847 CU.YDS
CAPACITY = 297,416 BBLS

POND 2 SOIL BALANCE CALCULATION
TOTAL AREA = 6.73 ACRES
FILL VOLUME (1.6x) = 28,655 CU.YDS
EXCAVATION VOLUME = 29,375 CU.YDS
EXCESS VOLUME = 720 CU.YDS

LEGEND

- EXISTING 5' CONTOUR INTERVAL (FEET, MSL)
- EXISTING 1' CONTOUR INTERVAL
- PROPOSED 5' CONTOUR INTERVAL (FEET, MSL)
- PROPOSED 1' CONTOUR INTERVAL
- BURIED PIPELINE
- PERMIT BOUNDARY
- FILL SYMBOL AND SLOPE
- UNIMPROVED ROAD

NOTE:

1. GRADE 0.5 % TO THE NORTH AND SOUTH - GRADE AT TOE 0.25% AWAY FROM EACH POND TOE WHERE EROSION CONTROL IS INSTALLED .

NATHAN A. LANGFORD, NEW MEXICO, 24389, PROFESSIONAL ENGINEER

REVISIONS		
NO.	DATE	DESCRIPTION

DESIGNED NL
DRAWN DRK
CHECKED SCG
DATE 9/17

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CHEVRON N.A. E&P, MCBU
EDDY COUNTY, NEW MEXICO
GPS (WGS84)
32.068884°N, -104.166851°W

VERIFY SCALE
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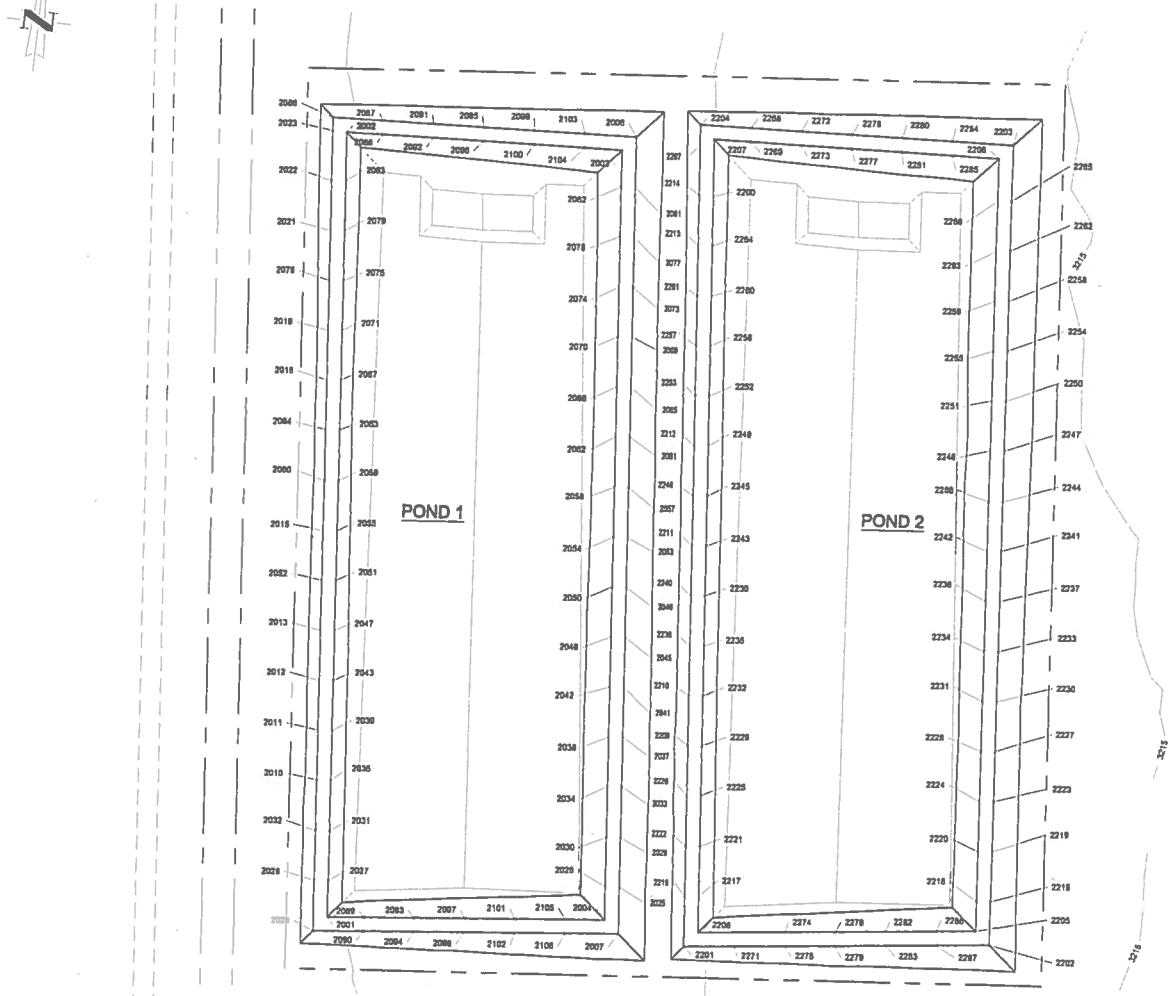
0 1"
IF NOT ONE (1) INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY.

SCALES:
HORIZONTAL SCALE: 1" = 80'
VERTICAL SCALE: NA

POND 1 AND POND 2 COMPLETION PLAN HAYHURST SECTION 2 EDDY COUNTY, NEW MEXICO

PROJECT NO. 212C-MD-00848
DRAWING NO. C-5
SHEET NO. 5 OF 18



NOTES

1. POND 1 ABOVE GRADE STAKING POINTS ARE FROM 2000 THRU 2093 REFERENCE ASCII FILE - POND1 ABOVE GRADE STAKING.TXT
2. POND 2 ABOVE GRADE STAKING POINTS ARE FROM 2200 THRU 2293 REFERENCE ASCII FILE - POND2 ABOVE GRADE STAKING.TXT
3. STAKING POINT FILE IS A COMMA DELINEATED FILE WITH CORRESPONDING POINT NUMBER, NORTHING, EASTING AND ELEVATION

LEGEND

- 3250 — EXISTING 5' CONTOUR INTERVAL (FEET, MSL)
- EXISTING 1' CONTOUR INTERVAL
- BURIED PIPELINE
- PERMIT BOUNDARY
- UNIMPROVED ROAD

HAYHURST A. LANGFORD
NEW MEXICO
24309
PROFESSIONAL ENGINEER

REVISIONS		
NO.	DATE	DESCRIPTION

DESIGNED MS
DRAWN DNK
CHECKED SDD
DATE 9/17

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(432) 682-4559

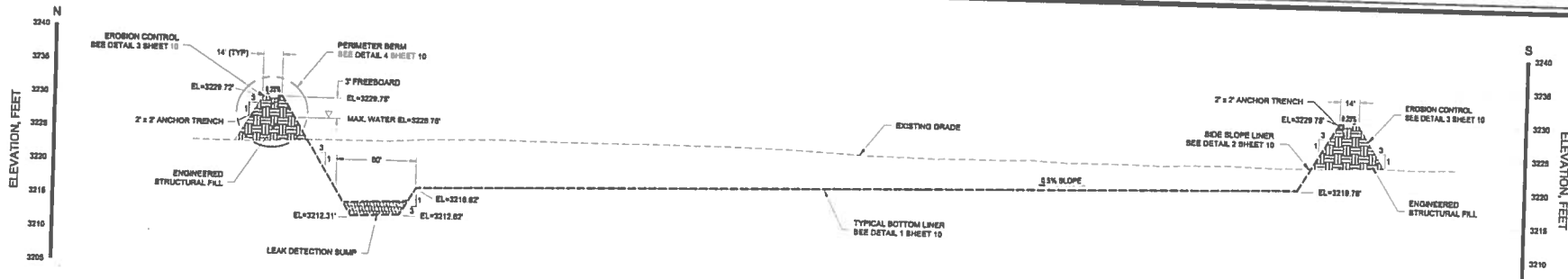
CHEVRON N.A. E&P, MCBU
EDDY COUNTY, NEW MEXICO
GPS (WGS84)
32.088884°N, -104.166851°W

VERIFY SCALE
BAR IS ONE (1) INCH ON ORIGINAL DRAWING.
0 — 1"
IF NOT ONE (1) INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

SCALES:
HORIZONTAL SCALE: 1" = 60'
VERTICAL SCALE: NA

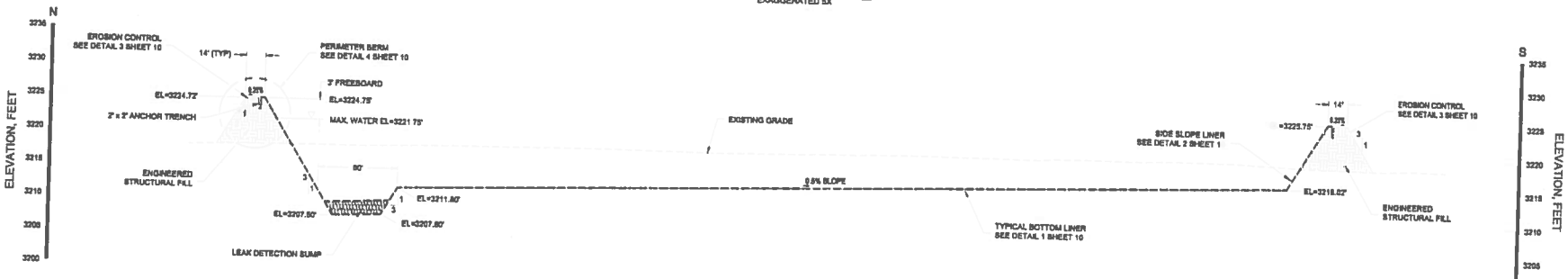
POND 1 AND POND 2 ABOVE GRADE STAKING PLAN HAYHURST SECTION 2 EDDY COUNTY, NEW MEXICO

PROJECT NO. 212C-MD-00648
DRAWING NO. C-6
SHEET NO. 6 OF 18



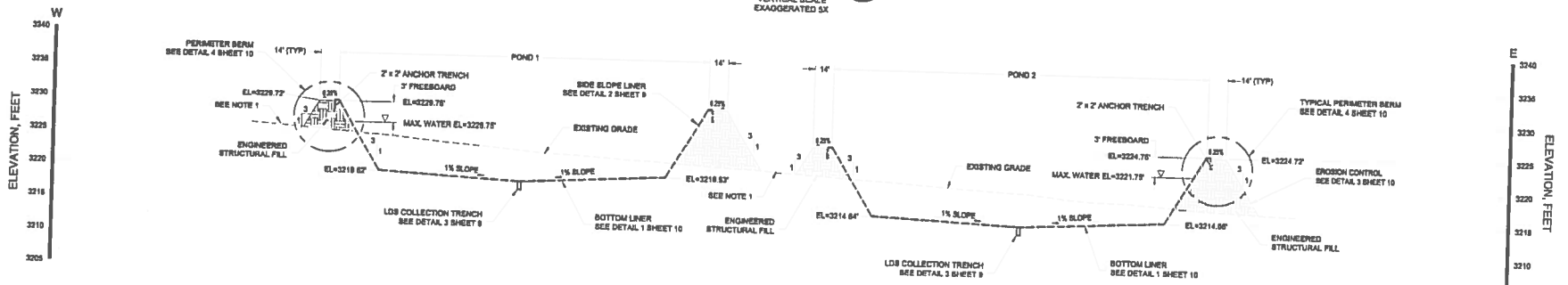
Section A

VERTICAL SCALE
EXAGGERATED 5X



Section B

VERTICAL SCALE
EXAGGERATED 5X



Section C

VERTICAL SCALE
EXAGGERATED 5X

NOTE:

1. GRADE 0.5 % TO THE NORTH AND SOUTH - GRADE AT TOE 0.25% AWAY FROM EACH POND TOE WHERE EROSION CONTROL IS INSTALLED .

NATHAN A. LANGFORD
NEW MEXICO
24309
PROFESSIONAL ENGINEER

REVISIONS		
NO.	DATE	DESCRIPTION

DESIGNED	NL
DRAWN	DKK
CHECKED	SDD
DATE	9/17

Tetra Tech Inc.
Texas Registered Engineering Firm F-3864
4000 N. BIG SPRING, Suite 401
MIDLAND, TEXAS 79705
(432) 682-4559

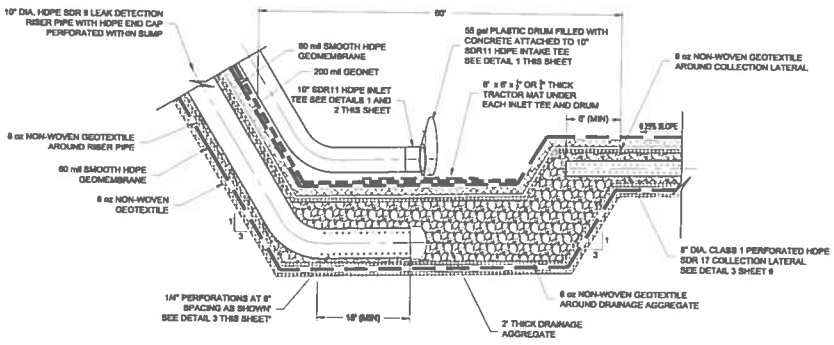
CHEVRON N.A. E&P, MCBU
EDDY COUNTY, NEW MEXICO
GPS (WGS84)
32.088884°N, -104.166851°W

VERIFY SCALE
BAR IS ONE (1) INCH ON ORIGINAL DRAWING.
IF NOT ONE (1) INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

SCALES:
HORIZONTAL SCALE: 1" = 60'
VERTICAL SCALE: NA

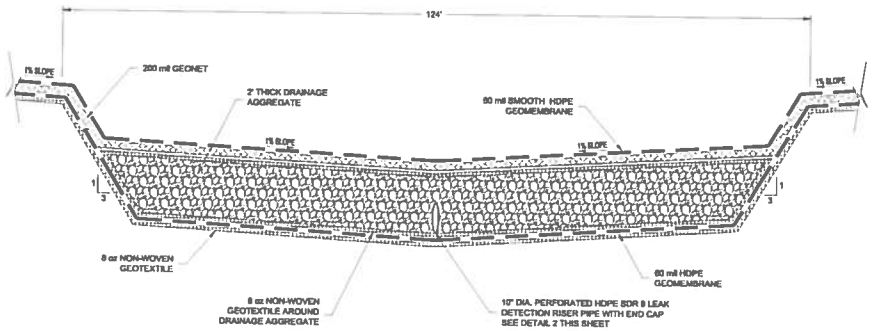
POND 1 AND POND 2 CROSS-SECTIONS HAYHURST SECTION 2 EDDY COUNTY, NEW MEXICO

PROJECT NO.	212C-MD-00648
DRAWING NO.	C-7
SHEET NO.	7 OF 18



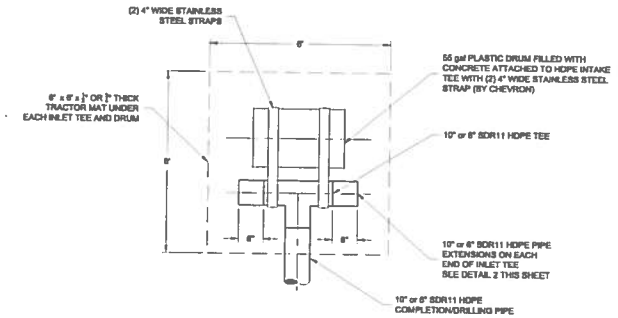
Section D

VERTICAL SCALE EXAGGERATED 5X



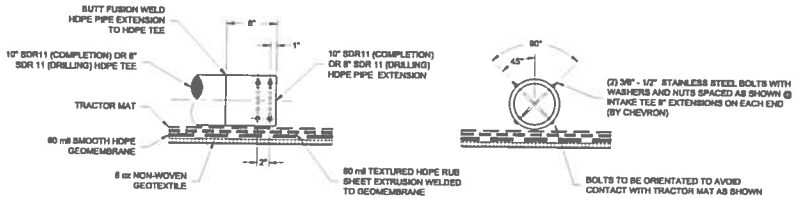
Section E

VERTICAL SCALE EXAGGERATED 5X



1 TYPICAL INLET TEE & DRUM

FOR OVERALL PLAN VIEW SEE SHEET 10
SCALE 1" = 2'



2 TYPICAL @ INLET TEE END

NTS

NOTES:

1. SECTION D AND SECTION E ARE TYPICAL FOR POND 1 AND POND 2.
2. GEOSYNTHETICS HAVE BEEN EXAGGERATED FOR CLARITY.
3. THE CONTRACTOR SHALL REFER TO THE TECHNICAL SPECIFICATIONS FOR THE HAYHURST SECTION 2 HYDRAULIC FRACTURING POND 1 AND POND 2 CONSTRUCTION IN ADDITION TO THE DRAWINGS FOR GEOSYNTHETICS SPECIFICATIONS.
4. DETAIL 1 AND DETAIL 2 ON THIS SHEET TO BE SPECIFIED BY CHEVRON.

NORMAN A. LANGFORD NEW MEXICO 24389 PROFESSIONAL ENGINEER

REVISIONS

NO.	DATE	DESCRIPTION

DESIGNED	ML
DRAWN	DKK
CHECKED	SDD
DATE	9/17

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4000 N. BIG SPRING, Suite 401
MIDLAND, TEXAS 79705
(432) 682-4559

CHEVRON N.A. E&P, MCBU
EDDY COUNTY, NEW MEXICO
GPS (WGS84)
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VERIFY SCALE

BAR IS ONE (1) INCH ON ORIGINAL DRAWING.

0 1"

IF NOT ONE (1) INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

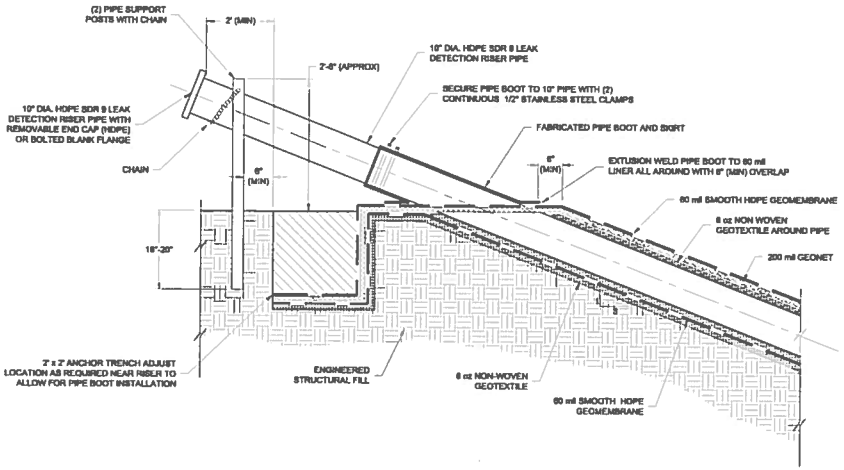
SCALES:

HORIZONTAL SCALE: 1" = 10'

VERTICAL SCALE: NA

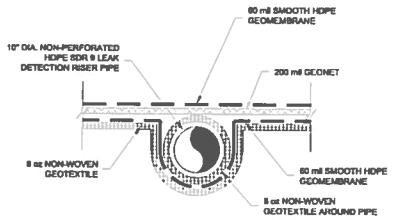
SUMP CROSS-SECTIONS AND DETAILS
HAYHURST SECTION 2
EDDY COUNTY, NEW MEXICO

PROJECT NO.	212C-MD-00848
DRAWING NO.	C-8
SHEET NO.	8 OF 18



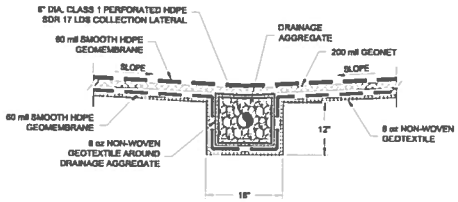
1 LDS RISER PIPE BOOT AND REMOVABLE CAP DETAIL

GEOSYNTHETICS EXAGGERATED FOR CLARITY



2 LDS RISER TRENCH

NTS

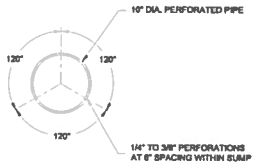


3 LDS COLLECTION TRENCH

NTS

NOTES:

1. 10" LDS RISER PIPE TO EXTEND A MINIMUM OF 3' BEYOND THE ANCHOR TRENCH. PIPE SUPPORT FOR LEAK DETECTION PIPE TO BE LOCATED A MINIMUM OF 6' PAST ANCHOR AND HEIGHTS SHOWN ARE APPROXIMATE AND WILL BE DETERMINED IN THE FIELD.
2. 10" LDS RISER PIPE WILL BE PERFORATED WITHIN SUMP. PERFORATIONS WILL BE 1/4" TO 3/8" DIAMETER HOLES AT 6" SPACING INTERVALS. PERFORATIONS WILL BE AT 120° AROUND THE CIRCUMFERENCE OF THE LEAK DETECTION SYSTEM RISER PIPE REFERENCE DETAIL 4 THIS SHEET.
3. ANCHOR TRENCH WILL BE INSTALLED PER THE DRAWINGS AND AS RECOMMENDED BY THE MANUFACTURER.
4. THE CONTRACTOR SHALL REFER TO THE TECHNICAL SPECIFICATIONS FOR THE HAYHURST SECTION 2 HYDRAULIC FRACTURING POND 1 AND POND 2 CONSTRUCTION IN ADDITION TO THE DRAWINGS FOR GEOSYNTHETICS SPECIFICATIONS.
5. GEOSYNTHETICS HAVE BEEN EXAGGERATED FOR CLARITY.



4 SUMP PIPE DETAIL

NTS

NATHAN A. LANGFORD NEW MEXICO 24388 PROFESSIONAL ENGINEER

REVISIONS			DESIGNED	NL
NO	DATE	DESCRIPTION	DRAWN	CHX
			CHECKED	SDD
			DATE	9/17

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Texas Registered Engineering Firm F-3884
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MIDLAND, TEXAS 79705
(432) 682-4559

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EDDY COUNTY, NEW MEXICO
GPS (WGS84)
32.068884°N, -104.166851°W

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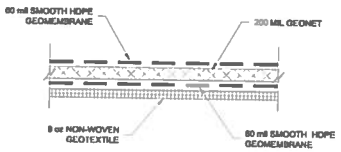
0 1"
IF NOT ONE (1) INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

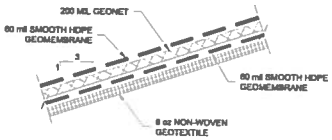
SCALES:
HORIZONTAL SCALE: NA
VERTICAL SCALE: NA

LDS RISER PIPE AND DETAILS
HAYHURST SECTION 2
EDDY COUNTY, NEW MEXICO

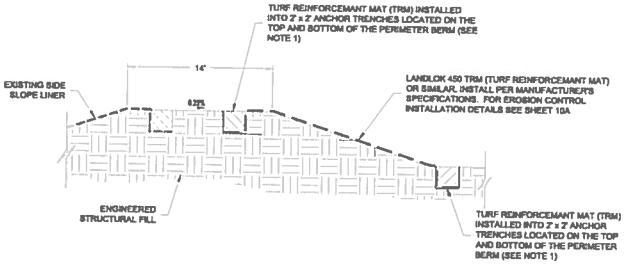
PROJECT NO. 212C-MD-00845
DRAWING NO. C-9
SHEET NO. 9 OF 18



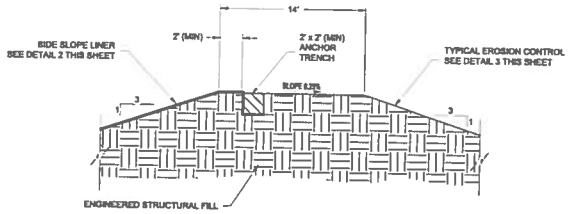
1 TYPICAL BOTTOM LINER
NTS



2 TYPICAL SIDE SLOPE LINER
NTS



3 TYPICAL EROSION CONTROL EXTERIOR PERIMETER BERM
NTS



4 PERIMETER BERM
NTS

NOTES:

1. ANCHOR TRENCHS WILL BE INSTALLED PER THE DRAWINGS AND NOT RECOMMENDED BY THE MANUFACTURER.
2. EROSION CONTROL PROVIDED IN DETAIL 3 ARE RECOMMENDED.
3. THE CONTRACTOR SHALL REFER TO THE PROPEX GEOSOLUTIONS EROSION CONTROL INSTALLATION DETAILS ON SHEET 10A.
4. DURING CONSTRUCTION AND OPERATIONAL PERIODS WHEN THE PONDS ARE NOT IN USE, BALLASTS, SUCH AS SANDBAGS OR SIMILAR, SHOULD BE PLACED ON TOP OF ALL LINERS TO MINIMIZE POTENTIAL FOR LINER SYSTEM PULLOUT. SEE SPECIFICATIONS FOR DETAILS.

NATHAN A. LANGFORD — NEW MEXICO — 24388 — PROFESSIONAL ENGINEER

REVISIONS			DESIGNED	ML
NO.	DATE	DESCRIPTION	DRAWN	DKK
			CHECKED	BDD
			DATE	9/17

Tetra Tech Inc.
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MIDLAND, TEXAS 79705
(432) 682-4559

CHEVRON N.A. E&P, MCBU
EDDY COUNTY, NEW MEXICO
GPS (WGS84)
32.068884°N, -104.166851°W

VERIFY SCALE
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0 — 1"
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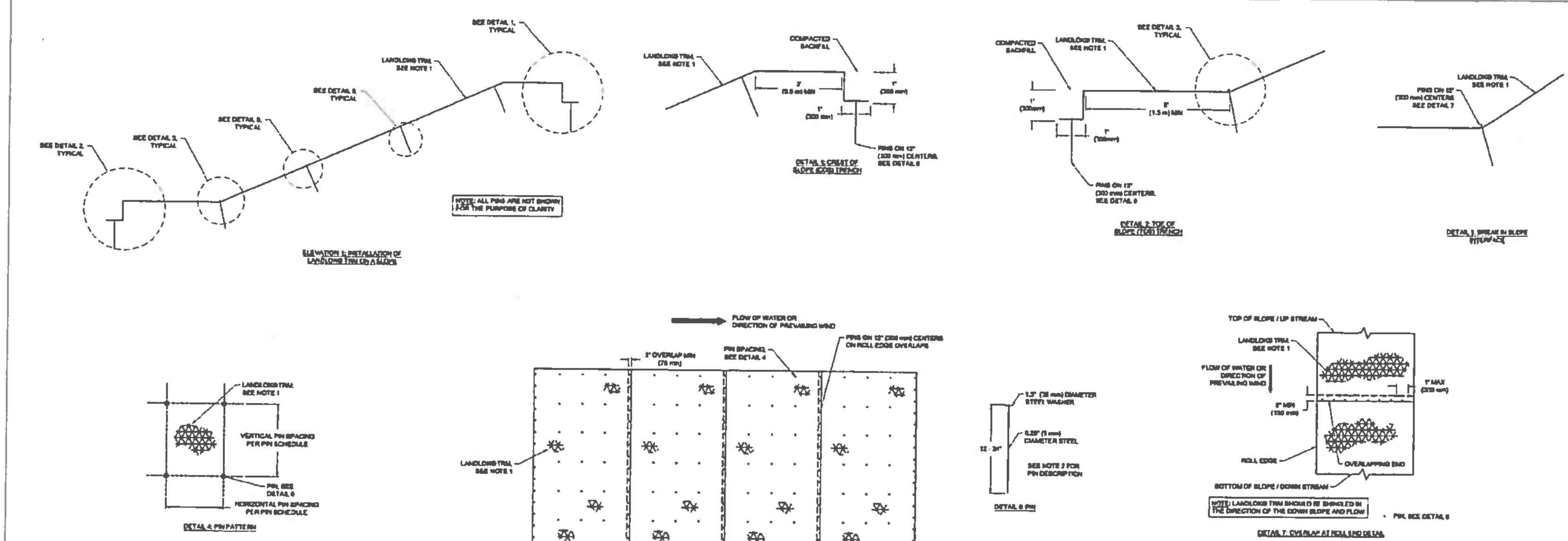
SCALES:
HORIZONTAL SCALE: NA
VERTICAL SCALE: NA

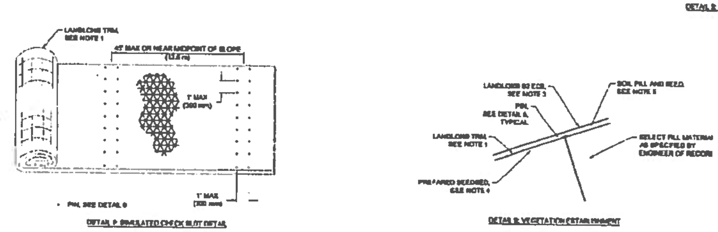
TYPICAL LINER DETAILS AND EROSION CONTROL HAYHURST SECTION 2 EDDY COUNTY, NEW MEXICO

PROJECT NO. 212C-MD-00848
DRAWING NO. C-10
SHEET NO. 10 OF 18



• PIN, SEE DETAIL 6

DETAIL 5: PIN PATTERN



PIN SCHEDULE	
SECURING DEVICE	PIN
HORIZONTAL PIN SPACING	3' (0.9 m)
VERTICAL PIN SPACING	2.5' (0.76 m)
EMBEDMENT DEPTH	PER MANUFACTURES DESIGN

LANDLOK® TRM ON A SLOPE FOR EROSION CONTROL GENERAL INSTALLATION GUIDELINES

GENERAL NOTES

1. The LANDLOK® TRM is a three-dimensional, [illegible] polypropylene geotextile [illegible] designed for erosion control applications on steep slopes and vegetated waterways. [illegible]
2. The 12", 18", and 24" Securing Pins are composed of a wire, [illegible] at the top. A washer is then placed on the wire [illegible] [illegible]
3. Landlok® 82 Erosion Control Blankets consist of 100% wheat straw [illegible] [illegible] This product is NTPEP approved for AASHTO standards.

VEGETATION ESTABLISHMENT

4. Prepare seedbed by [illegible] 50 to 75 mm (2 to 3 in) of soil above final grade. [illegible]
5. The installed LANDLOK® TRM [illegible] LANDLOK® 82 Erosion Control Blanket (ECB) [illegible] (1.7 staples per square yard).
6. Irrigate as necessary to establish and maintain vegetation until 70% of vegetation has established and has reached a height of 2 inches. [illegible]

BEFORE INSTALLATION BEGINS

7. Coordinate with a Propex Representative. A pre-construction meeting is suggested with the construction team and a representative from Propex. [illegible]
8. Gather the Tools Needed: [illegible] LANDLOK® TRM [illegible]
9. Determine how to Establish Vegetation: [illegible]
10. Please consult the Propex Website for the most up to date installation guidelines.

EROSION CONTROL INSTALLATION DETAILS

Propex GEOSOLUTIONS

[illegible]

LANDLOK® TURF REINFORCEMENT MAT (TRM) LANDLOK® TRM INSTALLATION DETAILS FOR SLOPES

*ALL DIMENSIONS ARE TO BE VERIFIED BY ENGINEER OF RECORD

REVISIONS		
NO.	DATE	DESCRIPTION

DESIGNED	NL
DRAWN	DKK
CHECKED	BDD
DATE	8/17

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[illegible]

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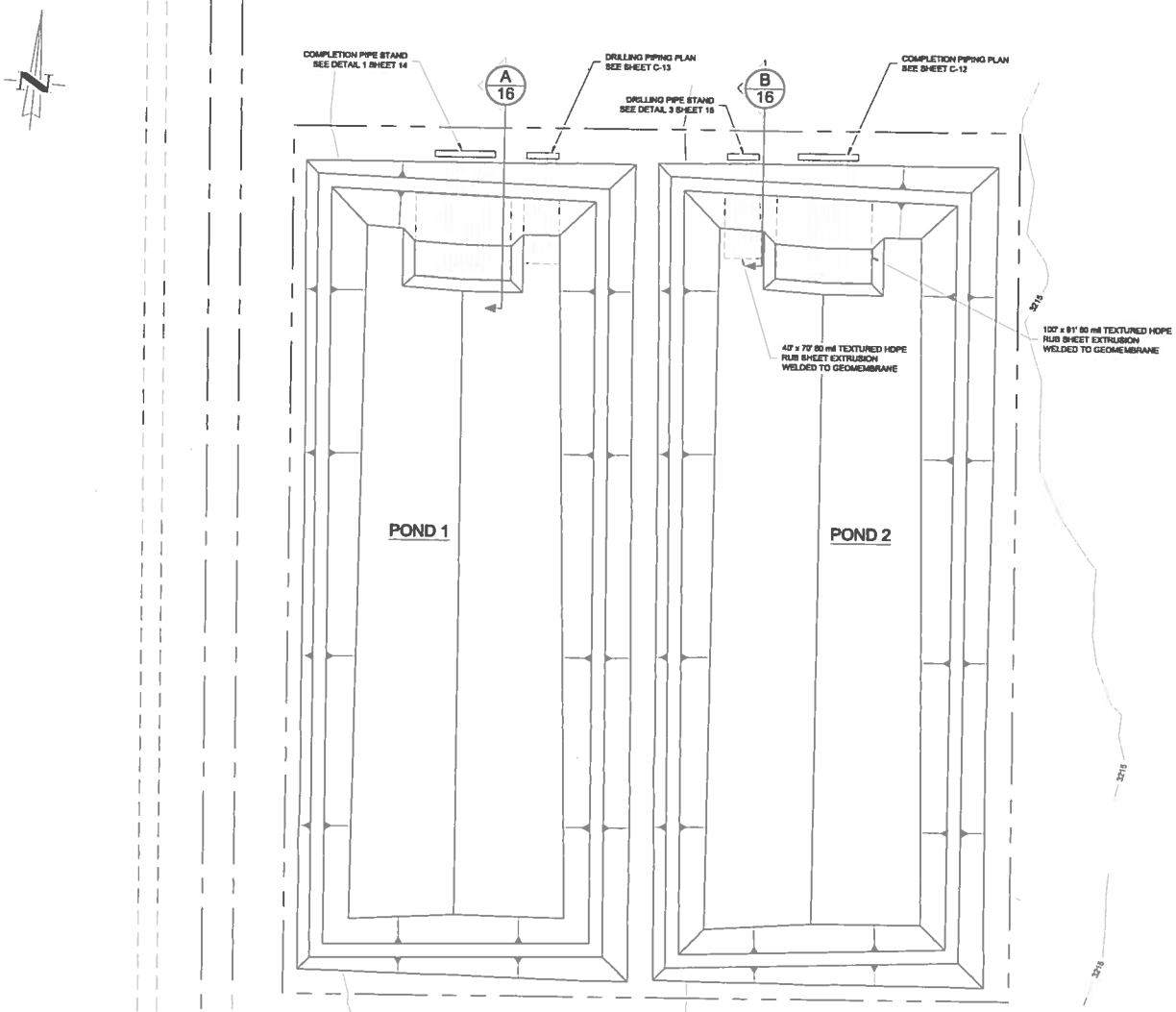
PROPEX GEOSOLUTIONS
EROSION CONTROL INSTALLATION DETAILS
HAYHURST SECTION 2
EDDY COUNTY, NEW MEXICO

PROJECT NO. 212C-MD-00848
DRAWING NO. C-10A
SHEET NO. 10A OF 18



LEGEND

- EXISTING 5' CONTOUR INTERVAL (FEET, MSL)
- EXISTING 1' CONTOUR INTERVAL
- PERMIT BOUNDARY
- PERIMETER FENCE
- HDPE PIPE
- DRILLING/COMPLETION LINE
- FILL SYMBOL
- UNIMPROVED ROAD
- BURIED PIPELINE

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DATE 9/17

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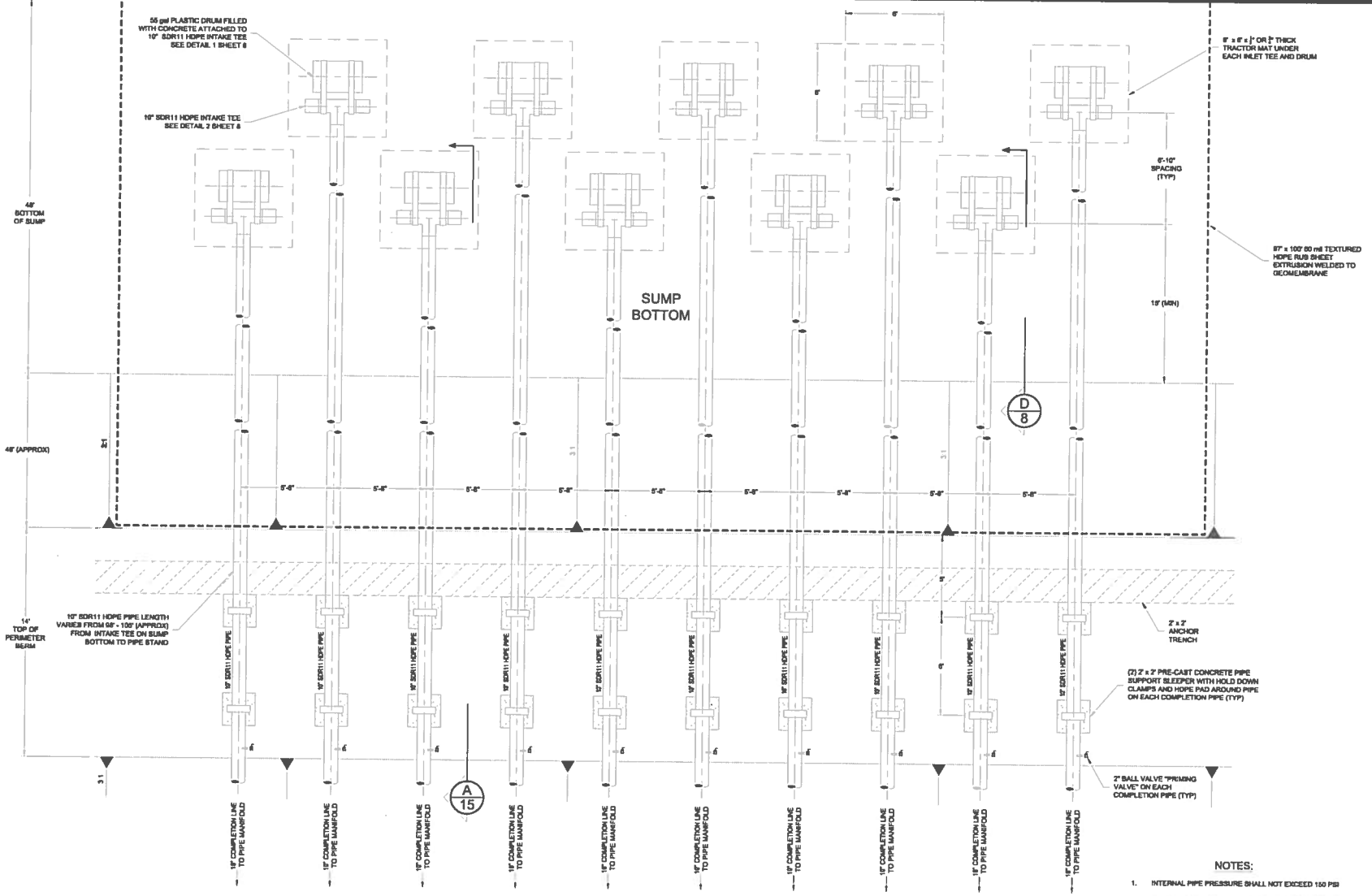
0 1"
IF NOT ONE (1) INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

SCALES:
HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: N/A

SITE PIPING PLAN HAYHURST SECTION 2
EDDY COUNTY, NEW MEXICO

PROJECT NO. 212C-MD-00848
DRAWING NO. C-11
SHEET NO. 11 OF 18



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0 1"
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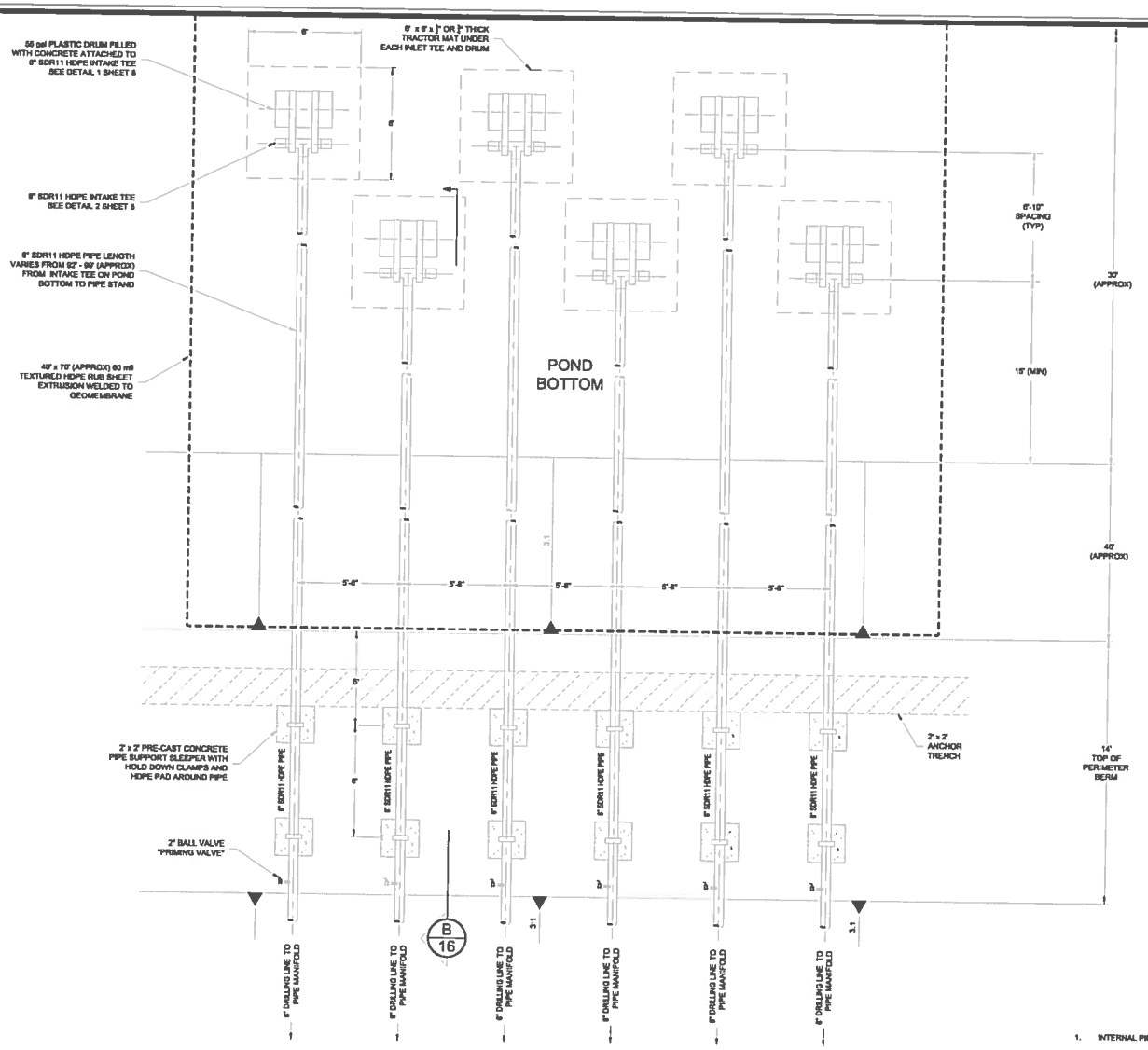
SCALES:
HORIZONTAL SCALE: 1" = 5'
VERTICAL SCALE: NA

COMPLETION PIPING PLAN
HAYHURST SECTION 2
EDDY COUNTY, NEW MEXICO

PROJECT NO. 212C-MD-00848
DRAWING NO. C-12
SHEET NO. 12 OF 18



NOTES:

1. INTERNAL PIPE PRESSURE SHALL NOT EXCEED 150 PSI
2. ALL PIPING, VALVES AND FITTINGS TO BE SPECIFIED BY CHEVRON.

REVISIONS

NO.	DATE	DESCRIPTION

DESIGNED	NL
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0 1"
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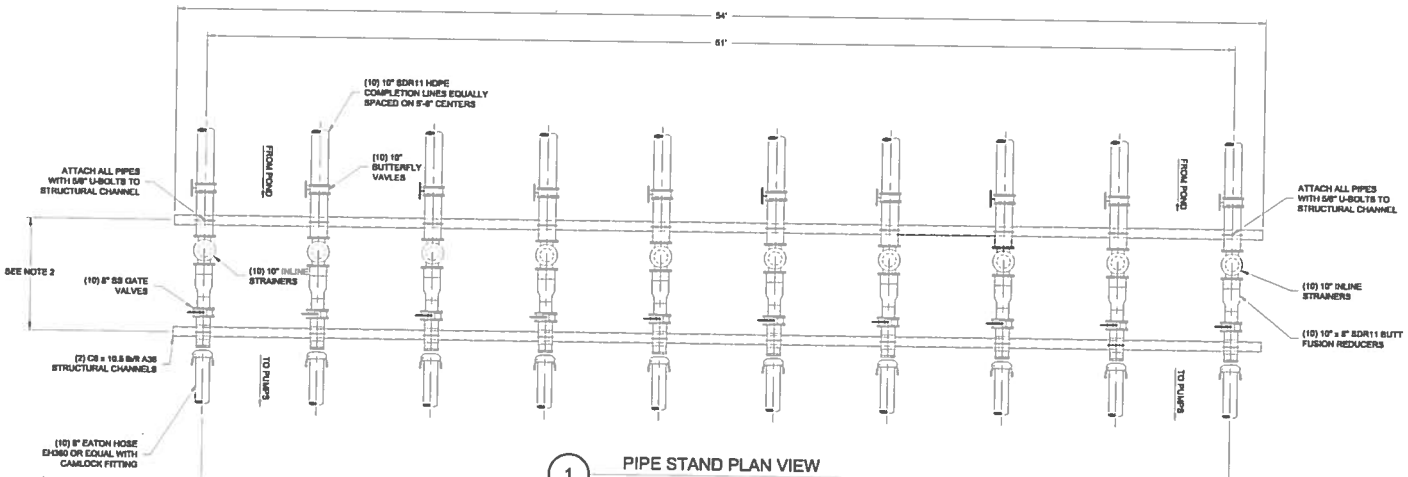
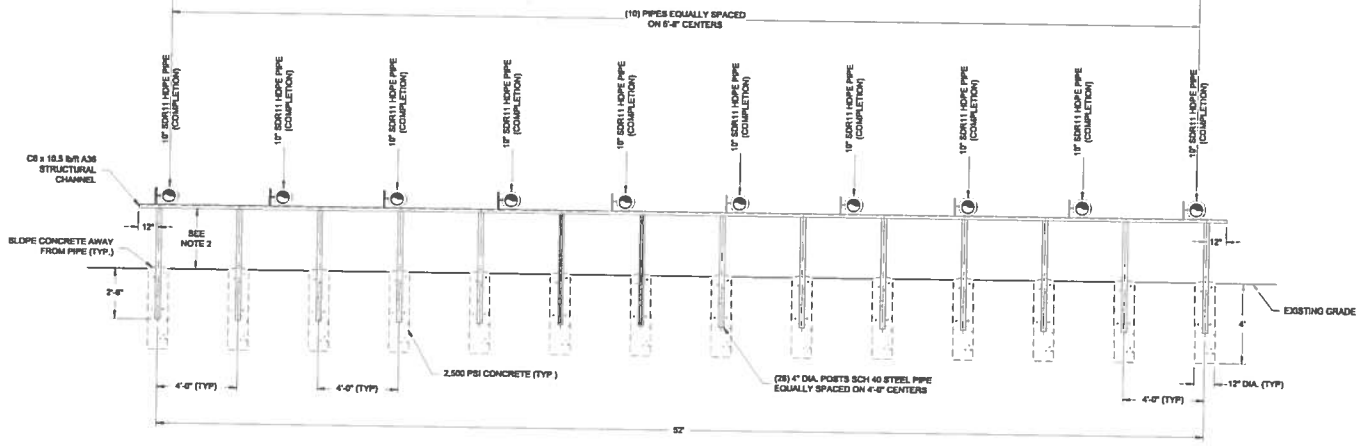
SCALES:
HORIZONTAL SCALE: 1" = 5'
VERTICAL SCALE: NA

DRILLING PIPING PLAN
HAYHURST SECTION 2
EDDY COUNTY, NEW MEXICO

PROJECT NO.	212C-MD-00648
DRAWING NO.	C-13
SHEET NO.	13 OF 18



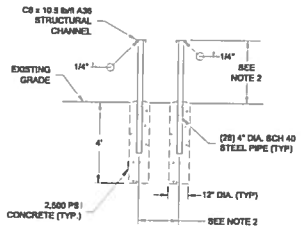
1 PIPE STAND PLAN VIEW
COMPLETION



2 PIPE STAND FRONT ELEVATION
COMPLETION

NOTES

1. PIPE STAND AND ALL PIPE TO BE PAINTED WITH URETHANE ALKYD PAINT. COLORS AS SPECIFIED BY CHEVRON. "INTAKE" OR "DISCHARGE" SHALL BE CLEARLY SKETCHED ON THE APPROPRIATE LINE.
2. COMPLETION PIPE STAND HEIGHT ABOVE GRADE AND SPACING BETWEEN STRUCTURAL CHANNELS TO BE DETERMINED IN THE FIELD DEPENDING ON THE EQUIPMENT SPACING ON THE PIPE STAND (TO BE DETERMINED BY CHEVRON).
3. ALL CONCRETE MATERIAL USED FOR ANCHOR OR BALLAST SHALL BE PREPARED AND CURED TO OBTAIN A MINIMUM COMPRESSIVE STRENGTH OF 3500 PSI.
4. INTERNAL PIPE PRESSURE SHALL NOT EXCEED 150 PSI.
5. ALL PIPING, VALVES AND FITTINGS TO BE SPECIFIED BY CHEVRON.



3 PIPE STAND SIDE ELEVATION
COMPLETION

REVISIONS			
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MIDLAND, TEXAS 79705
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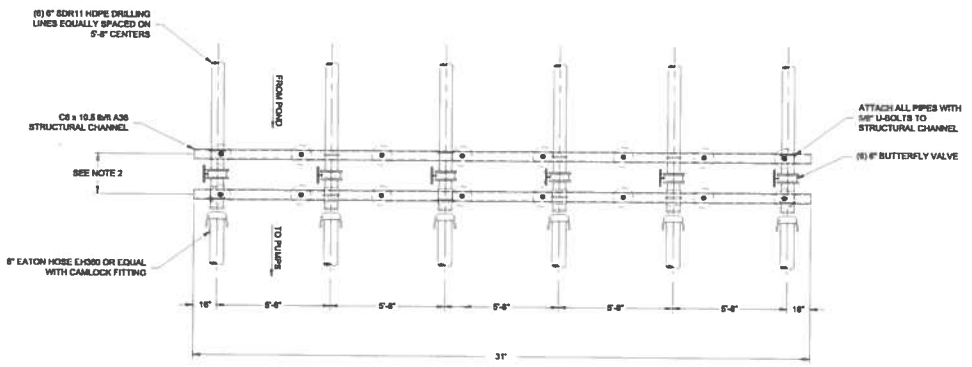
SCALES:
HORIZONTAL SCALE: 1" = 5'
VERTICAL SCALE: N/A

COMPLETION PIPING STAND
HAYHURST SECTION 2
EDDY COUNTY, NEW MEXICO

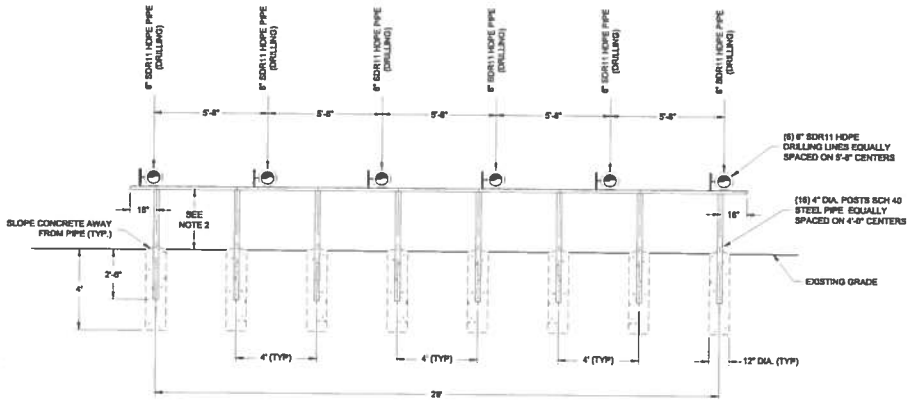
PROJECT NO.	212C-MD-00848
DRAWING NO.	C-14
SHEET NO.	14 OF 18



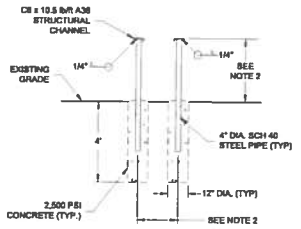
1 PIPE STAND PLAN VIEW
DRILLING

NOTES

1. PIPE STAND AND ALL PIPE TO BE PAINTED WITH URETHANE ALKYD PAINT. COLORS AS SPECIFIED BY CHEVRON. "INTAKE" OR "DISCHARGE" SHALL BE CLEARLY SKETCHED ON THE APPROPRIATE LINE.
2. DRILLING PIPE STAND HEIGHT ABOVE GRADE AND SPACING BETWEEN STRUCTURAL CHANNELS TO BE DETERMINED IN THE FIELD DEPENDING ON THE EQUIPMENT SPACING ON THE PIPE STAND (TO BE DETERMINED BY CHEVRON).
3. ALL CONCRETE MATERIAL USED FOR ANCHOR OR BALLAST SHALL BE PREPARED AND CURED TO OBTAIN A MINIMUM COMPRESSIVE STRENGTH OF 2500 PSI.
4. INTERNAL PIPE PRESSURE SHALL NOT EXCEED 150 PSI.
5. ALL PIPING, VALVES AND FITTINGS TO BE SPECIFIED BY CHEVRON.



2 PIPE STAND FRONT ELEVATION
DRILLING



3 PIPE STAND SIDE ELEVATION
DRILLING

REVISIONS			DESIGNED	NL
NO	DATE	DESCRIPTION	DRAWN	DKK
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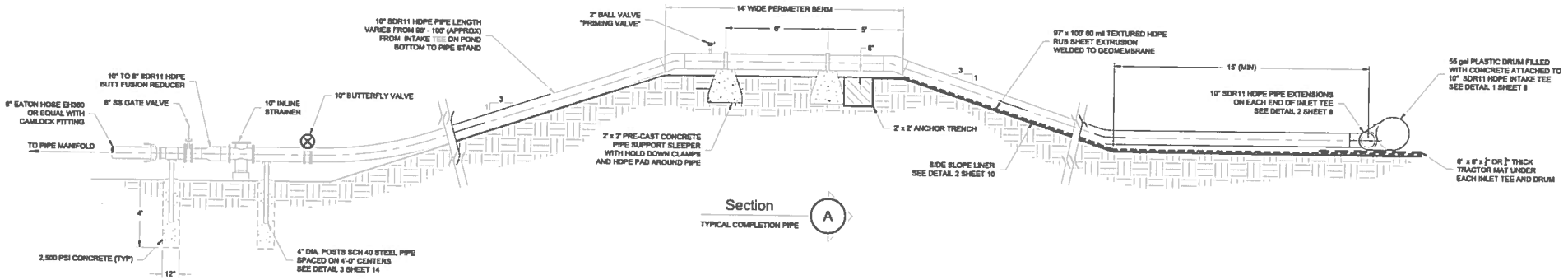
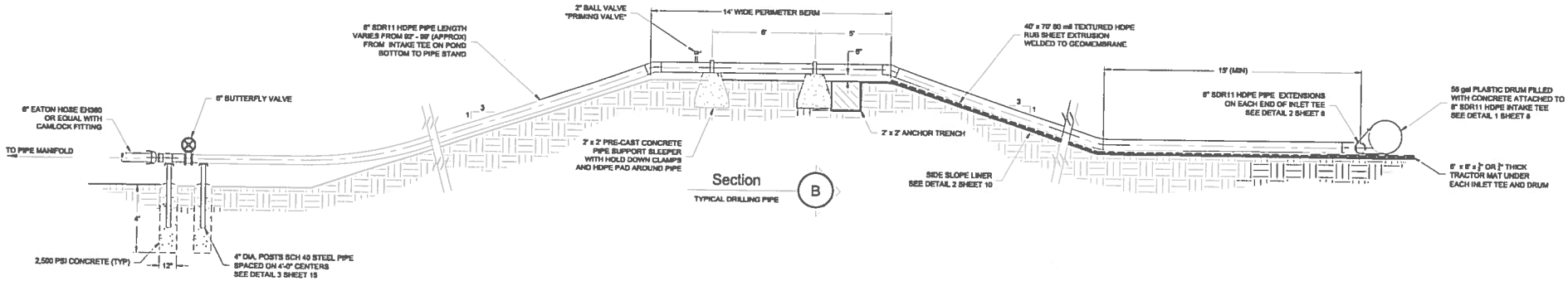
SCALES:
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: NA

DRILLING PIPING STAND
HAYHURST SECTION 2
EDDY COUNTY, NEW MEXICO

PROJECT NO. 212C-MD-00848
DRAWING NO. C-15
SHEET NO. 15 OF 18





NOTES

1. ALL CONCRETE MATERIAL USED FOR ANCHOR OR BALLAST SHALL BE PREPARED AND CURED TO OBTAIN A MINIMUM COMPRESSIVE STRENGTH OF 2300 PSI.
2. INTERNAL PIPE PRESSURE SHALL NOT EXCEED 150 PSI.
3. ALL PIPING, VALVES AND FITTINGS TO BE SPECIFIED BY CHEVRON.
4. ALL PIPE STAND HEIGHT ABOVE GRADE AND SPACING BETWEEN STRUCTURAL CHANNELS TO BE DETERMINED IN THE FIELD DEPENDING ON THE EQUIPMENT SPACING ON THE PIPE STAND (TO BE DETERMINED BY CHEVRON).

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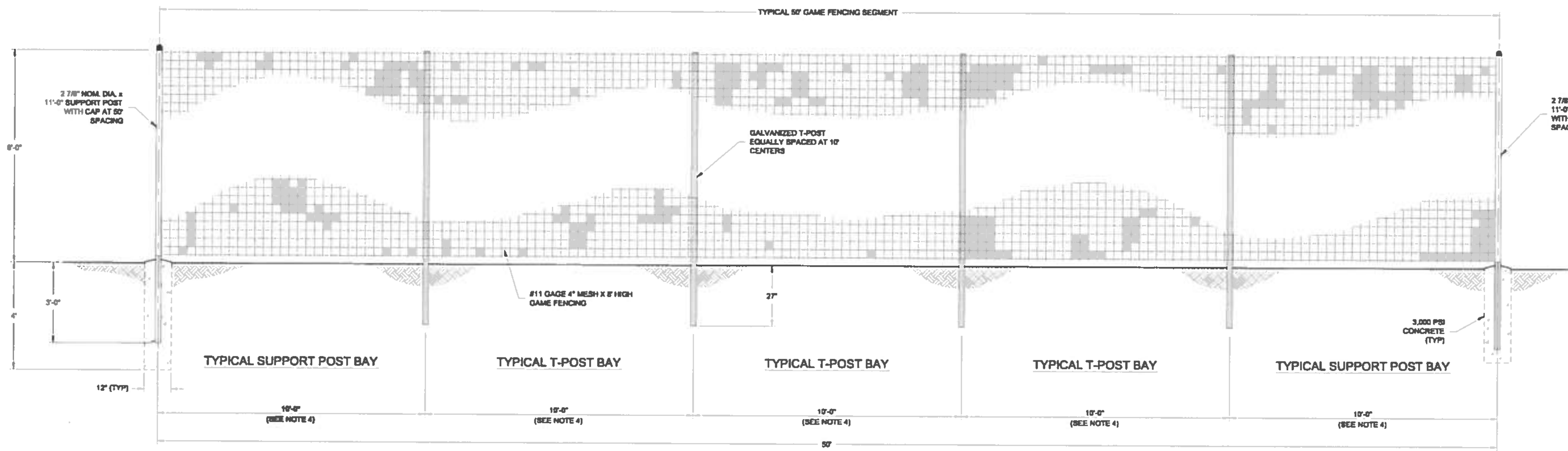
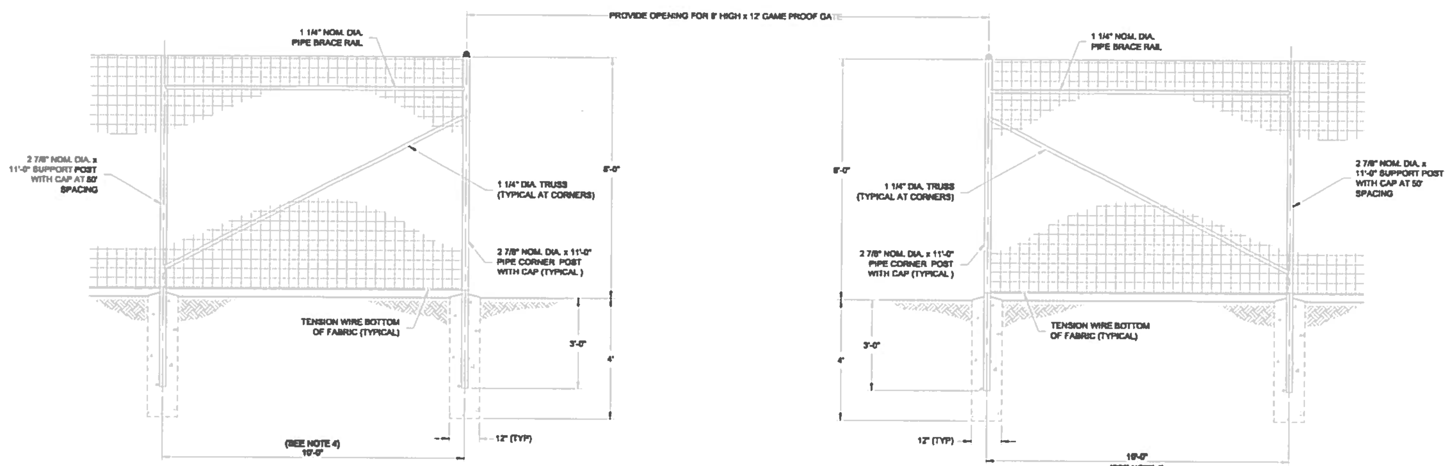
VERTICAL SCALE: NA

PIPING CROSS-SECTIONS
HAYHURST SECTION 2
EDDY COUNTY, NEW MEXICO

PROJECT NO. 212C-MD-00848
DRAWING NO. C-16
SHEET NO. 16 OF 18



1 TYPICAL FENCE DETAIL



2 TYPICAL @ CORNER AND/OR GATE POST DETAIL

NOTES

1. ALL POST HOLES SHALL BE AUGURED, DO NOT FORM
2. FOR PLAN AND LOCATION OF GATES SEE SHEET 15.
3. CONCRETE SHALL REACH A MINIMUM STRENGTH OF 3,000 P.S.I. AT 28 DAYS.
4. T- POSTS SHALL BE INSTALLED EQUALLY SPACED ALONG FENCE LINE AT A MAXIMUM OF 10'-0"CENTER TO CENTER.
5. ALL WIRE, FENCE FABRIC, POST, BRACE RAILS AND HARDWARE TO BE HOT DIPPED GALVANIZED.
6. SUPPORT POSTS SHALL BE INSTALLED EQUALLY SPACED ALONG FENCE LINE AT A MAXIMUM OF 50'-0"CENTER TO CENTER.

REVISIONS		
NO	DATE	DESCRIPTION

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VERTICAL SCALE: NA

FENCING DETAILS
HAYHURST SECTION 2
EDDY COUNTY, NEW MEXICO

PROJECT NO. 212C-MD-00848
DRAWING NO. C-17
SHEET NO. 17 OF 18

NATHAN A. LANGFORD, NEW MEXICO, 24369, PROFESSIONAL ENGINEER

Appendix 6 – Recycling Containment Geotechnical Engineering Report

TETRA TECH

Hayhurst Section 2 Hydraulic Fracturing Ponds

Eddy County, New Mexico

August 2017

complex world

CLEAR SOLUTIONS™

Report of Geotechnical Study Hayhurst Section 2 Hydraulic Fracturing Ponds

Eddy County, New Mexico

Prepared for:

Mr. Ruben Kopara
Chevron North America Exploration and Production Company
6301 Deauville Blvd, Midland, Texas 79706
Phone: (432) 687-7215

Prepared by:

Tetra Tech

4000 North Big Spring Street, Suite 401
Midland, Texas 79705
Phone (432) 682-4559; Fax (432) 682-3946
Texas Registered Engineering Firm 3924

Tetra Tech Project No. 212C-MD-02848

THOMAS A. CHAPEL NEW MEXICO 18861 8/2/17 PROFESSIONAL ENGINEER

Thomas A. Chapel
Principal Engineer

Reviewed by: Don Grahlherr, P.E.
Vice President

August 2, 2017

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Chevron North America Exploration and Production Company (Chevron) plans to construct hydraulic fracturing ponds at the Hayhurst, New Mexico, Section 2 property located in Eddy County, New Mexico. Chevron will construct two separate ponds, with a capacity of approximately 350,000 barrels (bbl) each to service well drilling operations. The ponds will be designed with a double liner and a leak detection system. The floor of each pond will be sloped to a sump where fluids can be collected, sampled, and pumped if needed.

The purposes of this study were to obtain information on subsurface conditions, and to provide geotechnical design criteria for the construction of the proposed ponds. The general site location is shown on the Site Location Map, Figure 1 and Topographic Map (Figure 2).

Between May 16th and 19th, 2017, Tetra Tech and a subcontractor mobilized to the site with a truck-mounted drilling rig to drill five (5) exploratory soil borings to identify subsurface conditions and collect samples. Borings B-1 and B-4 were drilled to a depth of approximately 45 feet below the existing ground surface (bgs). Borings B-2 and B-3 were drilled to a depth of approximately 40 feet bgs. Boring B-5 was drilled to a depth of approximately 73 feet. Water was encountered at approximate depths of 31, 28, and 31 feet (bgs) in B-1, B-4, and B-5 respectively, and rose to depths of 26, 26, and 29 feet when checked prior to backfilling the boreholes one to two days following the initial drilling. New Mexico Oil Conservation Division Rules published in the New Mexico Administrative Code (NMAC) have specific siting requirements for "pits" (ponds), associated with oil and gas exploration and production, which are within specified proximities to groundwater. A hydrogeological study to meet the requirements of the NMAC should be performed to determine whether the groundwater encountered is a perched layer or a continuous water bearing feature. Approximate locations of the borings are shown on Figure 4.

The borings encountered 3½ to 8½ feet of loose to very dense sand and silt over naturally cemented soil. The cemented soil extended to the maximum depth drilled of 40 feet in boreholes B-2 and B-3.Relatively less cemented soil was encountered starting at depths of 23.5, 28, and 33 feet, and continued to depths of 38.5, 40, and 60 feet respectively in B-1, B-4, and B-5 (located in the southern and central portions of the site). The poorly cemented layer continued to the maximum depth drilled of 45 feet in B-1. Strongly cemented soil was encountered in B-4 and B-5 to the maximum depths drilled of 45 and 73 feet respectively.

Review of mapping by the U.S. Geological Survey (Figure 3) indicates that the Rustler Formation, which is a carbonate based sedimentary rock with evaporates present, underlies the site, and can be prone to karst formation and dissolution leaving voids. No voids were encountered during our investigation, however this does not ensure that voids do not exist beneath the proposed site. Tetra Tech recommends that Chevron consider additional investigation to determine more conclusively if voids exist beneath the site.

Additional investigation and construction recommendations for development of the site are provided in the body of this report.

We have prepared this executive summary solely to provide a general overview, and it should not be used for any purpose except that for which it was intended. We recommend detailed review of the entire report for information about our findings, recommendations and other concerns related to geotechnical conditions for the site.

1.0 PURPOSE AND SCOPE OF STUDY

Chevron plans to construct hydraulic fracturing ponds at the Hayhurst New Mexico, Section 2 property located in Eddy County, New Mexico. Chevron will construct two ponds at the site. Each pond will have an approximate operational capacity of 350,000 barrels (bbls) and will service well drilling operations. We understand the hydraulic fracturing ponds will be designed with a double liner and a leak detection system. The bottom of the pond will be sloped and equipped with a sump and access port/riser at the low point of the floor of the pond.

The scope of the study for this project included the following.

1) New Mexico 811 Utility locate request;

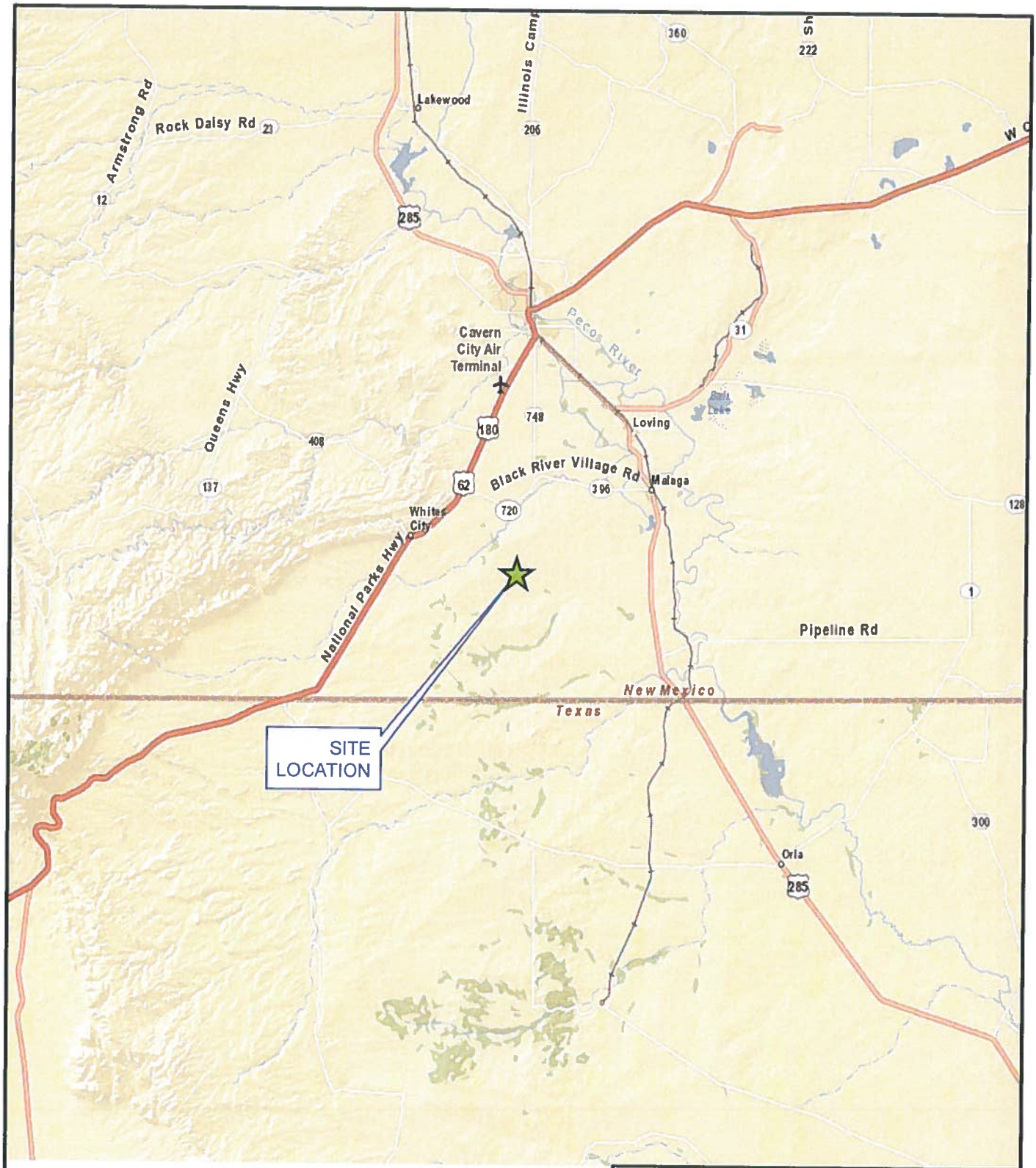
2) Mobilize a CME 75 drilling rig to drill four (4) borings to a depth of 40 or 45 feet and one (1) boring to a depth of 73 feet to look for evidence of groundwater;

3) Perform Standard Penetration Tests (SPT) at every 5 or 10-foot interval to evaluate soil consistency and collect soil samples for evaluation;

4) Backfill borings with soil cuttings after completion of drilling and 24-hour measurements, as required; and

5) Provide geotechnical engineering design criteria and recommendations and prepare a geotechnical report.

The general location of the site is shown on the Site Location Map, Figure 1 and Topographic Map, Figure 2.



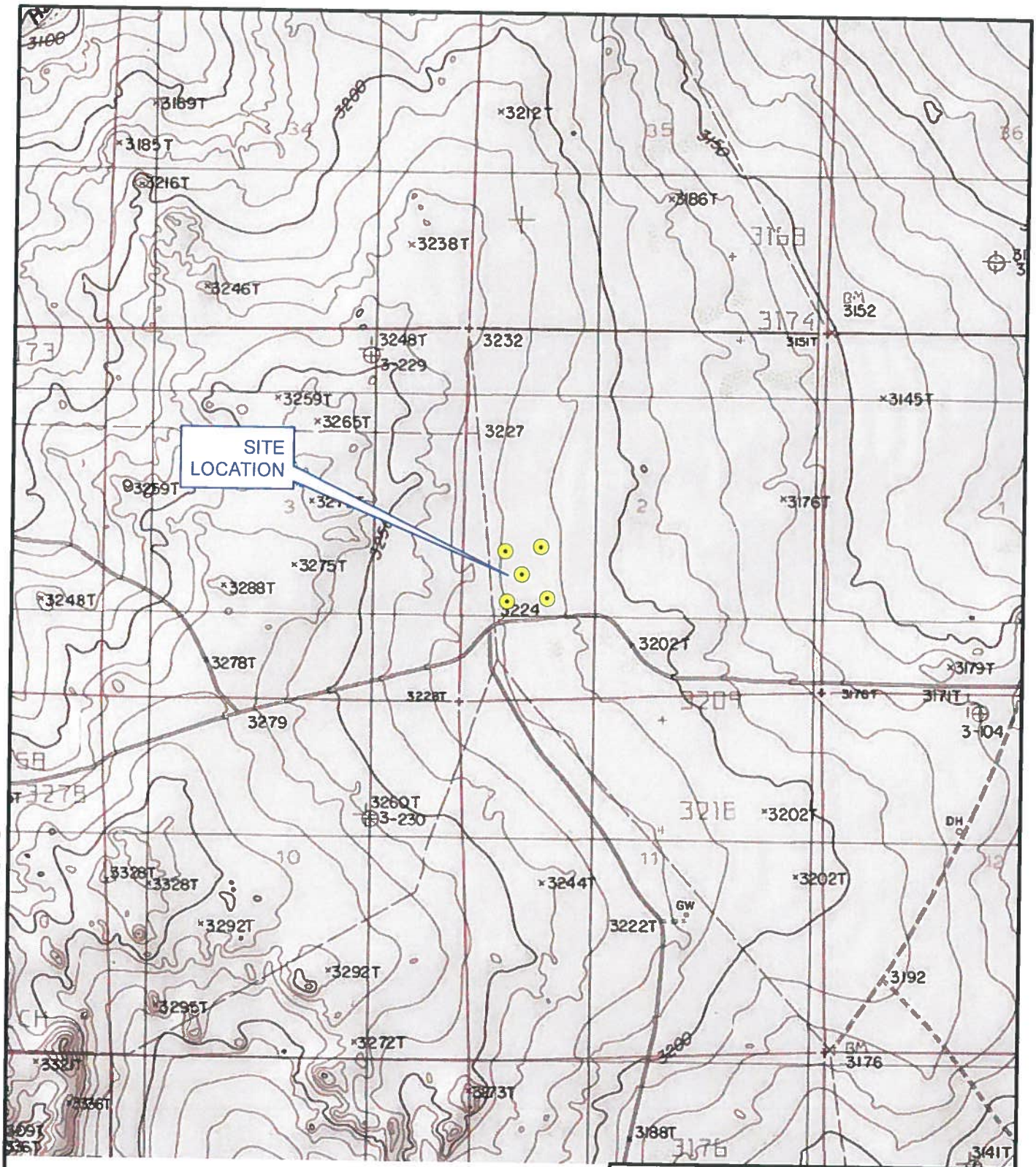
SOURCE: MODIFIED FROM ESRI STREETMAP, 2017

CHEVRON
HAYHURST
SEC. 2 FRAC POND
EDDY COUNTY, NEW MEXICO

FIGURE 1
SITE LOCATION MAP

TETRA TECH

Date Saved: 7/10/2017 3:22:13 PM User: Joel Peters Path: L:\CADD\P\212C-MD\00848\Chevron_Hayhurst_212C_MD_00848_1.mxd



Legend

- Boring Location

N
W E
S

0 1,000 2,000
Feet

SOURCE: MODIFIED USGS, COTTONWOOD HILLS, NM-TX 1985 QUADRANGLE.

CHEVRON
HAYHURST
SEC. 2 FRAC POND
EDDY COUNTY, NEW MEXICO

FIGURE 2
TOPOGRAPHIC MAP

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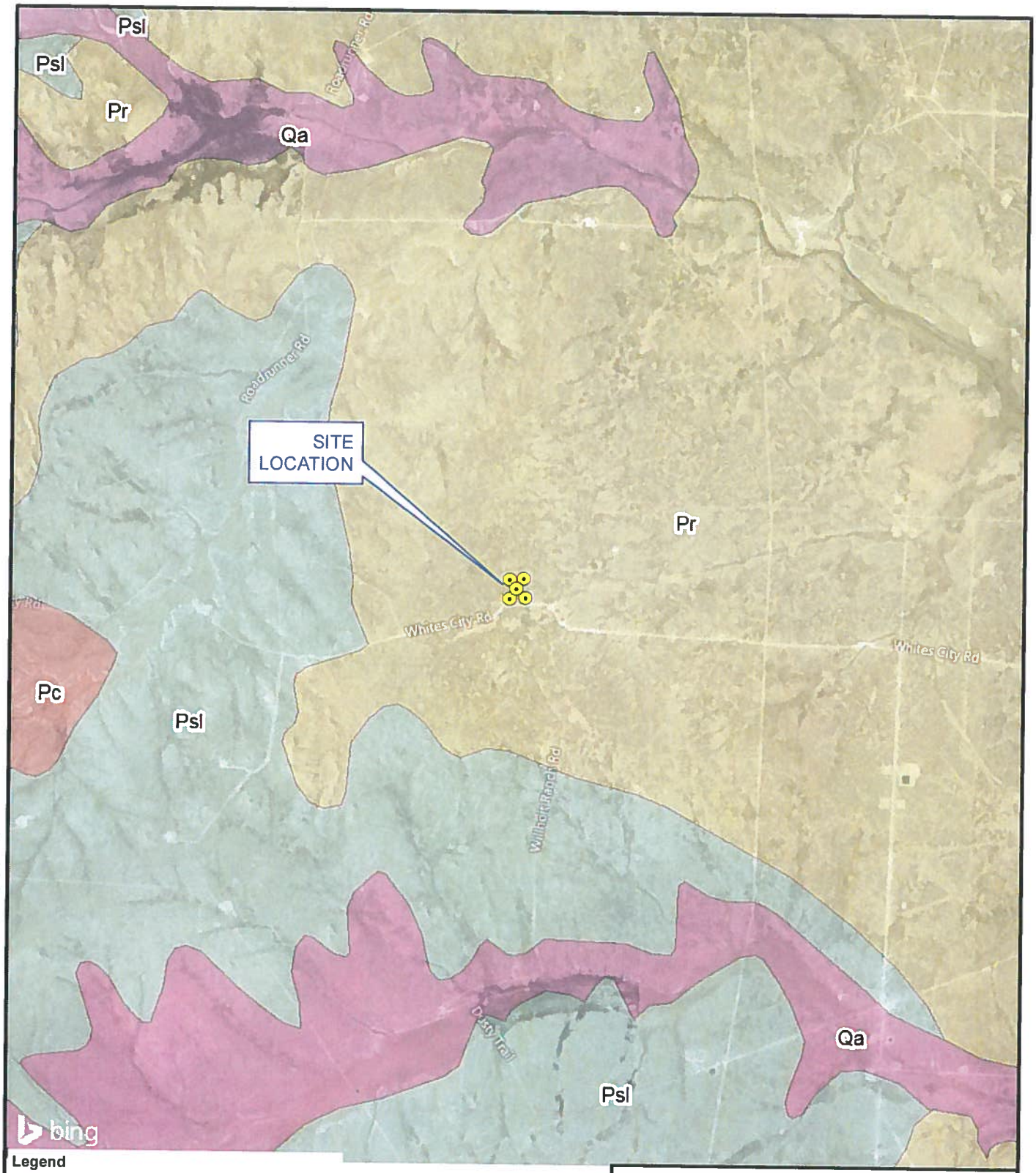

Legend

Boring Location

Rock Unit

- Pc - Castile Formation
- Pr - Rustler Formation
- Psl - Salado Formation
- Qa - Alluvium

N
W E
S

0 0.5 1
Miles

SOURCE: MODIFIED FROM USGS, PRELIMINARY INTEGRATED GEOLOGIC MAP FOR THE UNITED STATES CENTRAL STATES, 2005, AND BING MAPS HYBRID IMAGERY, 2011.

CHEVRON
HAYHURST
SEC. 2 FRAC POND
EDDY COUNTY, NEW MEXICO

FIGURE 3
SOIL TEST BORING LOCATION MAP
AND AREA GEOLOGY

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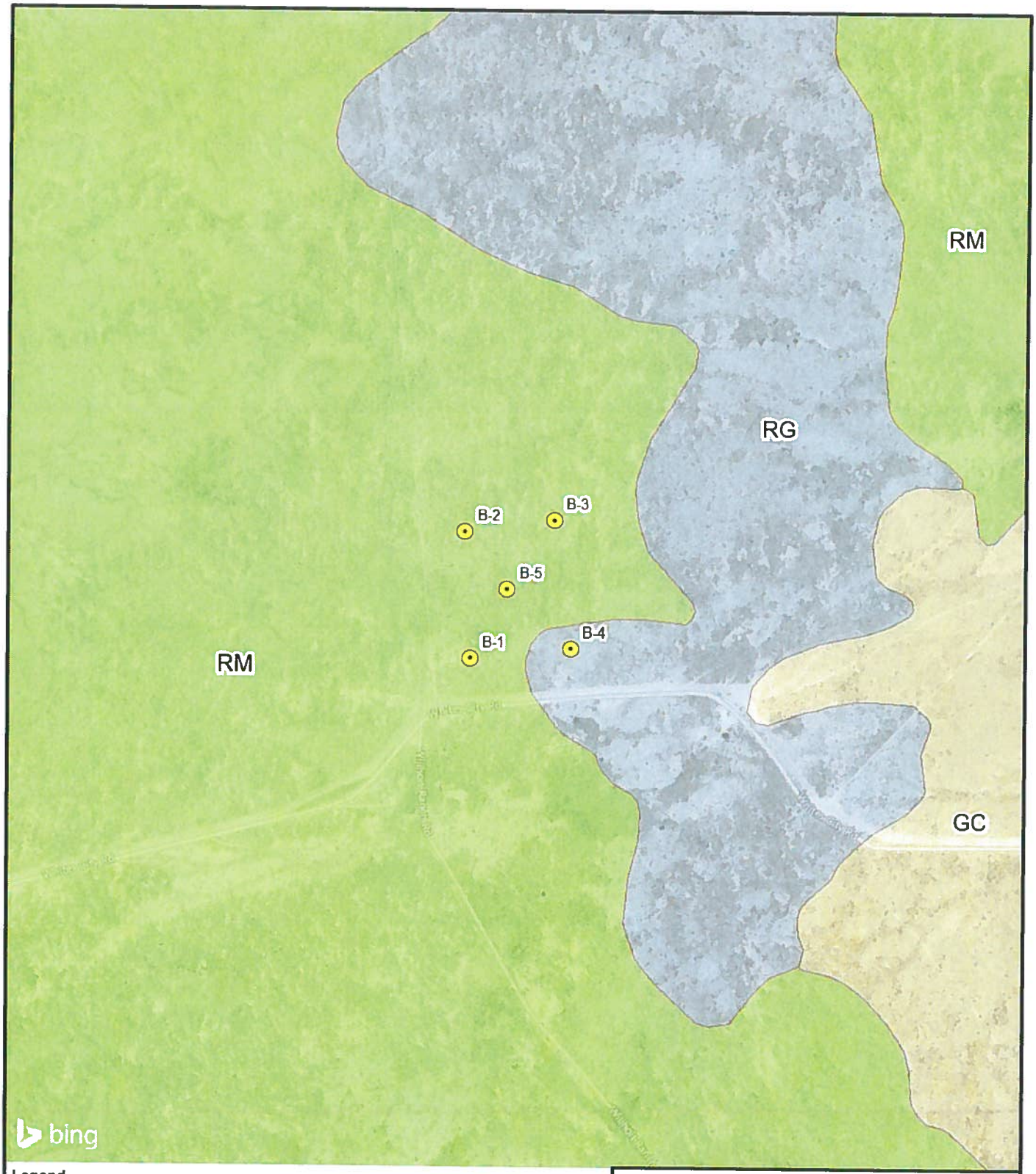

Legend

Boring Location

Soil Type

GC - Gypsum land-Cottonwood complex, 0 to 3 percent slopes

RG - Reeves-Gypsum land complex, 0 to 3 percent slopes

RM - Reeves-Reagan loams, 0 to 3 percent slopes

SOURCE: MODIFIED FROM USDA, NRCS SOIL SURVEY GEOGRAPHIC DATABASE FOR EDDY AREA, NEW MEXICO, 2016, AND BING MAPS HYBRID IMAGERY, 2011.

N W E S

0 400 800

Feet

CHEVRON
HAYHURST
SEC. 2 FRAC POND
EDDY COUNTY, NEW MEXICO

FIGURE 4
NRCS SOIL TYPES

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2.0 SITE CONDITIONS

The site for the proposed hydraulic fracturing pond is identified as the Hayhurst Section 2 site. It is located adjacent to unpaved roads, 12½ miles southwest of Malaga, New Mexico in Eddy County at the intersection of County Road 775 and Whites City Road. GPS coordinates recorded at the site are 32.067930N and 104.167640W.

The site was wooded with mesquite trees and wild shrubs; clearing with a bulldozer was necessary to access the boring locations at the central and north ends of the site. The site appeared to be relatively flat. Surface utilities, fences, and access roads (on the site) were not observed to be present at the time of drilling, however two underground pipeline right-of-ways were observed at the west and south ends of the site adjacent to the south and west lease roads. In addition, an abandoned underground pipeline running from the southwest to northeast direction was noted. Care was taken to ensure the borings were not located near these underground lines. Drainage streams, swales, playa, or other potential issues were not observed. The existing ground surface appeared to be loose but it adequately supported the drilling rig during drilling. The immediate surrounding property was undeveloped.

3.0 PROPOSED DEVELOPMENT

Based on the information provided by Chevron via electronic mail, the proposed development will consist of two hydraulic fracturing ponds, constructed adjacent to each other, in accordance with the standards outlined in the Chevron Mid-Continent Business Unit General Standards for Brackish and Produced Water Containment Structures (MCBU General Standards) and New Mexico Oil Conservation Division (NMOCD), to service well drilling operations. Each pond will have an operational storage capacity of approximately 350,000 bbl and will be partially below ground. We understand Chevron prefers to balance cut and fill volumes using onsite soil for fill to construct the earthen berms. The ponds will be double lined and equipped with a leak detection system. The bottom of the ponds will be sloped to drain to an installed liquid leak detection sump.

4.0 GEOLOGIC CONDITIONS

Geologic mapping by the U.S. Geological Survey (USGS, 2005 and 2014) indicates the Rustler Formation is the foundation bedrock at the site (Figure 3). This sedimentary rock is primarily composed of carbonate from the Permian Period with evaporites also present. The contact with sediments of the underlying Permian Salado Formation is mapped about one mile west of the subject site.

Mapping by the Natural Resources Conservation Service (NRCS, 2017) identifies the site soils as the Reeves-Gypsum and Reeves-Reagan mapping units (Figure 4). These soils are both described as loam or clay loam derived as residuum weathered from gypsum.

The bedrock and soils described above can often be prone to karst formation and dissolution leaving voids, especially in the presence of groundwater. The size, orientation, extent and such voids is difficult to predict using conventional exploratory geotechnical drilling. Geophysical methods often provide a more effective means to identify potential karst features which can then be verified or ruled out using exploratory drilling.

Our findings of the geotechnical study are consistent with this characterization within the depths explored. No voids in the subsurface were encountered in our borings.

5.0 EXPLORATORY SOIL BORINGS

Tetra Tech drilled five (5) exploratory soil borings (B-1 through B-5) to identify subsurface conditions at the site between May 16 and 18, 2017. The boring locations were selected by a representative from Tetra Tech using a satellite image provided by Chevron. The proposed pond footprint was overlaid on the satellite image and GPS coordinates were obtained for each boring location. The boring locations were marked in the field by Tetra Tech using these GPS coordinates and a commercially available hand held GPS unit. The boring locations were cleared for drilling by comparing the proposed locations to buried utility locations marked by New Mexico 811 utility locating services. In addition, Chevron subcontractors cleared the boring locations using hand-held pipeline locating instruments.

The borings were drilled by Enviro-Drill Company from Albuquerque, New Mexico using a truck mounted CME 75 drilling rig. After the necessary vegetation clearing, the ground surface was stable for the drilling rig to access the boring locations and no access issues were noted. Tetra Tech's representative was on site to observe site conditions and the drilling.

Hollow stem auger (HSA) drilling equipment was used to complete the borings. Borings B-1 and B-4 were drilled to a depth of approximately 40 feet below the existing ground surface (bgs) and borings B-2 and B-3 were drilled to a depth of approximately 45 feet bgs. Boring B-5 was drilled to an approximate depth of 73 feet bgs to investigate the presence or absence of groundwater. All borings were left open for a period of approximately 24 to 48 hours to let groundwater levels stabilize. Final water level measurements were taken in each boring after 24 or 48 hours (as applicable) and groundwater was sampled in B-5 and delivered to a commercial laboratory for purposes of analyzing for TPH, Chlorides and RCRA metals, as requested by Chevron.

Soil samples were collected using a split-spoon sampler in borings B-1 through B-4 at 5-foot intervals. In boring B-5 samples were collected at 5-foot intervals to a depth of 30 feet bgs, then the spacing interval was increased to 10-feet. Standard Penetration Tests (SPT) were performed during sampling in accordance with ASTM D 1586 where a 140-pound automatic hammer is repeatedly dropped from a height of 30 inches. The number of blows for each 6-inch increment was recorded on the logs to categorize the consistency of the soil. After drilling and sampling activities were complete the borings were backfilled with soil cuttings. The soil boring logs are presented in Appendix A, and approximate locations of the borings are shown on Figure 4.

6.0 SUBSURFACE CONDITIONS

The information from the borings indicate the subsurface conditions were relatively consistent within the area where the borings were drilled. Beneath minimal vegetation and topsoil, all five (5) borings encountered 3½ to 8½ feet of unconsolidated soil over naturally cemented soil. The cemented soil extended to the maximum depth drilled of 40 feet in boreholes B-2 and B-3 (located on the north side of the proposed site). Relatively less cemented soil was encountered starting at depths of 23.5, 28, and 33 feet, and continued to depths of 38.5, 40, and 60 feet in B-1, B-4, and B-5 (located in the southern and central portions of the site) respectively. The poorly cemented layer continued to the maximum depth drilled of 45 feet in B-1. Strongly cemented soil was encountered in B-4 and B-5 to the maximum depths drilled of 45 and 73 feet respectively. Free water appears to coincide with the relatively less cemented layers in B-1, B-4, and B-5 as described below.

A moisture content of 23.5% was measured on a sample recovered from B-4 at 3.5 feet that had a fines content (percent silt and clay sized particles) of 54.8% by mass. Standard Penetration Test (SPT) N-values in this stratum ranged from 25 bpf in B-4 at 3.5 feet to 62 blows per foot (bpf) in B-1 at 3.5 feet and 50 blows for 3 inches in B-5 at 3.5 feet. Cemented layers had in-situ moisture contents at ranged from 9.8 to 20.4% for 19 samples tested at depths of up to 45 feet. Deeper samples from B-5 at 48.5 and 58.5 feet had moisture contents of 33.1 and 28.8% respectively. In-situ dry densities ranged from 82.3 to 122.6 pounds per cubic foot (pcf). Eleven of the 22 cemented soils samples had a fines content less than 50% and were therefore classified as sand soils in accordance the Unified Soil Classification System (USCS). No consistent layering was observed among the cemented soils in relation to the fines content. Atterberg limits testing of the cemented soils indicated a liquid limit ranging from 33 to 83 and plasticity index ranging from 6 to 61. The sample from B-5 at 48.5 feet was anomalous with a much higher liquid limit of 83 and plasticity index of 61 than the rest of the cemented soils where the liquid limit ranged from 33 to 42 and the plasticity index ranged from 6 to 15. Based on these index properties three of the samples were classified as silty sand (SM) and three were classified as clayey sand (SC). The fines content of the cemented soils with 50% or more fines ranged from 50 to 92%. Atterberg limits testing of these samples indicated a liquid limit ranging from 29 to 62 and plasticity index ranging from 12 to 37. Five of the fine grained cemented soil samples were classified as low plasticity clay (CL) and two were classified as high plasticity clay (CH). N-values within this stratum ranged from 13 bpf to greater than 100 bpf with the lower N-values corresponding to clayey samples or zones where free water was prevalent.

Free water was encountered in three of the five borings at the time of drilling. Water was not encountered in borings B-2 and B-3 (both located on the northern side of the site). Depths to water at the time of drilling were 31, 28 and 31 feet in borings B-1, B-4, and B-5, respectively. Water levels rose to depths of 26, 26, and 29 feet when checked prior to backfilling the boreholes one to two days following the initial drilling. Our observations are only indicative of conditions at the time and boring locations indicated. Water levels can vary due to many factors, including seasonal changes, site topography, surface runoff, post development conditions, the layering and permeability of subsurface strata, water levels in waterways, utilities, and other factors that may not have been evident at the time this study. Long-term observations would be necessary to more accurately evaluate the groundwater behavior and fluctuations.

7.0 ENGINEERING ANALYSES AND RECOMMENDATIONS

7.1 Primary Geotechnical Considerations

The two primary concerns that could impact the proposed development are the presence of strongly cemented soil within the proposed depths of excavation and the possibility of voids due to karst/evaporite subsurface conditions.

Excavation of strongly cemented soil will be difficult for construction due to the high energy required to excavate and eventually pulverize the cemented soil into fragments small enough to use as fill as described below.

While no voids due to karst/evaporite soil and bedrock were encountered during our borehole exploration, they could exist beneath the construction site and could become evident as a result of additional loading or changes to groundwater conditions as a result of construction or through natural progression. Settlement of pond floors or sidewalls due to undetected voids could cause distress or failure of liner systems and discharge of the pond contents to the subgrade. We recommend a geophysical exploration program be considered to search for voids that may not have been identified by the exploratory drilling. Such a program was beyond the scope of the current investigation; however should Chevron decide to undertake a geophysical investigation, Tetra Tech is available to assist.

7.2 Site Preparation

To prepare the site for pond construction, an area larger than the proposed footprint by at least 10 feet in plan dimension on all sides should be stripped of vegetation, roots, organic material, existing construction materials, debris, and other unsuitable materials. A typical stripping depth is approximately 6 inches; however, the actual depth will vary and should be based on field conditions and observations. After stripping, we anticipate a moderately stable surface for support of construction equipment. Unsuitable areas (such as those with loose, wet, soft, yielding, and/or pumping subgrade) should be corrected before construction proceeds.

Obstructions that could hinder preparation of the site should also be removed, with special attention given to unknown or un-documented below ground appurtenances and any existing above and below ground flow lines. Care should be taken not to damage any existing buried utilities located within the footprint of the proposed construction. Any resulting utility trenches/excavations due to replacement or relocation of utilities should be backfilled as discussed in the Fill Placement and Compaction section of this report.

7.3 Excavation and Embankment Slopes

Based on the subsurface data, sandy soil is present to depths of 3½ to 8½ feet below the existing grade and then cemented soils were encountered. Conventional construction equipment can be used to excavate the soil, however excavation into the cemented soils will be more difficult and additional effort to excavate may be necessary. Heavy duty rock ripping equipment like a ripper mounted on a Caterpillar D8 bulldozer or equivalent may be necessary.

The earthwork contractor should review the subsurface conditions and appropriately select excavation equipment and initial slope of the excavation to minimize potential sloughing and to remain in compliance with OSHA Regulations 1926.651 and 1926.652 on excavation safety. Wetting of the exposed excavation sides to a moisture content near or slightly above optimum may be necessary to stabilize and maintain the slopes during construction.

During construction the excavation slopes should be inspected and kept under observation for safety purposes. Excavation slopes specified by OSHA are dependent on types of soil and groundwater conditions encountered. Based on our investigation the on-site soil is classified as Type C and the cemented soil can be considered to be Type B according to OSHA 1926, Subpart P, Appendix A. The contractor's "competent person" should identify the soils encountered in the excavation and refer to OSHA 1926.651 and 1926.652 to verify the conditions and classifications from our investigation and determine appropriate slopes. If deemed unstable, the excavation sides should be flattened or benched to remain in compliance. Stockpiles of soils and equipment should not be placed within a horizontal distance equal to one-half the excavation depth, from the edge of excavation. Excavations deeper than 20 feet should be designed by a Professional Engineer as recommended by OSHA.

Embankment slopes must be constructed slopes flat enough to prevent slope failures. For soil and embankment fill design parameters, an angle of internal friction of 30 degrees with no cohesion is recommended in lieu of design parameters based on shear strength testing. A compacted/improved subgrade soil unit weight of 120 pcf is appropriate. The pond will be lined and we have assumed the liner system will function to prevent development of a phreatic surface within the embankment. We understand that side slopes will be designed at 3 horizontal to 1 vertical (3H:1V), which is consistent with the New Mexico Administrate Code (NMAC) requirements for design of "pits" (or ponds) associated with oil and gas exploration and production operations and not considered temporary, which states that the maximum allowed pond embankment slope is 3H:1V for exterior slopes and 2H:1V for interior slopes. Although steeper slopes may be shown to be stable and acceptable per regulations, we recommend 3H:1V based on consideration of potential constructability issues, liner stability, seepage, and slope stability. We understand the MCBU General Standards have similar slope requirements. If Chevron would like to consider construction of slopes steeper than the 3H:1V recommended above Tetra Tech is available to conduct slope stability analysis to evaluate the feasibility of steeper slopes and liner system performance on those slopes. This analysis would be supported by slope stability modeling and hand calculations to present to the NMOCD in a variance request.

7.4 Fill Placement and Compaction

On-site soils free of rocks greater than 1-inch in diameter, organics, and debris are suitable for use as structural fill or backfill. The cemented soils will likely require additional processing beyond ripping to achieve a soil consistency and meet the maximum particle size dimension in the construction specifications. Fill and backfill should not be placed on organics or other deleterious materials such as soil or rock with soluble components such as gypsum. If additional fill is needed for construction of the embankment, imported fill should be a well-graded clayey sand (SC) or low plasticity clay (CL), or imported soils with engineering properties that are similar to on-site soils (depending on the intended use of the fill). For structural support, a uniform, granular material having 100% passing the 1-inch sieve, 30% to 70% passing the No. 4 sieve, and 3% to 15% passing the number 200 sieve is recommended. Prior to importation, samples of soils being considered as fill should be examined and evaluated by a geotechnical engineer for engineering properties to determine suitability of the material for its intended use.

The bases of fills in soil should be scarified at least 8 inches deep, moisture-conditioned or dried to within 2% of optimum moisture content, processed to a uniform condition, and then compacted to at least 95 percent of maximum dry density determined by standard Proctor (ASTM D698). For on-site and imported fill and backfill, moisture should be adjusted to within minus 1 to 3 percent above optimum moisture content as determined by standard Proctor and the soils thoroughly mixed prior to placement and compaction to provide uniform water content throughout the fill. Fill and backfill should be placed in uniform lifts of 8 inches or less in loose thickness and compacted to at least 95% of standard Proctor maximum dry density (ASTM D 698). Fill should be compacted using heavy vibratory equipment. In areas with limited space for heavy equipment, appropriate compaction equipment, such as a jumping jack or other hand tools should be used. Where smaller compacting equipment or hand tools are used, the fill lifts should be 6 inches or less in loose thickness. The contractor should select the equipment type based upon the fill soil conditions.

Placement and compaction of fill should be observed and tested by a qualified geotechnical engineer or their qualified representative during construction. Each vertical foot of compacted fill placed should be tested for compaction comparison to standard Proctor results. A minimum of one moisture/density verification test should be performed for every 5,000-square-feet of compacted area, or for every 150-lineal feet of utility trench backfill. For smaller areas, a minimum of three (3) verification tests should be conducted for every lift. Subsequent lifts should not be placed until the exposed lift has been tested to confirm compliance with the specified moisture and density. Lifts failing to meet the moisture and density requirements should be reworked to meet the required specifications prior to subsequent lifts being placed. Density and moisture verification testing is recommended to provide an indication that adequate earthwork is being performed. However, the quality of the fill and compaction is the sole responsibility of the contractor. Satisfactory verification testing is not a guarantee of the quality of the contractor's earthwork operations.

The specified moisture content must be maintained until compaction of the overlying lift, or until the cushioning sand layer or geotextile fabric and geomembrane liner are installed. Failure to maintain the specified moisture content could result in excessive soil movement resulting in embankment failure. The contractor must provide some means of controlling the moisture content (such as water hoses, water trucks, etc.). Maintaining subgrade moisture is always critical, but will require the most effort during warm, windy and/or sunny conditions.

7.5 Proof Rolling

Proof rolling of the subgrade prior to fill placement and liner installation should be used to detect areas of soft and/or pumping soil. Proof rolling should be conducted using a heavy, rubber-tired vehicle weighing at least 25 tons, with the tires inflated to the manufacturer's specified operating pressure. The entire area should be proof rolled, with each succeeding pass offset by not greater than one tire width. The geotechnical engineer or an experienced soils technician should be present during proof rolling activities to assist with the identification of unsuitable soil. Unsuitable soil should be undercut and reworked, or otherwise improved in a manner that is suitable to the design and approved by the geotechnical engineer.

7.6 Geomembrane Liner Protection

Where the exposed surface is rough, rock protrusions and sharp edges can potentially damage the geomembrane liner. Additionally an irregular foundation with voids can create localized stress points on the geomembrane liner. The subsurface conditions at this site indicate sandy soils to a depth of 3½ to 8½ feet deep which should suffice for geomembrane liner foundation, however, the pond bottom will likely be in the underlying cemented soil with rock-like protrusions and surface irregularities. If the protrusions are greater than $^1/_4$-inch or if voids greater than 2 inches deep will exist below the liner, a cushion, such as a fine grained sand layer, approximately 6 inches thick or a properly designed cushion geotextile should be used to reduce the risk of damage to the liner. Liner requirements must meet those presented in the New Mexico Administrative Code (NMAC).

7.8 Freeboard

An important aspect of embankment stability and performance is maintaining the appropriate freeboard (the vertical distance from the water surface to the crest of the embankment). If the freeboard is insufficient, the embankment could overtop, leading to excessive erosion and possible failure. The NMAC requirements for operation of "pits" (or ponds) associated with oil and gas exploration and production and MCBU General Standards require a minimum freeboard of three feet which must be maintained at all times.

7.9 Settlement of Subgrade and Embankment Materials

Settlement of embankment material is another important aspect of embankment stability and total fluid storage potential over time. It is anticipated that the embankments will be constructed of fill consisting of on-site material or imported fill. The on-site sandy soils have a relatively low potential for post-construction settlement. Construction recommendations from above for subgrade proof rolling, subgrade improvements, and fill placement will reduce the amount of settlement. Due to the sandy nature of the soils, most of the anticipated or potential settlement within the embankments and under the embankments should occur during construction.

7.10 Permitting

If applicable, a permit application should be filed with the NMOCD in accordance with NMAC regulations prior to construction. Construction and installation in accordance with NMOCD regulations found in the NMAC and the design drawings and construction specifications is recommended. The NMOCD may require notification prior to construction and prior to operation of the pond.

8.0 CONCLUSIONS

The Tetra Tech investigation identified two potential issues that should be addressed prior to development of the proposed hydraulic fracturing ponds at the Hayhurst Section 2 site. The first is that water in the boreholes stabilized at depths of 26, 26, and 29 feet in borings 1, 4, and 5, respectively (when measured one to two days following the initial drilling). New Mexico Oil Conservation Division rules in the NMAC have specific siting requirements for "pits" (ponds), associated with oil and gas exploration and production, which are within specified proximities to groundwater. A hydrogeological study to meet the requirements of the NMAC should be performed to determine whether the water encountered is a perched layer or a continuous water bearing feature.

Another potential issue is based on review of mapped geology at the site which indicated a bedrock formation that is susceptible to formation of voids, especially in the presence of groundwater, where dissolution of the carbonate and evaporite minerals can occur. Voids can be exacerbated by loading or changes in hydrology that could occur as a result of the pond construction. Collapse of soils overlying such voids could damage the ponds or liner system and result in release of stored fluids to the environment.

Geophysical methods can be an effective means to identify potential voids that may exist at depth but are not readily identifiable by exploratory drilling. If geophysical methods suggest that voids may exist, additional exploratory drilling might be needed to confirm the presence of voids.

Tetra Tech can assist Chevron with further analyses of the Hayhurst Section 2 site should it be of interest. We can prepare a scope of work and cost estimate for Chevron review prior to authorization of these tasks.

Following further understanding of the groundwater and presence of subsurface voids, the proposed hydraulic fracturing ponds can be constructed in accordance with MCBU General Standards and NMOCD regulations, as described herein. Construction should be conducted in accordance with MCBU General Standards, NMOCD regulations, the engineering drawings and specifications prepared by Tetra Tech, and this report.

9.0 REFERENCES

Chevron Mid-Continent Business Unit MCBU General Standards for Brackish and Produced Water Containment Structures, DRAFT version (MCBU General Standards)

U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS, 2017). Web Soil Survey. http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx. Accessed July 10, 2017.

United States Geological Survey (USGS, 2005). Preliminary Integrated Geologic Map for the United States Central States. Open-File Report 2005-1351

United States Geological Survey (USGS, 2014). Karst in the United States: A Digital Map Compilation and Database. Open-File Report 2014-1156. Weary, D.J., and Doctor, D.H.

10.0 LIMITATIONS

This report was prepared from data developed during our field exploration, laboratory testing, and engineering judgment. Our design recommendations were based on subsurface data and our experience with similar projects and subsurface conditions. Our borings were located to obtain a reasonable interpretation of subsurface conditions. It should be noted that the borings were widely spaced and variation in the subsoils between borings is likely.

A qualified, experienced geotechnical engineer or their designated representative should observe the construction to look for evidence that would indicate differences in subsurface conditions from those described in this report. If any information becomes available that would alter our assumptions, conclusions or recommendations, the opinions presented in this report should be considered invalid until we have been contacted to review our recommendations based on the new information. The geotechnical engineer should review plans and specifications during the design. Placement and compaction of engineered fill, backfill, subgrade and other fills should be observed and tested by a representative of a Construction Materials Testing (CMT) firm during construction, and Tetra Tech should be retained to review these data.

We believe this study was conducted in a manner consistent with that level of skill and care ordinarily used by members of the profession currently practicing under similar conditions in the locality of this project. No warranty, express or implied, is made. If we can be of further service in discussing the contents of this report or in the analysis of the planned project from the geotechnical point of view, please contact us.

APPENDIX A

EXPLORATORY BORING LOGS

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-1

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/16/2017
GROUND ELEVATION: NA
METHOD: HSA
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.067930 N
LOGGED BY: Clint Merritt and Raj Meruva
DRILLING CONTRACTOR: Enviro Drill
LONGITUDE: 104.167640 W
DRILLED BY: Juan Uribe
Notes: Not Recorded

DEPTH (ft)	SAMPLE TYPE	N Value	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
3.5						
5	SS	62				Very Dense, Pink, Fine Grained **SAND**
8.5						
10	SS	50/5"	MC = 19.8% Fines = 36.1%			Very Dense, Pink, Weakly Cemented Fine Grained **SAND**, with < 20% Fine Gravel, Calcareous, Moist
15	SS	50/4"				
20	SS	50/1"				
23.5						
25	SS	50/3"	MC = 13.2% DD = 106.1 pcf LL = 37 Fines = 49.5%	SM		Very Dense to Medium Dense, Dark Brown, Moderately Cemented Fine Silty and Clayey **SAND**, Increasing Plasticity with Depth, Moist to Wet
30	SS	13				▼ Water depth 48 hours after drilling ▼ Water depth at the end of drilling
35	SS	15	MC = 18.8% DD = 102.3 pcf LL = 33 Fines = 47.4%	SC		▽ Water depth during drilling
40	SS	13				

BOREHOLE/TP/WELL - VECTOR HAYHURST.GPJ LAB SUMMARY.GDT 7/13/17

(Continued Next Page)

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-1

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	N Value	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
45	SS	46	MC = 17.7% DD = 122.6 pcf LL = 29 Fines = 57.7%	CL		Stiff to Very Stiff, Dark Brown, Low Plasticity **CLAY** with Sand, Moist
						45.0
						Borehole terminated at 45.0

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-2

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/18/2017
GROUND ELEVATION: NA
METHOD: HSA
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.069966 N
LOGGED BY: Clint Merritt and Raj Meruva
DRILLING CONTRACTOR: Enviro Drill
LONGITUDE: 104.167700 W
DRILLED BY: Juan Uribe
Notes: Not Recorded

DEPTH (ft)	SAMPLE TYPE	N Value	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
5	SS	50/5"	MC = 14.1% Fines = 41.9%			3.5 Very Dense, Pink, Strongly Cemented Medium Grained **SAND**, with <50% Quartz Fragments, Moist
10	SS	50/2"				5.0 Hard, Red, **SILT TO CLAY** Fines and Plasticity Increasing with Depth, with Sand, with <50% Quartz Fragments, Calcareous, Moist
15	SS	50/3"	MC = 15.6% DD = 96.0 pcf LL = 44 Fines = 50.3%	ML		
20	SS	50/4"				
25	SS	50/3"				
30	SS	50/4"	MC = 20.4% DD = 93.1 pcf LL = 53 Fines = 59.2%	CH		30.0 Very Dense, Pink, Strongly Cemented Medium Grained **SILTY SAND**, with >50% Quartz Fragments, Calcareous, Moist
35	SS	50/2"				
40	SS	50/4"	MC = 19.5% LL = 42 Fines = 38.8%	SM		40.0 Borehole terminated at 40.0

BOREHOLE/TP/WELL - VECTOR HAYHURST GPJ LAB SUMMARY GDT 7/13/17

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-3

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/18/2017
GROUND ELEVATION: NA
METHOD: HSA
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.070140 N
LOGGED BY: Clint Merritt and Raj Meruva
DRILLING CONTRACTOR: Enviro Drill
LONGITUDE: 104.165980 W
DRILLED BY: Juan Uribe
Notes: Not Recorded

DEPTH (ft)	SAMPLE TYPE	N Value	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0					Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
3.5					
5	SS	50/5"	MC = 13.8% Fines = 52.9%		Very Dense, Pale Red, Weakly Cemented Medium Grained Sandy Silty **CLAY** with <10% Small Angular Limestone Fragments, Moist
10	SS	50/5"			
13.0					
15	SS	50/3"			Hard, Yellowish Brown, Strongly Cemented **SILTY CLAY**, with < 20% Small Angular Limestone Fragments, Slight odor, Calcareous, Slightly Moist
20	SS	50/4"	MC = 9.8% Fines = 85.6%		
25					
30					
35					
40					
40.0					Borehole terminated at 40.0

TETRA TECH
Tetra Tech Inc.
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Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-4

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/17/2017
GROUND ELEVATION: NA
METHOD: HSA
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.068070 N
LOGGED BY: Clint Merritt and Raj Meruva
DRILLING CONTRACTOR: Enviro Drill
LONGITUDE: 104.165660 W
DRILLED BY: Juan Uribe
Notes: Not Recorded

DEPTH (ft)	SAMPLE TYPE	N Value	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
3.5						
5	SS	25	MC = 23.5% Fines = 54.8%			Medium Dense, Pink, Weakly Cemented Medium Grained **SILT**, Calcareous, Moist
8.5						
10	SS	50/2"				Hard, Red, Strongly Cemented Low Plasticity **CLAY**, with Sand, Calcareous, Moist
15	SS	50/2"	MC = 16.5% DD = 96.1 pcf LL = 37 Fines = 61.9%	CL		
20	SS	50/2"				
20.0						
25	SS	50/4"	MC = 10.0% Fines = 43.2%			Very Dense, Red, Moderately Cemented Medium Grained Silty Clayey **SAND**, with < 20% Gypsum Fragments, Moist to Wet
						▽ Water depth 48 hours after drilling
28.0						▽ Water depth during drilling
30	SS	20				Very Stiff to Hard, Red, Low Plasticity **CLAY**, with Sand, Moist
35	SS	26	MC = 15.5% DD = 113.9 pcf LL = 29 Fines = 92.1%	CL		
40	SS	35				Freestanding water

BOREHOLE/TPWELL - VECTOR HAYHURST.GPJ LAB SUMMARY.GDT 7/13/17

(Continued Next Page)

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-4

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	N Value	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
						Very Stiff to Hard, Red, Low Plasticity **CLAY**, with Sand, Moist *(continued)*
45	SS	*50/1"*	MC = 15.1% LL = 30 Fines = 88.6%	CL		45.0
						Borehole terminated at 45.0

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-5

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/17/2017
GROUND ELEVATION: NA
METHOD: HSA
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.069030 N
LOGGED BY: Clint Merritt and Raj Meruva
DRILLING CONTRACTOR: Enviro Drill
LONGITUDE: 104.166890 W
DRILLED BY: Juan Uribe
Notes: Not Recorded

DEPTH (ft)	SAMPLE TYPE	N Value	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
3.5						
5	SS	50/3"	MC = 17.0% Fines = 19.3%			Very Dense, Pink, Strongly Cemented Medium Grained **SAND**, Calcareous, Moist
8.5						
10	SS	50/4"	MC = 15.8% DD = 99.8 pcf LL = 42 Fines = 44.4%	SM		Very Dense, Pale Red, Strongly Cemented Medium Grained, Silty to Clayey **SAND** with > 40% Gypsum/Quartz Fragments, Calcareous, Moist
15	SS	50/4"				
20	SS	50/5"	MC = 15.9% DD = 114.2 pcf LL = 46 Fines = 49.7%	SC		
25	SS	50/4"	MC = 16.5% Fines = 25.9%			
25.0						
30	SS	50/3"	MC = 20.3% DD = 96.6 pcf LL = 62 Fines = 51.5%	CH		Hard, Pink, High Plasticity **CLAY** with Sand, Calcareous, Wet Water depth 22.5 hours after drilling Water depth during drilling
33.0						
35	SS	49				Very Dense to Medium Dense, Reddish Brown, Moderately Cemented Medium Grained **CLAYEY SAND** with > 30% Quartz Fragments, with Lenses of Clay, High Plasticity, Slightly Wet
40	SS	49				

BOREHOLE/TP/WELL - VECTOR HAYHURST.GPJ LAB SUMMARY.GDT 7/13/17

(Continued Next Page)

TETRA TECH
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Telephone: 432-682-4559
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BOREHOLE ID: B-5

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	N Value	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
45						Very Dense to Medium Dense, Reddish Brown, Moderately Cemented Medium Grained **CLAYEY SAND** with > 30% Quartz Fragments, with Lenses of Clay, High Plasticity, Slightly Wet *(continued)*
50	SS	25	MC = 33.1% DD = 82.3 pcf LL = 83 Fines = 39.2%	SC		
55						
60	SS	50/3"	MC = 28.8% LL = 45 Fines = 56.3%	CL		60.0
65						Very Dense, Reddish brown, Clayey, Strongly Cemented Medium Grained **SAND**, with > 40% Quartz, Wet and Muddy
70	SS	50/1"				73.0
						Borehole terminated at 73.0

TETRA TECH

September 7, 2017

Mr. Ruben Kopara
Chevron North America Exploration and Production Company
6301 Deauville Blvd,
Midland, Texas 79706

Subject: **Addendum to Geotechnical Investigation Report**
Hayhurst Section 2 Hydraulic
Fracturing Ponds
Eddy County, New Mexico

Dear Mr. Kopara:

On August 2, 2017, Tetra Tech published a report of our geotechnical study for the referenced site where Chevron intends to construct two earthen impoundments with capacities of approximately 350,000 bbl each to service well drilling operations. Subsequent to that investigation and report, Chevron moved the location of the proposed pits to an adjacent area immediately north of the previous site. On August 17 and 18, 2017, Tetra Tech returned to the site and drilled three additional borings in the new area to investigate subsurface conditions. The locations of the borings are shown on the attached Figure 1. Previous borings are labeled B-1 through B-5; the more recent borings are labeled B-6 through B-8.

Borings B-6 through B-8 encountered 21 to 30 feet of medium dense to dense sand over hard clay with cemented lenses. Standard Penetration Tests (SPT) in the sand had values or blow counts (N) ranging from 23 blows per foot to 50 blows for 2 inches; blow counts in the clay ranged from 9 blows per foot (in B-8 at the contact with the overlying sand) to 50 blows for 2 inches. In general, the density of the soils increases with depth based on the SPT values. Free water was not encountered in the borings.

The additional borings indicate that the subsurface conditions on the northern part of the site are consistent with those encountered to the south. The soils to the south have a higher silt and clay content, but blow counts are similar. The borings to the north have a lesser degree of cementation at shallow depth, which may simplify earthwork. No voids or carbonate rocks or deposits were encountered.

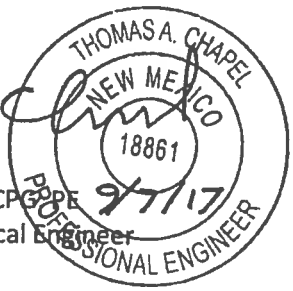
Recommendations made in our geotechnical report for the original site remain valid for the revised pit location. Our report: *Hayhurst, Section 2 Hydraulic Fracturing Ponds, Eddy County New Mexico*, dated August 2, 2017, should be carefully reviewed in its entirety during design and construction of the pits at the proposed revised location. In particular, we reiterate that although evidence of voids or karst terrain were not encountered, the site is located in a karst-prone geologic area and voids that were not observed in our widely spaced borings could exist under portions of the site. We recommend Chevron consider geophysical investigation to more conclusively determine if voids could exist below portions of the site.

Tetra Tech
3801 Automation Way, Suite 100, Fort Collins, CO 80525
Tel 970.223.9600 Fax 970.223.7171 www. tetratech.com

Please contact the undersigned with any questions or comments you may have regarding this addendum letter or our recommendations for these sites.

Sincerely,

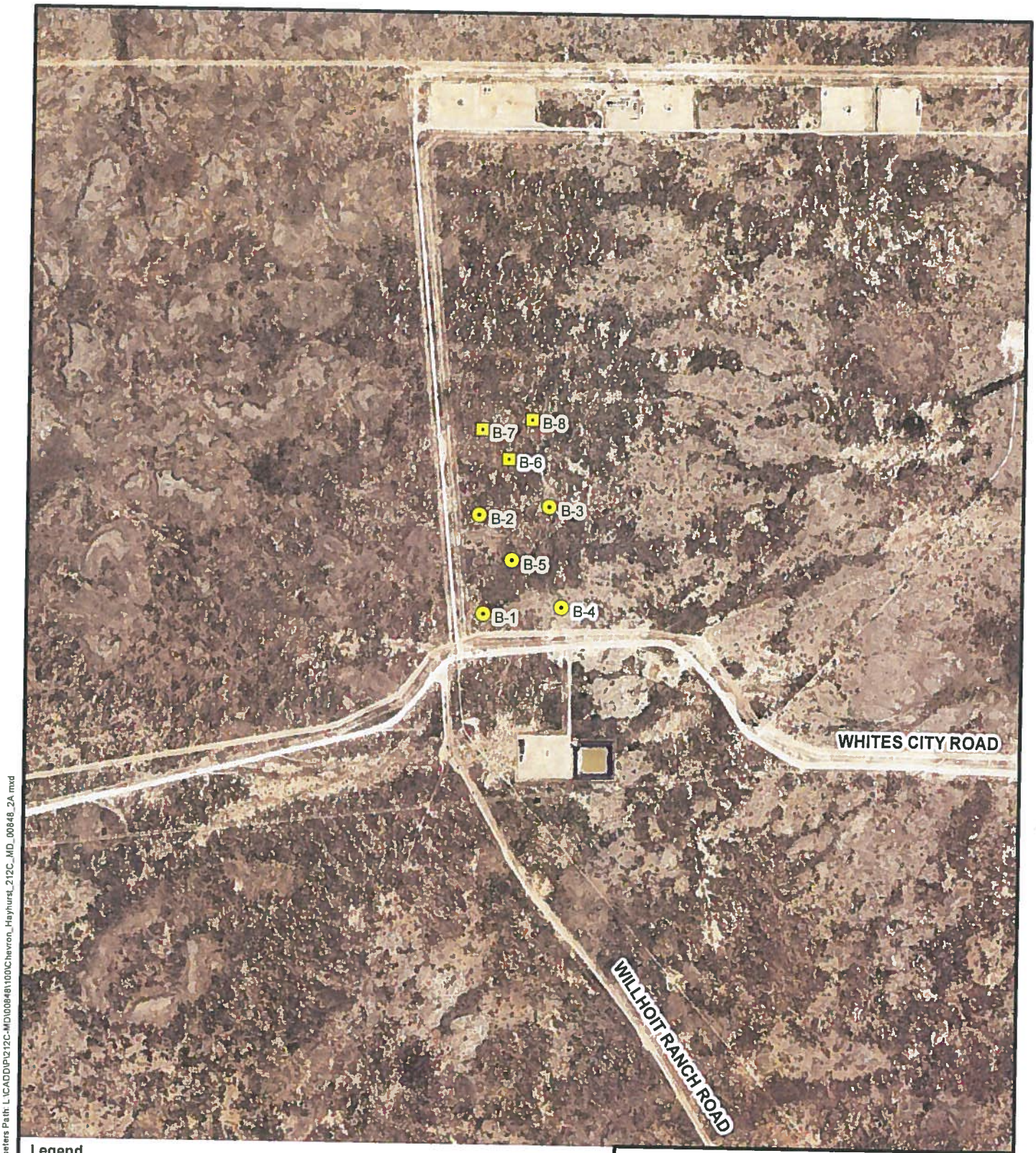
TETRA TECH, INC.



Thomas A. Chapel, CPG, PE
Principal Geotechnical Engineer

Reviewed by

Don Grahlherr, PE
Vice President



Legend

- Boring Location
- Additional Boring Location

N
W E
S

0 500 1,000
Feet

SOURCE: MODIFIED FROM USDA NAIP IMAGERY, 2016

CHEVRON
HAYHURST
SEC. 2 FRAC POND
EDDY COUNTY, NEW MEXICO

FIGURE 1
AERIAL MAP

TETRA TECH

Date Saved: 9/5/2017 5:51:37 PM User: joel.peters Path: L:\CADD\P\212C-MD\00848\100\Chevron_Hayhurst_212C_MD_00848_2A.mxd

ATTACHMENT A

BORING LOGS

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-1

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/16/2017
GROUND ELEVATION: NA
METHOD:
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.067930 N
LOGGED BY: Clint Merritt and Raj Meruva
DRILLING CONTRACTOR: Enviro Drill
LONGITUDE: 104.167640 W
DRILLED BY: Juan Uribe
Notes: Not Recorded

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
5	SS	62				3.5 Very Dense, Pink, Fine Grained **SAND**
10	SS	50/5"	MC = 19.8% Fines = 36.1%			8.5 Very Dense, Pink, Weakly Cemented Fine Grained **SAND**, with < 20% Fine Gravel, Calcareous, Moist
15	SS	50/4"				
20	SS	50/1"				
25	SS	50/3"	MC = 13.2% DD = 106.1 pcf LL = 37 Fines = 49.5%	SM		23.5 Very Dense to Medium Dense, Dark Brown, Moderately Cemented Fine Silty and Clayey **SAND**, Increasing Plasticity with Depth, Moist to Wet
30	SS	13				▼ Water depth 48 hours after drilling ▼ Water depth at the end of drilling
35	SS	15	MC = 18.8% DD = 102.3 pcf LL = 33 Fines = 47.4%	SC		▽ Water depth during drilling
40	SS	13				

BOREHOLE/TP/WELL - TT_HAYHURST.GPJ_LAB SUMMARY.GDT 8/24/17

(Continued Next Page)

TETRA TECH
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Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-1

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
						Very Dense to Medium Dense, Dark Brown, Moderately Cemented Fine Silty and Clayey **SAND**, Increasing Plasticity with Depth, Moist to Wet *(continued)*
45	SS	46	MC = 17.7% DD = 122.6 pcf LL = 29 Fines = 57.7%	CL		Stiff to Very Stiff, Dark Brown, Low Plasticity **CLAY** with Sand, Moist Stiff to Very Stiff, Dark Brown, Low Plasticity **CLAY** with Sand, Moist *(continued)*
						45.0 Borehole terminated at 45.0

TETRA TECH

Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-2

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/18/2017
GROUND ELEVATION: NA
METHOD:
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.069966 N
LOGGED BY: Clint Merritt and Raj Meruva
DRILLING CONTRACTOR: Enviro Drill
LONGITUDE: 104.167700 W
DRILLED BY: Juan Uribe
Notes: Not Recorded

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
3.5						
5	SS	50/5"	MC = 14.1% Fines = 41.9%			Very Dense, Pink, Strongly Cemented Medium Grained **SAND**, with <50% Quartz Fragments, Moist
5.0						Hard, Red, **SILT TO CLAY** Fines and Plasticity Increasing with Depth, with Sand, with <50% Quartz Fragments, Calcareous, Moist
10	SS	50/2"				
15	SS	50/3"	MC = 15.6% DD = 96.0 pcf LL = 44 Fines = 50.3%	ML		
20	SS	50/4"				
25	SS	50/3"				
30	SS	50/4"	MC = 20.4% DD = 93.1 pcf LL = 53 Fines = 59.2%	CH		
30.0						Very Dense, Pink, Strongly Cemented Medium Grained **SILTY SAND**, with >50% Quartz Fragments, Calcareous, Moist
35	SS	50/2"				
40	SS	50/4"	MC = 19.5% LL = 42 Fines = 38.8%	SM		
40.0						Borehole terminated at 40.0

BOREHOLE/TPWELL - TT HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-3

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/18/2017
GROUND ELEVATION: NA
METHOD:
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.070140 N
LOGGED BY: Clint Merritt and Raj Meruva
DRILLING CONTRACTOR: Enviro Drill
LONGITUDE: 104.165980 W
DRILLED BY: Juan Uribe
Notes: Not Recorded

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0					
					Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
					3.5
5	SS	50/5"	MC = 13.8% Fines = 52.9%		Very Dense, Pale Red, Weakly Cemented Medium Grained Sandy Silty **CLAY** with <10% Small Angular Limestone Fragments, Moist
10	SS	50/5"			
					13.0
15	SS	50/3"			Hard, Yellowish Brown, Strongly Cemented **SILTY CLAY**, with < 20% Small Angular Limestone Fragments, Slight odor, Calcareous, Slightly Moist
20	SS	50/4"	MC = 9.8% Fines = 85.6%		
25					
30					
35					
40					
					40.0
					Borehole terminated at 40.0

BOREHOLE/TP/WELL - TT HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-4

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/17/2017
GROUND ELEVATION: NA
METHOD:
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.068070 N
LOGGED BY: Clint Merritt and Raj Meruva
DRILLING CONTRACTOR: Enviro Drill
LONGITUDE: 104.165660 W
DRILLED BY: Juan Uribe
Notes: Not Recorded

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
3.5						
5	SS	25	MC = 23.5% Fines = 54.8%			Medium Dense, Pink, Weakly Cemented Medium Grained **SILT**, Calcareous, Moist
8.5						
10	SS	50/2"				Hard, Red, Strongly Cemented Low Plasticity **CLAY**, with Sand, Calcareous, Moist
15	SS	50/2"	MC = 16.5% DD = 96.1 pcf LL = 37 Fines = 61.9%	CL		
20	SS	50/2"				
20.0						
25	SS	50/4"	MC = 10.0% Fines = 43.2%			Very Dense, Red, Moderately Cemented Medium Grained Silty Clayey **SAND**, with < 20% Gypsum Fragments, Moist to Wet
						▼ Water depth 48 hours after drilling
28.0						▽ Water depth during drilling
30	SS	20				Very Stiff to Hard, Red, Low Plasticity **CLAY**, with Sand, Moist
35	SS	26	MC = 15.5% DD = 113.9 pcf LL = 29 Fines = 92.1%	CL		
40	SS	35				Freestanding water

BOREHOLE/TP/WELL - TT HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

(Continued Next Page)

TETRA TECH
Tetra Tech Inc.
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Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-4

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
						Very Stiff to Hard, Red, Low Plasticity **CLAY**, with Sand, Moist *(continued)*
45	SS	*50/1"*	MC = 15.1% LL = 30 Fines = 88.6%	CL		45.0
						Borehole terminated at 45.0

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-5

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/17/2017
CONSULTANT: Tetra Tech, Inc.
DRILLING CONTRACTOR: Enviro Drill
Notes: Not Recorded

GROUND ELEVATION: NA
LATITUDE: 32.069030 N
LONGITUDE: 104.166890 W

METHOD:
LOGGED BY: Clint Merritt and Raj Meruva
DRILLED BY: Juan Uribe

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
3.5						
5	SS	50/3"	MC = 17.0% Fines = 19.3%			Very Dense, Pink, Strongly Cemented Medium Grained **SAND**, Calcareous, Moist
8.5						
10	SS	50/4"	MC = 15.8% DD = 99.8 pcf LL = 42 Fines = 44.4%	SM		Very Dense, Pale Red, Strongly Cemented Medium Grained, Silty to Clayey **SAND** with > 40% Gypsum/Quartz Fragments, Calcareous, Moist
15	SS	50/4"				
20	SS	50/5"	MC = 15.9% DD = 114.2 pcf LL = 46 Fines = 49.7%	SC		
25	SS	50/4"	MC = 16.5% Fines = 25.9%			
25.0						
30	SS	50/3"	MC = 20.3% DD = 96 6 pcf LL = 62 Fines = 51.5%	CH		Hard, Pink, High Plasticity **CLAY** with Sand, Calcareous, Wet Water depth 22.5 hours after drilling Water depth during drilling
33.0						
35	SS	49				Very Dense to Medium Dense, Reddish Brown, Moderately Cemented Medium Grained **CLAYEY SAND** with > 30% Quartz Fragments, with Lenses of Clay, High Plasticity, Slightly Wet
40	SS	49				

BOREHOLE/TP/WELL - TT_HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

(Continued Next Page)

TETRA TECH
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Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-5

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
45						Very Dense to Medium Dense, Reddish Brown, Moderately Cemented Medium Grained **CLAYEY SAND** with > 30% Quartz Fragments, with Lenses of Clay, High Plasticity, Slightly Wet *(continued)*
50	SS	25	MC = 33.1% DD = 82.3 pcf LL = 83 Fines = 39.2%	SC		
55						
60	SS	50/3"	MC = 28.8% LL = 45 Fines = 56.3%	CL		60.0
65						Very Dense, Reddish brown, Clayey, Strongly Cemented Medium Grained **SAND**, with > 40% Quartz, Wet and Muddy
70	SS	50/1"				73.0
						Borehole terminated at 73.0

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-6

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 08/17/2017
GROUND ELEVATION: NA
METHOD:
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.071130 N
LOGGED BY: Not Recorded
DRILLING CONTRACTOR: Not Recorded
LONGITUDE: 104.166990 W
DRILLED BY: Not Recorded

Notes: No groundwater encountered. N values have been corrected for sampler diameter.

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0				Medium Dense, Brown, **SAND**, some Organics, No Odor, Dry
	CA	29		
3.0				Very Dense, Reddish Yellow, **SAND** with about 40% Small, Fine, Moderately Cemented Gravel Sandstone Fragments, No Organics, No Odor, Dry
5	CA	49		
	CA	50/5"		
7.0				Very Dense, Yellowish Brown, Fine **SAND**, with about 50%, Coarse Strongly Cemented Sandstone, Gravel, with Fine Moderately Cemented Quartz Gravel, No Odor, No Organics, Dry
10	ST			
15	CA	50/1"		
20	CA	50/3"		
25	CA	72		~ 10% Coarse Strongly Cemented Chert Gravel
30				
30.0	CA	19		Hard, Pale Red, **CLAY**, with about 20% Quartz, No Organics, No Odor, Dry
35	ST			
40	CA	50/1"		

(Continued Next Page)

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-6

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION
45				Hard, Pale Red, **CLAY**, with about 20% Quartz, No Organics, No Odor, Dry *(continued)*
50	ST			50.0
55				
60	CA	50/2"		
65				
70	CA	50/3"		
75				Borehole terminated at 76.5

BOREHOLE/TP/WELL - TT HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

TETRA TECH
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Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-7

CLIENT Chevron **PROJECT NAME** Hayhurst NM, Sec.2 Frac Pond

PROJECT NUMBER 212C-MD-00848 **PROJECT LOCATION** Eddy County, New Mexico

DATE(S) OF DRILLING: 08/18/2017 **GROUND ELEVATION: NA** **METHOD:**

CONSULTANT: Tetra Tech, Inc. **LATITUDE: 32.071740 N** **LOGGED BY: Not Recorded**

DRILLING CONTRACTOR: Not Recorded **LONGITUDE: 104.167650 W** **DRILLED BY: Not Recorded**

Notes: No groundwater encountered. N values have been corrected for sampler diameter.

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0				Dense to Very Dense, Reddish Brown **SAND**, No Organics, No Odor, Dry
	CA	27		
5	CA	50/5"		
	CA	50/3"		
	CA	50/2"		
10	CA	50/4"		
15	CA	50/3"		
20	CA	50/4"		21.0
25	ST			Hard, **CLAY**, with about 60% Moderately Cemented Quartz, No Odor, No Organics, Dry
30	CA	63		
35	CA	43		
40	ST			

BOREHOLE/TPWELL - TT_HAYHURST.GPJ_LAB SUMMARY.GDT 8/24/17

(Continued Next Page)

TETRA TECH
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Fax: 432-682-3946

BOREHOLE ID: B-7

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION
41.5				Borehole terminated at 41.5

TETRA TECH
Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-8

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 08/18/2017
GROUND ELEVATION: NA
METHOD:
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.071940 N
LOGGED BY: Not Recorded
DRILLING CONTRACTOR: Not Recorded
LONGITUDE: 104.166430 W
DRILLED BY: Not Recorded

Notes: No groundwater encountered. N values have been corrected for sampler diameter.

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0				Medium Dense to Very Dense, Reddish Brown, **SAND**, some Organics, No Odor, Dry
	CA	23		
5	CA	50/5"		
	CA	50/4"		
7.0				Very Dense, Red, **SAND**, some Organics, No Odor, Dry
	CA	50/5"		
10	CA	50/5"		
15	CA	50/5"		
20	CA	50/6"		
25			25.0	
	CA	9		Stiff, Red, **CLAY**, with 30% Quartz, No Odor, No Organics, Dry
30	ST			
	CA	16		Very Stiff to Hard, Red, **CLAY**, with 30% Quartz, No Odor, No Organics, Moist
35	ST			
40	CA	50/4"		

(Continued Next Page)

TETRA TECH
Tetra Tech Inc.
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Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

BOREHOLE ID: B-8

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION
41.5				Borehole terminated at 41.5

Appendix 7 – HDPE Liner Specifications

19103 Gundle Road
Houston, TX 77073
800 435 2008 • 281 443 8564
281 230 8650 Fax
www.gseworld.com

October 27, 2016

Tony Banuelos
EC Applications-Texas
12002 E Highway 158
Gardendale, TX 79758

RE: GSE Geomembrane – Permeability for EDS-040NE and EDS-060NE

Certification of Compliance

The undersigned, being qualified and authorized to do so, hereby certifies that GSE 40 mil and 60 EDS Geomembrane will meet a permeability of $< 1 \times 10^{-12}$ cm/s when tested per ASTM E96.

Sincerely,

Miguel Garcia
GSE Technical Support

MG16-0214

PRODUCT DATA SHEET

GSE HD Smooth Geomembrane

GSE HD is a smooth high density polyethylene (HDPE) geomembrane manufactured with the highest quality resin specifically formulated for flexible geomembranes. This product is used in applications that require excellent chemical resistance and endurance properties.

[*]

AT THE CORE:

An HDPE geomembrane used in applications that require excellent chemical resistance and endurance properties.

Product Specifications

These product specifications meet GRI GM 13

Tested Property	Test Method	Frequency	Minimum Average Value				
			30 mil	40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	30 27	40 36	60 54	80 72	100 90
Density, g/cm³	ASTM D 1505	200,000 lb	0.940	0.940	0.940	0.940	0.94
Tensile Properties (each direction) Strength at Break, lb/in-width Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lb	 114 63 700 12	 152 84 700 12	 228 126 700 12	 304 168 700 12	 380 210 700 12
Tear Resistance, lb	ASTM D 1004	45,000 lb	21	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lb	54	72	108	144	180
Carbon Black Content, % (Range)	ASTM D 1603*/4218	20,000 lb	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lb	Note [1]	Note [1]	Note [1]	Note [1]	Note [1]
Notched Constant Tensile Load, hr	ASTM D 5397, Appendix	200,000 lb	500	500	500	500	500
Oxidative Induction Time, mins	ASTM D 3895, 200°C; O₂, 1 atm	200,000 lb	>100	>100	>100	>100	>100
TYPICAL ROLL DIMENSIONS							
Roll Length [2], ft			1,120	870	560	430	340
Roll Width [2], ft			22.5	22.5	22.5	22.5	22.5
Roll Area, ft			25,200	19,575	12,600	9,675	7,650

NOTES:
- [1] Dispersion only applies to mear spherical agglomerates 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- [2] Roll lengths and widths have a tolerance of ±1%.
- GSE HD is available in rolls weighing approximately 3,900 lb.
- All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77°C when tested according to ASTM D 746.
- *Modified.

GSE is a leading manufacturer and marketer of geosynthetic lining products and services. We've built a reputation of reliability through our dedication to providing consistency of product, price and protection to our global customers.

Our commitment to innovation, our focus on quality and our industry expertise allow us the flexibility to collaborate with our clients to develop a custom, purpose-fit solution.

[DURABILITY RUNS DEEP]

For more information on this product and others, please visit us at GSEworld.com, call 800 435.2008 or contact your local sales office.

GSE ENVIRONMENTAL™